

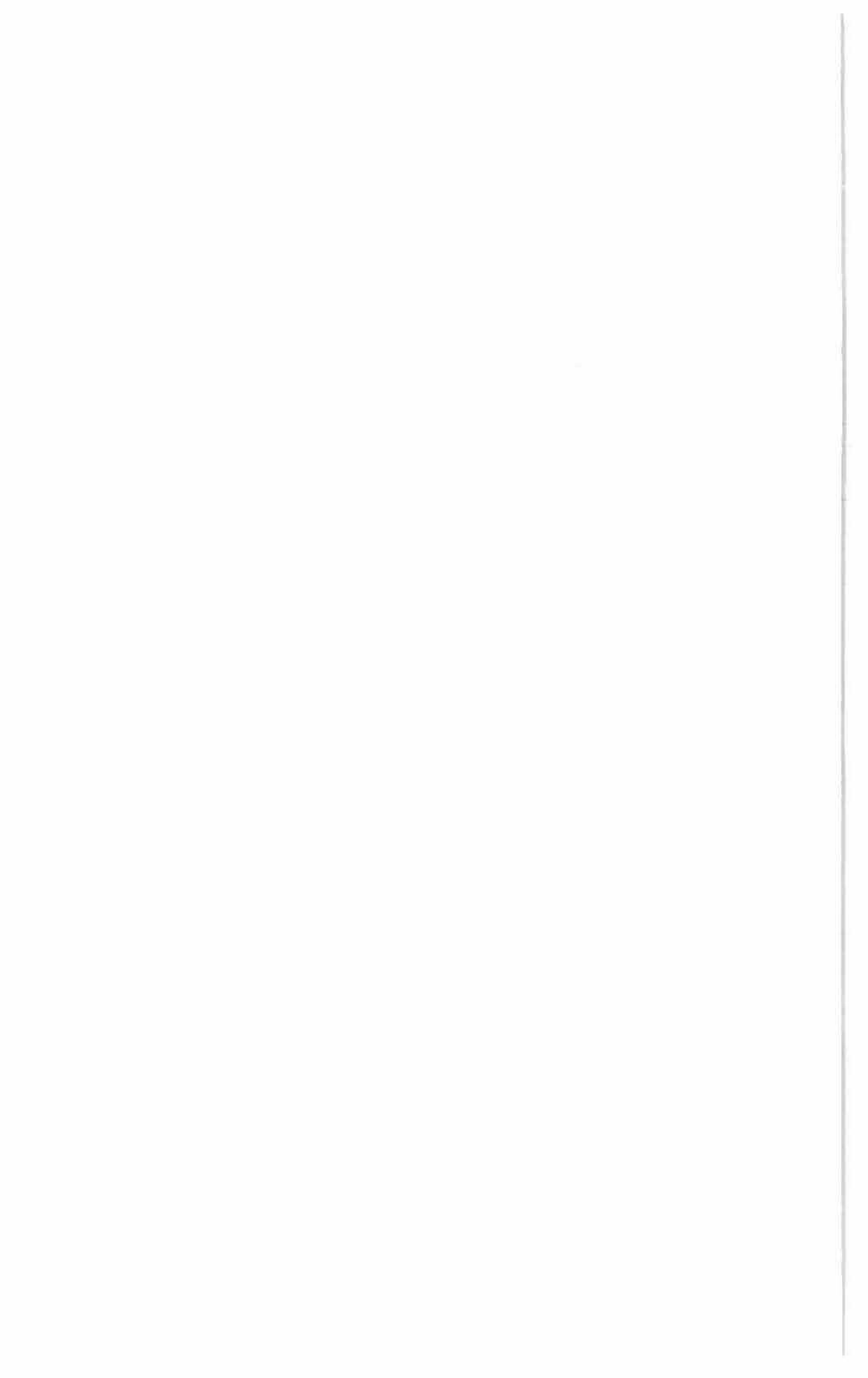
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A SERIES OF BOTANICAL STUDIES

edited by Cyrus Longworth Lundell

Volume 6

Manual of the
Vascular Plants of Texas



Manual of the Vascular Plants of Texas

BY

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and Collaborators



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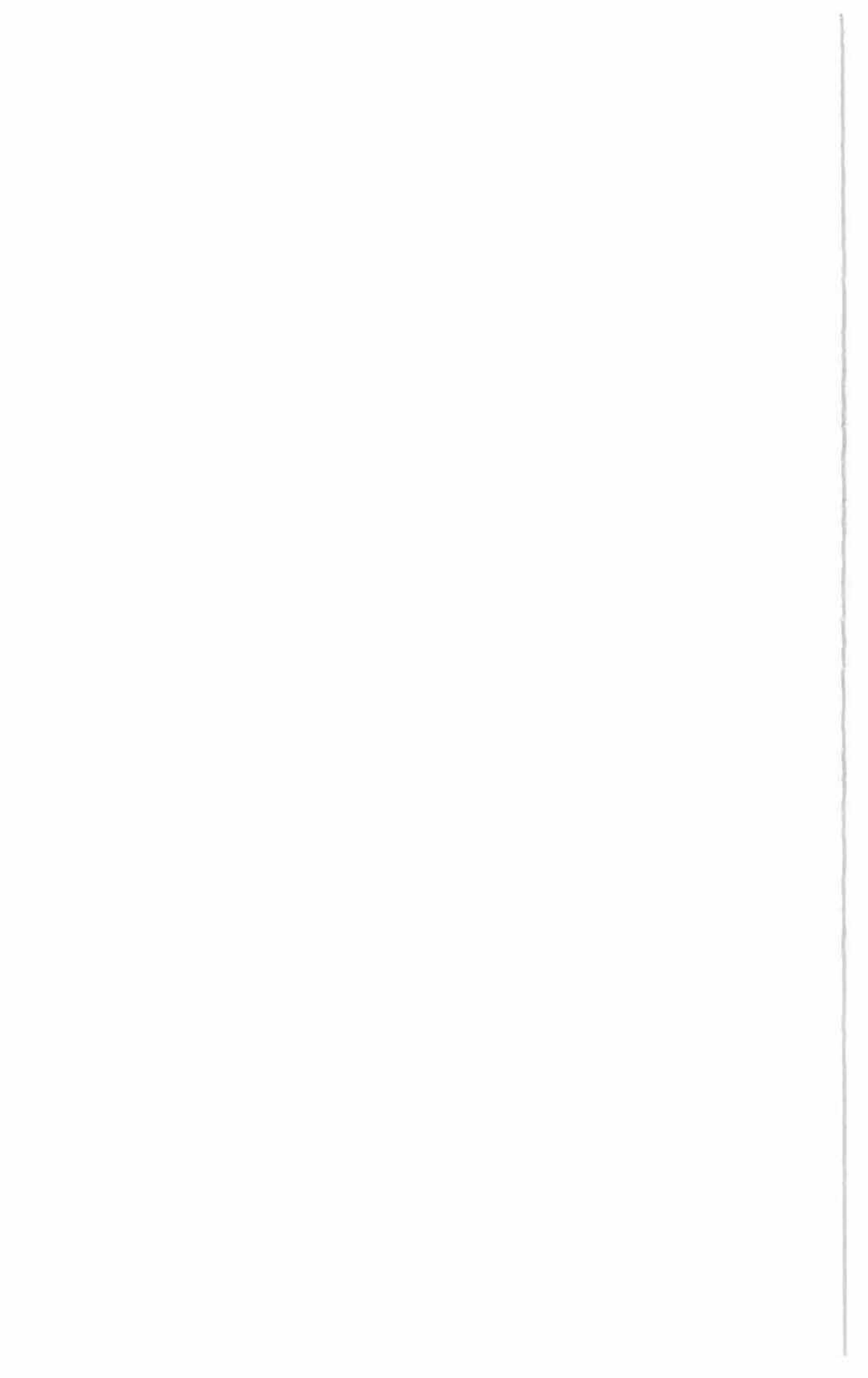
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EDITOR'S PREFACE

The **MANUAL OF THE VASCULAR PLANTS OF TEXAS** is a continuation of the systematic account of the ferns and flowering plants of Texas initiated in 1942 with the publication of Volume 3, Part I of Lundell's **FLORA OF TEXAS**. As originally projected, the **FLORA OF TEXAS** was planned as a ten-volume work, with volumes 1 and 2 to contain the history of botanical exploration, the key to the families, a catalogue of all the species, and maps of the species showing distribution according to counties. Volumes 3 through 10 were designated to include a series of definitive treatments covering all vascular plants of the state.

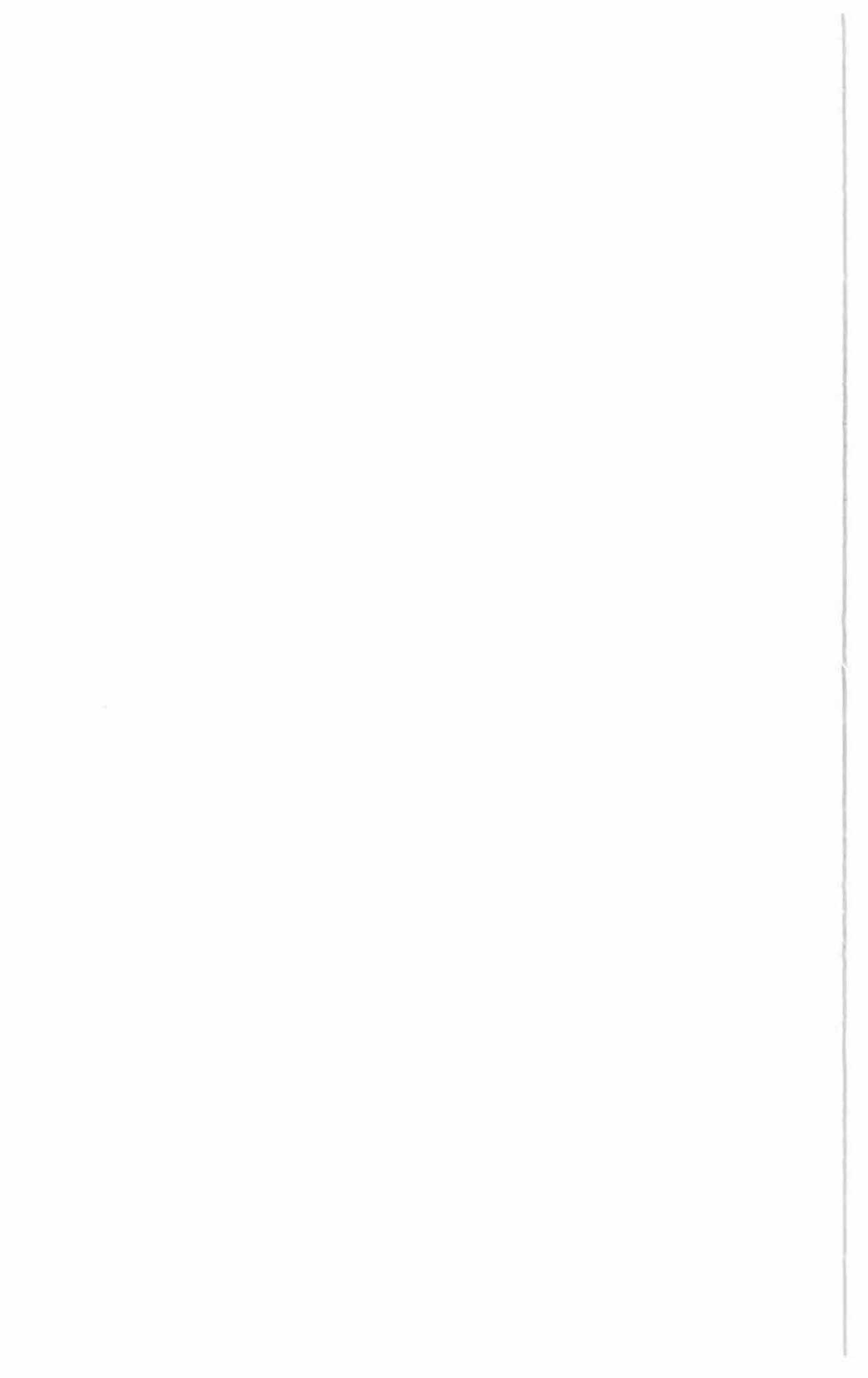
With the issuance of Volume 1, Part I in 1955, the original plan was changed, and the **FLORA** was converted into a serial publication. Volume 3 was completed in 1961, Volume 1 under the new plan was issued in 1966, and Volume 2 was published in 1969. With the issuance of Volumes 1, 2 and 3, the **FLORA OF TEXAS** will be continued as a serial devoted to monographic papers.

When the projected two-volume introduction to the **FLORA** was abandoned in 1955, and the publication converted into a serial, plans were made to bring out a **MANUAL OF THE VASCULAR PLANTS OF TEXAS** to incorporate much of the material initially planned for these volumes.

Based on published parts of the **FLORA OF TEXAS**, but involving revision of these, and the treatment of the entire flora in a more concise form, the **MANUAL** is designed to make available the first complete taxonomic treatise covering all the vascular plants of the state.

The **FLORA OF TEXAS** will serve as a continuing serial of monographic papers to provide a base for updating future editions of the **MANUAL**.

—C. L. LUNDELL
Director of the Foundation



AUTHORS' PREFACE

This is the first complete assemblage of information regarding all of the plant resources of Texas. It is a taxonomic, floristic and, to some extent, ecologic and economic treatment of all the native and naturalized flowering plants and ferns known to occur in Texas.

It is hoped that this work will prove to be a valuable teaching and research tool for teachers and students in the schools, colleges and universities of Texas and southwestern United States, generally, and for biologists everywhere who are interested in any or all aspects of the flora of Texas. The ever-increasing interest in all native vegetation in fields of economic botany, as represented by agricultural, medical, pharmaceutical, chemical, and all other such agencies in both private and government circles has stressed the need for works such as this *MANUAL*. It will make possible the identification of the plants of this part of the country and also aid such agencies as those noted in their search for plants. We hope that this work will fulfill these needs.

The senior author would like to emphasize that to have been given the time and support to prepare a work of this nature is a rare privilege. It is a reflection of the broad-mindedness and serious interest of the supporters and administrators of Texas Research Foundation in not only the agriculture of Texas but in all phases of the botanical resources of the state. We are, indeed, grateful to Texas Research Foundation, its Board of Trustees, and its Director, C. L. Lundell, for support and encouragement during the course and preparation of this research. The junior author wishes to express his appreciation to the Department of Botany, The University of Texas at Austin, and its Chairmen, Harold Bold and B. L. Turner, for encouragement and time allowed for research on this project. Without the cooperative support of these two institutions the authors could not have succeeded in producing this *MANUAL*.

When this project was first proposed, and during its initial stages, some of our colleagues were of the opinion that it was "too soon" to attempt the preparation of a *MANUAL* of the vascular plants of Texas. Our response was, and continues to be, "When is soon enough?" We were of the opinion that further and constant delay was against, not in favor of, the ultimate production of a *MANUAL*. Realizing this, we decided to move ahead.

We knew from the beginning that in order to produce this work we would need all the support, encouragement and cooperation that we could possibly obtain. We are pleased to say that throughout the project we have received far more of each of the above than we had anticipated in our most optimistic moments of planning.

We are indebted to hosts of individuals who have made this work possible. First, we wish to acknowledge our indebtedness to the many plant collectors who, from the early days of Jean Louis Berlandier, Charles Wright, Thomas Drummond, Ferdinand J. Lindheimer, Julien Reverchon and many others,

to the present time, have gone through all the vicissitudes of exploration to make available specimens upon which our present knowledge of the flora of Texas is founded. Through their efforts of more than a century we now have a sound basis for the preparation of a work such as this.

We were most fortunate to have the unselfish cooperation and collaboration of many capable colleagues who willingly contributed treatments of their special groups. These individuals and the contributions they provided us are: Loran C. Anderson (*Chrysothamnus*); Lyman Benson (Cactaceae); Andre F. Clewell (*Lespedeza*); L. Turner Collins (*Orobanche*, Section *Myzorrhiza*); Lincoln Constance (Hydrophyllaceae); Helen B. Correll (Phrymaceae, Plantaginaceae); Frank S. Crosswhite (*Penstemon*); Imre J. Eifert (*Caesalpinia*, *Hoffmanseggia*); Walter S. Flory (*Cooperia*, *Zephyranthes*); Lowell David Flyr (*Brickellia*); John D. Freeman (*Trillium*); Howard Scott Gentry (*Agave*); Vernon L. Harms (*Heterotheca*); F. G. Hawksworth and Delbert Wiens (*Arceuthobium*); Richard H. Hevly (Martyniaceae); Noel H. Holmgren (*Castilleja*); Hugh H. Iltis (Cappariaceae); John W. Ingram (*Argythamnia*); Robert S. Irving (*Hedeoma*, *Rhododon*); Howard S. Irwin (*Cassia*); R. Roy Johnson (*Porophyllum*); Walter H. Lewis (*Hedyotis*); Mildred E. Mathias and Lincoln Constance (Umbelliferae); Ronald L. McGregor (*Echinacea*); Thomas R. Mertens (*Polygonum*); Kim I. Miller (*Tragia*); Lillian W. Miller (*Acalypha*); Harold N. Moldenke (Avicenniaceae, Verbenaceae); Cornelius H. Muller (*Quercus*); Royce L. Oliver (*Sisyrinchium*); Kittie F. Parker (*Hymenoxys*); Willard W. Payne (*Ambrosia*); Donald J. Pinkava (*Berlandiera*); Duncan M. Porter (Zygophyllaceae); A. Michael Powell (*Perityle*); Peter H. Raven (Onagraceae, excepting *Calylophus*); Clyde F. Reed (Amaranthaceae, Chenopodiaceae, Nyctaginaceae); James L. Reveal (*Eriogonum*); C. Marvin Rogers (Linaceae); David J. Rogers (*Manihot*); Reed C. Rollins, Elizabeth A. Shaw and Ray J. Davis (Cruciferae); Norman H. Russell (Violaceae); Bernice G. Schubert (*Desmodium*); Lloyd H. Shinnars (Convolvulaceae); John Strother (*Dyssodia*); Tod F. Stuessy (*Melampodium*); Henry J. Thompson and Joyce Roberts Zavortink (Loasaceae); Howard F. Towner (*Calylophus*); Wesley C. Walraven (*Rhynchosia*); U. T. Waterfall (*Physalis*); Grady L. Webster (*Phyllanthus*); Delbert Wiens (Viscaceae family description and key, *Phoradendron*); Robert L. Wilbur (Cistaceae); James S. Wilson (*Persicaria*). Except for minor editorial changes and those made so as to maintain consistency in presentation, these contributions have been published without alteration. We also wish to acknowledge the assistance of Gerald W. Thomas in the preparation of the Introduction.

The many researchers who have produced monographs, revisions and published notes have immeasurably lightened our burden. Their published works have in many instances been adapted to the Texas plants for inclusion in this work, and are acknowledged where they occur in the text. The publication of a "Catalogue of the Flora of Texas" in 1937 by V. L. Cory and H. B. Parks and the subsequent publication in 1962 of F. W. Gould's "Texas Plants—a Checklist and Ecological Summary" were most helpful in bringing to a focus the species of plants that were to be found in Texas. These two publications served as much-appreciated guideposts during the initial phases of this work.

We have relied upon and, in some instances, drawn to some extent upon various Manuals and comprehensive published floristic studies, reference works and other such publications in the assemblage of this work. Without their availability, the identification of plants and the preparation of some parts of our text would have been a most difficult task. Our appreciation and grateful acknowledgment is herewith accorded the authors and publishers of these works. All such works that have not been acknowledged somewhere in the text are cited in the Selected References section, not only as an acknowledgment of their usefulness to us but also as a convenience for those who might wish to consult them. We would like to note particularly the generosity of Philip A. Munz in permitting us to use material from "Abbreviations of Authors' Names" and "Glossary" that was assembled by David D. Keck for their "A California Flora" (1959). In regard to the abbreviations of authors' names, we are indebted to many individuals who supplied us with supplementary information, especially to George H. M. Lawrence, who checked numerous names for us in the files of the Hunt Botanical Library.

There are many individuals, too numerous to mention by name, who have been directly or indirectly helpful to us in our research, and to whom we are most grateful. Foremost among these are the curators of various herbaria in which Texas specimens are deposited. In regard to specimens, those of Barton H. Warnock from Trans-Pecos Texas that we were able to study were most helpful. We are indebted to Chester M. Rowell for his having made available to us his research findings in the Plains Country prior to their publication. Our understanding of the taxonomy of many of the grasses was helped immensely by the cooperation of our colleague, Frank W. Gould. The assistance of Lyman B. Smith and Elbert L. Little, Jr. in helping to solve some difficult determinations is gratefully acknowledged. Several botanists actively participated in field work on the project. Among these was the late Ivan M. Johnston who was especially helpful in the initial planning of the work and whose untimely death was a real and personal loss to the senior author. Others who participated in field work were Lyman Benson, Kenton L. Chambers, Gabriel Edwin, Howard Scott Gentry, Craig A. Hanson, Elbert L. Little, Jr., Eugene C. Ogden, James L. Reveal, Reed C. Rollins, Charles Schweinfurth, C. Earle Smith, Jr., Henry K. Svenson and Dieter C. Wasshausen. We are indebted to all of them.

In addition to help received from professional botanists, a number of highly skilled amateurs have either directed us to new elements in the flora or have provided assistance in one way or another. Among these are the late Robert Runyon of Brownsville and Lance Rosier of Saratoga, Geraldine Watson of Silsbee, Peggy A. Amerson of Mt. Pleasant, Jim D. Bowmer of Temple, Fred B. Jones of Corpus Christi, and Raymond J. Fleetwood, now of Angleton. The majority of Mexican-American common names cited here are those published in 1947 by Mr. Runyon in his "Vernacular Names of Plants Indigenous to the Lower Rio Grande Valley of Texas."

We are indebted to the Big Bend National Park Service, especially to Park Naturalists Douglas Evans and Roland Wauer, and to the Texas State Parks and Wildlife Service personnel, especially William M. Gosdin and Eugene A. Walker, who were most generous in permitting us to collect within the

boundaries of the domains for which they were responsible. We are equally indebted to many ranchers, farmers and other individuals who permitted us to botanize on their lands.

The financial aid and encouragement of the National Science Foundation through its several grants (Nos. G15901; GB-572; GB-3138; N-3228) made it possible for us to explore more fully every floristic region in the State of Texas, provided means for us to visit various institutions to further our research on the project, and enabled us to publish the work. We are, indeed, grateful to the National Science Foundation and its officials for this much-needed support. We are equally grateful to the Hoblitzelle Foundation for its help in the publication of this work.

We wish to thank Miss Mary Humphries, Librarian of Texas Research Foundation, and Mrs. Sharon L. Horn, research assistant to Reed C. Rollins, Harvard University, for their much-appreciated bibliographic assistance. W. Andrew Archer generously made available to us both bibliographic material and herbarium specimens, for which we are most grateful.

The careful and painstaking work of Mrs. Aileen Maddox in typing the manuscript and in assisting with the preparation of the Index is gratefully acknowledged. Her ability to transcribe at times almost undecipherable hieroglyphics made our burden much lighter than it would have otherwise been. Lastly, our wives, Helen B. Correll and LaVerne A. Johnston, were a continuous source of help and encouragement during the course of this work. We are most grateful to them.

The main purpose of this work, as is that of any Manual, is to provide a means for the identification of the plants in the region under consideration; namely, Texas. For the most part, we feel, the text is uncomplicated and straightforward and needs no explanation. Several points, however, should be clarified. Although the families are arranged phylogenetically essentially in accordance with the Engler and Prantl System, many of the genera and the species within a family or genus, respectively, are not arranged in phylogenetic order. This phase needs more study than time allowed for the present and remains to be done in hoped-for future revisions of this work. In the Keys the first number in each couplet, except in the first pair, is accompanied by a number in parenthesis. This number in parenthesis refers back to the previous couplet from which the present one was derived. With this aid one can quickly and readily retrace one's steps back to the very beginning of the Key if need be. The branches or "legs" of each couplet are always terminated either by a plant name or by a number in parenthesis that refers to a subsequent couplet. In regard to measurements and numbers of parts given in some sections of the text, as "petals (5-) 7-9 (-12) mm. long," such may be interpreted as "petals usually 7-9 mm. long but sometimes as short as 5 mm. or as long as 12 mm. long." The less common extremes in measurements and numbers of parts are enclosed in parentheses.

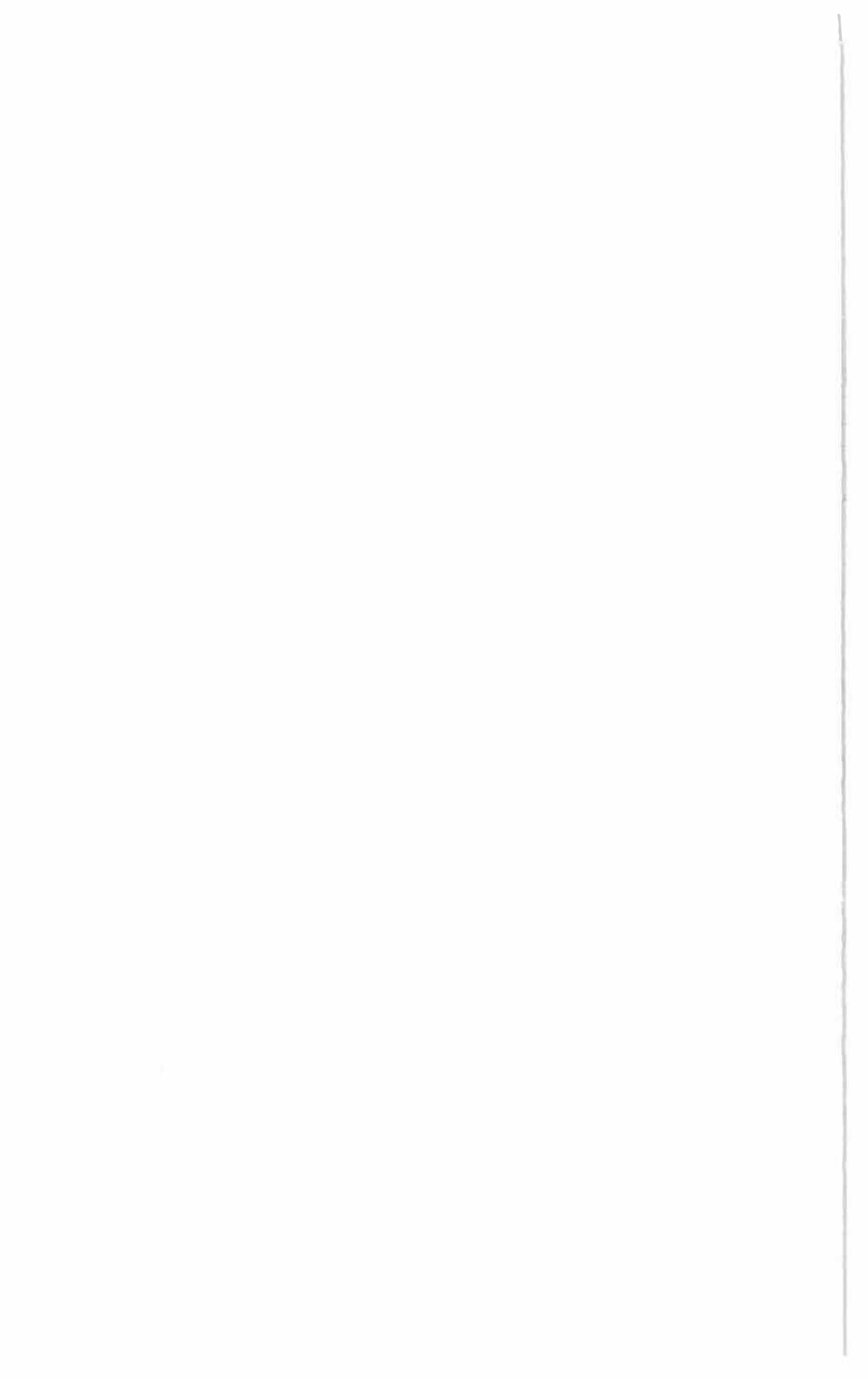
A factor that has undoubtedly affected our vegetation more than any other in the past, and is a continuing factor, is the grazing and browsing by wild and domestic animals; first the buffalo, antelope and deer, and later the cattle, horses, sheep, goats, antelope and deer. Because of this, and the

fact that Texas is a leading cattle-raising state, emphasis in some parts of the Introduction is placed upon the vegetational composition with respect to forage.

We can not over-emphasize the need for greater conservation and a need for the utmost intelligence in the handling of the plant resources of Texas. An ample representation of each of the many different plant communities found in the state should be obtained by the state and set aside and conserved as examples for future generations. Greater restraint should be practiced in the use of our pasturelands before many of our valued species are greatly reduced or even exterminated. Overgrazing is far too prevalent throughout much of the state. Some species, such as all of our native orchids, should be protected, and a state law should exist forbidding the cutting of our magnificent native magnolia (*Magnolia grandiflora*) mainly for the making of railroad ties and furniture.

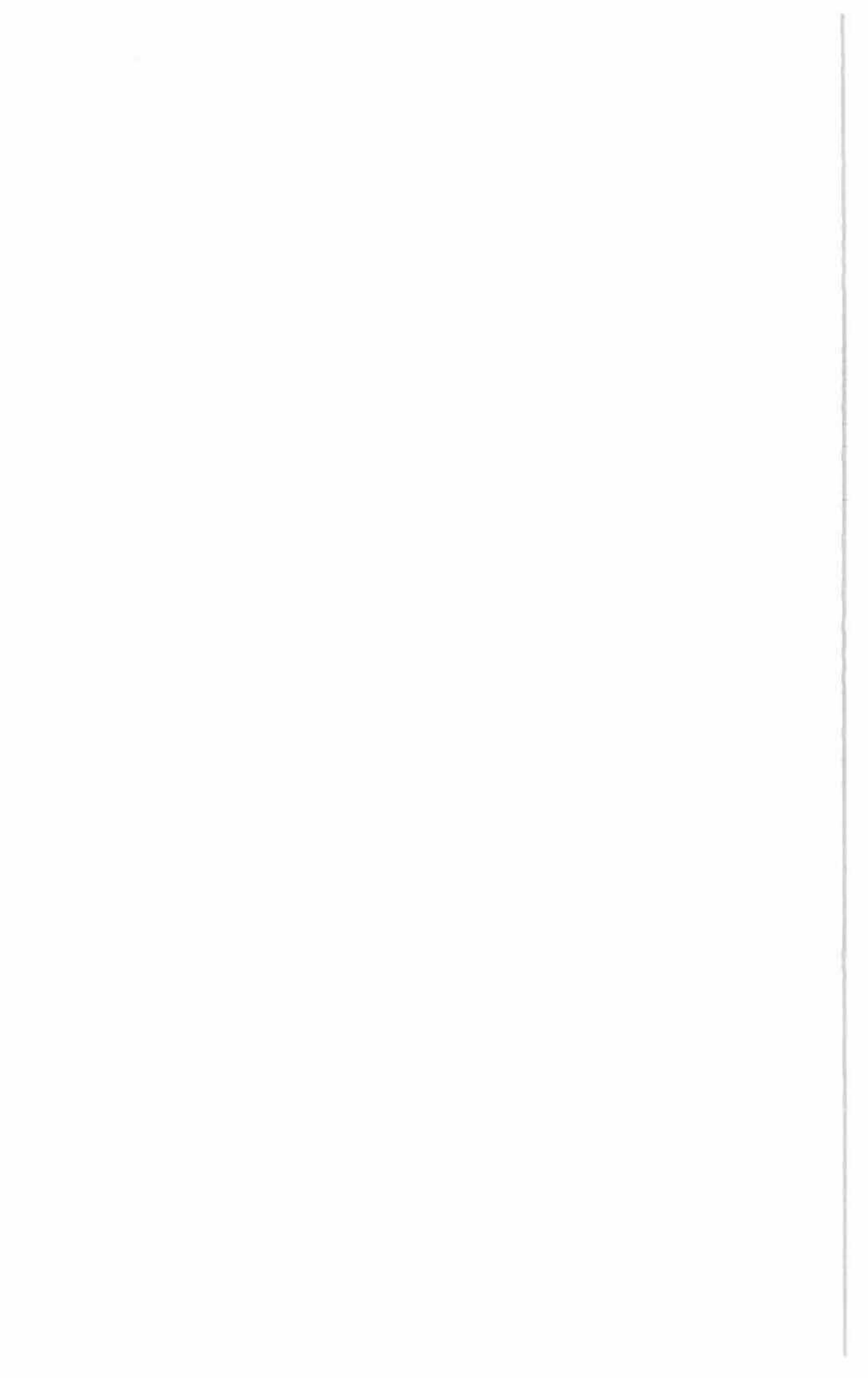
Finally, we believe that a MANUAL, in so far as possible, should epitomize and extol the results of the labor of all those who have gone before. If it were otherwise it would be for them a case of "love's labor lost." To evolve knowledge of any sort, we should build on the results that have accrued to us through the work of others. We like to think of the present work as an evolverment of this nature, but the authors can not relinquish the responsibility of its contents. They are solely responsible for any shortcomings that may be found within these covers.

DONOVAN S. CORRELL
MARSHALL C. JOHNSTON



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INTRODUCTION¹

The vital statistics of Texas are, or should be, familiar to every school child in the state. They have been heralded far and wide, and are engraved in granite at a roadside park near the geographical center of the state. With slight modification and updating, this reads:

Texas is 860 miles north to south and 773 miles east to west. Enclosed within the 4,137 mile perimeter of the state are 267,339 square miles. Brewster County, alone, is larger than Connecticut. Texas has a 624 mile coastline and 90 peaks in the Trans-Pecos a mile or more high. Each year about 56 inches of rain fall in the pine-hardwood forests along the Sabine River, which forms part of the state's eastern boundary. Less than 8 inches fall in the Chihuahuan Desert in the extreme west. This is likened to Miami and Phoenix, respectively.

The wide variety of rainfall, soils and elevation in Texas result in great differences in its vegetation in any given area. Nearly half of the grass species indigenous to the United States are to be found in Texas, and almost 5,000 species of vascular plants are found in the state. Texas is the only state in which both Rocky Mountain and eastern varieties of oaks and pines are native, while in the extreme south are found many subtropical species.

The major plant zones of Texas have been given various designations, but they are all basically and broadly those mapped by V. L. Cory and H. B. Parks in their 1937 "Catalogue," and later by F. W. Gould in his 1962 "Texas Plants." The fundamental breakdown and following discussion is based on the zones as designated in our Map 1.

THE TIMBER BELT (Region 1)

The Timber Belt, also known as Pineywoods and East Texas Forest Region, contains approximately 15,000,000 acres. For the most part it is a gently rolling or hilly country, averaging 200 to 500 feet in elevation, with numerous streams feeding into several large rivers, an ideal habitat for a diversified flora. It is characterized by extensive pine and pine-hardwood forests with intermittent swamps and occasional cultivated or pasture land, and represents the most mesophytic area in Texas. It also represents the southwestern terminus of the vast southeastern United States pine-hardwood forest that extends east to Florida and northeast at least to Virginia, and in giving the general distribution of species it is here considered as a part of southeastern United States. Most of the genera and many of the species in this region are also found east and northeast of Texas.

This is an area of relatively high rainfall with annual averages of 35 to more than 50 inches. The monthly average rainfall is rather uniformly distributed throughout the year although in any given year small deficiencies

¹ Prepared with the collaboration of Gerald W. Thomas, Dean of Agricultural Sciences, Texas Tech University.

or excesses are likely in some months. Temperatures usually are high in summer, and the area is comparatively free from persistent winds. The winters are mild.

Soils are mostly light-colored to dark-gray sands or sandy loams of usually acid reaction. Very few evident rock outcrops occur. The most notable are the sandstone ridge formations that extend from Newton and Jasper counties, northwestward through Tyler and Angelina counties to Cherokee County, and the ferruginous rock formation in Morris County and vicinity.

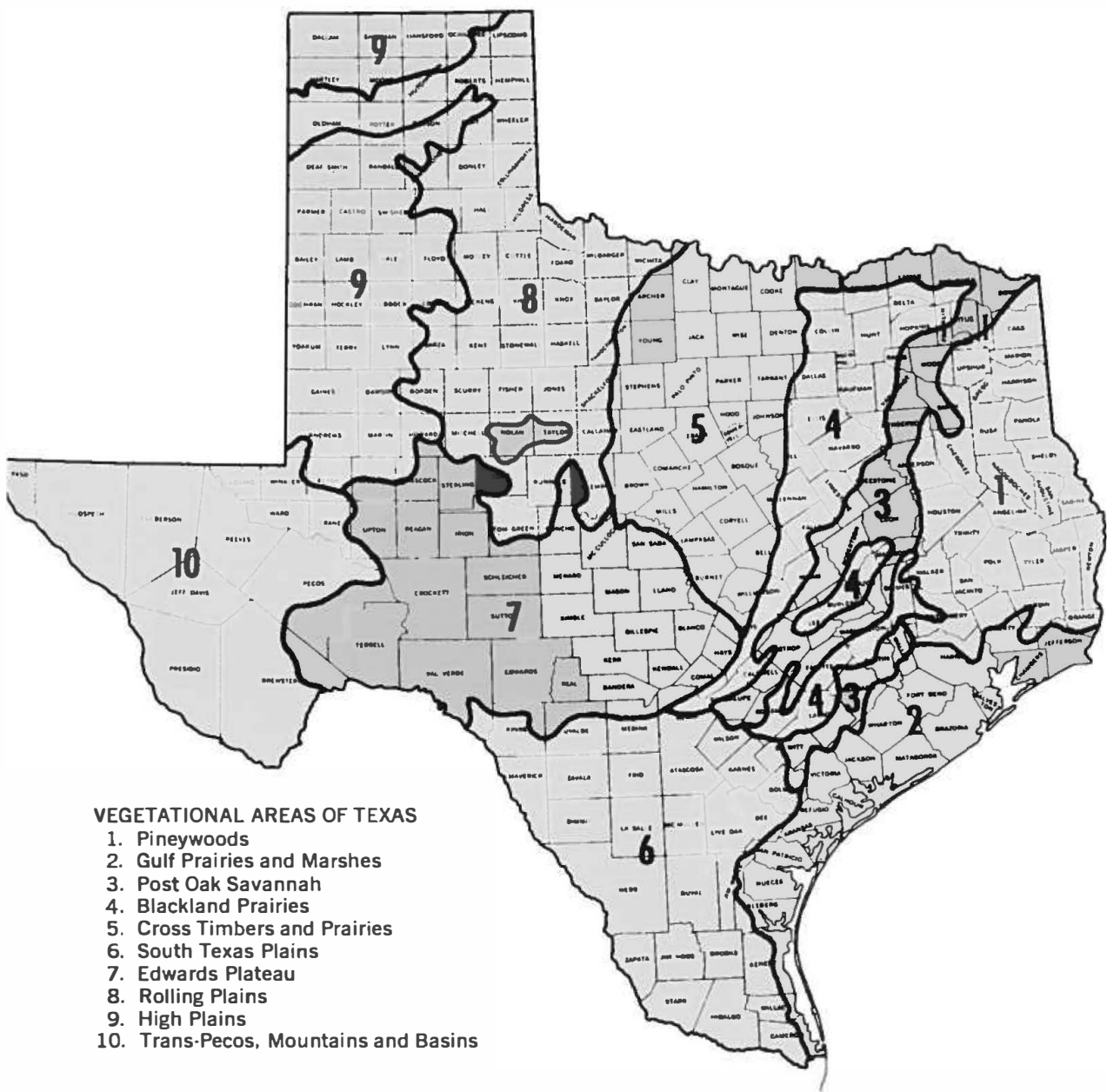
Although at the turn of the century this was a region primarily of small farms and woodlands, today it is essentially one of forestry and ranching. The major commercial timber species are loblolly, shortleaf, longleaf and slash pines. Many hardwoods, such as oaks, elm, magnolia, hickory and maple, also are present in the overstory. Most ecologists consider the pine forest as a subclimax or fire disclimax. Ranches are extremely varied in size and type of operation. The principal class of livestock is cattle. Deer are numerous and must be considered in vegetational management.

Herbs and shrubs abound in the Timber Belt, many of which provide forage for native and domesticated animals. These are predominantly species of *Andropogon*, *Sporobolus*, *Panicum*, *Paspalum*, *Muhlenbergia*, *Eragrostis*, *Chasmanthium*, Indian grass (*Sorghastrum avenaceum*), native legumes and occasional shrubs. Many other grasses as well as a large variety of herbs are represented to form an extremely complex association of forbs and brush species. Common invaders are broomsedge (*Andropogon virginicus*), smutgrass (*Sporobolus indicus*), yankee weed (*Eupatorium compositifolium*), red lovegrass (*Eragrostis oxylepis*), green brier (*Smilax* spp.) and yaupon (*Ilex vomitoria*).

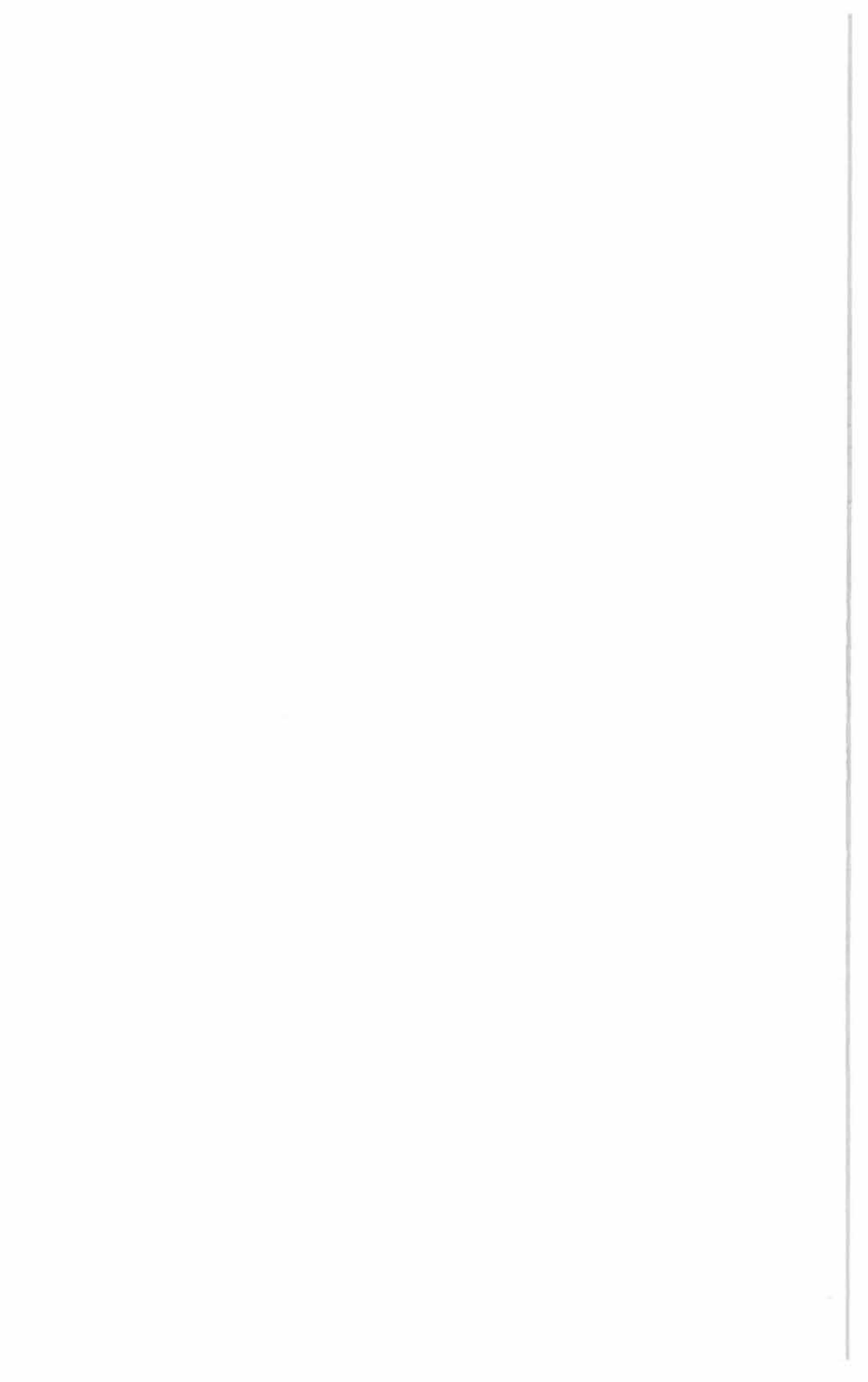
Introductions of grasses and legumes, mostly for improved pastures, have complicated the plant successional patterns. Some of these plants have invaded or have been overseeded in native vegetation. The most important of these are Bermuda grass (*Cynodon Dactylon*), Dallis grass (*Paspalum dilatatum*), Vasey grass (*Paspalum Urvillei*), carpet grass (*Axonopus affinis*), *Medicago* spp., *Lespedeza* spp. and others.

In pockets throughout the region are evergreen shrub bogs, open seepage slopes and cypress-tupelo swamps. They are characterized by usually having peat moss (*Sphagnum* spp.) present in varying degrees. The shrubs in and about these habitats are mostly viburnums, hollies, rhododendrons, wax-myrtles, hypericums, dogwoods, vacciniums, leatherwood (*Cyrilla racemiflora*), and occasionally a sprinkling of poison sumac (*Rhus vernix*). Often the herbaceous vegetation is quite different from that of the surrounding country, and is represented by such uncommon species as nodding-nixie (*Apteria aphylla*), *Bartonia texana*, *Viola lanceolata*, grass-of-Parnassus (*Parnassia asarifolia*), bogmoss (*Mayaca Aubletii*), pitcher plant (*Sarracenia alata*), rose pogonia (*Pogonia ophioglossoides*), bearded grass-pink (*Calopogon barbatus*), small wood orchid (*Habenaria clavellata*) and yellow fringed orchid (*H. ciliaris*).

In the extreme southeast, centered in Jasper, Tyler and Newton counties, are savannahs of broad, level, grassy, open pinelands. These are characterized by a fluctuating water-table, and they support a rather distinctive and



Map 1. Vegetational Areas of Texas. From "Texas Plants—A Checklist and Ecological Summary" by Frank W. Gould (1962; 1969). Used with permission of Texas Agricultural Experiment Station, Texas A&M University.



interesting flora. This includes several orchids, as the snowy orchid (*Habenaria nivea*), crested fringed orchid (*H. cristata*), grass-pink (*Calopogon pulchellus*) and several species of ladies' tresses (*Spiranthes* spp.), yellow stargrass (*Aletris aurea*), pipeworts (*Eriocaulon* spp.), whitehead bog-button (*Lachnocaulon anceps*), several meadow beauties (*Rhexia* spp.), clubmosses (*Lycopodium* spp.), milkworts (*Polygala* spp.), small butterwort (*Pinguicula pumila*), bluehearts (*Buchnera* spp.), sundews (*Drosera* spp.), seedboxes (*Ludwigia* spp.), and numerous sedges, grasses and bulrushes that are indigenous to this type of plant community. The savannahs and shrub bogs commonly grade into one another. Plants in this border-zone are often a mixture of those in the two communities.

GULF PRAIRIES AND MARSHES AREA (Region 2)

The Gulf Prairies and Marshes Area occupies approximately 9,500,000 acres along the coast of Texas. The Gulf or Coastal Prairies Area is a nearly level, slowly drained plain less than 150 feet in elevation, with numerous sluggish rivers, creeks, bayous and sloughs. It is characterized by level grasslands that support ranching and farming, low flat woodlands especially along the streams, swamps and fresh-water marshes. The Marsh Area is limited to narrow belts of low wet marsh interspersed with dunes immediately adjacent to the coast.

Average annual rainfall varies from less than 30 inches in the west to about 50 inches in the east. The growing season usually is more than 300 days, with warm temperatures and high humidity. On the average, rainfall is fairly uniformly distributed throughout the year with slight highs in September and late spring.

Soils in the coastal Marsh Area are acid sands, sandy loams and clays. The upland prairie soils tend to be heavier textured acid clays or clay loams, although there are some sandy loams. In general, soils have slowly permeable profiles. The soil moisture is not readily available to the vegetation. Typical range sites include blackland, sandy prairie, lowland flats, coastal sands, salt meadow and salt marsh.

Most of the marsh is grazed by cattle in large land holdings. Ranches and rangelands of the uplands of the Gulf Prairies are interspersed with farms. The better soils are highly productive under cultivation, or as improved pasture or native range. Wildlife, particularly deer, are an important consideration in management of the vegetation.

The climax vegetation of the Gulf Prairies is largely grassland (tall grass prairie) or post oak savannah. However, much of the area has been invaded by trees and brush such as mesquite (*Prosopis glandulosa*), oaks (especially *Quercus virginiana*), prickly pear (*Opuntia* spp.) and several acacias. The principal climax plants are tall bunch grasses such as big bluestem (*Andropogon Gerardi*), seacoast bluestem (*Schizachyrium scoparium* var. *littoralis*), Indian grass, eastern gamagrass (*Tripsacum dactyloides*), gulf muhly (*Muhlenbergia capillaris*), species of *Panicum* and others. Some invading plants, other than brush species, include yankee weed, broomsedge, smutgrass, western ragweed (*Ambrosia psilostachya*), tumblegrass (*Schedonnardus paniculatus*) and many annual weeds and grasses.

The salt marsh areas typically support species of *Carex*, *Cyperus*, *Eleocharis*, *Juncus*, *Scirpus*, several cordgrasses (*Spartina* spp.) and seashore saltgrass (*Distichlis spicata*).

Introduced grasses, such as Bermuda and carpet grass, are common in tame pastures and some have escaped into uncultivated areas.

The families Amaranthaceae and Chenopodiaceae are well-represented in the Coastal Prairies and Marshes. In the eastern half are to be found many of the same species that occur in the Timber Belt. To the south, however, are found such subtropical plants as black mangrove (*Avicennia germinans*), *Scaevola Plumieri* and *Borreria verticillata*. Many additional interesting species are also found in the southern coastal area, such as the introduced but well-established *Callisia repens*, and *Aneilema nudiflorum*, leafless cress (*Cressa nudicaulis*), *Polygonum striatulum*, saltbush (*Atriplex klebergorum*), *Thurovia triflora*, *Willkommia texana*, Swallen's lovegrass (*Eragrostis Swallenii*) and Texas pink-root (*Spigelia texana*).

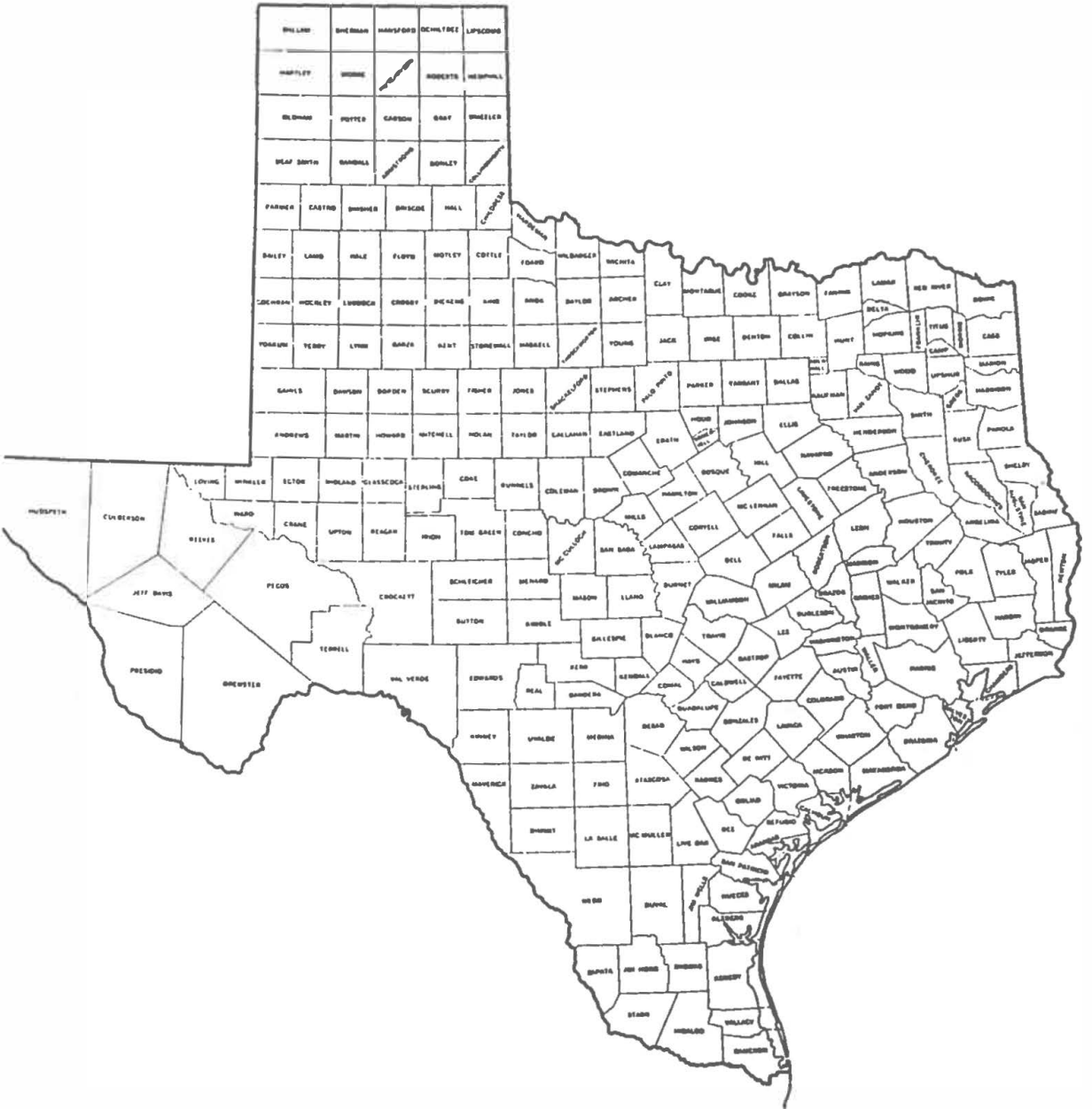
Aquatic plants abound in this region. Among these are *Wolffia* spp., *Wolffiella lingulata*, parrot's feather (*Myriophyllum* spp.), pondweeds (*Potamogeton* spp.), duckweeds (*Lemna* spp.), duck meat (*Spirodela* spp.), water-lilies (*Nymphaea* spp.), cow-lily (*Nuphar luteum*), *Hygrophila lacustris* and arrowheads (*Sagittaria* spp.). The beneficial aquatic plant species as well as open water for fish and wildlife in many of the streams, canals, lakes and ponds are being threatened by several introduced noxious, weedy species. Foremost among these are the water hyacinth (*Eichhornia crassipes*) and alligator weed (*Alternanthera philoxeroides*). The native cat-tails (*Typha* spp.) also belong here. Other species that can and may prove to be troublesome in this and other regions of Texas are aquatic species of water-primrose (*Ludwigia* spp.), water-lettuce (*Pistia Stratiotes*), common frogbit (*Limnobium Spongia*) and American featherfoil (*Hottonia inflata*). In bays and open waters along the Gulf Coast are to be found such species as *Cymodocea filiformis*, *Thalassia testudinum*, *Halophila Engelmannii*, *Halodule Beaudettei*, and rarely *Posidonia oceanica*. Some of these are often found washed up on the beaches along the coast.

POST OAK SAVANNAH AREA (Region 3)

The Post Oak Savannah Area comprises approximately 8,500,000 acres, and lies immediately west of the primary forest region. In addition to this area, both the East and West Cross Timbers are classed as Post Oak Savannah. Some authorities consider this plant association as a part of the oak-hickory or deciduous forest formation. Others prefer to class the area as a part of the true prairie association of the grassland formation. This latter view is based on the fact that the understory vegetation is typically tall grass. There also is evidence that the brush and tree densities have increased tremendously from the virgin condition.

Topography of the Post Oak Savannah is gently rolling to hilly. Elevations are 300 to 800 feet above sea level. Annual rainfall is 35 to 45 inches. The high rainfall month usually is May or June.

Soils on the uplands are light-colored, acid sandy loams or sands. Bottom-land soils are light-brown to dark-gray and acid, ranging in texture from



Map 2. Texas county outline map.

sandy loams to clays. Typical range sites, based primarily on these soil differences, are deep sands, uplands and bottomlands.

Most of the Post Oak Savannah is still in native or improved pastures, although small farms are common. Brush control and good management have shown that the area is capable of producing an abundance of forage, primarily tall grasses. Improved pastures are commonly seeded to Bermuda grass, Dallis grass, Vasey grass, carpet grass and clovers. All classes of livestock are grazed but cattle are the most common.

Climax grasses include little bluestem (*Schizachyrium scoparium* var. *frequens*), Indian grass, switchgrass (*Panicum virgatum*), purpletop (*Tridens flavus*), silver bluestem (*Bothriochloa saccharoides*), Texas wintergrass (*Stipa leucotricha*) and *Chasmanthium sessiliflorum*. The overstory primarily is post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*). Many other brush and weedy species also are common. Some invading plants are red lovegrass, broomsedge, splitbeard bluestem (*Andropogon ternarius*), yankee weed, bull nettle (*Cnidoscolus texanus*), green brier, yaupon, smutgrass and western ragweed.

BLACKLAND PRAIRIES (Region 4)

The Blackland Prairies region consists of about 11,500,000 acres, including the San Antonio and Fayette Prairies. Topography is gently rolling to nearly level, well-dissected with rapid surface drainage. Elevations above sea level are 300 to 800 feet.

Average annual rainfall varies from 30 inches in the west to slightly more than 40 inches in the east. The monthly distribution pattern shows highs in May to the north to an almost uniform pattern at College Station in the south-central region.

Blackland soils are fairly uniform dark-colored calcareous clays interspersed with some gray acid sandy loams. For the most part, this fertile area has been brought under cultivation, although a few excellent (but very small) native hay meadows and a few ranches remain.

Research on the native vegetation of the Blackland Prairies indicates that it should be classed as true prairie with little bluestem as a climax dominant. Other important grasses are big bluestem, Indian grass, switchgrass, side-oats grama (*Bouteloua curtipendula*), hairy grama (*Bouteloua hirsuta*), tall dropseed (*Sporobolus asper*), silver bluestem and Texas wintergrass. Under heavy grazing, Texas wintergrass, buffalo grass (*Buchloë dactyloides*), Texas grama (*Bouteloua rigidisetata*), smutgrass and many annuals increase or invade. Mesquite also has invaded hardland sites of the southern portion of the Blackland Prairies. Post oak and blackjack oak increase on the medium- to light-textured soils.

Some excellent improved pastures have been established on cultivated lands within the Blackland Prairies. These have been seeded to various grasses including Dallis, Bermuda and some native species.

Although classed as a true prairie, this region has much timber, especially along the streams that traverse it. The tree species include a variety of oaks, pecan, cedar elm (*Ulmus crassifolia*), bois d'arc (*Maclura pomifera*) and mesquite. Very few species are unique to the area but the endemics

Dasistoma macrophylla and *Vernonia vulturina* grow in Dallas County and a rose (*Rosa ignota*) is apparently endemic to the area.

CROSS TIMBERS AND PRAIRIES (Region 5)

There are roughly 17,000,000 acres in the Cross Timbers and Prairies. About 1,000,000 acres make up the East Cross Timbers, about 3,000,000 acres the West Cross Timbers and about 6,500,000 acres the Grand Prairie. The remaining area is sometimes called the North Central Prairies. Most of this region is rolling to hilly, deeply dissected and with rapid surface drainage. Average annual rainfall is 25 to 40 inches. April, May and June are the high rainfall months.

The East and West Cross Timbers range from open savannah to dense brush, largely of post and blackjack oaks. Additional species, such as cedar elm and pecan, occur along the streams. Mesquite, despite constant efforts by ranchers to remove it, is still well-established, especially to the south. The East Cross Timbers is a poorly defined region lying along the Red River mainly between Grayson and Clay counties and ending southward between the Blackland and Grand prairies. The West Cross Timbers lie immediately west of the Grand Prairie.

Soils of the North Central Prairies are brown, neutral to slightly acid, sandy or clay loams. Some areas are rather stony. The Grand Prairie typically has dark-colored calcareous clays over limestone. Both the East and West Cross Timbers have acid or slightly acid sandy or sandy loam soils.

Land use in this region is variable. Although the better soils are under cultivation, there are many large ranches which predominantly raise cattle. Other classes of livestock, including goats, are found on some ranches and farms.

In spite of the wide variation in soils and range sites, the climax understory vegetation is rather uniform. The predominant grasses are little bluestem, big bluestem, Indian grass, switchgrass, Canada wild-rye (*Elymus canadensis*), side-oats and hairy grama, tall dropseed and Texas wintergrass. Brush species also have invaded the prairie proper, along with the weedy annual and perennial grasses, including *Erioneuron pilosum*, Texas grama, red grama (*Bouteloua trifida*), tumble windmill grass (*Chloris verticillata*), tumblegrass, red lovegrass and some perennial weeds.

RIO GRANDE PLAINS (Region 6)

The Rio Grande Plains region, also known as the South Texas Plains or Tamaulipan Brushlands, consists of about 20,000,000 acres. The topography is level to rolling, and the land is dissected by arroyos or by streams flowing into the Rio Grande and Gulf of Mexico. Elevations range from about sea level to 1,000 feet. It is characterized by open prairies and a growth of mesquite, granjeno (*Celtis pallida*), cacti, clepe (*Ziziphus obtusifolia*), coyotillo (*Karwinskia Humboldtiana*), guayacan (*Porlieria angustifolia*), white brush (*Aloysia gratissima*), brasil (*Condalia Hookeri*), bisbirinda (*Castela texana*), cenizo (*Leucophyllum* spp.), huisache (*Acacia Farnesiana*), catclaw (*A. Greggii*), black brush (*A. rigidula*), guajillo (*A. Berlandieri*) and other small trees and shrubs which are found in varying degrees of abundance and composition.

Average annual rainfall is 16 to nearly 30 inches, increasing from west to east. At irregular intervals drouths occur in the area. An all-time low record of 2.82 inches fell at Cotulla during 1917. Average monthly rainfall is lowest during January and February and highest in May or June. After a mid-summer depression, another peak is reached in September. Summer temperatures are high, with extremely high evaporation rates in the Laredo area.

Soils range from clays to sandy loams, and vary in reaction from very basic to very slightly acid. A wide range of soil profile types is responsible for great differences in soil drainage and moisture holding capacities. Typical range sites include deep sands, hardlands, shallow ridges, bottomlands, alkali flats and mixed sandy land.

Although there are large acreages of cultivated land in the Rio Grande Plains, most of the area is still range land. Land holdings predominantly are large cattle ranches. Deer and other wildlife species are common.

About 100 to 150 years ago this area supported, on its rockier, more broken uplands, a dense brush dominated by chaparro prieto or black brush (*Acacia rigidula*), guajillo (*A. Berlandieri*) and other low shrubs, many of them thorny. The flatter, deeper-soiled areas supported an open brush or savannah with mesquites and other shrubs in mottes or scattered. A mixture of short or desert grasses and forbs constituted the matrix of the vegetation. Since the settlement of the area, the density of mesquite and other woody plants has increased in many areas.

There are distinct differences in climax plant communities and successional patterns on the various range sites. Characteristic grasses of the sandy loam soils are seacoast bluestem, species of *Setaria*, *Paspalum*, *Chloris* and *Trichloris*, silver bluestem and coast sandbur (*Cenchrus incertus*). The dominants on the clay and clay loams are silver bluestem, Arizona cottontop (*Trichachne californica*), buffalo grass, curly mesquite (*Hilaria Belangeri*) and species of *Setaria*, *Pappophorum* and *Bouteloua*. Low saline areas are characterized by gulf cordgrass (*Spartina spartinae*), seashore saltgrass and sacaton (*Sporobolus Wrightii*). Grasses of the oak savannahs are mainly seacoast bluestem, Indian grass, switchgrass, crinkle-awn (*Trachypogon secundus*) and species of *Paspalum*.

On the rolling open or brush-covered hills saladillo (*Varilla texana*) and its root-parasite, broomrape (*Orobanche multiflora*), form extensive stands in saline and gypsophilous soils. The endemic, *Frankenia Johnstonii*, is occasionally associated with them. The uncommon damiana (*Turnera diffusa*), *Gochmatia hypoleuca*, *Amyris madrensis* and *Mortonia Greggii* are scattered infrequently among the Cactaceae and more common shrubs while the rare ashy dogweed (*Dyssodia tephroleuca*) is local only near the Rio Grande. The Malvaceae are also abundantly represented here as well as in the coastal area.

In the extreme southern part of the Rio Grande Plains region is the Rio Grande Valley, also known as the Brownsville Area, where small groves of native palm (*Sabal texana*) still survive the encroachments of agriculture. In these groves and in the surrounding brush-country occur shrubs, vines and herbs that have their affinity farther to the south. A few of these are

Tournefortia volubilis, David's milkberry (*Chiococca alba*), *Urvillea ulmacea*, *Serjania* spp., *Isocarpha oppositifolia*, tropical heartseed (*Cardiospermum corindum*), Palmer's bloodleaf (*Iresine Palmeri*), *Colubrina Greggii*, *Verbena cameronensis* and *Egletes viscosa*.

In dunes and sandy soils to the southeast are found such plants as the endemic *Monarda maritima* and the more widespread *M. fruticulosa*, *Croton Parksii*, *C. Coryi*, sand brazier (*Brazoria arenaria*), Texas senna (*Cassia texana*), Silveus-grass (*Trichoneura elegans*) and Texas grass (*Vaseyochloa multinervosa*).

EDWARDS PLATEAU (Region 7)

The Edwards Plateau comprises about 24,000,000 acres of "Hill Country" in west-central Texas. Included in the region as herein designated is the granitic Central Basin or Llano Area, centering in Burnet, Llano and Mason counties, and the Stockton Plateau to the west. The Cedar Brakes and part of the Mesquite Belt occur on the Plateau, and are characterized by a dense growth of *Juniperus Ashei*, scrub oaks and mesquite. On the east and south, the Balcones Escarpment, with its spectacular canyons, forms a distinct boundary to the Edwards Plateau, but on the north and west the Plateau blends into and interfingers with other regions. The surface is generally rough, elevations ranging from slightly less than 1,000 feet to more than 3,000 feet.

Average annual rainfall varies from less than 15 inches in the west to more than 33 inches in the east. On the average, there are more years with below average rainfall than above. Drouths have occurred in the area frequently but the most severe and prolonged drouth on record was from 1950 to 1958. The seasonal rainfall pattern shows a typical high in May and June and again in September. This pattern shifts to a late summer high on the western edge of the Stockton Plateau.

Soils are usually shallow, with a wide range of surface textures. They are underlain by limestone or caliche on the Plateau proper and in the Central Basin by granite or gneiss. Typical range sites include adobe hills, shallow uplands, rough stony hills and deep valley soils.

The Edwards Plateau predominantly is range land, with cultivation largely confined to the deeper soils, valley bottoms and around the larger towns. It has an excellent but often sparse mixture of forage plants, and ranches are often stocked with combinations of cattle, sheep and goats to make full use of the few edible plants. Deer are abundant on much of the area and serve as a valuable source of income for many ranchmen.

The most important climax grasses of the Plateau include switchgrass, several species of bluestems and gramas, Indian grass, Canada wild-rye, curly mesquite and buffalo grass. The rough, rocky areas typically support a tall or mid-grass understory and a brush overstory complex made up primarily of live oak, Texas oak, shinnery oak, junipers and mesquite. The northwestern portion of the Edwards Plateau grades into "mesquite-tobosa country" similar to that of the Rolling Plains, whereas the Stockton Plateau portion supports the shorter vegetation of semi-desert grassland. Throughout the region, the brush species are generally considered as "invaders" with the

climax largely grassland or open savannah, except on the steeper, rockier canyon slopes which have continually supported a dense cedar-oak thicket.

The rough, irregular surface of the Plateau is well-drained, being dissected by several perennially flowing river systems that have their origin in the large number of springs in this limestone-based region. Noteworthy is the growth of cypress along most of the streams and rivers. Because of the many large canyons and rugged terrain, this area is botanically of much interest and has consequently been visited by many botanical collectors. The ferns as well as many of the flowering plants are primarily lithophilous, being represented mainly by various species of lipferns (*Cheilanthes* spp.), cloak-ferns (*Notholaena* spp.) and cliff brakes (*Pellaea* spp.). Columbine (*Aquilegia canadensis*), endemics such as *Anemone edwardsensis* and wand butterfly-bush (*Buddleja racemosa*), and other species are sometimes found together on large boulders in shaded ravines along with such species as mock-orange (*Philadelphus* spp.), American smoke-tree (*Cotinus americana*), spicebush (*Benzoin aestivale*) and the endemic silver bells (*Styrax platanifolia* and *S. texana*). Near the western edge of the Plateau are found such species as *Pistacia texana* in sheltered canyons and *Bauhinia congesta* in the Anacacho Mts., and in streams and canals in the Del Rio area occurs the largest known *Physostegia*, *P. Correllii*, towering to more than 8 feet high.

The Plateau is a region of endemism. Some of the endemics, in addition to those above, are netleaf forestiera (*Forestiera reticulata*), plateau milk-vine (*Matelea edwardsensis*), basin bellflower (*Campanula Reverchonii*), Lindheimer crownbeard (*Verbesina Lindheimeri*), *Lythrum ovalifolium*, *Tridens Buckleyanus*, twisted-leaf yucca (*Yucca rupicola*), sotol (*Dasy-lirion heteracanthium*), bracted twist-flower (*Streptanthus bracteatus*) and cliff bedstraw (*Galium Correllii*). In addition to endemism, the Plateau flora reveals a close relationship to that of Mexico. For instance, on limestone are found the uncommon fern species, *Anemia mexicana*, whitefoot lipfern (*Cheilanthes leucopoda*), halberd-fern (*Tectaria heracleifolia*) and hairy maidenhair fern (*Adiantum tricholepis*). Two other ferns on the granite of the Llano Area are the rare American pillwort (*Pilularia americana*), of wide but erratic distribution, and rock quillwort (*Isoetes lithophila*), of local occurrence.

ROLLING PLAINS (Region 8)

The Rolling Plains, along with the High Plains, form the "Panhandle" of Texas. They are a part of the Great Plains region of central United States. The Rolling Plains area in Texas consists of approximately 24,000,000 acres of gently rolling to moderately rough topography. It is dissected by narrow intermittent stream valleys flowing east to southeast. Elevation is 800 to 3,000 feet. The southeastern portion is sometimes referred to as the Reddish Prairies while the middle portion is often referred to as a part of the "South Plains".

Annual rainfall ranges from about 22 inches in the west to almost 30 inches in the eastern portion. Although seasonal precipitation is highly variable, May and September normally are the high rainfall months.

Typically there is a summer dry period, with high temperatures and high evaporation rates.

Soils vary from coarse sands along outwash terraces adjacent to streams to tight clays or red-bed clays and shales. Soil reaction is neutral to slightly basic. Some typical range sites include hardland, mixed land, sandy land, sandy rough breaks and bottomland.

Approximately two thirds of this area is still in range land. The primary class of livestock is cattle, most of which are grazed on large ranches as cow-calf operations.

The original prairie vegetation included tall and mid-grasses, such as little bluestem, big bluestem, sand bluestem (*Andropogon Hallii*), side-oats grama, Indian grass, switchgrass, hairy grama, blue grama, Canada wild-rye and western wheatgrass (*Agropyron Smithii*). Buffalo grass, curly mesquite, tobosa (*Hilaria mutica*), species of three awn (*Aristida* spp.), sand dropseed, hooded windmill grass (*Chloris cucullata*) and *Cenchrus* species tend to increase under grazing. Mesquite is a common invader on all soils. Shinnery oak (*Q. Havardii*) and sand sage (*Artemisia filifolia*) increase or invade on the sandy lands. In addition to brush invaders, heavy grazing tends to increase sandburs (*Cenchrus* spp.), hairy tridens, red grama, Texas grama, tumblegrass, gummy lovegrass (*Eragrostis curtipedicellata*), Texas croton (*Croton texensis*), western ragweed and many other annuals and weedy perennials.

HIGH PLAINS (Region 9)

The High Plains region is also known as the Staked Plains or Llano Estacado, and comprises about 20,000,000 acres. It is a part of the central Great Plains. It is a relatively level high plateau rather sharply separated from the Rolling Plains by the Cap Rock Escarpment and dissected in the north by the Canadian and Red River breaks and in the south by the Brazos and Colorado River systems. Some of the Escarpment walls along the Canadian and Red River reach a height of 800 feet or more. Elevation is 3,000 to 4,500 feet, sloping gently toward the southeast. The southern part is sometimes referred to as the South Plains. The surface is spotted with "playa lakes" which sometimes cover more than 40 acres and contain several feet of water after heavy rains. According to their degree of wetness, these "playa lakes" support various vegetation compositions that differ from that of the surrounding terrain.

Average annual rainfall is 15 to 21 inches, with some years showing as little as 12 and others more than 45 inches. Extended drouths have occurred in the area, the worst in 1917-18, in the 1930's and during 1951-56. Rainfall generally is low during the winter, high in April and May, low in midsummer and high in September and October. The average frost-free period is 179 to 225 days.

Soils range in surface texture from clays on hardland sites in the north to medium textures on mixed land sites and sands on the Southern High Plains. Surface soils are generally underlain with caliche accumulations at depths of 2 to 5 feet.

Although cultivation has increased tremendously with underground water

irrigation, large areas of range land remain on the High Plains. Ranches are primarily cattle operations, usually in large holdings. The principal large wildlife species is antelope.

The vegetation on the High Plains is variously classified as mixed-prairie, short-grass prairie and in some locations as tall-grass prairie. There are distinct differences among the plant communities found on the hardlands, mixed lands, sandy lands, draws and caliche breaks. Successional patterns usually are different and relatively uncomplicated compared with other areas of Texas.

The most abundant native grasses are buffalo grass and blue grama (*Bouteloua gracilis*). These grasses respond as "increasers" on most range sites, although blue grama often may be a "decreaser." Total density or ground cover tends to be higher under grazing, particularly in the intermediate range condition classes. Other important grasses are side-oats grama, black grama (*Bouteloua eriopoda*), little bluestem, western wheatgrass, Indian grass and switchgrass. Sand dropseed and sandbur are common on the sandy lands to the south.

The High Plains region characteristically is free from trees or brush, but mesquite and yucca have invaded some of the area. Sand sage and shinnery oak are common on the deep sandy lands and cedars have spread out from some of the breaks onto the Plains proper. Forbs are common, but not in the abundance or in the complicated patterns found in other regions of Texas. Some of the more interesting species found in the Plains Country are smooth cliff brake (*Pellaea glabella*), gay feather (*Liatris lancifolia*), *Crepis runcinata*, *Townsendia texensis*, and numerous Eriogonums, including the rare *E. Correllii*.

TRANS-PECOS, MOUNTAINS AND BASINS (Region 10)

The Trans-Pecos region consists of approximately 19,000,000 acres of mountains and arid valleys in the extreme western part of Texas. As the name implies, the area includes the region west of the Pecos River. The extreme southeast portion is considered by some to be a part of the Stockton (Edwards) Plateau. It is a region of diverse habitats and vegetation, varying from desert valleys and plateaus to wooded mountain slopes and summits that support forests of conifer and hardwoods. Elevation is about 2,500 to more than 8,500 feet. Treatment of this region as a single vegetational area is justified only in view of its extreme variability and the impracticability of recognizing more vegetational units. The region includes the main representation of the Chihuahuan Desert in the United States. Also, in the Trans-Pecos are to be found the most arid localities in Texas, with very scant growth of arid-land grasses and shrubs.

The average annual precipitation over most of the area is less than 12 inches. Precipitation increases at the higher elevations, to 16.1 inches at Fort Davis and a reported 20 inches on Mt. Locke. Although records at many locations are incomplete, there is much evidence of extreme variability. The high rainfall months usually are July and August.

Soils have developed from outwash materials from the mountains and are varied in surface texture and profile characteristics. In general, soil reaction



Map 3. Environmental map of Texas to show major elevation lines, variations in precipitation, wind and evaporation at different locations, and temperature factors, all of which influence plant growth and distribution in the state. Data compiled from numerous sources. Adapted from "Texas Plants—A Checklist and Ecological Summary" by Frank W. Gould (1969). Courtesy of Texas Agricultural Experiment Station, Texas A&M University.

is basic and some areas show accumulations of alkali as a result of poor drainage. Typical range sites are stony hills, clay flats, sands, salty-saline soils, gypsum flats, deep upland, rough stony mountains, gravelly outwash and badlands.

Cultivated areas are confined largely to the irrigated valleys. Most of the land remains in native range in large holdings. Ranch operations typically are with cattle or sheep, some mixed cattle and sheep and some Angora goats.

Because of the numerous ecological sites, many vegetation types exist. The most important of these are creosote-tarbrush desert shrub, grama grassland, yucca and juniper savannahs, piñon pine and oak forests, and a limited amount of ponderosa pine forests. Saline sites support salt brush (*Atriplex* spp.), alkali sacaton (*Sporobolus airoides*) and other salt-tolerant plants.

Some of the important climax forage plants are *Bothriochloa* spp., side-oats grama, green sprangletop (*Leptochloa dubia*), Arizona cottontop, bush muhly (*Muhlenbergia Porteri*), plains bristlegrass (*Setaria macrostachya*), Indian grass, alkali sacaton, vine-mesquite (*Panicum obtusum*), dropseeds, blue grama, black grama, chinograss (*Bouteloua ramosa*) and other species of grama, tobosa, sacaton and three awns. Common invaders are burro grass (*Scleropogon brevifolius*), fluffgrass (*Erioneuron pulchellum*), *Erioneuron pilosum*, ear muhly (*Muhlenbergia arenacea*), sand muhly (*M. arenicola*), *Croton dioicus*, snakeweeds (*Xanthocephalum* spp.) and Cactaceae.

The flora of the Trans-Pecos is rich and varied, and much of it is rather localized. About one out of twelve species of the Texas flora occurs in the Trans-Pecos and nowhere else in Texas. On the eastern edge along the Pecos River is a region of low rainfall and high evaporation where the principal growth consists of such shrubs as lechuguilla (*Agave lecheguilla*), ocotillo (*Fouquieria splendens*), several species of *Yucca*, cenizo and other arid-land plants. In the more arid areas, chino and tobosa grasses prevail. In places creosote bush (*Larrea tridentata*) and tarbrush (*Flourensia cernua*) grow with tussocks of burro and salt grasses. There is also some mesquite.

In the dunes of Crane, Ward and Winkler counties are to be found such interesting plants as adder's tongue (*Ophioglossum petiolatum*), shinnery oak, *Maurandya Wislizenii*, big sandreed (*Calamovilfa gigantea*), *Cyperus onerosus*, and the rare endemic *Proboscidea sabulosa*.

Extending westward to El Paso, the families Compositae, Nyctaginaceae, Euphorbiaceae, Aizoaceae, Labiatae, Cruciferae, Hydrophyllaceae, Rubiaceae and Malvaceae are especially abundantly represented. For instance, the genera *Galium* and *Sphaeralcea* are each represented by 20 or more species and *Euphorbia* by nearly 30. Species of *Gilia* and *Ipomopsis* in the Polemoniaceae are also rather numerous. In Presidio County, at Capote Falls, the highest in Texas, are the endemic columbine (*Aquilegia Hinckleyana*) in the spray of the falls and the cockroach plant (*Haplophyton Crooksii*), *Sageretia Wrightii* and *Setcreasea leiandra* on boulder-covered slopes nearby.

In the higher, more mesophytic mountains are to be found such species as Texas madrone (*Arbutus xalapensis*), Mexican manzanita (*Arctostaphylos*

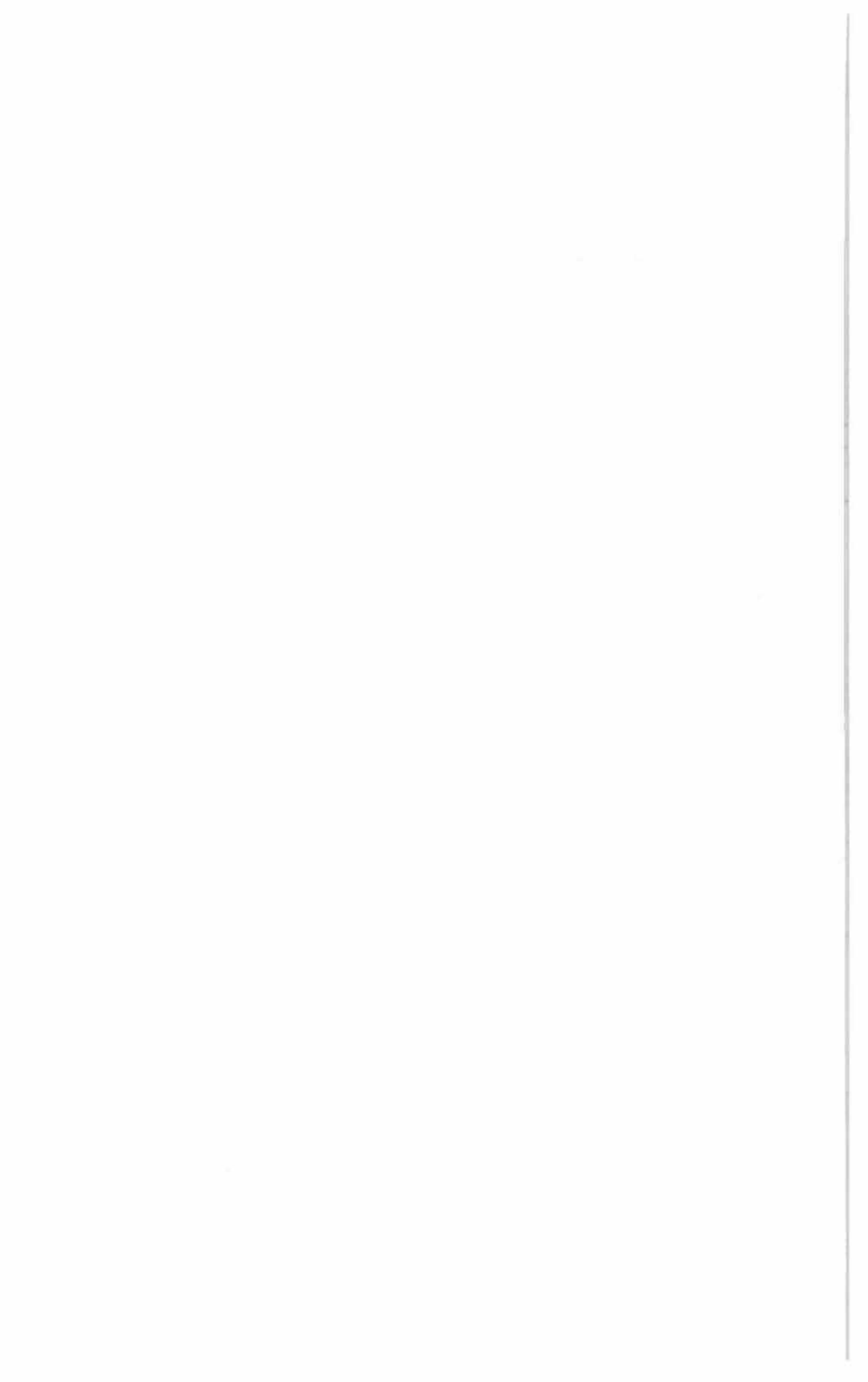
pungens), deer's-ears (*Swertia radiata*), valerians (*Valeriana texana* and *V. arizonica*), American bittersweet (*Celastrus scandens*), American spike-nard (*Aralia racemosa*), fragile fern (*Cystopteris fragilis*), bladder fern (*C. bulbifera*), maidenhair spleenwort (*Asplenium Trichomanes*), and malefern (*Dryopteris Filix-mas*). In the conifer forests only on the higher mountains are found several tuber-bearing species of *Solanum*, relatives of the cultivated potato; *S. Fendleri* is especially prevalent.

Endemics to the lower, hotter parts of the Trans-Pecos deserts include *Andrachne arida*, *Euphorbia perennans*, *E. Golondrina*, *E. theriaca*, *E. Fendleri* var. *triligulata*, *Lycium berberioides* and *Ericameria triflora*.

SUMMARY OF THE FLORA OF TEXAS

The flowering plants and ferns of Texas are incorporated in 1,216 genera in 174 families. In the count given below each species is represented by one entity, be it the nomenclatural type, subspecies or variety. Additional taxa below specific rank, other than those that represent the species count, are included in their proper category. In other words, there are 5,479 taxa to be found in Texas. Of this number, 379 species, 17 subspecies, 66 varieties and 2 forms are considered to be endemic to the state; about 8.3% of the total.

Species	4,839
Subspecies	44
Varieties	532
Forms	39
Hybrids	25
Total number of taxa in Texas	5,479



ARTIFICIAL ANALYTICAL KEY TO THE HIGHER TAXA OF THE VASCULAR PLANTS OF TEXAS

KEY TO THE MAJOR GROUPS

1. Rushlike, fernlike, mosslike or quill-leaved plants without true seeds or flowers, reproducing chiefly by spores I. *Pteridophyta*, p. 17.
1. Habit various; plants producing seeds (2)
 - 2(1). Plants producing seeds but not true flowers, i.e., either having "cones" (with seeds borne more or less exposed on the upper surfaces of the scales of the cones) or fleshy structures with the basic structures of cones (as juniper "berries"), or cones with only a few thin scales (as in Ephedraceae) II. *Gymnospermae*, p. 18.
 2. Plants producing true flowers, i.e., the seeds borne enclosed in specialized structures (ovaries) (*Angiospermae*) (3)
 - 3(2). Plants with several if not all of the following characters: vascular bundles scattered in the usually solid internodes (these bundles can be seen as scattered dots in the stem-transsection); cotyledon (seed leaf) solitary; when flower parts in whorls then some in whorls of 3, at least not in whorls of 5 parts; leaves parallel-veined; root system fibrous (i.e., most roots adventitious); plants nearly always herbaceous III. *Monocotyledoneae*, p. 18.
 3. Plants with several if not all of the following characters: vascular bundles of young stems forming an interrupted cylinder (seen as a ring of dots in stem-transsection); cotyledons usually 2, rarely more or one; flower parts (when in whorls) often in 4's or 5's, less often in 3's, 2's, 6's, etc.; leaves usually reticulate-veined; roots either fibrous or not; plants herbaceous or woody, the wood forming concentric layers when present; young stems nearly always hollow or with a pithy zone in the center IV. *Dicotyledoneae*, p. 21.

I. PTERIDOPHYTA (p. 36 of text)

1. Foliage leaves scalelike or long-subulate, sometimes united into toothed sheaths (2)
 1. Foliage leaves or entire frond with broad or narrow, entire, toothed, pinnate, pinatifid or variously dissected blades (6)
 - 2(1). Stems hollow, fluted, jointed; sporangia borne under peltate scales in a cone ... 5. *Equisetaceae*, p. 41.
 2. Stems solid, not fluted or jointed; sporangia borne in the axils of scalelike or small leaflike or long-subulate bracts (3)
 - 3(2). Leaves rushlike, long-subulate, more than 3 cm. long, borne in a tuft on a short cormlike stem 4. *Isoetaceae*, p. 40.
 3. Leaves scalelike, flat, sometimes concave or cymbiform, less than 3 cm. long, borne on erect or creeping elongate stems and branches (4)
 - 4(3). Plants often forming broomlike clumps; stem naked except for distantly placed minute scalelike leaves; sporangia subtended by 2 minute scale leaves and scattered on upper part of branches 1. *Psilotaceae*, p. 36.
 4. Plants not in broomlike clumps; stem with closely placed or imbricated leaves; sporophylls not bifid, borne in cones (5)

- 5(4). Plants with erect fruiting stems; cones cylindric; spores of 1 kind 2. *Lycopodiaceae*, p. 36.
5. Plants with ascending or spreading fruiting branches; cones more or less quadrangular; spores of 2 kinds 3. *Selaginellaceae*, p. 38.
- 6(1). Plants usually large and conspicuous, growing in soil or on rocks or trees, or (if free-floating or submerged) large and dendroid; spores of 1 kind, minute (7)
6. Plants small, free-floating or partially submerged or rooted in mud; spores of 2 kinds, borne in sporocarps (11)
- 7(6). Fertile fronds with 2 distinct parts, the fertile part being in the form of a spike or panicle and arising from the petioles, the sterile part of the frond being either entire or pinnately dissected 6. *Ophioglossaceae*, p. 42.
7. Fronds not as in *Ophioglossaceae* (8)
- 8(7). Sporangia borne on the back of (the lower side of) or on the margin of the blade (9)
8. Sporangia in panicles or (sometimes fingerlike) spikes developed from the modified blade or parts of the blade (10)
- 9(8). Plants never free-floating nor dendroid; sporangia usually long-stalked 11. *Polypodiaceae*, p. 49.
9. Plants usually free-floating or very rarely deeply submerged, the sterile leaves forming a floating sterile rosette; sporangia sessile or nearly so 12. *Parkeriaceae*, p. 69.
- 10(8). Plants always erect, robust; sterile blades pinnate-pinnatifid to bipinnate, 40 cm. long or more when well-developed 8. *Osmundaceae*, p. 45.
10. Plants vinelike and twining or (if erect) small and with the sterile blades simply pinnate and less than 25 cm. long 7. *Schizaeaceae*, p. 45.
- 11(6). Plants rooting in mud or on muddy bottoms; rootstocks creeping; leaves quadri-lobulate or filiform, not imbricate or matted, distant . 9. *Marsileaceae*, p. 46.
11. Plants free-floating or resting on mud; rootstocks pinnately branched; leaves deeply 2-lobed, imbricate, matted 10. *Salviniaceae*, p. 48.

II. GYMNOSPERMAE (p. 70 of text)

1. Stems jointed; leaves reduced to more or less deciduous scales that are distant and opposite or in whorls or 3's; ovules or seeds in small thin-scaled cones which in one species become fleshy 16. *Ephedraceae*, p. 80.
1. Stems not jointed; leaves needlelike or linear, or (if scalelike) persistent and closely imbricate; ovules or seeds in thick-scaled cones that are sometimes berrylike (2)
- 2(1). Leaves (in the adult state) short, scalelike or awl-shaped; cones either dry and woody or fleshy at maturity 15. *Cupressaceae*, p. 76.
2. Leaves elongate, narrowly linear or needlelike; cones dry and woody at maturity (3)
- 3(2). Leaves in sheathed fascicles of 2 to 5 or solitary, long-persistent; cones usually more or less elongate; cone scales and bracts distinct, each of the scales usually with 2 winged seeds 13. *Pinaceae*, p. 70.
3. Leaves spreading in 2 ranks, usually seasonally deciduous; cones globose; cone scales club-shaped, without distinct bracts, flat or peltate, with two 3-angled or somewhat 3-winged seeds 14. *Taxodiaceae*, p. 75.

III. MONOCOTYLEDONEAE (p. 84 of text)

1. Plants 1 cm. long or usually less, thalluslike, stemless, usually floating 30. *Lemnaceae*, p. 343.
1. Plants usually larger, not with above combination of characters (2)

- 2(1). Each pistillate flower with 4 free carpels each of which at fruiting time is long-stipitate; submerged aquatics with linear leaves 21. *Ruppiaceae*, p. 94.
2. Carpels either coalescent or if free then not stipitate (3)
- 3(2). Carpels 2 to numerous, free from each other (4)
3. Carpels solitary or if more than 1 then these (at base or throughout) coalescent for more than a third their length (7)
- 4(3). Carpels numerous per female flower 23. *Alismataceae*, p. 95.
4. Carpels 2 to 9 per flower (5)
- 5(4). Ovules numerous; flowers showy, yellow 24. *Butomaceae*, p. 100.
5. Ovules solitary; flowers inconspicuous (6)
- 6(5). Perianth of 4 free, rounded, shortly clawed valvate segments 1-4 mm. long 19. *Potamogetonaceae*, p. 86.
6. Perianth absent (genus *Zannichellia* of) 20. *Zannichelliaceae*, p. 93.
- 7(3). Ovary inferior; perianth clearly epigynous (8)
7. Ovary superior or apparently so, in some taxa the perianth reduced or absent, in some the perianth adnate to the ovary for a very short distance basally (15)
- 8(7). Partly or wholly submerged plants; ovules numerous, spread all over the inner surface of the carpels or on the intrusive septa 25. *Hydrocharitaceae*, p. 100.
8. Plants not submerged or if partly so the ovules confined to placental areas (9)
- 9(8). Twining vines with net-veined leaves 40. *Dioscoreaceae*, p. 424.
9. Habit otherwise; leaves parallel-veined (10)
- 10(9). At least the inner 3 tepals dissimilar to one another, the flower thus not radially symmetrical (11)
10. At least the inner 3 tepals (and usually the outer ones, too) equal to each other or nearly so, the flower thus approaching true radial symmetry (13)
- 11(10). Ovule solitary in each cell 43. *Marantaceae*, p. 433.
11. Ovules more numerous (12)
- 12(11). Flowers only slightly zygomorphic, reddish or orange, in terminal thyrses on erect stems to 12 dm. tall 42. *Cannaceae*, p. 432.
12. Flowers strongly zygomorphic, the lower of the 3 inner tepals strikingly different from the other 2, forming a labellum; stems usually less than 5 dm. long 45. *Orchidaceae*, p. 434.
- 13(10). Leaves equitant, distichous and folded along the midrib; stamens 3 41. *Iridaceae*, p. 425.
13. Leaves not equitant; stamens 3 or 6 (14)
- 14(13). Stamens 3; basal leaves usually linear and grasslike and stem or scape leaves scalelike 44. *Burmanniaceae*, p. 433.
14. Stamens usually 6; basal leaves usually broader; plants very diverse in habit 39. *Amaryllidaceae*, p. 413.
- 15(7). Palmlike plants with perennial stem 5-70 cm. thick at ground level and fanlike leaves 4-12 dm. broad 28. *Palmae*, p. 340.
15. Habit otherwise (16)
- 16(15). Submerged perennials mainly of salt-water gulfs and bays, occasionally inland in brackish water 20. *Zannichelliaceae*, p. 93.
16. Plants terrestrial or if submerged then occurring mainly in fresh or slightly brackish water, rarely (*Posidonia*) marine (17)
- 17(16). Plants grayish-lepidote epiphytes 34. *Bromeliaceae*, p. 354.
17. Plants aquatic or terrestrial, not epiphytic (18)
- 18(17). Wholly submerged fresh or brackish water or rarely marine aquatics 22. *Najadaceae*, p. 94.
18. Not wholly submerged (19)

- 19(18). Proper perianth absent or nearly so, the flowers borne in dense heads, spikes or racemes or thickly crowded on a fleshy axis or else variously disposed in panicles, when genitalia subtended by scalelike structures these never numbering precisely 3 in 1 series or 6 in 2 series (20)
19. Proper perianth present, often in 2 series of 3 members each (in some families the outer or inner or both series scalelike) (25)
- 20(19). Flowers crowded on a terminal elongate fleshy axis which below the flower-bearing zone usually has a large foliaceous partially or wholly sheathing bract (spathe) which covers the inflorescence during its early development 29. *Araceae*, p. 341.
20. Axis of inflorescence not fleshy; bract (if present) not so large and not covering the young inflorescence (21)
- 21(20). Inflorescence a series of globose heads at the upper nodes, the uppermost heads of staminate flowers, the lower ones of pistillate flowers 18. *Sparganiaceae*, p. 86.
21. Inflorescence otherwise (22)
- 22(21). Inflorescence solitary, terminal, globose or hemispheric, 2-15 mm. thick, exceedingly dense, not subtended by large bracts (bracts only 1-4 mm. long) 33. *Eriocaulaceae*, p. 352.
22. Inflorescences not globose or hemispheric, or if so (as in some *Cyperaceae*) then closely subtended by several bracts several times as long as the inflorescence is thick (23)
- 23(22). Inflorescence a very dense brownish spike 12-40 cm. long and 1-2 cm. thick with thousands of minute flowers, the male above, female below; "cat-tails" 17. *Typhaceae*, p. 84.
23. Inflorescence otherwise (24)
- 24(23). Leaves distichous (and sometimes equitant); with rare exceptions each floret subtended by 2 scales (the lower or lemma abaxial and with 1 midvein; the upper or palea adaxial and with 2 unequal nonmedial nerves) 26. *Gramineae*, p. 103.
24. Leaves tristichous; each floret subtended by a single abaxial scale (seemingly 2 scales in *Hemicarpha*, or by a sac in *Carex*, or by bristles in addition to the scale in some genera) 27. *Cyperaceae*, p. 261.
- 25(19). Desert plants with spreading rosettes of tough perennial sublinear arcuate leaves which at margins have rows of curved spines several mm. long (genus *Hechtia* of) 34. *Bromeliaceae*, p. 354.
25. Habitally not as above or if slightly similar then marginal spines minute or absent (26)
- 26(25). Calyx irregular, glumaceous, the 2 persistent lateral sepals cymbiform and dorsally keeled or winged, the third sepal larger, obovate and enfolding or forming a hood over the corolla in bud and deciduous with it 32. *Xyridaceae*, p. 348.
26. Calyx otherwise (27)
- 27(26). The 3 inner tepals (petals) quite distinct in color and/or texture from the 3 outer ones (sepals) (28)
27. The 6 tepals all rather similar in color and texture, either all dry and scalelike or all corolline (29)
- 28(27). Ovary completely 3-celled; lower part of leaves sheathing the internodes 35. *Commelinaceae*, p. 356.
28. Ovary incompletely 3-celled or 1-celled; leaves not sheathing 31. *Mayacaceae*, p. 347.
- 29(27). Perianth of 6 scalelike dry brown noncorolline tepals 37. *Juncaceae*, p. 368.
29. Perianth of 6 corolline tepals or with 6 corolline segments (30)

- 30(29). Usually floating, partially submerged or at least rooting in mud; inflorescence subtended by spathe-like leaf sheath; seeds usually ribbed; flowers usually somewhat zygomorphic 36. *Pontederiaceae*, p. 366.
30. Dry-land or marsh plants; inflorescence usually not subtended by a spathe-like leaf sheath; seeds various, usually not ribbed; flowers almost always radially symmetrical 38. *Liliaceae*, p. 378.

IV. DICOTYLEDONEAE (p. 447 of text)

1. Plants cactuslike, leafless (or with vestigial permanently deciduous leaves on the young stems) with fleshy stems and spines borne in clusters on specialized areas (areoles) 131. *Cactaceae*, p. 1087.
1. Plants not as above, either with or without leaves and either unarmed or with solitary spines or thorns (these never clustered in specialized structures) (2)
 - 2(1). Flowers with all the petals united at their edges (at least near the base) into a single structure, this corolla often deciduous as a unit and often shaped like a saucer, a cup or a trumpet (3)
 2. Flowers not as above, if any petals joined then not all of them involved or else not joined at their edges (occasionally the petals may seem to be joined somewhat in bud but not in the mature open flower), or petals absent (61)
 - 3(2). Flowers epigynous or partly so, i.e., the perianth and stamens when present appearing to be attached to the top or near the middle of the sides of the ovary (4)
 3. Flowers hypogynous or perigynous, the sides of the ovary free from the perianth or the floral cup, the perianth attached below the ovary (15)
 - 4(3). Perianth (actually a corolline calyx) S-shaped or U-shaped; stamens 6 58. *Aristolochiaceae*, p. 506.
 4. Perianth otherwise; stamens more or fewer than 6 (rarely 6 in *Ericaceae* and *Styracaceae*) (5)
 - 5(4). Anthers 5 or 4, coalescent but filaments free (anthers exceptionally free in the genera *Ambrosia*, *Xanthium*, *Iva*); fruit an achene and usually crowned by the modified calyx of bristles or scales; style branches usually 2, usually divergent; flowers usually very small and aggregated in involucre heads 174. *Compositae*, p. 1523.
 5. Anthers usually free (exceptions: *Cucurbitaceae*; 1 genus of *Campanulaceae*); fruit diverse but rarely an achene (exception: *Valerianaceae*); style branches 1 to 20; flowers rarely aggregated in involucre heads (6)
 - 6(5). Stems trailing or twining, often vinelike, often scabrous, often with lobed leaves; fruits with a leathery or tougher rind and fleshy placental tissue inside and numerous flattish seeds either buried in flesh (watermelon) or in 2 to many longitudinal rows on the several (3 to 5, usually) placentas which are on the walls of the chamber (as pumpkin, gourd, cucumber, etc.); stamens often united 171. *Cucurbitaceae*, p. 1506.
 6. Plants not with the cucurbitaceous character-combination (7)
 - 7(6). Anthers 8 or more (8)
 7. Anthers 5 or fewer (rarely 6 in *Ericaceae*) (10)
 - 8(7). Stamens numerous, a cluster of them present at the base of each petal 146. *Symplocaceae*, p. 1191.
 8. Stamens 8 to 16 (9)
 - 9(8). Leaves and branchlets nearly glabrous, at least never with stellate or lepidote vestiture; fruit a many-seeded berry; anthers appendaged (genus *Vaccinium* of) 140. *Ericaceae*, p. 1173.
 9. Leaves and branchlets with at least some stellate or lepidote vestiture; fruit winged or few-seeded, round and dry; anthers unappendaged 145. *Styracaceae*, p. 1189.

- 10(7). Placenta free, central, attached to base of locule (genus *Samolus* of) 141. *Primulaceae*, p. 1181.
10. Placenta when axile not free from the sides (in a few taxa the placenta is apical) (11)
- 11(10). Leaves alternate (rarely fortuitously subopposite in Goodeniaceae) (12)
11. Leaves opposite or whorled (13)
- 12(11). Style not indusiate 172. *Campanulaceae*, p. 1514.
12. Style beneath the stigma with an indusium (a 2-lobed cup-shaped pollen receptacle) 173. *Goodeniaceae*, p. 1522.
- 13(11). Fruit an achene or an achenelike structure or at least indehiscent and with a single maturing ovule 170. *Valerianaceae*, p. 1503.
13. Fruit a capsule, berry, drupe or schizocarp (14)
- 14(13). Stipules present (these sometimes in the form of leaflike structures which add to the number of "leaves" at a node) 168. *Rubiaceae*, p. 1479.
14. Stipules absent but stipular lines sometimes evident . 169. *Caprifoliaceae*, p. 1496.
- 15(3). Corolla forming a cap over the tiny flower and falling as a unit at the onset of anthesis, the petals separating from each other only at the base; stamens opposite petals but not attached to the corolla, persistent after the corolla falls (genus *Vitis* of) 113. *Vitaceae*, p. 1015.
15. Corolla not behaving as in grape flowers (16)
- 16(15). Gynoecium at anthesis or shortly before anthesis with a 2-lobed ovary (or appearing as 2 carpels or 2 ovaries) but only a single style owing to fusion of the styles above the ovary-lobes; 1 or each lobe of the ovary maturing into a folliclelike structure; stigma massive (17)
16. Ovary entire or if deeply 2-lobed then styles not united or if so the single style gynobasic; stigmas not often massive (18)
- 17(16). Sap milky or not; stigma free from or only loosely coherent to anther- and/or corolla tissue 150. *Apocynaceae*, p. 1211.
17. Sap always milky; stigma massive and united to anther-tissue and often to some corolla tissue to form a "crown" or "gynostegium" .151. *Asclepiadaceae*, p. 1219.
- 18(16). Leaves pinnately twice-compound 91. *Leguminosae*, p. 761.
18. Leaves simple to pinnately once-compound or palmately compound (19)
- 19(18). Anthers more than 3 times as numerous as the petals (or as the corolla lobes) (20)
19. Anthers numbering from 3 times as numerous as the petals or corolla lobes to as few as 2 per flower (24)
- 20(19). Viciously armed desert plants with tubular reddish flowers 122. *Fouquieriaceae*, p. 1069.
20. Plants unarmed (21)
- 21(20). Filaments not coalescent (22)
21. Filaments either coalescent to form a tube or at least coalescent at base (23)
- 22(21). Herbs with deeply dissected leaves and highly zygomorphic flowers (genus *Delphinium* of) 72. *Ranunculaceae*, p. 634.
22. Woody plants with mostly entire leaves and actinomorphic flowers 146. *Symplocaceae*, p. 1191.
- 23(21). Filaments forming a tube which loosely sheaths the style(s) for most of the length 115. *Malvaceae*, p. 1025.
23. Filaments not forming a tube 117. *Theaceae*, p. 1059.
- 24(19). Stamens (6 or) 7 to 18, usually precisely 2 or 3 times as numerous as the petals or corolla lobes (25)
24. Stamens 2 to 5 (or very rarely 6), as many as the petals or corolla lobes or fewer than them (32)

- 25(24). Carpels free, equal in number to the calyx segments or corolla lobes, each maturing into a follicle 86. *Crassulaceae*, p. 714.
25. Carpels coalescent into a compound pistil (26)
- 26(25). Viciously armed desert shrubs with tubular reddish flowers 122. *Fouquieriaceae*, p. 1069.
26. Either unarmed or else flowers not red (27)
- 27(26). Petals typically 3; flowers extremely zygomorphic; stamens 8 or rarely 6 101. *Polygalaceae*, p. 914.
27. Petals or corolla lobes 4 to 7; flowers only slightly if at all zygomorphic; stamens (6 or) 7 to 18 (28)
- 28(27). Anthers often with little hornlike appendages and dehiscent by apical slits, clefts or pores 140. *Ericaceae*, p. 1173.
28. Anthers unappendaged, usually opening longitudinally (29)
- 29(28). Woody plants with stellate or lepidote vestiture . 145. *Styracaceae*, p. 1189.
29. Plants herbaceous or woody, vestiture absent or else not stellate or lepidote (30)
- 30(29). Flowers perfect; plants herbaceous and with acidulous juice; leaves usually palmately compound with 3 leaflets (pinnately compound in 1 species and reduced to 1 leaflet in 1 species) 94. *Oxalidaceae*, p. 893.
30. Flowers unisexual; plants herbaceous or shrubby (31)
- 31(30). Stamens 15 or 16; rounded shrubs or small trees with entire leaves; fruits fleshy, persimmonlike, with several seeds 144. *Ebenaceae*, p. 1189.
31. Stamens (6 to) 8 to 10; leaves often lobed; fruits dry, capsular, usually with 3 seeds (genera *Manihot*, *Cnidoscolus* and *Jatropha* cf) .. 102. *Euphorbiaceae*, p. 923.
- 32(24). Ovule viviparous, i.e., germinating while still on the parent-plant; opposite-leaved mangrovelike small rhizomatous shrubs growing on salty mud flats along the coast 156. *Avicenniaceae*, p. 1311.
32. Ovule not viviparous; plants not growing in salty mud or if so then not shrubby (33)
- 33(32). Succulent perennial twining vines with alternate simple entire leaves; flowers whitish, in spikelike inflorescences several cm. long . 68. *Basellaceae*, p. 611.
33. Nontwining vines or if so then not succulent or flowers and inflorescences not as described above (34)
- 34(33). Fruit an incompletely celled capsule (i.e., 1-celled with incomplete partitions), dehiscent apically 69. *Caryophyllaceae*, p. 612.
34. Fruit otherwise, if capsular then dehiscent differently (35)
- 35(34). Fruit a circumscissile capsule; herbs with leaves nearly all basal and flowers in dense spikes terminating the scapes 167. *Plantaginaceae*, p. 1475.
35. Fruit not a circumscissile capsule or if so then habit otherwise (36)
- 36(35). Fruit a capsule terminated by 2 prominent curved and incurved beaks, 1-3 dm. long 162. *Martyniaceae*, p. 1445.
36. Fruit not as above (37)
- 37(36). Herbs with opposite leaves and the odor of wet wool (or a wet dog); stamens 3 (rarely 2); flowers minute, white, in terminal dichasia or compound cymes; calyx minute, annular, involute (often unrolling after anthesis) or with minute teeth; fruit a 1-seeded achenelike structure 170. *Valerianaceae*, p. 1503.
37. Plants not as above, usually with 2, 4 or 5 stamens and with the calyx usually better-developed (38)
- 38(37). Herbs usually with linear leaves; fruit a capsule, more or less completely 10-celled, at maturity splitting into 5 or 10 parts which fall away separately 95. *Linaceae*, p. 897.
38. Herbs, shrubs or trees; fruit not as in flax (39)

- 39(38). Leaves alternate and stipulate (the stipules sometimes small, deciduous) (40)
39. Leaves alternate, opposite or whorled, either not having stipules or if with stipules then opposite (41)
- 40(39). Fruit subglobose, drupaceous (with several stones), reddish, usually 5-10 mm. thick 106. *Aquifoliaceae*, p. 993.
40. Fruit a capsule or schizocarp 116. *Sterculiaceae*, p. 1055.
- 41(39). Leaves opposite or whorled and with stipules, the evidence of stipules sometimes reduced to mere stipular lines or membranes at the sides of the node (here may also be sought certain Rubiaceae whose essential epigyny has been overlooked) 148. *Loganiaceae*, p. 1200.
41. Leaves opposite or alternate, without the slightest evidence of stipules (42)
- 42(41). Stamens 2 or 4, fewer than the 5 corolla lobes (the number of corolla lobes may be obscure in highly zygomorphic corollas) (43)
42. Stamens 5 in flowers with 5 corolla lobes or 4 in flowers with 4 corolla lobes (this usually easily ascertained) (52)
- 43(42). Fruit solitary, achenelike, dry, ellipsoid, 1-celled, 1-seeded 166. *Phrymaceae*, p. 1475.
43. Fruit not achenelike (in a few taxa the fruit schizocarpous and the parts of the fruit achenelike) (44)
- 44(43). Fruit not capsular, either schizocarpous and breaking into 1-seeded achenelike parts or else drupaceous; leaves always opposite (45)
44. Fruit a capsule or a samara; leaves opposite or alternate (47)
- 45(44). Flowers strongly zygomorphic; style usually manifestly bifurcate near the apex (the lower branches usually shorter than the upper); fruit a schizocarp ... 158. *Labiatae*, p. 1342.
45. Flowers usually only slightly if at all zygomorphic; style usually microscopically if at all bifurcate at apex; fruit schizocarpous or drupaceous (46)
- 46(45). Fruit a 1-seeded drupe 147. *Oleaceae*, p. 1192.
46. Fruit a schizocarp or a drupe with 2 or more seeds . 157. *Verbenaceae*, p. 1312.
- 47(44). Plants not green, appearing to be devoid of chlorophyll, terrestrial 163. *Orobanchaceae*, p. 1449.
47. Plants green (very darkly so, almost black in some Scrophulariaceae or orange in the stem-parasite *Cuscuta* of the Convolvulaceae) (48)
- 48(47). Seeds compressed, winged, sometimes comose; mostly woody climbers but a few shrubs and trees 161. *Bignoniaceae*, p. 1442.
48. Seeds sometimes flat but wingless or if winged then the plant herbaceous (49)
- 49(48). Seeds minute, attached to a free central placenta in the 1-celled ovary; fruit a 2- or 4-valved capsule; small herbs 164. *Lentibulariaceae*, p. 1452.
49. Seeds attached to axile or nearly axile placentas in the 2-celled ovary; fruit a capsule or a samara (50)
- 50(49). Corolla lobes usually convolute in bud; capsule elastically dehiscent, the seeds ballistically ejected at dehiscence 165. *Acanthaceae*, p. 1456.
50. Corolla lobes usually imbricated or valvate in bud; capsule not elastically dehiscent (or fruit a samara in some taxa), the seeds not ballistic (51)
- 51(50). The 2 stamens opposite each other or at least widely separated on the nearly actinomorphic corolla 147. *Oleaceae*, p. 1192.
51. The 2 or 4 stamens not widely separated in the usually strongly zygomorphic corolla 160. *Scrophulariaceae*, p. 1408.
- 52(42). Only a single seed maturing in each flower (see also *Cryptantha texana* of the Boraginaceae) (53)
52. At least 2 and commonly more seeds produced by each flower (54)

- 53(52). Fruit dry, either achenelike or capsular; herbs or unarmed shrubs with usually perfect flowers 142. *Plumbaginaceae*, p. 1185.
53. Fruit fleshy, drupaceous; thorny shrubs or trees with unisexual flowers 143. *Sapotaceae*, p. 1187.
- 54(52). Placenta obviously free-central, attached at base of the single cell of the ovary; stamens opposite the corolla lobes 141. *Primulaceae*, p. 1181.
54. Placenta axile or parietal, or if basal then the ovary with more than 1 cell, or if placentation difficult to determine, at least not obviously free-central; stamens alternate with the corolla lobes (but this very obscure in some flowers) (55)
- 55(54). Ovary 3-celled; style usually 3-cleft at apex; plant never twining; sepals united by translucent webbing tissue 153. *Polemoniaceae*, p. 1262.
55. Ovary usually 2- or 4-celled, rarely 1-celled (56)
- 56(55). Placentae parietal (but often intruded deeply into the chamber and meeting at the center, their parietal nature then revealed only by very careful dissection); seeds small and numerous; anthers after anthesis shrivelling into a spiral or helix; leaves opposite (except in genus *Nymphoides*, of aquatic plants); cymes never scorpioid 149. *Gentianaceae*, p. 1204.
56. Placentae axile or axile-basal (except parietal in some *Hydrophyllaceae* with scorpioid cymes and more than 1 stigma); seeds few to numerous; anthers after anthesis not shrivelling into a spiral or a helix; leaves opposite or alternate (57)
- 57(56). Fruit drupaceous or a deeply lobed schizocarp of 2 to 4 achenelike mericarps 155. *Boraginaceae*, p. 1280.
57. Fruit a capsule or berry (58)
- 58(57). Each flower with a single (sometimes shallowly 2-lobed) stigma (59)
58. Each flower with 1 or 2 styles and at least 2 stigmas (60)
- 59(58). Herbs or shrubs; leaves alternate (sometimes fascicled); flowers almost exclusively radially symmetrical; fruit a capsule or berry 159. *Solanaceae*, p. 1386.
59. Either coarse stellate-tomentose alternate-leaved biennials or winter annuals with nearly regular yellow flowers (genus *Verbascum*) or opposite-leaved herbs with strongly zygomorphic corollas (genus *Penstemon*); fruit a capsule 160. *Scrophulariaceae*, p. 1408.
- 60(58). Often herbaceous twining vines or rhizomatous or stoloniferous creeping herbs, very rarely shrubs (1 species of *Bonamia* and 1 of *Ipomoea*); flowers usually solitary from the axils; ovary usually 2- or 3- or 4-celled 152. *Convolvulaceae*, p. 1241.
60. Never twining, usually small erect taprooted herbs, very rarely shrubby (1 species of *Nama*); flowers in cymes or helicoid or scorpioid cymes, or solitary; ovary usually 1-celled (2-celled in *Nama*) 154. *Hydrophyllaceae*, p. 1272.
- 61(2). Completely submerged fresh-water aquatics with much-reduced flowers and very peculiar habits (cf. also *Haloragaceae* and *Lemnaceae*) (62)
61. Either terrestrial plants or if aquatic then not completely submerged (or only briefly so at some seasons), the flowers always aerial or with a less bizarre habit (63)
- 62(61). Leaves whorled; plants usually seemingly free-floating 71. *Ceratophyllaceae*, p. 633.
62. Leaves alternate, distichous; plants attached to rocks usually in swift-flowing water 85. *Podostemaceae*, p. 713.
- 63(61). Stem-parasites not in contact with the soil (64)
63. Nonparasitic or if parasitic then appearing rooted in soil (66)

- 64(63). Vegetative parts immersed in the host; external parts (flowers) appearing as warts or bumps on the woody stems of leguminous shrubs of the genus *Dalca* ..
..... 59. *Rafflesiaceae*, p. 509.
64. Vegetative portions more extensive and conspicuous (65)
- 65(64). Vegetative parts appearing threadlike, the leaves reduced to minute scales (genus *Cassytha* of) 77. *Lauraceae*, p. 660.
65. Vegetative parts usually leafy bushes, if not leafy then stems not at all threadlike ...
..... 56. *Viscaceae*, p. 503.
- 66(63). Shrublets or subshrubs with creeping underground organs, forming colonies on low salty ground near the coast; leaves well-developed (cf. *Salicornia* where they are mere scales), opposite, fleshy, linear; pistillate flowers aggregated into and largely sunken in the axes of short axillary inflorescences; staminate flowers in spikelike axillary inflorescences 64. *Bataceae*, p. 599.
66. Habitally diverse, if fleshy then having leaves reduced to scales or alternate leaves or the inflorescences different from *Batis* (67)
- 67(66). Corolla absent, the flower either with no perianth or with only one series of perianth parts (sepals or "tepals"); (also see here *Rumex* with 2 dissimilar whorls of sepals) (68)
67. Each flower with both calyx and corolla or occasionally in families with unisexual flowers the petals absent from the pistillate ones or in some taxa petals present only in the chasmogamous flower but absent from cleistogamous ones (125)
- 68(67). Trees with flowers and fruits small and numerous in spherical heads; leaves palmately lobed (69)
68. Trees, shrubs, herbs or vines with flowers not in spherical heads or if so then leaves not palmately lobed (70)
- 69(68). Bark furrowed; leaves deeply 5- or 7-lobed to resemble a star, smooth and shiny (genus *Liquidambar* of) 88. *Hamamelidaceae*,
p. 726.
69. Bark exfoliating in thin sheets; leaves 3- or 5-lobed, usually with broad rounded shallow sinuses, the undersurfaces usually pubescent . 89. *Platanaceae*, p. 727.
- 70(68). Sepals coalescent at least near their bases either above the receptacle in hypogynous flowers or above the floral cup or hypanthium in perigynous flowers or above the ovary in epigynous ones (71)
70. Sepals free from each other either completely to the receptacle in hypogynous flowers or above the ovary in epigynous ones, or sepals absent (83)
- 71(70). Calyx tube S-shaped or U-shaped 58. *Aristolochiaceae*, p. 506.
71. Calyx tube not S-shaped or U-shaped (72)
- 72(71). Ovary completely inferior (73)
72. Ovary superior or only partly inferior near the base (75)
- 73(72). Herbs usually growing partially submerged or in mud but the flowers aerial ..
..... 135. *Haloragaceae*, p. 1136.
73. Plants never aquatic (74)
- 74(73). Erect herbs with merely opposite leaves and a pungently fetid odor (like that of a wet dog) 170. *Valerianaceae*, p. 1503.
74. Erect or often trailing herbs with whorled leaves and not strongly odoriferous (genus *Galium* of) 168. *Rubiaceae*, p. 1479.
- 75(72). Pistils several, free from each other 72. *Ranunculaceae*, p. 634.
75. Pistil solitary (76)
- 76(75). Seeds (or ovules) campylotropous, with embryos curved around the periphery surrounding the perisperm or endosperm (77)
76. Seeds not as above (80)
- 77(76). Seeds several to numerous (78)
77. Seeds solitary (79)

- 78(77). Stamens more numerous than sepals 66. *Aizoaceae*, p. 602.
78. Stamens as many as the sepals 69. *Caryophyllaceae*, p. 612
- 79(77). Calyx scalelike or scarious in texture 62. *Amaranthaceae*, p. 551.
79. Calyx not scalelike but usually corolline 63. *Nyctaginaceae*, p. 574.
- 80(76). Branches of inflorescence scorpioid (genus *Penthorum* of)
..... 87. *Saxifragaceae*, p. 717.
80. Branches of inflorescence (if any) not scorpioid (81)
- 81(80). Leaves pinnately compound (genus *Fraxinus* of) .. 147. *Oleaceae*, p. 1192.
81. Leaves simple (82)
- 82(81). Ovary 1-celled; stigma solitary; stamens 2 to 5 .. 55. *Urticaceae*, p. 498.
82. Ovary usually 3-celled; stigma usually more than 1; stamens usually more than 5 ..
..... 102. *Euphorbiaceae*, p. 923.
- 83(70). Stamen solitary; leaves opposite; low-growing subaquatics or aquatics; perianth
absent 103. *Callitrichaceae*, p. 985.
83. Stamens more numerous or if only 1 then the leaves alternate or else the plants
woody; calyx often present (84)
- 84(83). Carpels several, distinct (see also *Zanthoxylum* of the *Rutaceae*)
..... 72. *Ranunculaceae*, p. 634.
84. Carpels (when more than 1) united at least at their bases (at least at anthesis) (85)
- 85(84). Ovary completely inferior as shown by micro- or macroscopic scales or sepals
at top (use strong lens) and/or in some taxa by stamens at the very top of the
ovary (86)
85. Ovary superior or at least half-superior (93)
- 86(85). Climbing twining plant (genus *Agdestis* of) ... 65. *Phytolaccaceae*, p. 600.
86. Plants not climbers or twiners (87)
- 87(86). Plants herbaceous (88)
87. Plants woody; fruit a nutlike structure (90)
- 88(87). Ovary of several folliclelike structures partially or almost wholly immersed in
the inflorescence axis and associated floral tissue (genus *Anemopsis* of)
..... 46. *Saururaceae*, p. 448.
88. Ovary not as in *Anemopsis* (89)
- 89(88). Fruit a small indehiscent 1-seeded nut 57. *Santalaceae*, p. 506.
89. Fruit a schizocarp of 2 mericarps 137. *Umbelliferae*, p. 1139.
- 90(87). Nut subtended by a cupule of more or less consolidated bracts
..... 52. *Fagaceae*, p. 465.
90. Nut not having a basal cupule of bracts (91)
- 91(90). Leaves compound 50. *Juglandaceae*, p. 457.
91. Leaves simple (92)
- 92(91). Stipules present; leaves usually serrate 51. *Betulaceae*, p. 462.
92. Stipules absent; leaves usually entire-margined 138. *Cornaceae*, p. 1170.
- 93(85). Thorny shrubs, the thorns either straight or curved; fruits fleshy (see also
Maclura of the *Moraceae*) (94)
93. Unarmed trees, shrubs, herbs or vines, if with occasional thorns (as in *Maclura*,
Moraceae) the "fruit" an aggregate of achenes (97)
- 94(93). Thorns usually paired and short, occasionally somewhat curved; fruit orange;
styles 2 (species *Celtis pallida* of) 53. *Ulmaceae*, p. 492.
94. Thorns solitary (occasionally branched), elongate; fruit white to red or black, rarely
orange; styles usually not 2 (95)
- 95(94). Flowers with floral cup at rim of which are the 5 sepals and 5 stamens alternate
with the sepals (genus *Condalia* of) 112. *Rhamnaceae*, p. 1008.
95. Flower without a floral cup; stamens usually more than 5 (96)

- 96(95). Fruits white, translucent, drying black; ovule solitary, basal, with curved embryo (genus *Phaulothamnus* of) 65. *Phytolaccaceae*, p. 600.
96. Fruit opaque, red; ovules and seeds several, anatropous 127. *Flacourtiaceae*, p. 1078.
- 97(93). Annual herbs; sepals 4; fruit a compressed-flattened 2-celled pod with a thin narrow vertical septum parallel to the direction of compression 80. *Cruciferae*, p. 671.
97. Annual or perennial herbs or shrubs, trees or vines (98)
- 98(97). Plants herbaceous (include in this category woody-based vines and herbs which may have slightly woody stems at base but which die back to near the base every year) (99)
98. Plants woody, never vinelike (112)
- 99(98). Embryo curved, occupying the periphery of the rounded ovule and surrounding the perisperm and/or endosperm (100)
99. Embryo otherwise (108)
- 100(99). Each pistillate or perfect flower maturing only 1 seed (101)
100. Each pistillate or perfect flower maturing several seeds (rarely only 1 in *Claytonia* of the *Portulacaceae*) (105)
- 101(100). Fleshy vines with spreading white perianth ... 68. *Basellaceae*, p. 611.
101. Herbs (102)
- 102(101). Sepals dry, scalelike, for the most part not green 62. *Amaranthaceae*, p. 551.
102. Sepals herbaceous in texture (103)
- 103(102). Fruit with several hooked bristles (genus *Petiveria* of) 65. *Phytolaccaceae*, p. 600.
103. Fruit not with hooked bristles (104)
- 104(103). Stipules absent 61. *Chenopodiaceae*, p. 527.
104. Stipules present (Subfamily *Illecebroideae* of) 69. *Caryophyllaceae*, p. 612.
- 105(100). Leaves alternate; flowers in terminal racemes .. 65. *Phytolaccaceae*, p. 600.
105. Leaves alternate or opposite; flowers not in terminal racemes (106)
- 106(105). Leaves usually opposite; ovary never even slightly inferior; fruit usually dehiscent by terminal valves 69. *Caryophyllaceae*, p. 612.
106. Leaves alternate or if opposite then the fruit opening otherwise and not uncommonly at least slightly inferior (107)
- 107(106). Each flower with 2 bracteoles (or "sepals") at base which often enclose the bud; ovary 1-celled or incompletely several-celled 67. *Portulacaceae*, p. 605.
107. Flowers rarely bibracteolate; ovary completely several-celled 66. *Aizoaceae*, p. 602.
- 108(99). Fruit a capsule of several folliclelike parts, each part dehiscent through the apical portion of the ventral suture 46. *Saururaceae*, p. 448.
108. Fruit not as in *Saururaceae* (109)
- 109(108). Flowers unisexual; fruits capsular, 3-celled 102. *Euphorbiaceae*, p. 923.
109. Flowers usually bisexual; fruits achenelike, indehiscent (110)
- 110(109). Leaves palmately lobed or palmately or pinnately compound (genera *Alchemilla* and *Sanguisorba* of) 90. *Rosaceae*, p. 728.
110. Leaves not palmately lobed (111)
- 111(110). Stipules usually present, usually deciduous, never sheathing or scarious; placenta apical; ovule anatropous; achene usually not shiny, often neither lenticular nor trigonous 55. *Urticaceae*, p. 498.
111. Stipules (when present) usually sheathing; placenta basal; ovule orthotropous; achene usually smooth and shiny, either lenticular or trigonous 60. *Polygonaceae*, p. 510.

- 112(98). Plants with curved prickles on the herbage (genus *Zanthoxylum* of)
 97. *Rutaceae*, p. 906.
112. Plants not having curved prickles (113)
- 113(112). Embryo curved, occupying the periphery of the rounded ovule and surrounding the perisperm and/or endosperm (go back to couplet 102).
113. Embryo not as above (114)
- 114(113). Leaves opposite (115)
114. Leaves alternate (117)
- 115(114). Fruit a berry borne in a spike (genus *Garrya* of)
138. *Cornaceae*, p. 1170.
115. Fruit a drupe or samara (116)
- 116(115). Fruit a drupe or a simple samara147. *Oleaceae*, p. 1192.
116. Fruit a double samara, with the seed-bearing bases connate and the 2 blades diverging as in maple fruit108. *Aceraceae*, p. 1001.
- 117(114). Flower with pronounced floral cup or hypanthium; fruit an achene, sheathed by the remains of the floral cup; style long, persistent, plumose; Trans-Pecos mountains (genus *Cercocarpus* of) 90. *Rosaceae*, p. 728.
117. Flowers without pronounced floral cups or long persistent plumose styles; mostly east of Trans-Pecos Texas (118)
- 118(117). Leaves pinnately compound (genus *Pistacia* of) .104. *Anacardiaceae*, p. 986.
118. Leaves simple (119)
- 119(118). Carpels separating from each other at maturity (but persistent on torus) and each dehiscing ventrally, folliclelike (genus *Firmiana* of)
116. *Sterculiaceae*, p. 1055.
119. Carpels when more than 1 not separating from each other (120)
- 120(119). Seeds numerous, each surrounded by a basal coma of hairs
 47. *Salicaceae*, p. 448.
120. Seeds often 1 or few, with coma absent (121)
- 121(120). Androecium of 4 series, each series of 3 stamens whose anthers open by 2 or 4 uplifting valves, often an additional 3 staminodia present
 77. *Lauraceae*, p. 660.
121. Androecium otherwise, usually the stamens fewer than 12; anther dehiscence usually by longitudinal slits (122)
- 122(121). Sap usually milky; flowers unisexual, aggregated very closely either on the outside on the inflorescence axis or (in figs) lining the inside of a hollow receptacle, the entire pistillate or bisexual inflorescence at maturity constituting the "fruit" or syncarp and falling as a unit 54. *Moraceae*, p. 496.
122. Sap not milky; flowers perfect or unisexual, not forming synanthetic "fruits" that fall as unitary syncarps, each pistillate or perfect flower maturing a separate fruit (123)
- 123(122). Flowers perfect or unisexual with both sexes on the same plant, solitary or in few-flowered fascicles; calyx 4- or 5-merous; fruit a samara, a roundish drupe or a nutlike structure 53. *Ulmaceae*, p. 492.
123. Flowers unisexual, usually with male and female flowers on separate plants or sometimes on the same plant, on small spikes or aments; calyx absent at least in staminate flowers; fruit either a small wax-coated sphere or an elongate drupe (124)
- 124(123). Fruit a small wax-coated sphere; leaves subpersistent, usually toothed or lobulate above the middle 48. *Myricaceae*, p. 459.
124. Fruit an elongate leathery-skinned drupe; leaves deciduous, usually entire-margined 49. *Leitneriaceae*, p. 457.
- 125(67). Ovary inferior or mostly so (126)
125. Ovary superior or mostly so (here also see *Nelumbo* of the *Nymphaeaceae* whose separate ovaries are mostly immersed in the receptacle and certain *Rhamnaceae* and *Celastraceae* in which the massive disk may appear to adhere lightly to the side of the ovary) (134)

- 126(125). Fruit consisting of 2 achenelike mericarps which at maturity separate from each other and from the receptacle 137. *Umbelliferae*, p. 1139.
126. Fruit otherwise (127)
- 127(126). Embryo curved, forming the periphery of the roundish or disklike ovule, surrounding the perisperm and/or endosperm (go back to couplet 107).
127. Embryo and ovule otherwise (128)
- 128(127). Herbs usually with brittle stems; herbage very rough to the touch with barbed or sometimes stinging hairs; petals usually large and showy; stamens usually numerous; ovary 1-celled with 1 to 5 placentas; fruit a capsule or achene 130. *Loasaceae*, p. 1082.
128. Herbs or woody plants; herbage rarely rough or stinging; stamens few to numerous; ovary usually several-celled; fruit a capsule, drupe, berry, pome or follicetum (129)
- 129(128). Fruit a pome 90. *Rosaceae*, p. 728.
129. Fruit not a pome or if resembling one then seeds numerous (130)
- 130(129). Fruit a drupe 138. *Cornaceae*, p. 1170.
130. Fruit a berry, capsule or follicetum (131)
- 131(130). Leaves compound 136. *Araliaceae*, p. 1139.
131. Leaves simple (sometimes deeply lobed) (132)
- 132(131). Usually a long hypanthium present and prolonged above and completely obscuring the top of the ovary; stamens (often 8) usually precisely twice as numerous as the petals; fruit a capsule 134. *Onagraceae*, p. 1120.
132. Top of ovary often plainly visible at or slightly above the point of attachment of the stamens and perianth (except in *Ribes*); fruit a capsule, berry or follicetum (133)
- 133(132). Plants partially submerged weak-stemmed aquatics (genus *Myriophyllum* of) 135. *Haloragaceae*, p. 1136.
133. Plants not partially submerged 87. *Saxifragaceae*, p. 717.
- 134(125). Filaments monadelphous or diadelphous, or confluent with a gynophore (anthers free or united) (135)
134. Filaments distinct from each other or joined into more than 2 groups (145)
- 135(134). Pistil solitary and simple, often folliclelike at maturity; stigma solitary (136)
135. Pistil solitary but compound, rarely folliclelike; stigmas mostly more than 1 (137)
- 136(135). Upper 3 petals united at their clawlike base; lower 2 petals purplish or greenish, glandlike, separate 92. *Krameriaceae*, p. 889.
136. Not as in *Krameria* 91. *Leguminosae*, p. 761.
- 137(135). Flowers strongly bilaterally symmetrical; carpels usually 2; stamens monadelphous or diadelphous (138)
137. Flowers nearly radially symmetrical; carpels more than 2; stamens monadelphous (139)
- 138(137). Sepals 2; petals 4; stamens diadelphous 79. *Fumariaceae*, p. 667.
138. Sepals 5; petals usually 3; stamens monadelphous 101. *Polygalaceae*, p. 914.
- 139(137). Filament tube elongate and forming a more or less loose sheath not only around the ovary but also around the elongate style(s); stamens numerous; flowers perfect 115. *Malvaceae*, p. 1025.
139. Filament tube not so elongate (or if so then stamens only 10); stamens numerous or fewer; flowers perfect or unisexual (140)
- 140(139). Leaves bipinnately compound 99. *Meliaceae*, p. 912.
140. Leaves simple or palmately compound (141)
- 141(140). Carpels 3 as shown by number of stigmas or placentas (142)
141. Carpels 5 (143)

- 142(141). Placentae axile-apical; ovules 1 per cell 102. *Euphorbiaceae*, p. 923.
 142. Placentae parietal; ovules more numerous 129. *Passifloraceae*, p. 1079.
- 143(141). Fruit separating at maturity into 5 or 10 uni- or biovulate mericarps which fall separately 95. *Linaceae*, p. 897.
 143. Fruit not a schizocarp or if so then the cells several-seeded (144)
- 144(143). Stamens 10; herbs; leaves usually palmately or pinnately trifoliolate but in one species unifoliolate 94. *Oxalidaceae*, p. 893.
 144. Stamens 5 or if more numerous then plants woody; leaves simple 116. *Sterculiaceae*, p. 1055.
- 145(134). Aquatic perennial herbs with thick horizontal rhizomes, rooted in mud at bottom of water; leaves (at least those borne at or near the surface of the water) usually peltate or very deeply rounded-cordate 70. *Nymphaeaceae*, p. 630.
 145. Habit not as in the water-lily family (146)
- 146(145). Pistils several (each simple) and quite separate (even at base) at all stages of development (147)
 146. Pistil 1, either simple or compound (in some taxa the carpels united only near their bases as for example the Simaroubaceae, Magnoliaceae and genera of Rutaceae, Saxifragaceae, Hamamelidaceae, etc.) (151)
- 147(146). Flowers with a floral cup (or "hypanthium") at the rim of which are attached the sepals, petals and stamens; stipules usually present; endosperm absent 90. *Rosaceae*, p. 728.
 147. Calyx, corolla and androecium hypogynous or nearly so; stipules present or often absent; endosperm usually present (148)
- 148(147). Herbs (149)
 148. Trees, shrubs or vines (150)
- 149(148). Leaves usually fleshy and succulent, simple, unlobed or usually so, with entire or toothed margins 86. *Crassulaceae*, p. 714.
 149. Leaves not succulent, usually deeply lobed or compound 72. *Ranunculaceae*, p. 634.
- 150(148). Twiners and climbers 74. *Menispermaceae*, p. 656.
 150. Trees or shrubs 76. *Annonaceae*, p. 659.
- 151(146). Carpels numerous, crowded together to cover the prolonged floral axis, cohering to each other and in fruit forming a fleshy or rather woody conelike fruit, each folliclelike carpel opening longitudinally by a dorsal slit and each carpel uni- or biovulate; trees or shrubs 75. *Magnoliaceae*, p. 656.
 151. Gynoecium and fruit not as in the Magnoliaceae (152)
- 152(151). Flowers bilaterally symmetrical; petals 3, bilobed; stamens 5, each filament with a scale and all 5 scales connivent over the stigma; capsules explosively dehiscent 111. *Balsaminaceae*, p. 1008.
 152. Character combination not as above (153)
- 153(152). Flowers bilaterally symmetrical; lowermost petal spurred or gibbous; fruit a capsule with 3 valves and 3 parietal placentae 126. *Violaceae*, p. 1074.
 153. Character combination not as above (154)
- 154(153). Embryo curved around the periphery of the roundish or disklike seeds, surrounding the perisperm and/or endosperm (go back to couplet 100).
 154. Ovules and seeds not as in centrospermous plants (155)
- 155(154). Fertile stamens precisely as many as sepals and alternate with them and/or as many as petals and opposite them (156)
 155. Fertile stamens either more numerous than petals or sepals or if as few as petals or sepals then opposite the sepals and alternate with the petals (160)

- 156(155). Vines; fruit a several-seeded berry 113. *Vitaceae*, p. 1015.
156. Mostly trees, shrubs or herbs; fruit mostly drupes or capsules or (if vines) then fruit a drupe (157)
- 157(156). Petals 6 or 9, yellow; leaves usually spiny-margined; anther valves lifting like trap-doors (genus *Berberis* of) 73. *Berberidaceae*, p. 654.
157. Petals fewer, usually (4 or) 5; leaves rarely spiny; anthers dehiscing by longitudinal slits (158)
- 158(157). Fruit a drupe or a schizocarpous capsule; floral cup well-developed, the sepals, petals and stamens perigynous at the margin of the cup 112. *Rhamnaceae*, p. 1008.
158. Fruit usually a capsule; floral cup absent; perianth parts and stamens hypogynous (159)
- 159(158). Opposite-leaved herbs; capsule circumscissile (genus *Anagallis* of) 141. *Primulaceae*, p. 1181.
159. Alternate-leaved plants; capsule not circumscissile . . 116. *Sterculiaceae*, p. 1055.
- 160(155). Fruit a specialized capsule completely divided into 2 cells by a thin partition, each cell then with 2 placentae situated at the juncture of the partition and the walls, at dehiscence the 2 valves separating from the persistent partition (starting at base) and falling free 80. *Cruciferae*, p. 671.
160. Fruit not a silique or silicle (161)
- 161(160). Flowers bilaterally symmetrical, perfect, solitary in the axils of distal leaves (which are simple, exstipulate); petals 5, very unequal, the upper 3 long-clawed and distinct or partly united and usually purplish or reddish, the 2 others much smaller, broad, thick, sessile, greenish and glandlike; ovary 1-celled 92. *Krameriaceae*, p. 889.
161. Flowers (especially corolla) not as above (162)
- 162(161). Very thorny dark green desert shrubs, essentially leafless; sepals and petals 4; stamens 8; fruit a small blackish berry 125. *Koerberliniaceae*, p. 1073.
162. Character combination not as above (163)
- 163(162). Leaves palmately compound, opposite; flowers bilaterally symmetrical; fruit a leathery structure with 1, 2 or 3 seeds 109. *Hippocastanaceae*, p. 1004.
163. Character combination not as above (164)
- 164(163). Leaves tubiform, basal, trumpet-shaped, dilated upward, to 7 dm. long, partially filled with fluid, with a ridge on the adaxial side and terminated by an expanded hood to 8 cm. long; stamens numerous . . 83. *Sarraceniaceae*, p. 712.
164. Character combination not as above (165)
- 165(164). Rosettelike low nearly acaulous herbs; leaf blades usually rotund, the margins with gland-tipped hairs that exude drops of clear glittering glutinous fluid; insectivorous by means of folding leaf blades 84. *Droseraceae*, p. 712.
165. Character combination not as above (166)
- 166(165). Herbs; flowers large, terminal, usually conspicuously pedunculate; buds usually drooping until shortly before anthesis when the peduncle becomes fully erect and the 2 or 3 large sepals fall completely from the flower; petals 4 to 8 or more, usually showy; stamens many 78. *Papaveraceae*, p. 662.
166. Character combination not as above (167)
- 167(166). Tree with opposite palmately lobed leaves on long slender reddish petioles; fruit of geminate samaras (*Acer rubrum* of) . . . 108. *Aceraceae*, p. 1001.
167. Character combination not as above (168)
- 168(167). Shrub or tree with alternate simple stipulate leaves; flowers usually perfect, small, borne in small axillary pedunculate clusters or heads, with 3 sepals, petals, stamens and staminodes, and 2 long styles; capsule bivalvate, opening loculicidally from the top; seed 1 in each cell 88. *Hamamelidaceae*, p. 726.
168. Character combination not as above (169)

- 169(168). Epidermis usually nearly throughout the plant with aromatic oil-glands visible under a lens and detectible in fresh material by smell; leaves often compound (but never 2-foliolate); hypogynous disk usually present just above the androecium and below the ovary; stamens 3 to 15; ovary with more than 1 cell 97. *Rutaceae*, p. 906.
169. Character combination not as above (170)
- 170(169). Trees with simple alternate stipulate serrate leaves; cymes axillary, pedunculate, the peduncle adnate about the middle of a narrow short-petioled foliaceous membranous bract; stamens numerous; fruit a nut (genus *Tilia* of) 114. *Tiliaceae*, p. 1023.
170. Character combination not as above (171)
- 171(170). Perennial herbs forming colonies by creeping rhizomes; stems erect, the sterile ones terminated by a solitary peltate leaf, the flowering ones with 2 leaves and a single short-pedunculate nodding large flower; sepals 6, fugacious; petals 6 or 9, waxy-white (Yucca-like), to 4 cm. long; stamens 12 to 18; fruit a large yellow berry with many seeds on a single lateral placenta (genus *Podophyllum* of) 73. *Berberidaceae*, p. 654.
171. Character combination not as above (172)
- 172(171). Ovary with a slender axis 1-5 cm. long, at the base of which are 5 small cells, each with 2 ovules; at maturity when dry the cells suddenly separating from the axis and coiling up on their styles which are also adnate to the full length of the axis 93. *Geraniaceae*, p. 890.
172. Character combination not as above (173)
- 173(172). Pistil simple, folliclelike with a single style and stigma and a single ventral placenta 91. *Leguminosae*, p. 761.
173. Pistil not simple as shown by 2 or more stigmas, 2 or more cells, or 2 or more placentae (174)
- 174(173). Flowers unisexual; carpels 3 or rarely seemingly 2 (as in *Croton monanthogynus*) or 1 (as in *Crotonopsis*); fruit usually a capsule (achene in *Crotonopsis*) and usually with a well-developed central axis (columella) which persists after dehiscence; ovules 1 or 2 in each of the 1, 2 or usually 3 cells, attached to an apical-axial (columellar) placenta 102. *Euphorbiaceae*, p. 923.
174. Flowers usually bisexual; carpels 2 to 10, if 3 then character combination not as above (175)
- 175(174). Herbs with alternate palmately compound leaves (rarely reduced to 1 leaflet); flowers hypogynous, often somewhat bilaterally symmetrical; stamens 6 to 27 or more, as long as or usually longer than the petals; ovary borne on a slender gynophore (rarely nearly sessile), 1-celled (2-celled in *Wislizenia*), usually capsular with 2 valves and many seeds 81. *Capparidaceae*, p. 706.
175. Character combination not as above (176)
- 176(175). Petals and stamens either definitely perigynous, i.e., inserted in a floral cup or "calyx tube" or very slightly epigynous (the cup attached to the very basal part of the ovary) (177)
176. Petals and stamens hypogynous (rarely very slightly or obscurely perigynous as in some *Sapindaceae* and some *Celastraceae*) (180)
- 177(176). Leaves opposite; hypanthium urceolate; petals 4, fugacious, rose-color to purple (rarely white or yellow); stamens 8, basally appendiculate; anthers dehiscent by apical pores 133. *Melastomataceae*, p. 1118.
177. Character combination not as above (178)
- 178(177). Herbs; leaves mostly basal; ovary very shortly at base adnate to a floral cup; stigmas 4; capsule 1-celled, 4-valved; stamens 5, plus 5 staminodes (genus *Parnassia* of) 87. *Saxifragaceae*, p. 717.
178. Ovary superior; style 1, 2, 3 or 5, never 4; stamens 4 to numerous (179)

- 179(178). Flowers usually uniformly 5-merous (except for the gynoecium of *Physo-carpus*); stamens 10 to 40, inserted near the rim of the floral cup not very far from where the petals are inserted; stipules present . . . 90. *Rosaceae*, p. 728.
179. Flowers 4- to 7-merous; stamens 4 to numerous, usually inserted well down into the calyx tube or floral cup, whereas the petals are inserted near the rim between the short calyx teeth; stipules minute or usually absent 132. *Lythraceae*, p. 1113.
- 180(176). Shrubs or trees with numerous twigs and very numerous alternate scalelike or nearly terete leaves only about 1 mm. long, the entire plant often appearing grayish; flowers pink or white, very small, inconspicuous 121. *Tamaricaceae*, p. 1068.
180. Character combination not as above (181)
- 181(180). Leaves opposite, simple and gland-dotted (as seen with transmitted light); styles often separate or nearly so or only lightly cohering until after anthesis; mostly herbs or weak-stemmed shrubs; sepals, petals and stamens free and hypogynous or stamens in 5 phalanges opposite the petals; placentae parietal or usually axile; ovules usually numerous; fruit a capsule; stamens 6 to numerous, when numerous tending to be in as many groups as there are petals 118. *Hypericaceae*, p. 1059.
181. Character combination not as above but if most of the characters are similar then the leaves mostly alternate or the styles permanently united (182)
- 182(181). Perennial herbs with alternate or falsely verticillate simple leaves and yellow or red usually fugacious petals; styles permanently united often into a club-shaped or fungoid structure; sepals, petals and stamens free and hypogynous; placentae 3, parietal (or deeply intruded); seeds 1 to 22 per capsule; stamens 3 to 50, not clumped 123. *Cistaceae*, p. 1070.
182. Character combination not as above (183)
- 183(182). Stamens more than 15, usually numerous; flowers large; petals 25-50 mm. long (184)
183. Stamens 15 or fewer, usually 5 or 10; petals usually shorter (185)
- 184(183). Herbs; leaves palmately lobed; petals pinkish to orange; fruit a rather soft oblong-ovoid capsule 30-50 mm. long with numerous seeds on parietal placentae 124. *Cochlospermaceae*, p. 1073.
184. Shrubs; leaves not lobed; petals white; fruit a capsule about 15 mm. thick and with few seeds on axile placentae 117. *Theaceae*, p. 1059.
- 185(183). Shrubs or small trees of eastern Texas; flowers usually white, in elongate racemes usually 5-20 cm. long and only 1 cm. thick (186)
185. Habit various but if flowers in elongate racemes then plants herbaceous (187)
- 186(185). Fruit dehiscent 139. *Clethraceae*, p. 1172.
186. Fruit indehiscent 105. *Cyrillaceae*, p. 992.
- 187(185). Woody plants, occasionally scandent or perennial vines somewhat woody at base, commonly with a pubescence of medifixed hairs; leaves opposite, stipulate, simple; each sepal usually with 2 dorsal glands (absent in *Thryallis*); petals conspicuously clawed 100. *Malpighiaceae*, p. 913.
187. Character combination not as above (188)
- 188(187). Shrubs of dry areas, the branches thorny; leaves alternate, simple, either small and sparse or absent; ovary deeply lobed and at maturity the lobes largely separate (except immediately at base), each maturing into a somewhat dryish reddish drupelike mericarp 98. *Simaroubaceae*, p. 911.
188. Character combination not as in *Castela* or *Holacantha* (189)
- 189(188). Fruit indehiscent and usually fleshy, usually 1-seeded except in *Sapindus* (190)
189. Fruit dehiscent, usually dry at maturity (192)

- 190(189). Leaves pinnately compound; fruit a colorless or yellowish berry (genus *Sapindus* of)110. *Sapindaceae*, p. 1005.
190. Leaves compound or simple; fruit a usually reddish drupe (191)
- 191(190). Leaves simple, usually stipulate; stamens never more numerous than petals; drupes usually nearly circular in transection, not resinous, usually glabrous106. *Aquifoliaceae*, p. 993.
191. Leaves usually compound, usually exstipulate; stamens as many as or rarely twice as many as the petals; drupes usually somewhat flattened, resinous, often pubescent104. *Anacardiaceae*, p. 986.
- 192(189). Leaves opposite (193)
192. Leaves alternate (196)
- 193(192). Leaves compound 96. *Zygophyllaceae*, p. 901.
193. Leaves simple (194)
- 194(193). Flowers with thick-lobed disk that fills the bottom of the calyx and sometimes hides much of the ovary; plants woody, with 4-sided green-barked branchlets; seeds with bright-red arils (genus *Euonymus* of) ...107. *Celastraceae*, p. 998.
194. Disk (if present) not so thick; plants various in habit but usually mostly herbaceous in texture; seeds not with bright-red arils (195)
- 195(194). Stamens 6; sepals united high up into a tube ...120. *Frankeniaceae*, p. 1067.
195. Stamens 2 or 3, or 5 or 10; sepals free119. *Elatinaceae*, p. 1066.
- 196(192). Leaves simple but deeply pinnatifid into linear lobes (genus *Peganum* of) 96. *Zygophyllaceae*, p. 901.
196. Leaves not as in *Peganum* (197)
- 197(196). Leaves compound (198)
197. Leaves simple (200)
- 198(197). Trees with pinnately compound leaves; leaflets 13 to 41 98. *Simaroubaceae*, p. 911.
198. Herbs or vines, if woody then with leaflets fewer than 13 (usually only 3) (199)
- 199(198). Fruit with 5 cells and numerous seeds 94. *Oxalidaceae*, p. 893.
199. Fruit usually with 3 cells and only 1 seed in each110. *Sapindaceae*, p. 1005.
- 200(197). Shrubs (201)
200. Herbs or herbaceous vines (202)
- 201(200). Leaf blades often biglandular at base; styles apically fringed; fruit a many-seeded capsule128. *Turneraceae*, p. 1079.
201. Leaf blades never biglandular; styles not fringed; fruit usually a few-seeded capsule or a follicle or achene107. *Celastraceae*, p. 998.
- 202(200). Petals white; leaves linear; capsule 4-beaked, depressed-globose 82. *Resedaceae*, p. 712.
202. Petals yellow; leaves not linear; capsule not 4-beaked, usually elongate (203)
- 203(202). Leaf blades ovate to narrowly lanceolate, to 6 cm. long, serrate; herbs usually 10-100 cm. tall (genus *Corchorus* of)114. *Tiliaceae*, p. 1023.
203. Leaf blades suborbicular or nearly so, 1-3 cm. long; herbs only 5-30 cm. tall (*Oxalis dichondraefolia* of) 94. *Oxalidaceae*, p. 893.

DIVISION I. PTERIDOPHYTA²**FERNS AND FERN ALLIES**

Terrestrial epiphytic, saxicolous or occasionally aquatic plants with a life cycle of two distinct phases—Sporophyte and Gametophyte. The sporophyte is usually differentiated into root, stem, and leaf provided with vascular tissue (phloem and xylem), and produces spores asexually that are either alike (plants homosporous) or of two very unlike kinds called microspores and megaspores (plants heterosporous). The spores germinate to produce the gametophyte or minute inconspicuous sexual stage (prothallium). In the homosporous series the prothallia are similar but may be either monoecious or dioecious; in the heterosporous series they are dissimilar and dioecious—the ones developing from microspores bearing only male reproductive organs (antheridia), and those from megaspores only female organs (archegonia). Fertilization consists of the impregnation of an egg cell (archegonia) by the coiled motile male cell (spermatozoid); the resulting growth is the sporophyte or usually conspicuous asexual stage commonly known as a fern or fern ally.

The Pteridophyta include more than 9,000 species in about 215 genera. Although world-wide in distribution, they attain their greatest number and most luxuriant development in the tropics and subtropics. Of the approximately 345 species in about 60 genera found in North America north of Mexico, 111 species, representing 35 genera, occur in Texas.

FAM. 1. PSILOTACEAE EICHLER**WHISK FERN FAMILY**

Terrestrial or more or less epiphytic perennial plants with short creeping coralloid rhizomes; aerial stems and branches wiry, dichotomously branched, with minute remote alternate scalelike leaves; sporangia somewhat depressed-globose and 3-celled, opening at the apex into 2 or 3 valves, sessile in the axils of the usually 2-lobed minute sporophylls on the upper part of the numerous branches; spores all alike, numerous.

A small family of two genera, *Tmesipteris* of Oceania and Australasia, with several species, and *Psilotum*.

1. PSILOTUM Sw.

Characters of the family. About 3 species that are widely distributed in tropical or warm temperate regions throughout the world.

1. *Psilotum nudum* (L.) Beauv. Plant dichotomously branched 3 to 5 times, usually about 25 cm. tall, rarely to 5 dm. tall; common stalks simple, 3-angled, up to 4 mm. thick; branches lightly winged along the 3 angles; scalelike leaves about 1 mm. long; sporophylls rudimentary. In swamps and low wet woods about base of trees and stumps, more or less partly saprophytic, in s.e. Tex., summer; from Fla., n. to S.C., w. to Tex., through Mex. and C. A. to s. S. A. and in W.I.; also widely distributed in the Old World trop.

FAM. 2. LYCOPODIACEAE REICHB.**CLUBMOSS FAMILY**

Low terrestrial erect or trailing perennial plants; stems mostly prostrate or arching and giving rise to aerial peduncles or branches, alternately branched or repeatedly dichoto-

² Cf. D. S. Correll in C. L. Lundell, *Flora of Texas I*: 3-121. 1955, and *Ferns and Fern Allies of Texas*. 1956, for more detailed treatments.

moss, densely or sparsely covered with small leaves; leaves numerous, mostly small and thin, 1-nerved, usually uniform and imbricate, several- to many-ranked, rigidly ascending to spreading-reflexed; sporophylls similar to the vegetative leaves or more or less modified, crowded into a cone at the apex of the aerial stems; sporangia large, in the axils of the sporophylls, uniform, 1-celled; spores all alike (plants homosporous), small, globose, light yellow; prothallia fleshy, tuberous, monoecious.

This family is composed of two genera, the monotypic genus *Phylloglossum*, of Australia and New Zealand, and *Lycopodium*.

1. LYCOPODIUM L. CLUBMOSS

Characters same as those of the family. About 450 species that are found mainly in temperate and mountainous tropical regions.

- 1. Stems arching and rooting, not truly prostrate; stem leaves spreading radially
 1. *L. alopecuroides* var. *alopecuroides*.
- 1. Stems prostrate (2)
- 2(1). Foliage leaves unlike sporophylls; stem leaves spreading, arranged so as to appear 2-ranked 3. *L. carolinianum*.
- 2. Foliage leaves and sporophylls similar (3)
- 3(2). Sporophylls incurved, appressed; cone slender, only slightly thicker than the supporting peduncle 2. *L. adpressum*.
- 3. Sporophylls more or less spreading; cone stout, 2 to 3 times the diameter of the supporting peduncle 1. *L. alopecuroides* var. *pinnatum*.

1. *Lycopodium alopecuroides* L. var. *alopecuroides*. FOXTAIL CLUBMOSS. Peduncles to 35 cm. tall; cone 2-10 cm. long; leaves linear-lanceolate, bristle-toothed below, 6-8 mm. long; sporophylls similar to leaves in shape and size. In wet places in savannahs and boggy areas in low open pinelands in s.e. Tex., July-Nov.; from Fla., in the Coastal Plain, n. to N.Y. and w. to Tex.; also S. A.

The outstanding characteristic by which var. *alopecuroides* is most easily recognized in the field is the arching stem that usually roots at the tip when it touches the ground, and the several more or less erect peduncles.

Var. *pinnatum* (Chapm.) Lloyd & Underw. CREEPING FOXTAIL CLUBMOSS. The prostrate habit of this variety is the only characteristic separating it from var. *alopecuroides*. *L. prostratum* Harper. Apparently isolated in Travis Co.; also from cen. La., e. to Fla. and n. along the coast to N.C.

2. *Lycopodium adpressum* (Chapm.) Lloyd & Underw. SOUTHERN CLUBMOSS. Peduncles to 3 dm. tall and about 3 mm. in diameter; cone slender, 2-7 cm. long; leaves linear-lanceolate to lanceolate, entire or slightly toothed below, 6-7 mm. long; sporophylls similar to the leaves. *L. alopecuroides* var. *adpressum* Chapm. In depressions in savannahs and flat open pinelands, bogs and sphagnous habitats in e. and s.e. Tex., June-Oct.; mostly on Coastal Plain from Fla., n. to N.Y. and w. to Tex.

The incurved appressed leaves on the peduncle and the slight difference in size between the peduncle and cone are distinctive.

3. *Lycopodium carolinianum* L. SLENDER CLUBMOSS. Peduncles slender, rigidly erect, to 25 cm. tall and 1.5 mm. in diameter; cones 1-5 cm. long and about twice the diameter of the peduncle; leaves of the peduncle subulate, in whorls or scattered, about 5 mm. long; sporophylls broadly ovate to deltoid, acuminate, about as long as the peduncle leaves. Rare in depressions in savannahs and open flat pinelands in s.e. Tex., July-Sept.; from Fla., n. to N.Y., w. to Tex.; also occurring as variants in S.A., Asia, Afr., Austral. and N. Zeal.

The erect slender peduncle with scattered small leaves and sporophylls different from the foliage leaves are distinctive.

FAM. 3. SELAGINELLACEAE METT.

SPIKEMOSS FAMILY

Small terrestrial or saxicolous plants of spreading habit, prostrate to ascending or suberect, usually profusely branched, with slender stems; stems leafy, usually producing wiry elongate rhizophores at some or all the nodes; leaves all alike or of two kinds, elliptic to lanceolate, several-ranked or in two planes, numerous, minute, 1-nerved, obscurely ligulate, approximate to widely imbricate; sporophylls somewhat modified, borne in compact sessile cones at the apex of branches; sporangia of two kinds (plants heterosporous), solitary in the axils of sporophylls, 1-celled; megasporangia containing 1 to 4 rather large megaspores; microsporangia containing numerous microspores.

Only one genus in the family.

1. SELAGINELLA BEAUV.

Characters same as those of the family. About 700 species are recognized in this complex genus that is highly developed in tropical and subtropical regions of both hemispheres.

1. Plants delicately thin-herbaceous, flaccid, in moist habitats; stem leaves distant, spreading 1. *S. apoda*.
1. Plants not as above, in xerophytic habitats; stem leaves closely or loosely imbricate, not noticeably spreading (2)
 - 2(1). Plants forming conspicuous rosettes (3)
 2. Plants typically forming dense mats, not noticeably rosulate (4)
 - 3(2). Leaves conspicuously white-marginate, broadly rounded or at most short-cuspidate at the apex 2. *S. lepidophylla*.
 3. Leaves not conspicuously white-marginate, with a long white seta terminating the acute apex 3. *S. pilifera*.
 - 4(2). Plants wholly prostrate or creeping and spreading, not erect (5)
 4. Plants assurgent to ascending or erect (9)
 - 5(4). Stems definitely dorsiventral; leaves strongly upswept in habit, those of the lower side of stem usually somewhat larger than the leaves of the upper side (6)
 5. Stems not at all dorsiventral; leaves all alike and symmetrically arranged on the stem (8)
 - 6(5). Seta of leaves stout, yellowish-white, not sharply distinguished from the leaves 9. *S. Wrightii*.
 6. Seta of leaves slender, whitish, arising rather abruptly at apex of leaves (7)
 - 7(6). Seta persistent, 0.5 mm. long or more 12. *S. peruviana*.
 7. Seta readily broken off in age, usually less than 0.3 mm. long 13. *S. arizonica*.
 - 8(5). Leaves linear-lanceolate to subulate, usually about 2 mm. long 10. *S. Underwoodii*.
 8. Leaves typically ovate-elliptic, usually 1.5 mm. long or less 8. *S. mutica*.
 - 9(4). Leaves without a conspicuous terminal seta, 1.5 mm. long or less 7. *S. viridissima*.
 9. Leaves with a prominent terminal seta, usually more than 1.5 mm. long (10)
 - 10(9). Plants rigidly erect to strongly ascending, usually much less than 1 dm. tall 6. *S. Riddellii*.
 10. Plants assurgent to laxly ascending or weakly erect, often 1 dm. tall or more (11)
 - 11(10). Stems short and compact, more or less dorsiventral with the leaves of the lower side larger than those of the upper side 11. *S. densa* var. *scopulorum*.
 11. Stems lax and open, not dorsiventral, with the leaves all alike (12)

- 12(11). Leaves lance-aciculate, evenly attenuate to an elongate yellowish-white seta that is about 1 mm. long4. *S. rupincola*.
12. Leaves subulate-attenuate to an acutish apex, giving rise rather abruptly to a short whitish seta that is 0.5 mm. long or less5. *S. × neomexicana*.

1. *Selaginella apoda* (L.) Spring. MEADOW SPIKEMOSS. Plants annual, frequently forming light- or bright-green mats on moist soil among grasses; leaves ovate to ovate-lanceolate, asymmetrical, the margins serrulate, 1-2 mm. long and about 1 mm. wide; cones to 2 cm. long and 4 mm. in diameter. *S. ludoviciana* A. Br. In moist places, usually in partial shade, in e. and s.e. Tex., w. into the Edwards Plateau and Rio Grande Plains, May-Dec.; from Me., w. to B.C., s. to Fla. and Tex.

2. *Selaginella lepidophylla* (Hook. & Grev.) Spring. RESURRECTION PLANT, SIEMPRE VIVA, FLOR DE PIEDRA. Plant hygrosopic, forming a distinct rosette of bright-green cespitose branches when moist, the branches inrolled to form a tight nestlike ball when excessively dry, to about 2 dm. across when expanded; leaves about 1 mm. long, broadly ovate to suborbicular, rounded to slightly cuspidate at apex, ciliolate on the prominently hyaline margins; cones at the ends of the ultimate branchlets, strongly quadrangular, to 15 mm. long and 1.5 mm. wide. On dry limestone ledges, bluffs and talus slopes, especially under and around large boulders where soil has accumulated on north-facing slopes, up to 6,500 ft. alt. in w. Tex., Apr.-Jan.; from Tex. and N.M., s. to s. Mex.

The plant is widely sold as a novelty and, in Mexico, great numbers are collected for this purpose.

3. *Selaginella pilifera* A. Br. RESURRECTION PLANT. Similar in habit and characteristics to *S. lepidophylla* but usually smaller in size and with more slender, less rigid, stems and paler green bristle-tipped leaves that are ovate to elliptic-lanceolate and about 2 mm. long; cones to 1 cm. long and 1.5 mm wide. *S. Pringlei* Baker, *S. pilifera* var. *Pringlei* (Baker) Morton. On rocky slopes and floors of limestone canyons, up to 6,000 ft. alt. in w. Tex., June-Oct.; from Tex., N.M. and n. Mex.

4. *Selaginella rupincola* Underw. Stems assurgent to nearly erect, ascendingly branched, to 7 cm. long or more, the shoots equally clothed on all sides by 8 ranks of appressed linear-lanceolate leaves that are 2-3 mm. long and are terminated by elongate whitish or occasionally tawny setae that form a conspicuous tuft at the end of sterile shoots, with 15 to 20 cilia on each side; cones quadrangular, to 1 cm. long. On shaded cliffs and ledges of igneous rocks, on open rocky hillsides, and in depressions on large boulders, up to 6,000 ft. alt. in w. Tex., July-Oct.; from Tex. to Ariz. and cen. Mex.

5. *Selaginella × neomexicana* Maxon. Because of its abortive spores and intermediate morphological characters, this plant is considered to be a putative hybrid of *S. mutica × S. rupincola*. The erect to ascendent branches with buds at their base are characteristics of *S. rupincola* while the typically linear-lanceolate leaves (usually with a strongly carinate apex) suggests *S. mutica*. On dry granite rock ledges, cliffs and canyon walls, slopes and boulders, up to 5,500 ft. alt. in w. Tex., June-Nov.; from Tex. to Ariz.

6. *Selaginella Riddellii* Van Eselt. Plants erect to ascending, cespitose, to 12 cm. tall; leaves triangular- to linear-lanceolate, acute-setaceous, deeply sulcate dorsally, 1.2-1.8 mm. long, minutely 6- to 12-ciliate on each side. *S. arenicola* Underw. subsp. *Riddellii* (Van Eselt.) R. Tryon. In sandy or gravelly soil in open woods, on sunny ledges, open rocky slopes, dry sandy ridges and barrens, in e. third of Tex., throughout the year; Ala. to Okla. and Tex.

7. *Selaginella viridissima* Weath. Plants erect or ascending, densely cespitose, usually about 1 dm. tall; leaves subulate-linear to linear-lanceolate, mucous at apex, about 1.5 mm. long, the margin sparsely denticulate. *S. Coryi* Weath. On large boulders, ledges and walls of canyons and on high mt. slopes, up to 7,500 ft. alt. in w. Tex., June-Aug.; Tex. and Coah.

Readily separated from other Texas species having an erect growth by its rather thick and convex mucous leaves. Its erect habit and differently shaped nonciliate leaves also separate it from the mucous-leaved *S. mutica*.

8. *Selaginella mutica* D. C. Eat. Plants wholly prostrate to form dense mats; leaves 6-ranked, typically ovate-elliptic and obtuse to subacute, 1-2 mm. long, minutely ciliolate on each side with about 9 cilia. On rocks of various kinds (limestone, basalt and sand-

stone), cliffs and ledges in steep dry canyons and on mt. slopes, up to 7,000 ft. alt. in w. Tex., Apr.-Oct.; from e. Ut., Colo. and Ariz., e. to w. Tex.

The several varieties found in Texas may be distinguished as follows:

1. Cilia (at least the upper) short, stiff, strongly ascending; sporophylls merely short-fimbriate; leaves with a short (0.2 mm. or less) terminal seta. var. *limitania* Weath.
1. Cilia of the foliage leaves long, weak and spreading; sporophylls definitely ciliate (2)
- 2(1). Leaves mucous or at most short-mucronatevar. *mutica*.
2. Leaves with a terminal seta to 0.4 mm. longvar. *texana* Weath.

9. *Selaginella Wrightii* Hieron. Plants wholly prostrate, the main stems rather rigid, to 12 cm. long, rooting at the branch nodes; leaves in 6 to 8 ranks, linear-lanceolate, the apical seta rufous-lutescent, with short-pungent cilia on the margins; cones erect, quadrangular, usually numerous, to 3 cm. long. On dry rocks, open hills, caprock, exposed flat rock outcrops, and on walls and ledges of canyons, usually on limestone, frequently forming large mats, up to 4,000 ft. alt. in w. half of Tex., Mar.-Dec.; from cen. Tex. and N.M. to cen. Mex.

A creeping plant often found carpeting shallow soil on limestone outcrops and commonly on ledges of north-facing cliffs. The erect spikes are usually produced in great abundance. In its prostrate habit and recurved sterile branchlets *S. Wrightii* superficially resembles *S. peruviana*. The stems, however, of *S. Wrightii* are shorter, the leaves chartaceous to subcoriaceous, decidedly greener, and much longer (up to 3.5 mm. long), the attenuate apex is tipped by a short, stiff, lutescent seta, and longer cilia.

10. *Selaginella Underwoodii* Hieron. Plants wholly prostrate; leaves loosely imbricate, linear-lanceolate to subulate, 1.5-2.5 mm. long, long-setigerous at the rather abruptly acute apex, at first bright-green, becoming brownish with age. On cliffs, rock ledges and rocky mt. slopes, floors of canyons, up to 8,000 ft. alt. in w. Tex., July-Oct.; from s.w. Tex and w. Okla. to Wyo., Ut., Ariz. and Chih.

11. *Selaginella densa* Rydb. var. *scopulorum* (Maxon) R. Tryon. Stems short, forming flat cushionlike mats; leaves ligulate to ligulate-lanceolate, setaceous; sporophylls eciliate toward the apex. On cliffs, talus slopes, ledges, among boulders or in thin soil over rocks, on igneous or sedimentary rocks, in Tex. found only in Brewster Co. on a sandstone slope 3 miles e. of Study Butte; Alta. to B.C., s. to Tex., Ariz. and n. Calif.

12. *Selaginella peruviana* (Milde) Hieron. Plants wholly prostrate; leaves curving upward to give a definite dorsiventral aspect to the plant, subulate to lanceolate-subulate, to 3 mm. long, setigerous at the acute apex, with 7 to 10 whitish widely spreading oblique or ascending cilia on each side. *S. Sheldonii* Maxon. On ledges of various types of rock (mostly igneous) and talus slopes, edge of rim-rock, in soil or on rocks along streams, commonly forming large mats, up to 7,600 ft. alt. in cen. and w. Tex., June-Oct.; from w. Okla. to Tex., N.M., Coah. and Chih.

13. *Selaginella arizonica* Maxon. Leaves linear-lanceolate, mostly 2-3 mm. long and about 0.5 mm. wide, with 12 to 22 oblique cilia on each side; cone to 5 mm. long; sporophylls ovate-deltoid, to 2 mm. long. On rocky slopes, ledges and cliffs or in depressions on boulders, up to 5,500 ft. alt., in several cos. in the cen. Trans-Pecos Tex. with an isolated locality in Mason Co. on the Edwards Plateau, July-Oct., from cen. Tex. to Ariz. and n. Mex.

Allied to *S. peruviana* but the shorter subsistent seta separates it from that species. Although the stiff straight or reflexed scabrous setae are readily broken off in age there are always some leaves in all plants that retain their setae.

FAM. 4. ISOETACEAE REICHB.

QUILLWORT FAMILY

Small herbaceous perennial aquatic or terrestrial sedgelike plants with short unbranched 2- to 5-lobed subterranean cormlike rhizomes that produce numerous branched roots and a tuft of compact erect or recurved rushlike leaves (sporophylls); leaves bearing a small membranous ligule on the inner surface just above the sporangium;

sporangia of two kinds, sunken in the axils of the leaf bases, more or less covered by a velum; the microspores germinate into prothallia that bear only a solitary antheridium; the megaspores germinate into prothallia that bear only archegonia.

This family is represented by two genera, *Isoetes* and *Stylites*.

1. ISOETES L. QUILLWORT

Characters same as those of the family. About 75 species that are widespread in temperate and tropical regions of both hemispheres.

1. Velum complete; megaspores dark-brown when wet, small-tuberculate; leaves 12 cm. long or less; plants light-brown at base 1. *I. lithophylla*.
1. Velum narrow, usually covering not more than one third of sporangium; megaspores whitish, nearly smooth to granular; leaves usually much more than 15 cm. long; plant usually blackish-brown at base 2. *I. melanopoda*.

1. *Isoetes lithophylla* Pfeiffer. ROCK QUILLWORT. Leaves 6 to 14. In shallow depressions and temporary pools on rock outcrops and mts. of granite, found only in Burnet and Llano cos. on the Edwards Plateau where it is apparently endemic, Apr.-June.

2. *Isoetes melanopoda* Gay & Durieu. Leaves 10 to 50. *I. melanopoda* var. *pallida* Engelm. In shallow ponds, bogs, old buffalo wallows, wet thickets and woods (especially pinelands), in seasonal streams and temporary sedge-grass puddles in meadows and prairies, and in temporary pools on granite outcrops, widely distributed but uncommon in e. Tex., w. to Mason Co. on the Edwards Plateau, Mar.-Oct.; from N.J., w. to Minn., S.D. and Ill., s. to Ga., La., Okla. and Tex.

FAM. 5. EQUISETACEAE RICH. HORSETAIL OR SCOURING-RUSH FAMILY

Large or small terrestrial rushlike plants with wide-creeping branching perennial rhizomes; roots felted, annual; aerial stems perennial or annual, cylindric, fluted, stout or slender, jointed, simple or with whorls of branches at the solid nodes, with usually hollow internodes, often roughened by a coating of silex; stomata arranged in regular rows or broad bands in the grooves; stem leaves minute, reduced and united to form toothed sheaths at the nodes, the free or connivent apical teeth persistent or deciduous; sporophylls aggregated into a cone or strobile at the summit of the main stem or at the apex of the branches, modified as stalked peltate scales; sporangia 6 or 7 under each scale, opening down the inner side; spores all alike, numerous, green; prothallia in damp places above ground, green, monoecious or dioecious, variously lobed.

The family is represented only by the following genus.

1. EQUISETUM L.

Characters same as those of the family. A complex genus consisting of about 23 species that are widespread in both hemispheres.

1. Aerial stems dimorphic; fertile stems light-brown, early-withering; sterile stems green, with regular whorls of branches 1. *E. arvense*.
1. Aerial stems uniform, without regular whorls of branches (2)
- 2(1). Cones rounded at the summit, without a firm sharp tip; stems annual, soft and easily crushed 2. *E. kansasum*.
2. Cones tipped by a firm dark point; stems perennial (evergreen), firm and resistant or somewhat soft (3)

- 3(2). Sheaths dilated upward, green (when young), with a narrow black band at the summit below the promptly deciduous teeth, frequently with a second irregular band below; stems smoothish, only slightly scabrous .3. *E. laevigatum*.
3. Sheaths cylindric, tightly pressed to the stem, ashy-gray, usually with 2 black bands, sometimes entirely black, the teeth mostly subsistent or irregularly deciduous; stems firm, scabrous4. *E. hyemale* var. *affine*.

1. *Equisetum arvense* L. BOTTLE BRUSH. Sterile stems to 75 cm. tall, usually much smaller; sheaths of fertile stems with 8 to 12 brown lance-acuminate teeth; cones cylindric to ovoid, obtuse, to 4 cm. long and 1 cm. in diameter; sheaths of sterile stems tipped with about 12 sharp brown teeth. In sandy or clayey soil along streams and about lakes, in meadows, low ground and open woodlands, and on railroad embankments, in Tex. found only at Buffalo Spring (now known as Buffalo Lakes) in Lubbock Co., in the Plains Country; from Nfld., w. to Alas. and s. to N.C., Ala., Tex. and Calif.; also Euras. and N. Afr.

2. *Equisetum kansanum* J. H. Schaffn. Stems 3-10 dm. tall, 2-7 mm. in diameter, usually very smooth to the touch, light-green; sheaths elongate, dilated upward, pale-green except for a narrow black band at summit, the articulate teeth soon deciduous; cone sessile or shortly pedunculate, 1-2.5 cm. long, 5-8 mm. in diameter. In moist or dry sandy or clayey soil, on bluffs, along irrigation ditches and lakeshores, in prairies, ditches, sloughs and among grasses and shrubs in marsh and swamp areas, mostly in the Plains Country, Trans-Pecos and s.e. Edwards Plateau, with a lone station in Somervell Co. in the Blackland Prairies; from Mich. to B.C., s.w. through the Lake States to Mo., Tex., N.M. and s. Calif.; also n. Mex.

Except for the absence of the hard blackish apicule on its cone, the smoother texture of its cone, and its annual habit, this species approaches very closely *E. laevigatum*. Two rather insignificant growth forms of this species occur in Texas; f. *caespitosum* (A.A.Eat.) Broun, with many small rough stems clustered around a large central one, and f. *variegatoides* (A.A.Eat.) Broun, with 6 to many small prostrate to ascending stems arising from the apex of the rhizome or about the old stems of the previous year.

3. *Equisetum laevigatum* A. Br. COLA DE CABALLO, CAÑUELA. Stems mostly clustered, 3-15 dm. tall, to 8 mm. in diameter. Distinguished from *E. hyemale*, which it closely resembles, by its smoothness, long green sheaths with a narrow black limb, and darker green color. In sandy soil or sandy loam along streams and lake banks, on seepage slopes, in alluvial thickets, marshes, meadows, prairies, sandy barrens and rocky creek beds of canyons, rather generally distributed in w. and cen. Tex., e. to Somervell and Waller cos. in the Blackland Prairies and s. to Starr Co. in the Rio Grande Plains; from Anticosti Is. and Que. to B.C., s. to N.C., La. and Tex.; also Mex. and Guat.

4. *Equisetum hyemale* L. var. *affine* (Engelm.) A.A.Eat. CAÑUELA. Stems erect, evergreen, stout, up to 3 m. tall and 25 mm. in diameter, fluted with numerous ridges that are scabrous with bands of siliceous tubercles; sheaths 5-12 mm. long, cylindric, not dilated above, usually with a black band at the base and apex, the marginal teeth long and flexuous; cone ovoid to cylindric-ellipsoid, apiculate, 15-25 mm. long, 5-10 mm. in diameter. *E. prealtum* Raf., *E. robustum* A. Br., *E. hyemale* var. *robustum* (A. Br.) A. A. Eat. In sandy or loamy soil in open or wooded areas along streams and on alluvial flats, in seepage and on wet ledges, rather generally distributed throughout Tex. but most frequent in the Blackland Prairies and on the Edwards Plateau; represented in most of the U. S. and Can. as well as in Mex. and Euras.

Two insignificant forms of this species occur in Texas; f. *Drummondii* (Milde) Broun having very tight sheath adorned with black and white rings, and f. *texanum* (Milde) Broun with long green amplified sheaths.

FAM. 6. OPHIOGLOSSACEAE PRESL

ADDER'S-TONGUE FAMILY

Succulent or herbaceous terrestrial or occasionally epiphytic plants with short fleshy rhizomes bearing numerous fibrous to tuberous-thickened roots; fronds solitary or clustered, the blade erect or bent in bud (not circinate), erect or pendent when epiphytic, consisting

of a basal common stalk bearing at its apex a simple to variously compounded sessile or stalked sterile blade and (if fertile) one or more erect or pendent stalked spore-bearing spikes or panicles; sporangia in two rows, naked, opening by a transverse slit, formed from the interior tissue of the sporophyll; spores numerous, all alike, yellowish; prothallia subterranean, not green.

This family is composed of four genera, including the monotypic Australasian genus *Helminthostachys*, the monotypic South African genus *Rhizoglossum* and the following genera.

- 1. Veins dichotomous and open; sterile blades ternately divided and variously dissected, rarely simple1. *Botrychium*, p. 43.
- 1. Veins reticulate; sterile blades simple or rarely palmatifid2. *Ophioglossum*, p. 43.

1. BOTRYCHIUM Sw. GRAPE-FERN

Succulent to thin-herbaceous plants of rich moist woods, with erect rhizomes bearing fleshy or tuberous-thickened coarse roots; fronds solitary or several, erect or spreading; common stalks entirely or partly underground, erect; sterile blades erect or bent down in veneration, subsessile to long-stalked, more or less ternately divided and variously dissected or rarely simple, with the ultimate segments mostly small, free-veined; fertile panicles long-stalked, usually bipinnate; sporangia rather large, globose, sessile or essentially so; buds for the following season borne at the apex of the rootstocks, exposed or enclosed within the base of the common stalk.

About 40 species widespread mainly in temperate regions.

- 1. Blade long-stalked, coarsely divided, the comparatively few ultimate segments ovate to oblong-lanceolate with the margins crenulate to serrulate1. *B. dissectum* var. *tenuifolium*.
- 1. Blade sessile, rather finely divided, the numerous ultimate segments oblong and coarsely toothed at the apex2. *B. virginianum*.

1. *Botrychium dissectum* Spreng. var. *tenuifolium* (Underw.) Farw. Plants slender, lax, 10-35 cm. tall; common stalks rarely as much as 8 cm. long; sterile blades thick-herbaceous, to 2 dm. long and 25 cm. wide; fruiting spikes long-stalked, to 12 cm. long. *B. tenuifolium* Underw., *B. obliquum* of auth. In low wet open woods, swamps, moist sandy pinelands, frequently on or about rotting wood, widely distributed but uncommon in the Timber Belt, s. to Jefferson Co. in the Coastal Prairies and w. to Brazos Co. in the Blackland Prairies; from Fla. to e. Tex., n. at least to Mo., s. Ind., and the Coastal Plain of Va. and Md.

2. *Botrychium virginianum* (L.) Sw. RATTLESNAKE-FERN. Plants slender, erect, 8-75 cm. tall; common stalks rarely less than 1 dm. long; sterile blades thin-membranous, to 3 dm. long, often broader than long; fruiting spikes to 25 cm. long. In moist rich woodlands and thickets, occasionally in alluvial soil of swamps, widespread but uncommon in the Timber Belt, w. to Kerr Co. on the Edwards Plateau; from Lab. and Nfld., s. to Fla., w. of B.C. and Ariz.; also Mex. and Euras.

2. OPHIOGLOSSUM L. ADDER'S-TONGUE

Small fleshy-succulent terrestrial or epiphytic plants of wet or moist soils, with short (sometimes bulbous) subterranean rhizomes bearing fibrous roots; fronds one or more from the same rhizome, erect in veneration, glabrous; common stalks slender, terete; sterile blades simple or palmatifid (in the Floridian *O. palmatum* L.), sessile or short-stalked, with the veins profusely reticulate; fertile spikes slender, erect, long-stalked; sporangia large, coalescent in two ranks, subglobose; spores numerous, yellow; buds of the following season borne at the apex of the rhizomes, exposed, free.

About 40 species of wide distribution in both hemispheres.

1. Rootstocks globose-bulbous; leaf blades (when spread out) with a cordate to very broadly cuneate base1. *O. crotalophoroides*.
1. Rootstocks cylindrical to subglobose, not globose-bulbous; leaf blades with a rounded to cuneate base (2)
 - 2(1). Blade distinctly and prominently apiculate; principal veins characteristically forming large primary areoles in which are included numerous veinlets forming secondary areoles4. *O. Engelmannii*.
 2. Blade rounded to acute at apex, rarely minutely apiculate; principal veins forming areoles not enclosing smaller secondary areoles but sometimes with included free veinlets (3)
 - 3(2). Blade inserted near base of plant; rootstocks subglobose2. *O. nudicaule* var. *tenerum*.
 3. Blade inserted towards middle of plant; rootstocks cylindrical (4)
 - 4(3). Blade small, usually less than 5 cm. long, typically ovate-lanceolate and acute, with 4 to 8 parallel veins passing down through base of blade3. *O. petiolatum*.
 4. Blade larger, usually more than 5 cm. long, broadly elliptic to oblong-elliptic or very rarely ovate, rounded at apex, typically with 8 to 20 parallel veins passing down through base of blade5. *O. vulgatum*.

1. *Ophioglossum crotalophoroides* Walt. Plant usually small, to 15 cm. tall; rootstocks about 8 mm. in diameter; common stalks mostly less than 3 cm. long; sterile blades orbicular-ovate to ovate, to 35 mm. long and 25 mm wide; fruiting spikes usually on short stalks that are to 7 cm. long, thick and abbreviated, sharp at apex, 3-4 mm. in diameter; sporangia 3 to 12, partly imbedded in the rachis. *O. pusillum* Nutt. In damp pastures, moist sandy soil of open pine forests, and on grassy slopes, rare in s.-cen. and s.e. Tex. (Bastrop, Hardin and Harris cos.), found once on top of Enchanted Rock (Llano Co.), reported by Reverchon from Newton Co. in the Timber Belt; from cen. peninsular Fla. to S.C. and w. to Tex.; also from Mex. to S. A.

2. *Ophioglossum nudicaule* L. f. var. *tenerum* (Prantl) Clausen. Plant mostly small and inconspicuous, to 12 cm. tall; common stalks mostly less than 1 cm. long; sterile blades ovate to elliptic or somewhat oblanceolate, to 15 mm. long and 8 mm. wide; fruiting spikes on very slender elongate weak stalks, much exceeding the sterile blades, with a sharp tip, to 2 mm. in diameter; sporangia as many as 12 on each side of the rachis. On grassy slopes and in wet meadows, damp depressions in pinelands, moist open woods, and on the edge of bogs, rare in Hardin Co. in s.e. Tex.; from Fla. and Ga., w. to Tex.; also Mex. to Arg., the W. I., Sumatra and the Phil.

3. *Ophioglossum petiolatum* Hook. ADDER'S TONGUE. Plant to 21 cm. tall; common stalks 2-9 cm. long; sterile blades thin in texture, to 6 cm. long and 1.7 cm. wide; fruiting spikes on stalks to 9 cm. long, 1-4 cm. long; sporangia to 1 mm. in diameter. In moist meadows, damp grassy places, depressions in old inland or coastal dunes, occasionally in moist woodlands and thickets, in Tex. only in Wink Co. in dunes about 10 miles n.e. of Kermit, in the Plains Country; in Fla., S.C. and Tex., Mex., the W. I. and n. S. A.; also in trop. Afr., Asia and Oceania.

4. *Ophioglossum Engelmannii* Prantl. Plant to 25 cm. tall; common stalks to 1 dm. long; sterile blades mostly elliptic, to 1 dm. long and 35 mm. wide; fruiting spikes on slender stalks to 1 dm. long, cylindrical, apiculate, to 3 cm. long and 4 mm. in diameter; sporangia to about 30 on each side of the rachis. *O. vulgatum* f. *Engelmannii* (Prantl) Clute. Usually found in large colonies in thin black soil on limestone barrens or ledges, rocky woodland slopes, in cedar brakes or in clayey soil along streams, occasionally invading pastures and old fields, generally distributed and rather frequent in the Blackland Prairies, with a few stations in the Timber Belt; from Va. to cen. Fla., w. to s. Ill., Kan. and Ariz.; also Mex.

5. *Ophioglossum vulgatum* L. Plant often tall and slender, to 35 cm. tall; common stalks to about 9 cm. long; sterile blades ovate to lanceolate, to 12 cm. long and 5 cm. wide; fruiting spikes on slender elongate stalks that are to 17 cm. long, to 4 cm. long and 3-5 mm. in diameter, compressed-cylindrical apiculate; sporangia to 30 on each side

of rachis. In moist open woods, meadows, alluvial woodlands and swamps, rare in several cos. in the n. Timber Belt of e. Tex. and in Jefferson Co. in the Coastal Prairies, reported (*vide* Clausen) from Denton and Harris cos.; from P. E. I. and N. S., s. to Fla., w. to Ont., Tex. and (?) Ariz.; also Mex., Alas. and Euras.

FAM. 7. SCHIZAEACEAE MART. CURLY-GRASS FAMILY

Terrestrial plants, rigidly erect to climbing, small and inconspicuous to rather large and prominent, with short or slender-creeping to ascending rhizomes; fronds erect to twining, of diverse forms; sporophylls borne on the fronds or on specialized fronds; sporangia superficial, borne singly or in a double row on narrow specialized leaf segments or upon slender ultimate divisions of specialized nonfoliose pinnae, usually obovoid, sessile, having a complete articulated annulus at the apex, dehiscing by a longitudinal slit, without indusia or with false indusia; prothallia green, flat, simple or somewhat filamentous and branched.

This family comprises four genera with about 160 species that are almost entirely confined to tropical regions of both hemispheres. They are rare in temperate regions.

1. Plants erect; sterile pinnae ovate to lanceolate 1. *Anemia*, p. 45.
 1. Plants climbing, twining; sterile and fertile pinnae palmate
 2. *Lygodium*, p. 45.

1. ANEMIA Sw.

About 90 species, mostly in tropical America.

1. *Anemia mexicana* Kl. Fronds to 5 dm. tall, from a hairy creeping rhizome; stipe to 3 dm. long; sterile portion of blade deltoid-ovate, pinnate, to 22 cm. long and 15 cm. wide; sterile pinnae in 4 to 6 pairs, subcoriaceous, with serrulate margins; fertile pinnae long-petioled, to 3 dm. long and 5 mm. in diameter, glandular, the pinnules composed of densely clustered sporangia. *Ornithopteris mexicana* (Kl.) Underw. On partially sheltered limestone ledges and bluffs, wooded rocky slopes, bank of dry ravines, rock walls of limestone conglomerate and clay in canyons and gorges, in s. half of the Edwards Plateau, with a lone station in Austin Co. in s.e. Blackland Prairies; also Mex. (s. to Hgo. and Mor.).

2. LYGODIUM Sw. CLIMBING FERN

Several species that are most abundant in tropical regions of both hemispheres.

1. *Lygodium japonicum* (Thunb.) Sw. Slender twining plants mostly of low woods and thickets with slender hairy rhizomes; fronds climbing, vinelike, pinnate, often several m. in length; sterile pinnae triangular-lanceolate in outline, long-acuminate, to 2 dm. long, the ultimate segments ovate to linear-lanceolate; fertile pinnae divided similarly to the sterile ones, to 1 dm. long, the ultimate segments deltoid to flabellate; sporangia obovoid, borne in a double row on the contracted fingerlike revolute segments of the ultimate lobes; false indusia membranous, scalelike, hooded, attached to short oblique veins. In sandy damp woods, usually along streams and rivers, and along roadside ditches, established in several cos. in the s.e. corner of Tex.; nat. of Asia and the Austral. trop., but escaped and well-established at several localities from Fla. to N.C., w. to La. and Tex.

FAM. 8. OSMUNDACEAE R. BR. CINNAMON FERN FAMILY

Large terrestrial to subaquatic plants of low moist soils and wet places with creeping to erect woody rhizomes, rarely arborescent, the roots hard and fibrous; fronds erect-spreading, occasionally as much as 18 dm. or more tall, clustered; stipes scaleless; blades

bipinnatifid to bipinnate, rather coarse, uniform to entirely dimorphic or with some of the pinnae dimorphic, with the usually forked veins free and extending to the margins of the ultimate segments; sporangia in dense paniculate clusters, entirely replacing the vegetative tissue of certain pinnae or whole fronds, naked, large, globose, usually short-stalked, longitudinally cleft into two halves, with the ring or annulus few-celled or wanting; spores green.

This family comprises three genera, the following and two Old World genera, that include about 20 species.

1. OSMUNDA L.

Rather coarse plants; fronds in a large crown from a woody rhizome, arranged in two circles, the inner circle fertile, erect and developing first, the outer circle sterile and spreading; blades wholly spore-bearing or with part of the pinnae spore-bearing either near the middle or at the apex, the spore-bearing tissue red or brown; sporangia short-stalked, densely clustered on the ultimate veinlets; spores copious, green.

About 10 species, mostly in the north temperate regions of both hemispheres.

1. Sterile blades pinnate-pinnatifid, the ultimate segments entire; fertile fronds separate, cinnamon-colored at maturity 1. *O. cinnamomea*.
1. Sterile blades bipinnate, the pinnules serrulate; upper pinnae modified for spore production 2. *O. regalis* var. *spectabilis*.

1. *Osmunda cinnamomea* L. CINNAMON FERN. Fronds several, erect, dimorphic, to 15 dm. tall; stipes irregularly coated with a loose cinnamon-colored tomentum; sterile blades lanceolate to oblong-lanceolate, acuminate, to 1 m. long and 35 cm. wide; pinnae opposite to subopposite, deeply pinnatifid, with a tuft of tomentum persisting at the base of each pinna; fertile blades succulent, nonfoliose, soon withering. Usually in moist or wet soil of swamps, marshes, on open or wooded seepage slopes, along streams, on the edge of lakes and bogs and occasionally on wet ledges, rather generally distributed in the Timber Belt, s. to Orange Co. in the Coastal Prairies, w. to Gonzales, Lee and Milam cos. in the Blackland Prairies, with a lone station in Uvalde Co. on the Edwards Plateau; throughout e. N. A. from Nfld. to Minn., s. to cen. Fla. and N. M.

2. *Osmunda regalis* L. var. *spectabilis* (Willd.) Gray. ROYAL FERN. Fronds clustered, to 18 dm. tall; stipes slender, glabrous; blades broadly elliptic to oblong-ovate, with the lower 2 to 6 pairs of pinnae sterile, the upper pinnae transformed into fertile ones. In swamps, marshes, moist woods, depressions in savannahs and prairies, on stream banks and seepage slopes, and in or on the edge of lakes, generally distributed and common in the Timber Belt, s. and s.w. to Jefferson and Victoria cos. on the Coastal Prairies, w. to Travis Co. in the Blackland Prairies adj. to the Edwards Plateau; from Nfld. to Sask., s. to Fla. and Tex.; also Berm., the W. I., Mex., C. A. and S. A.

FAM. 9. MARSILEACEAE R. BR.

PEPPERWORT FAMILY

Plants herbaceous, rooting in mud, creeping, often partly submerged, rarely floating, with slender branched rhizomes; leaves erect or floating, distichous, more or less remote, filiform or with long-petiolate 2- to 4-foliate blades; leaflets (when present) of a cuneate type, with close dichotomous venation; sporocarps hard, bony, globose to ellipsoid, pilose or essentially glabrous, pedunculate, one to several borne on the rhizome near the base of the petiole or upon the petiole; sori solitary within the compartments, each producing both megaspores and microspores; megaspores germinate into prothallia that bear mostly archegonia; microspores germinate into prothallia that bear antheridia.

This family comprises three genera containing more than 70 species that are found chiefly in the Old World.

1. Leaf blade 4-foliate 1. *Marsilea*, p. 47.
1. Leaves filiform 2. *Pilularia*, p. 48.

I. MARSILEA L. WATER CLOVER

Small plants forming dense colonies; leaves long-petiolate, with cruciform (4-foliate) blades; sporocarps subglobose to ellipsoid, mostly with 2 teeth near the base, splitting into 2 valves at maturity and emitting numerous sori on a gelatinous receptacle; sori including both megasporangia and microsporangia.

About 60 species of wide distribution, mainly in the Old World.

1. Sporocarps several on a special branch or from a common peduncle (2)
1. Sporocarps solitary, with paleaceous hairs or naked; leaves and petioles naked or sparsely pubescent (3)
 - 2(1). Leaflets and petioles with long loose hairs, without colored stripes; sporocarps densely covered with reddish hairs that are to 3 mm. long 1. *M. macropoda*.
 2. Leaflets and petioles essentially glabrous, usually developing (with age) reddish-brown stripes on the lower surface; sporocarps losing (with age) its light-brown hairs 2. *M. mexicana*.
- 3(1). Leaflets narrowly and obliquely cuneate, usually irregularly toothed or crenulate at the apex 5. *M. tenuifolia*.
3. Leaflets flabellate to broadly cuneate, with entire or undulate-crenulate margins (4)
- 4(3). Rhizome without conspicuous fascicled branches; peduncle usually very short, often scarcely as long as the sporocarp, usually free from the petiole or attached at its very base; sporocarp with rather long coarse reddish hairs 3. *M. mucronata*.
4. Rhizome producing fascicled branches that are paleaceous at their tips; peduncle about twice the length of the sporocarp or more, usually attached above the base of the petiole; sporocarp sparsely provided with short coarse hairs 4. *M. uncinata*.

1. *Marsilea macropoda* A. Br. Plants robust, to 25 cm. tall, forming large mats; leaflets broadly cuneate, to 5 cm. long and 2 cm. wide; sporocarps 2 to 6 on erect or ascending branched peduncles that are 2-3 cm. long, obliquely obovate, 6-8 mm. long, 5-6 mm. in diameter. In mud or sandy soil and water of swamps, marshes, woodland bogs, ditches, streams, and on the edge of ponds and lakes, apparently endemic to Tex. where it is widespread and rather frequent in the Rio Grande Plains, n. and e. to Jackson Co. in the Coastal Prairies, Travis Co. in the Blackland Prairies, and in the cos. bordering the Edwards Plateau.

2. *Marsilea mexicana* A. Br. Plants to 2 dm. tall; leaflets broadly cuneiform to obovate-flabellate, 1-1.5 cm. long, typically marked with reddish-brown stripes (or glands?) parallel with the veins on the lower surface; sporocarps densely clustered on special branchlets, these bearing also slender terete rigid rootlike structures, obovoid to ellipsoid, about 4 mm. long, dark-colored. In shallow water or on mud flats of pools and ponds in Aransas Co. on the Tex. coast; from Tex. and Mex., s. to Hond.

3. *Marsilea mucronata* A. Br. Plants to 2 dm. tall; leaflets obovate to spatulate, truncated to rounded at the entire or toothed apex, to 15 mm. long, about as wide as long; sporocarps oval to ellipsoid, to 18 mm. long, 3-6 mm. in diameter. *M. vestita* of auth. Usually in black waxy mud along streams and rivers, in and about ponds, in silt of lakes, and in ditches or depressions such as old buffalo wallows in prairies that are periodically inundated, the most widespread *Marsilea* in Tex., occurring in every section but the Timber Belt, most frequent and abundant in the Blackland Prairies and on the Edwards Plateau; from s. Sask. and Alta., s. to Tex., N. M., Ariz. and Coah. e. to Fla.

4. *Marsilea uncinata* A. Br. Plants to 2 dm. tall; rhizomes producing fascicled branches that are paleaceous at their tips; leaflets obovate to broadly flabellate, to 3 cm. long and wide; sporocarps subglobose to ellipsoid, 4-8 mm. long, 3-6 mm. in diameter, more or less covered with short reddish hair. In or on the edge of permanent ponds, along spring branches and in shallow water of brooks, ditches and bayous, rather generally distributed but uncommon in the Blackland Prairies and in several isolated localities in every section of Tex. except the Timber Belt; apparently confined to Tex. and La.

5. *Marsilea tenuifolia* Kunze. Plants slender, 5-17 cm. tall; leaflets narrowly cuneate, truncate and usually irregularly toothed at apex, more or less falcate, to 25 mm. long, 2-8 mm. wide; sporocarps on short slender peduncles, 5-8 mm. long, 4-5 mm. in diameter. *M. vestita* var. *tenuifolia* (Engelm.) Underw. & Cook. On the edge of lakes, in shallow beds of creeks, and in periodically inundated depressions, especially in old buffalo wallows, rare on the Edwards Plateau, in Travis Co. in the Blackland Prairies and in the s. part of the Plains Country; apparently confined to Tex. and Okla.

2. PILULARIA L. PILLWORT

Six widely distributed species.

1. *Pilularia americana* A. Br. AMERICAN PILLWORT. Very small inconspicuous plants of muddy situations, with slender wide-creeping rhizomes bearing at the nodes one to several leaves, forming dense mats; leaves setiform, solitary or sometimes several together from the nodes, glabrous, 2-6 cm. long, rarely to 1 dm. long; sporocarps produced just below surface of ground, axillary, pedunculate, globose, brownish-yellow, 2-3 mm. in diameter. In shallow temporary muddy pools on rock flats and depressions in clayey prairies, only in Burnet Co. on the Edwards Plateau; from s. Calif. to Ore., also isolated in s.-cen. Kan., w.-cen. Okla., w. Ark. and cen. Ga.

FAM. 10. SALVINIACEAE DUM. SALVINIA FAMILY

Plants minute or small, aquatic, free-floating or on mud, with a branched rhizome bearing simple roots (*Azolla*) or essentially stemless with some of the leaves modified as roots (*Salvinia*); leaves 2-ranked or in whorls, opposite or alternate, simple or lobulate; sporocarps soft, thin-walled, borne singly or two or more on a common stalk at the base of the leaves, 1-celled, with a central often branched receptacle, unisexual, bearing either megasporangia containing a solitary megaspore or microsporangia containing numerous minute microsporangia; massulae within macrosporangia bearing septate or non-septate glochidia with barbed tips; megasporangia germinate into prothallia bearing archegonia; microspores germinate into prothallia bearing antheridia.

This family comprises 2 genera of wide distribution—*Salvinia* and *Azolla* with about 16 species.

1. AZOLLA LAM. WATER FERN

Minute reddish or green free-floating plants, occasionally on mud, mostly densely matted and resembling some species of liverworts, with the stems pinnately branched and concealed by roots and imbricating leaves; leaves distichous, 2-lobed, with the upper lobe floating and the lower lobe submersed; sporocarps borne in one or two pairs on the lower leaf lobe.

This genus consists of about 6 species of wide distribution.

1. Glochidia not septate; plants to 1 cm. in diameter; leaves about 0.5 mm. long, not closely imbricate 1. *A. caroliniana*.
1. Glochidia many-septate; plants usually more than 1 cm. in diameter; leaves 0.7 mm. long or more, closely imbricate 2. *A. mexicana*.

1. *Azolla caroliniana* Willd. Plants forming floating mats to 3 cm. across; leaves minute, deeply bilobed, imbricate, mostly with hyaline margins, to 0.9 mm. long and 0.6 mm. wide, the upper emersed lobes oval or suborbicular-quadrate, deep-green to purplish-red, somewhat convex, hollow, provided with numerous 2-celled hairs, the lower submersed lobes glabrous, larger and paler than the upper lobes. On still water of swamps, ponds, lakes and in slow-moving water of streams and resting on mud, up to 5,500 ft. alt., sporadically distributed from Wood Co. in the n.e. Timber Belt, s. to

Orange Co. on the Coastal Prairies and Cameron Co. in the Rio Grande Plains, w. to Jeff Davis and Presidio cos. in the Trans-Pecos; from Fla. w. to Tex., n. to N.C., O. and Alas.; also the W. I. and Mex. to Patagonia.

2. *Azolla mexicana* Presl. Plants similar to *A. caroliniana* but with larger leaves; leaves tinged with purplish-cerise, papillose, with narrow hyaline cellular-papillose margins, the lower lobe usually much larger than the upper lobe. Floating on surface of lakes and ponds and in quiet waters of streams and irrigation canals in the Rio Grande Valley of s. Tex.; from s. Tex. and Mex., s. to n. S. A., n. to Ut., B.C., Wisc. and Ill.

FAM. 11. POLYPODIACEAE S. F. GRAY

TRUE FERN FAMILY

Usually large terrestrial or epiphytic plants of diverse habits with short or elongate creeping to suberect rhizomes; fronds clustered or remote, pendent to erect-spreading, commonly stalked, occasionally dimorphic; blades simple to much decomposed and variously dissected, with the veins simple to mostly forked, free or united and forming areoles with or without included veinlets; sporangia long-stalked, provided with an incomplete vertical annulus and opening transversely, borne either upon the veins on the lower surface or near the margins of ordinary leaf blades in lines or clusters (sori), occasionally borne on wholly fertile fronds or on partially sterile blades; sori naked or covered by a membrane (indusium) that develops from either the vein or modified leaf-margin; prothallia green.

This family, that includes about 50 genera and several thousand species, is by far the largest family of ferns in that it includes more than two thirds of the living ferns. They are found throughout the world from arctic to tropical regions in dense rain forests to desert areas.

1. Blades simple, pinnatifid or once-pinnate; pinnae or primary divisions entire, toothed or pinnatifid (2)
 1. Blades twice-pinnate or more dissected (20)
 - 2(1). Blades simple 12. *Polypodium*, p. 62.
 2. Blades not simple (3)
 - 3(2). Primary divisions or pinnae with the margins entire, undulate, irregularly toothed or incised, never distinctly pinnatifid (4)
 3. Primary divisions or pinnae distinctly pinnatifid (13)
 - 4(3). Sterile or leafy blades deeply pinnatifid, with greater portion of the rachis winged (5)
 4. Blades distinctly pinnate (7)
 - 5(4). Plants epiphytic or on rocks; fronds all alike 12. *Polypodium*, p. 62.
 5. Plants terrestrial in low wet places; fronds dimorphic (6)
 - 6(5). Primary segments with entire to undulate margins; sterile blades with the pinnae commonly opposite or essentially so; sporophylls with the divisions closely rolled together, beadlike 9. *Onoclea*, p. 61.
 6. Primary segments with serrulate margins; sterile blades with the pinnae commonly alternate; sporophylls with the divisions narrowly linear 11. *Lorinseria*, p. 62.
 - 7(4). Sori submarginal; indusia formed in part by the somewhat modified leaf margins (8)
 7. Sori dorsal; indusia not formed by the leaf margins (9)
 - 8(7). Fronds densely pubescent or scaly (or both), sometimes yellow- or white-farinosose beneath 8. *Notholaena*, p. 58.
 8. Fronds not densely pubescent or scaly beneath 6. *Pellaea*, p. 53.
 - 9(7). Sori linear to oblong-elliptic, never orbicular 13. *Asplenium*, p. 63.
 9. Sori reniform to orbicular (10)

- 10(9). Sori in a single row on either side of the midrib; veins all free (11)
10. Sori in two rows or more; veins free or sometimes anastomosing (12)
- 11(10). Pinnae with bristly teeth on the margins, the fertile pinnae much reduced; indusia orbicular 19. *Polystichum*, p. 66.
11. Pinnae without bristly teeth on the margins; fertile pinnae subequal to the sterile ones; indusia reniform-orbicular 20. *Nephrolepis*, p. 67.
- 12(10). Blades pinnately lobed; pinnae with spinulose-toothed margins; veins usually free 17. *Phanerophlebia*, p. 66.
12. Blades irregularly several-lobed; pinnae with smooth sinuate margins; veins anastomosing to form areoles 18. *Tectaria*, p. 66.
- 13(3). Blades pentagonal, waxy beneath or densely hispid-pubescent (14)
13. Blades not pentagonal, glabrous to laxly pubescent (15)
- 14(13). Blades densely hispid-pubescent 5. *Bommeria*, p. 53.
14. Blades white- or yellow-waxy beneath, otherwise glabrous 8. *Notholaena*, p. 58.
- 15(13). Sori submarginal; indusia formed in part by the somewhat modified leaf margins 3. *Pteris*, p. 52.
15. Sori dorsal; indusia not formed by the leaf margins (16)
- 16(15). Sori orbicular to reniform-orbicular (17)
16. Sori linear to elliptic, never orbicular (19)
- 17(16). Plants rather small, mostly less than 4 dm. tall; lowermost pinnules pinnatifid with the lobes toothed; indusia inferior, cuplike, cleft into narrow or broad segments with age 15. *Woodsia*, p. 64.
17. Plants usually large, mostly more than 5 dm. tall; pinnules coarsely toothed at most, never pinnatifid; indusia (when present) superior, reniform-orbicular, with a narrow sinus (18)
- 18(17). Acicular, unicellular hairs present on the costae above; segments of the fronds ciliate; stipe bundles 2, these united below the base of the blade; rhizome scales ciliate (sometimes sparingly so); rhizomes slender, mostly creeping; fronds membranous, mostly deciduous; veins reaching the margin 21. *Thelypteris*, p. 67.
18. Acicular hairs absent on the costae above; segments of the fronds not ciliate; stipe bundles 3 to 7, free to above the base of the blade; rhizome scales not ciliate, sometimes toothed; rhizomes massive, short-creeping to erect; fronds herbaceous to coriaceous, sometimes evergreen; veins ending short of the margin in elongate hydathodes 22. *Dryopteris*, p. 68.
- 19(16). Sori parallel to and contiguous to the midrib of the leaf segments on specialized veins 10. *Woodwardia*, p. 61.
19. Sori borne obliquely to and away from the midrib of the leaf segments on ordinary veins 14. *Athyrium*, p. 64.
- 20(1). Sori submarginal or essentially marginal; indusia usually formed in part by the somewhat modified leaf margins (21)
20. Sori dorsal; indusia not formed by the leaf margins (26)
- 21(20). Sori globular, cup-shaped and somewhat bivalvate 1. *Dennstaedtia*, p. 51.
21. Sori neither globular nor valvate (22)
- 22(21). Plants mostly large and coarse; rhizome hairy, not scaly; stipe (above base) and rachises stramineous; blades ternately divided; sporangia borne on a continuous veinlike receptacle connecting the apices of the veins 2. *Pteridium*, p. 51.
22. Plants mostly small and delicate; rhizome scaly, sometimes also hairy; stipes and rachises varying from stramineous to reddish-purple or blackish; sporangia borne at or near the apices of unconnected veins (23)

- 23(22). Sori borne on the under surface of the recurved portion of the ultimate segments; blades with only the apical margin of the ultimate segments recurved 4. *Adiantum*, p. 52.
23. Sori not borne on the under surface of a recurved marginal lobule but on the leaf surface under a recurved marginal lobule (when this is present) (24)
- 24(23). Margin usually strongly modified and reflexed, elongate and continuous; pinnae scaleless, mostly glabrous, sometimes white-waxy beneath; rhizomes multicipital or creeping 6. *Pellaea*, p. 53.
24. Margin reflexed or not, mostly interrupted (25)
- 25(24). Vein ends thickened; margin mostly reflexed, sometimes modified; rhizomes multicipital or creeping; pinnae glabrous or mostly hairy or scaly, not waxy 7. *Cheilanthes*, p. 55.
25. Vein ends thickened or not; margin not or scarcely reflexed, not modified; rhizomes multicipital; pinnae scaly, hairy, or mostly white- or yellow-waxy 8. *Notholaena*, p. 58.
- 26(20). Sori linear-elliptic; indusia curved and crescentiform 14. *Athyrium*, p. 64.
26. Sori round; indusia not curved or crescentiform (27)
- 27(26). Plants rather large, usually more than 5 dm. tall; indusia superior, reniform-orbicular, attached at the sinus (28)
27. Plants small, mostly less than 4 dm. tall; indusia not as above (29)
- 28(27). Acicular, unicellular hairs present on the costae above; segments of the fronds ciliate; stipe bundles 2, these united below the base of the blade; rhizome scales ciliate (sometimes sparingly so); rhizomes slender, mostly creeping; fronds membranous, mostly deciduous; veins reaching the margin 21. *Thelypteris*, p. 67.
28. Acicular hairs absent on the costae above; segments of the fronds not ciliate; stipe bundles 3 to 7, free to above the base of the blade; rhizome scales not ciliate, sometimes toothed; rhizomes massive, short-creeping to erect; fronds herbaceous to coriaceous, sometimes evergreen; veins ending short of the margin in elongate hydathodes 22. *Dryopteris*, p. 68.
- 29(27). Blades thick-membranous, broadest above the middle; indusia inferior, cuplike, cleft into narrow or broad segments with age 15. *Woodsia*, p. 64.
29. Blades thin-herbaceous, broadest below the middle or at the base; indusia attached by one side at the base, hoodlike 16. *Cystopteris*, p. 65.

1. DENNSTAEDTIA BERNH.

HAY-SCENTED FERN

About 70 species, mainly in tropical regions.

1. *Dennstaedtia globulifera* (Poir.) Hieron. Usually large plants with slender wide-creeping rhizomes; fronds not joined to the rhizome, more or less clustered to somewhat distant, erect or arching, devoid of scales; stipes rather stout, to 1 m. long, bright-yellowish-brown, lustrous; blade ample, thick-membranous, deltoid-lanceolate, 1-3 m. long and broad, coarsely tripinnate; ultimate segments toothed; veins free, simple or branched; sori numerous, marginal, solitary, terminal on the free veinlets; indusia cuplike or pouchlike, formed in part by a more or less modified recurved segment of the leaf margin. Rare in caves of Val Verde Co.; from s.w. Tex., s. through Mex., C. A. and the W. I. to n. S. A.

This primarily tropical fern, the largest species in our region, is well-established in the protective environment of caves or "sinks" north of Comstock.

2. PTERIDIUM SCOP.

BRACKEN

Coarse plants with slender woody subterranean branching rhizomes, often forming large colonies; fronds erect-ascending, spreading, borne singly; stipes stout, partly woody,

continuous with the rhizome; blades ternately divided, broadly triangular, rigidly herbaceous to coriaceous, the ultimate segments with entire margins, with the veins free and mostly forked; sori linear, marginal, continuous; indusia double, continuous, the outer one formed by the reflexed membranous margin of the ultimate segments, the minute inner one delicate and nearly concealed by the numerous sporangia.

One world-wide species represented by several geographic varieties.

1. Indusia glabrous; ultimate segments glabrous beneath or only slightly pubescent on part of the segment; east Texas 1. *P. aquilinum* var. *pseudocaudatum*.
1. Indusia ciliate or pubescent on the outer surface, or both; ultimate segments densely or sparsely pubescent beneath; Trans-Pecos 1. *P. aquilinum* var. *pubescens*.

1. *Pteridium aquilinum* (L.) Kuhn var. *pseudocaudatum* (Clute) Heller. Fronds to about 2 m. tall; stipes dark-purple-brown at the base to stramineous above; blades nearly or quite glabrous, about 5 dm. long, the 3 main divisions usually bipinnate; terminal pinnules long-produced, 7 to 15 (averaging 9) times as long as broad. *Pteris aquilina* var. *pseudocaudata* Clute, *Pteridium latiusculum pseudocaudatum* (Clute) Maxon. In dry woodlands and thickets in the Timber Belt of e. Tex. and in the s. half of the Blackland Prairies, s.w. to Wilson Co.; from Fla. to Tex., n. to Mass., Ind., Mo. and Okla.

Var. *pubescens* Underw. Plant similar to var. *pseudocaudatum* but with the blades usually densely pubescent to sericeous-tomentose on lower surface; longest entire segment or entire part of segment 3 to 5 (averaging 4) times as long as broad. Rocky open-wooded slopes of high mts. in Jeff Davis Co. in Trans-Pecos Tex., over 7,000 ft. alt.; from several isolated localities in Que., Ont., and Mich. to S.D., Alas., B.C. and w. U. S., s. to Tex. and Mex.

3. PTERIS L. BRAKE

About 250 species that are mostly found in tropical and subtropical regions of both hemispheres.

1. *Pteris multifida* Poir. HUGUENOT-FERN. Fronds clustered, usually drooping, 1-6 dm. long; stipes slender, sulcate, lustrous, to 28 cm. long; blades ovate to ovate-elliptic in outline, to 35 cm. long, pedately divided; ultimate segments linear-lanceolate and serrate along the sterile margins, 4-7 mm. wide, with the veins free and simple or forked; sori linear, marginal, mostly not continuing to the extreme base and apex of the pinnae; indusia single, linear, membranous, formed by the modified reflexed margins of the segments. *Pycnodoria multifida* (Poir.) Small. Naturalized in e. Tex. and in the Rio Grande Valley, commonly on masonry; believed to be a nat. of China but cult. throughout the world, occurring as an escape in the U. S. from Fla. to N. C. and Tex.

4. ADIANTUM L. MAIDENHAIR FERN

Delicate terrestrial or rock-inhabiting plants of moist wooded slopes, ravines and stream banks, with slender creeping to short and ascending scaly rhizomes; fronds suberect to pendent, distichous or in several ranks; stipes slender, strong, usually blackish and lustrous, glabrous or rarely pubescent, scaly at base only; blades pedately or pinnately decomposed, variously dissected, rarely simple; ultimate segments oblique, petiolate or sessile, articulate and deciduous in some species, membranous to subcoriaceous, mostly glabrous, with the veins free and forking or rarely anastomosing; sori borne along or rarely between the ends of the ultimate veins, appearing marginal on the back of the reflexed apex of the lobules of the pinnules or ultimate segments; indusia formed in part by the reflexed margins of the lobules.

About 200 species, mainly in tropical America. Many species are cultivated.

1. Fronds smooth; ultimate segments obovate-cuneate or rhombic, usually prominently incised1. *A. Capillus-Veneris*.
1. Fronds pilose with whitish hairs; ultimate segments suborbicular, not prominently incised2. *A. tricholepis*.

1. *Adiantum Capillus-Veneris* L. CULANTRILLO. Rhizome slender, creeping; fronds numerous, clustered or scattered along rhizome, to 7 dm. long, laxly ascending or pendulous; blades broadly ovate to lanceolate, to 4 dm. long and 35 cm. wide. *A. modestum* Underw., *A. tricholepis* f. *glabrum* Clute. Limestone rocks, ledges and cliffs, especially along streams and about pools in canyons and ravines, frequent on the Edwards Plateau and in the Trans-Pecos, e. to Harris Co. on the Coastal Plain and s.w. to Zavala Co. in the Rio Grande Plains, with a few stations in the Blackland Prairies and n.-cen. Plains Country; from Va., s. to Fla., w. to Ky., Tenn., Mo., Ariz. and Mex. to n. S. A.; also Euras.

2. *Adiantum tricholepis* Fée. HAIRY MAIDENHAIR FERN. Rhizome short, stout; fronds several, cespitose, erect-recurved to pendulous, to 7 dm. long; blades oval to ovate, to 4 dm. long and 35 cm. wide. On moist limestone cliffs along wooded streams on the Edwards Plateau; uncommon in Tex., Mex. and Guat.

5. BOMMERIA FOURN.

A small genus of 4 species that occur from Texas to California southward to Guatemala.

1. *Bommeria hispida* (Mett.) Underw. HAIRY BOMMERIA. Small terrestrial or saxicolous fern with slender wide-creeping scaly rhizomes; fronds erect, usually 10-15 cm. tall, rarely more; stipes slender, much longer than the blades, light-brown, hairy and sparingly scaly; blades deltoid, pentagonal, pinnatifid to tripinnatifid, the main rachis winged throughout, herbaceous to coriaceous, hispid on upper surface, hispid and rusty-tomentose on lower surface, to 10.5 cm. long and wide, with the veins free and forked or anastomosing; sporangia following the veins throughout, naked or rarely protected by the reflexed margins of the segments. *Gymnogramma hispida* Mett., *Gymnopteris hispida* (Mett.) Underw. Crevices of bluffs, on steep rocky slopes and flat rocks, in mts. of Trans-Pecos Tex.; from w. Tex. to Ariz. and Dgo.

6. PELLAEA LINK CLIFF BRAKE

Rather small or occasionally large rigid rock-inhabiting plants with slender long-creeping to short stout multicapital rhizomes; fronds erect to recurved; stipes and rachis slender, wiry, pale-brown or tan-colored to purplish-black, often shiny; blades 1- to 4-pinnate, the segments jointed and deciduous, with the free veins forked; sori intramarginal, terminal on the veins, elongate, at length contiguous laterally to form a marginal line, protected by the reflexed margins of the fertile segments, the margin often modified as a thin or membranous tissue.

About 80 species that are widespread but most abundant in tropical and subtropical regions.

1. Blades linear-oblong to oblong-lanceolate, pinnate-pinnatifid (trifoliate) or if bipinnate below with the 2 to 3 pairs of pinnules distinctly mucronate (2)
1. Blades triangular-ovate to broadly oblong or lanceolate, bipinnate to tripinnate or if simply pinnate with the pinnules nonmucronate (3)
- 2(1). Stipe dark-castaneous to ebeneous; pinnae all trifoliate; midvein of segments noticeably light-brown beneath3. *P. ternifolia* var. *ternifolia*.
2. Stipe purplish-brown; lowermost pinnae usually pinnate; midvein of segments beneath not apparent3. *P. ternifolia* var.

Wrightiana.

- 3(1). Pinnules or ultimate segments sharply long-mucronate
4. *P. longimucronata*.
3. Pinnules or ultimate segments not sharply long-mucronate (4)
- 4(3). Rachises uniformly fractiflex throughout6. *P. ovata*.
4. Rachises not fractiflex, at most slightly flexuous (5)
- 5(4). Rhizome slender, widely creeping, about 1.5 mm. in diameter; rachises of pinnae densely hispidulous7. *P. intermedia*.
5. Rhizome stout, usually multicapital, not widely creeping; rachises of pinnae glabrous to pubescent (6)
- 6(5). Pinnules or ultimate segments ovate to suborbicular, deeply cordate to subsagittate at base5. *P. sagittata* var. *cordata*.
6. Pinnules or ultimate segments elliptic to linear-lanceolate or rarely ovate, broadly cuneate to truncate or rarely shallowly subcordate at base (7)
- 7(6). Stipe reddish-brown, glabrous to very sparsely pubescent with long flaccid articulate hairs; blade bluish-green1. *P. glabella*.
7. Stipe dark-purple to blackish, provided with appressed crisp hairs; blade dull-green to grayish-green2. *P. atropurpurea*.

1. *Pellaea glabella* Kuhn. SMOOTH CLIFF BRAKE. Fronds clustered, to 3 dm. tall; blades oblong to lanceolate, to 9 cm. long, usually less than 5 cm. wide, pinnate to bipinnate (at least below). In crevices and on ledges of limestone or calcareous sandstone, in exposed situations, found only along John Rey Creek in Potter Co. in the n. Plains Country; from Que. to B. C., s. through N. E. to Va., Tenn., Ark., Okla., n.w. Tex. and Colo.

2. *Pellaea atropurpurea* (L.) Link. PURPLE CLIFF BRAKE. Fronds clustered, erect-spreading, to 45 cm. tall; blades deltoid-ovate to oblong or lanceolate, to 3 dm. long and 2 dm. wide, simply pinnate to bipinnate below; pinnae oblong to lanceolate. On rock ledges, among rocks, on cliffs, canyon walls, banks and talus slopes of limerock, and in open rocky woods, usually in partial shade, up to 6,500 ft. alt., represented throughout the state but most abundant on the Edwards Plateau and in the Trans-Pecos, rarest on the Coastal Prairies where rock outcrops are practically unknown; from Vt. and Ont. w. to S. D., s. to Fla. and s.w. through Tex., N. M., Ariz. and Mex. to Guat.

3. *Pellaea ternifolia* (Cav.) Link var. *ternifolia*. Fronds clustered, to 45 cm. tall; blades narrowly oblong-lanceolate to linear-lanceolate, to 3 dm. long and 7 cm. wide, pinnate-pinnatifid (at least below). Among rubble of shaded talus slopes and on ledges of igneous rock, usually in the protection of boulders and shrubs, up to 7,500 ft. alt., rare in the Trans-Pecos; from w. Tex., s. through Mex. and C. A. to Peru, Arg. and n. Chile; also Hisp. and H. I.

Var. *Wrightiana* (Hook.) A. Tryon. Fronds clustered, to 3 dm. tall; blades linear-oblong to lanceolate, to 25 cm. long and 3 cm. wide, pinnate-pinnatifid to bipinnate below. *P. Wrightiana* Hook. In crevices of ledges, shelter of boulders and on rocky ridges, on igneous rocks and sandstone, usually in exposed situations, up to 7,500 ft. alt., most frequent and widespread in s. and e. Edwards Plateau and in the s.w. Trans-Pecos, less common and s. to McMullen Co. in the Rio Grande Plains, n. to Palo Pinto Co. in the Cross Timbers, and e. to Washington Co., Blackland Prairies, and Tyler Co. in the Timber Belt; from e. Tex. and s.w. Okla. through Ariz. and n. Mex. to Baja Calif.

4. *Pellaea longimucronata* Hook. Fronds clustered, to 45 cm. tall; blades triangular-ovate to narrowly triangular-lanceolate, to 25 cm. long and 12 cm. wide below middle, bipinnate to occasionally tripinnate below. On and about granite boulders and in crevices of cliffs, up to 5,200 ft. alt., rare and of local occurrence in the Trans-Pecos and w. Edwards Plateau; from w. Tex. to Colo., Ariz. and Nev.; also n. Mex.

5. *Pellaea sagittata* var. *cordata* (Cav.) A. Tryon. Fronds approximate, erect or erect-arcuate, to 6 dm. tall; blades ovate-oblong, bipinnate to rarely tripinnate below. *P. cardiomorpha* Weath., *P. cordata* (Cav.) Sm. In shallow cavernous places in cliffs, on wet bluffs, in crevices on ledges of canyon walls and in rubble of talus slopes, up to 8,000 ft. alt., rare and of local occurrence in Trans-Pecos Tex., s. to cen. Mex.

6. *Pellaea ovata* (Desv.) Weath. Fronds approximate on slender rhizomes, to 1 m. or more tall; blades oblong, lax, to 7 dm. long and 15 cm. wide, divaricately bipinnate to

tripinnate. *Pteris flexuosa* Kaulf., *Pellaea flexuosa* (Kaulf.) Link. On dry ledges and talus slopes of limestone, calcareous rocks or granite, on or at the base of cliffs, and in rich soil in open rocky woodlands, in exposed or partially sheltered situations, up to 5,200 ft. alt., rather widespread and frequent in the s. and e. parts of the Edwards Plateau, w. to Brewster Co. in the Trans-Pecos, n. to Palo Pinto Co., with an isolated (possibly cult.) station in Chambers Co. in the Coastal Prairies; from Tex. to N. M., through e. Mex. to C. A. and S. A.

7. *Pellaea intermedia* Mett. Fronds distant on widely creeping slender rhizomes, to 4 dm. tall; blades broadly triangular-ovate to ovate-lanceolate or triangular-lanceolate, to 25 cm. long and 2 dm. wide, bipinnate to tripinnate. Incl. f. *pubescens* (Mett.) Broun and var. *pubescens* Mett. On dry rocky slopes and ledges, cap rock, cliffs and about boulders of limestone and igneous rocks, up to 7,000 ft. alt., rather frequent and generally distributed in the Trans-Pecos, with outlying stations in Val Verde Co. on the Edwards Plateau and Upton Co. in the extreme s. Plains Country; from s.w. Tex. to n. Mex.

7. CHEILANTHES Sw.

LIPFERN

Small evergreen plants with scaly short to wide-creeping multicipital rhizomes, usually found on rocks exposed to intense sunlight; fronds uniform, rigidly erect-spreading, mostly tomentose to glandular-pubescent or paleaceous; stipes wiry, blackish to reddish-brown or stramineous; blades pinnate to bipinnate-pinnatifid or more decomposed, often finely divided, with the veins free and thickened at the tips; sori borne at the thickened tips of the veins, marginal, roundish and distinct or narrowly confluent; indusia formed by the thin reflexed margin of the ultimate segments.

About 125 species widespread in temperate and tropical regions.

1. Blade broadly triangular to triangular-lanceolate or triangular-pentagonal (2)
1. Blade ovate to elliptic- or linear-lanceolate (5)
- 2(1). Rhizome slender, widely creeping12. *C. lendigera*.
2. Rhizome short, stout (3)
- 3(2). Frond essentially glabrous or glabrescent; stipe blackish or dark-purplish brown .
.....11. *C. aemula*.
3. Frond glandular-pubescent or hispid (4)
- 4(3). Stipe reddish-purple to purplish-brown, glandular-hirsute with brownish or
yellowish capitate hairs 1. *C. Kaulfussii*.
4. Stipe stramineous, hispid with whitish hairs 2. *C. leucopoda*.
- 5(1). Rhizome slender, widely creeping (6)
5. Rhizome stout, decumbent to suberect or shortly creeping (10)
- 6(5). Pinnae scaleless (7)
6. Pinnae conspicuously scaly (8)
- 7(6). Stipe and rachis terete, densely arachnoid-villous beneath
.....12. *C. lendigera*.
7. Stipe and rachis deeply channeled on the upper side, essentially glabrous
..... 9. *C. Wrightii*.
- 8(6). Ultimate segments hairy throughout; the larger scales of blade shortly ciliate at
the base13. *C. Lindheimeri*.
8. Ultimate segments glabrous above, essentially devoid of hairs throughout (9)
- 9(8). Scales of blade not ciliate, inconspicuously dentate .15. *C. Fendleri*.
9. Scales of blade long-ciliate (at least at the base)14. *C. Wootonii*.
- 10(5). Frond essentially glabrous to sparsely pubescent; ultimate segments not orbicular
or beadlike (11)
10. Frond densely pubescent, sometimes provided with prominent scales; ultimate seg-
ments usually minute, orbicular and beadlike (12)
- 11(10). Stipe and rachis terete throughout10. *C. alabamensis*.
11. Stipe and rachis deeply channeled on the upper side ... 9. *C. Wrightii*.

- 12(10). Frond provided with conspicuous scales that are ovate to ovate-lanceolate or narrowly lanceolate (13)
12. Frond scaleless or sometimes with extremely narrow palaceous hairs (16)
- 13(12). Blade rough on both surfaces with scattered short harsh whitish pustulate hairs; scales serrulate 5. *C. horridula*.
13. Blade not rough, densely long-pubescent; scales not serrulate (14)
- 14(13). Scales of rachises ovate-lanceolate, with a cordate base, closely imbricate; blade provided above with coarse white crisped flexuous hairs 6. *C. villosa*.
14. Scales of rachises narrowly lanceolate to linear, loosely imbricate (15)
- 15(14). Ultimate segments closely enveloped and held together by a mass of entangled hairs arising from both surfaces; pubescence and scales light-brown 7. *C. Eatonii* f. *Eatonii*.
15. Ultimate segments glabrescent above and separate, fewer and several times larger than in typical *C. Eatonii*; pubescence and scales usually deep-castaneous 7. *C. Eatonii* f. *castanea*.
- 16(12). Blade rough on both surfaces with scattered short harsh whitish pustulate hairs 5. *C. horridula*.
16. Blade not rough; hairs slender, not pustulate (17)
- 17(16). Stipe and rachis densely tomentose with hairs not noticeably articulate 8. *C. tomentosa*.
17. Stipe and rachis sparsely or densely hispidulous with noticeably articulate hairs (18)
- 18(17). Blade laxly villous-hirsute beneath with crisped hairs 3. *C. lanosa*.
18. Blade coarsely tomentose beneath 4. *C. Feei*.

1. *Cheilanthes Kaulfussii* Kunze. Fronds clustered, to 35 cm. tall, glandular-hirsute throughout with brownish to yellowish capitate hairs; blades short, broadly triangular-pentagonal, to 15 cm. long, ternately tripinnate to tripinnate-pinnatifid. In crevices of rock ledges and among boulders on hillsides and mt. slopes, up to 7,500 ft. alt., rare in the Trans-Pecos and in Llano Co. on the Edwards Plateau; from cen. Tex. through Mex. and C. A. to Col. and Venez.

2. *Cheilanthes leucopoda* Link. WHITEFOOT LIPFERN. Fronds clustered, to 3 dm. tall; blades triangular-pentagonal, sparsely glandular-pubescent throughout with yellowish hairs, to 16 cm. long and wide, tripinnate-pinnatifid to quadripinnate (at least below). On exposed limestone slopes and ledges on hills, mountainsides and in canyons, confined to several cos. on the Edwards Plateau; from s.w. Tex. to Dgo. and S. L. P.

3. *Cheilanthes lanosa* (Michx.) D. C. Eat. HAIRY LIPFERN. Fronds approximate, to 4 dm. tall; blades linear-oblong to oblong-elliptic or narrowly oblong-lanceolate, to 3 dm. long and 7 cm. wide, bipinnate-pinnatifid to occasionally tripinnate (at least below). On dry rocky slopes and ledges of sandstone in non-calcareous areas, only in McLennan Co. in the Blackland Prairies; from Conn. and N.Y., s. to Ga., La., Kan. and Tex.

4. *Cheilanthes Feei* Moore. SLENDER LIPFERN. Fronds cespitose, erect-spreading, to 25 cm. tall, usually much smaller; blades ovate to deltoid-ovate or linear-oblong, to 13 cm. long and 4 cm. wide, tripinnate or rarely bipinnate-pinnatifid. *C. lanuginosa* Hook. On dry rocky slopes and in dry crevices of boulders, cliffs and ledges of limestone or calcareous sandstone, usually exposed to intense sunlight, up to 7,000 ft. alt., rather generally distributed in the Plains Country and Trans-Pecos of n. and w. Tex., e. through the Edwards Plateau to Hamilton and Palo Pinto cos. in the n.w. Cross Timbers; from Ill. and Wisc., w. to B. C., s. to Ky., Ark., Okla., Tex., N. M., Ariz., s. Calif. and in adj. Mex. (Coah. and Chih.).

5. *Cheilanthes horridula* Maxon. Fronds clustered, to about 3 dm. tall; blades narrowly lanceolate to oblong-lanceolate, to 2 dm. long and 5 cm. wide, bipinnate to bipinnate-pinnatifid (at least below). *C. aspera* Hook., *Pellaea aspera* (Hook.) Hook. & Baker. In sheltered or exposed rock crevices of limestone or sandstone, where the plants are usually

so firmly imbedded that they are difficult to collect intact, up to about 4,000 ft. alt., rather frequent and generally distributed on the Edwards Plateau and in the Trans-Pecos, n. and e. to several cos. in the s. Plains Country and w. Blackland Prairies, s. along the Rio Grande to Starr Co. in the Rio Grande Plains; also Chambers Co.; from the Arbuckle Mts. of Okla., mainly through s.-cen. and w. Tex. to Dgo.

6. *Cheilanthes villosa* Davenp. Fronds clustered, to 35 cm. tall, usually much shorter; blades linear-oblong to narrowly oblong-lanceolate, acuminate, to 25 cm. long and 5 cm. wide, tripinnate to occasionally tripinnate-pinnatifid or rarely quadripinnate. In dry crevices of limestone ledges, cliffs and boulders or among granite boulders, in canyons and on mt. slopes, up to 6,000 ft. alt., generally distributed but uncommon in the Trans-Pecos and in Val Verde Co. on the Edwards Plateau; from w. Tex. to s. Ariz. and n. Mex.

7. *Cheilanthes Eatonii* Hook. & Baker f. *Eatonii*. Fronds tufted, to 4 dm. tall; blades oblong-lanceolate to narrowly lanceolate, to 6 cm. wide, mostly tripinnate. On and about igneous and limestone rocks on ledges and talus slopes, on bluffs and about large boulders in thinly wooded areas, chaparral and similar locations, up to 8,000 ft. alt., generally distributed and rather frequent in the Trans-Pecos, extending eastw. through the Edwards Plateau to Brown and Wilson cos., with an isolated station in Morris Co. in the n.e. Timber Belt where it occurs on ferruginous rocks and ledges in Daingerfield State Park; from n.e. Tex. to w.-cen. Okla., Colo. and Ariz. s. to Zac. and Hgo.

This species is represented in Texas by two intergrading phases—the densely villous typical form and the more or less glabrescent f. *castanea* (Maxon) Correll (*C. castanea* Maxon).

8. *Cheilanthes tomentosa* Link. WOOLLY LIPFERN. Fronds clustered, to 6 dm. tall; blades oblong-lanceolate to linear-lanceolate, acuminate, to 45 cm. long and 9 cm. wide, bipinnate-pinnatifid to tripinnate. In crevices of ledges on cliffs, on and about boulders, on wooded hillsides and mt. slopes, usually on sandstone, granite or siliceous rock, up to 7,000 ft. alt., rather generally distributed but of local occurrence in the n. half of the Blackland Prairies, in the s.e. Edwards Plateau and s. half of the Trans-Pecos, e. to Tyler Co. in the Timber Belt, s. to Atascosa Co. in the Rio Grande Plains and n.w. to Mitchell Co. in the extreme s. Plains Country; from Va., s. to Ga. and w. to Mo., Okla., Tex., Ariz. and n. Mex.

9. *Cheilanthes Wrightii* Hook. Fronds approximate, usually rigidly erect, usually less than 15 cm. tall, rarely to 25 cm.; blades lanceolate to elliptic-lanceolate, to 12 cm. long and 4 cm. wide, mostly tripinnatifid or bipinnate-pinnatifid. On exposed gravel and talus slopes and terraces, in crevices of igneous boulders and ledges in ravines and canyons, up to 5,000 ft. alt., rather generally distributed but uncommon in the s. and w. cos. of the Trans-Pecos; from w. Tex. to Ariz. and Mex. (s. to Dgo.).

10. *Cheilanthes alabamensis* (Buckl.) Kunze. ALABAMA LIPFERN. Fronds clustered, to 5 dm. tall; blades elliptic to narrowly lanceolate, to 35 cm. long and 8 cm. wide, bipinnate to bipinnate-pinnatifid. *C. microphylla* of auth. On limestone hillsides, in rock crevices and under protecting ledges in ravines and canyons, up to 5,500 ft. alt., often associated with *Pellaea atropurpurea*, rather widely distributed and frequent on the Edwards Plateau and in the Blackland Prairies and Trans-Pecos, with outlying stations in Walker Co. in the Timber Belt, Zapata Co. in the Rio Grande Plains and in several cos. in the s. Plains Country; from Fla. and Ala., n. to Va., w. to Mo., Okla., Tex., Ariz. and n. Mex.; also Jam.

11. *Cheilanthes aemula* Maxon. Fronds clustered, to 65 cm. tall; blades to 35 cm. long and 26 cm. wide at the base, deeply tripinnate-pinnatifid below, otherwise tripinnate nearly throughout. Shaded banks, among boulders, on ledges in limestone canyons, mainly on the Edwards Plateau, also in "western Texas," and in Austin Co. in s.e. Blackland Prairies; from s.-cen. Tex. and s. N.M. to cen. Mex. (s. to S. L. P.).

12. *Cheilanthes lendigera* (Cav.) Sw. Fronds scattered on a slender creeping rhizome, to 4 dm. tall; blades triangular-lanceolate to oblong- or elliptic-lanceolate, acuminate, to 2 dm. long and 7 cm. wide, tripinnate to quadripinnate. In crevices on cliffs and boulders in moist shaded ravines and canyons, up to 7,000 ft. alt., found only in the Chisos Mts., Brewster Co., in the Trans-Pecos; from w. Tex. and Ariz. through Mex. to Venez. and Ecu.

13. *Cheilanthes Lindheimeri* (Sm.) Hook. FAIRY SWORDS. Fronds scattered on a slender creeping rhizome, often forming extensive colonies, to 35 cm. tall; blades ovate-lanceolate to elliptic-lanceolate, to 2 dm. long and 5 cm. wide, tripinnate or quadripinnate. On dry shaded boulders and rock ledges of usually granite or sandstone, among talus rubble, in canyons, and on bluffs and cliffs, up to about 7,000 ft. alt., most frequent in the s. and w. Trans-Pecos and in the s.e. Edwards Plateau, with outlying stations in Palo Pinto Co. in the n. Cross Timbers and in McMullen Co. on the Rio Grande Plains; from Tex. to Ariz. and Mex. (s. to Dgo. and S. L. P.).

14. *Cheilanthes Wootonii* Maxon. BEADED LIPFERN. Fronds scattered on slender rhizomes, to 3 dm. tall; blades narrowly oblong to oblong-lanceolate, acuminate, to 18 cm. long and 5 cm. wide, tripinnate to tripinnate-pinnatifid or occasionally quadripinnate. In dry rocky places at the base of boulders and ledges or in shallow caverns formed by fallen boulders, up to 4,000 ft. alt., rare and of local occurrence in several cos. in the Trans-Pecos, with a questionable station in Hays Co. on the Edwards Plateau; from Okla., s.e. Colo. and s.-cen. Tex. to Ariz. and Son.

15. *Cheilanthes Fendleri* Hook. Fronds scattered on a slender creeping rhizome, to 3 dm. tall, usually much smaller; blades narrowly ovate-lanceolate to oblong-lanceolate, to 15 cm. long and 35 mm. wide, tripinnate, rigidly herbaceous. In rock crevices, at the base of boulders and along ledges, in shaded canyons and on dry wooded banks, up to 8,000 ft. alt., uncommon in the mts. of Hudspeth and Jeff Davis cos. in the Trans-Pecos, with an isolated locality in Crosby Co. in the Plains Country; from n.w. Tex. to Colo. and Ariz.

8. NOTHOLAENA R. BR.

CLOAKFERN

Small saxicolous ferns with glandular, paleaceous or variously hairy fronds from a short multicapital rhizome, very rarely without an indument, usually xerophytic; fronds rigidly erect or erect-spreading, uniform; stipes often longer than the blades, usually dark and rigid; blades linear to pentagonal, 1- to 4-pinnate and variously lobulate or pinnatifid, thick-herbaceous to coriaceous, sometimes white- to yellow-ceriferous beneath; veins all free, sometimes enlarged at the tips; sori usually submarginal, oblong to suborbicular, borne at the tip of veins; indusia wanting but the leaf margin either revolute and partially concealing the sporangia or flattish, the sporangia often somewhat protected and hidden by the hairy, scaly or waxy vestiture.

About 60 species that are found mainly in arid regions of both hemispheres. Included by some workers in *Cheilanthes*.

1. Indument of lamina (including upper and lower surface but excluding rachis) of scales or hairs, not ceraceous (2)
1. Indument of lamina (including upper and lower surface but excluding rachis) lacking or wholly (or at least in part) ceraceous (3)
- 2(1). Indument of scales (at least in part) 1. *N. sinuata*.
2. Indument of hairs only 2. *N. aurea*.
- 3(1). Indument of lamina ceraceous and of scales or hairs, or lacking (4)
3. Indument of lamina wholly ceraceous (8)
- 4(3). Indument lacking 13. *N. parvifolia*.
4. Indument of scales or hairs (or both) in addition to wax (5)
- 5(4). Indument on lower surface of lamina ceraceous and of large stiff brown trichomes 4. *N. Schaffneri* var. *Nealleyi*.
5. Indument on lower surface of lamina ceraceous and of scales and sometimes also tomentose (6)
- 6(5). Scales on lower surface of lamina long-ciliate or dissected 3. *N. Aschenborniana*.
6. Scales on lower surface of lamina entire or nearly so (7)

of the Trans-Pecos and Edwards Plateau, sparingly distributed in several extreme s. cos. in the Plains Country, e. to Anderson Co. on the e. edge of the Blackland Prairies, and s. to McMullen and Webb cos. in the Rio Grande Plains.

Var. *integerrima* Hook. is found in habitats similar to those of the other two phases. It has a wider area of general distribution than var. *cochisensis*, being found from s. Okla. and the w. half of Tex. to s.e. Ariz. and Mex. (s. to Ver.). In Tex. it is widespread and rather common in the Trans-Pecos and Edwards Plateau, more frequent than the other phases in the s. half of the Plains Country n. to Motley Co., e. to Palo Pinto Co. and s. to Zapata and Starr cos. in the Rio Grande Plains.

Var. *cochisensis* (Goodd.) Weath. (*HELECHILLO*) occurs from Tex. to Ariz. and Mex. It is widespread and frequent in the Trans-Pecos where it is usually abundant on high slopes and summits of limestone mts. It extends n.e. to Motley Co. in the Plains Country and e. to Sterling and Edwards cos. on the Edwards Plateau.

2. *Notholaena aurea* (Poir.) Desv. Fronds clustered, to 7 dm. tall; blades linear to linear-lanceolate, abruptly acute, to 45 cm. long and 35 mm. wide, pinnate-pinnatifid. *N. ferruginea* Desv., *N. bonariensis* (Willd.) C. Chr. On talus slopes and in crevices of ledges and cliffs, on canyon walls and about the base of boulders, up to 6,500 ft. alt., apparently confined to the w. and s. parts of the Trans-Pecos; from Tex. to Ariz. and Mex., s. to Arg.; also Jam. and Hisp.

3. *Notholaena Aschenborniana* Kl. Fronds clustered, to 5 dm. tall, usually much shorter; blades oblong to oblong-lanceolate, to 4 dm. long and 3 cm. wide, bipinnate to usually bipinnate-pinnatifid. On rocky slopes and ledges and in deep limestone canyons, up to 5,000 ft. alt., rare in the mts. of the Trans-Pecos and in Val Verde Co. on the Edwards Plateau; from w. Tex. to Ariz. and Mex.

4. *Notholaena Schaffneri* (Fourn.) Underw. var. *Nealleyi* (Seaton) Weath. Fronds clustered, to 2 dm. tall; blades linear-oblong to oblong-lanceolate, to about 15 cm. long and 6 cm. wide, pinnate-pinnatifid to pinnate-bipinnatifid. *N. Nealleyi* Seaton. On exposed or partially shaded rock ledges and in crevices of cliffs and canyon walls, at moderate elev., uncommon on the Edwards Plateau and in the Rio Grande Plains and Trans-Pecos; from s.w. Tex. to Ver.

5. *Notholaena Grayi* Davenp. Fronds clustered, to 35 cm. tall; blades oblong-lanceolate to lanceolate, to 18 cm. long and 4 cm. wide, pinnate-pinnatifid to bipinnate-pinnatifid. On talus slopes, in rock crevices and rocky barrens of granite and limestone, up to 6,000 ft. alt., rare in the Trans-Pecos and Edwards Plateau; from cen. Tex. to s.e. Ariz. and Mex. (s. to Jal.).

6. *Notholaena aliena* Maxon. Fronds clustered, to 16 cm. tall; blades linear to linear-oblong, to 85 mm. long and 15 mm. wide, pinnate-pinnatifid to sometimes bipinnate below. On bluffs, ledges, rocky hills and talus slopes, found only in Brewster Co. in the Trans-Pecos; from Tex. and n. Mex. (Tam., Coah. and Chih.).

7. *Notholaena candida* (Mart. & Gal.) Hook. var. *Copelandii* (C. Hall) R. Tryon. Fronds clustered, to 35 cm. long; blades triangular-ovate to broadly elliptic-lanceolate, pinnate-pinnatifid to bipinnate-pinnatifid, abruptly reduced to a narrowed tapering simply pinnatifid apex. *N. Copelandii* C. Hall. On limestone ledges and in crevices of canyon walls and bluffs, on open rocky slopes, at the base of cap rock and about boulders, up to 4,500 ft. alt., rather frequent in the cen. and s. parts of the Edwards Plateau and rare in the Trans-Pecos; in s.w. Tex. and n.e. Mex. (s. to n. S. L. P.).

8. *Notholaena Standleyi* Maxon. Fronds clustered, to 27 cm. tall; blades triangular-pentagonal, to 6 cm. long and 8 cm. wide, bipinnatifid to tripinnatifid. *N. Hookeri* D. C. Eat. On dry rock ledges and in crevices, on talus slopes, cliffs, canyon walls, and on and among boulders, up to 6,500 ft. alt., rare and of local occurrence on the Edwards Plateau but generally distributed and rather frequent in the Trans-Pecos; from w. Okla. and Tex. to Colo., Ariz. and Mex.

9. *Notholaena neglecta* Maxon. Fronds clustered, to 25 cm. tall, usually less than 1 dm.; blades triangular-pentagonal to elongate-pentagonal, to 85 mm. long and 65 mm. wide, tripinnate to quadripinnate in the basal half. In dry crevices of limestone ledges and cliffs, and on rocky slopes and in canyons, up to about 4,000 ft. alt., rare on the Edwards Plateau and in the Trans-Pecos; from s.w. Tex. and s.e. Ariz. to n. Mex.

10. *Notholaena Greggii* (Kuhn) Maxon. Fronds small, clustered, rarely more than 15 cm. tall; blades ovate-lanceolate to oblong-lanceolate, to 1 dm. long and 5 cm. wide

below middle, bipinnate-pinnatifid to tripinnate (at least below). In exposed crevices of rocks and at base of ledges of limestone and gypsum on open mt. slopes and in canyons, at moderate elev., found only along the Rio Grande in Brewster and Presidio cos.; apparently confined to s.w. Tex. and n. Mex.

11. *Notholaena limitanea* Maxon. Fronds clustered, to 25 cm. tall; blades deltoid-ovate to narrowly triangular-lanceolate, usually subpentagonal, to 25 cm. long and 16 cm. wide, 3- to 5-pinnate. *Pellaea limitanea* (Maxon) Morton. On limestone ledges and in talus rubble at base of limestone cliffs, up to 7,000 ft. alt., found only in the Chisos Mts. in Brewster Co. in the Trans-Pecos; from w. Tex. to s. Ut., Ariz. and Mex.

Our plant is referable to var. *mexicana* (Maxon) Broun. It differs from var. *limitanea* in its 3- to 4-pinnate narrow blade with the basal pinnae one fourth to one third (not half) as long as the blade and curved-ascending, not spreading.

12. *Notholaena dealbata* (Pursh) Kunze. Fronds clustered, to 12 cm. tall; blades triangular-ovate, to 1 dm. long and 8 cm. wide, tripinnate to quadripinnate, gradually less dissected above. *N. nivea* Desv. var. *dealbata* (Pursh) Davenport, *Pellaea dealbata* (Pursh) Prantl. In dry crevices on cliffs and boulders of limestone and other calcareous rocks, usually in partial shade, at moderate elev., concentrated in the e. part of the Edwards Plateau and in the Cross Timbers, with a station in Coleman Co. in the s. Plains Country and a questionable station in El Paso Co. in the Trans-Pecos; from Mo. and Neb. to Okla. and w.-cen. Tex.

13. *Notholaena parvifolia* R. Tryon. Fronds clustered, usually small, to 4 dm. tall but averaging about 15 cm.; blades triangular-ovate to ovate-oblong or narrowly triangular-lanceolate, to 23 cm. long and 15 cm. wide, tripinnate to quadripinnate, very rarely only bipinnate. *Pellaea microphylla* Kuhn. On limestone ledges in gorges and canyons, and on high limestone hills and talus slopes, face of cap rock, in shaded or exposed situations, apparently confined to limestone, up to 6,500 ft. alt., frequently and generally distributed in the Trans-Pecos, less frequent on the Edwards Plateau, with outlying stations in Howard Co. in the Plains Country and Brazos Co. in e. Blackland Prairies; from e. Tex. to n. Mex.

9. ONOCLEA L. SENSITIVE FERN

A monotypic genus native in the Northern Hemisphere.

1. *Onoclea sensibilis* L. Coarse herbaceous plant with slender branching rhizome to about 7 mm. thick and copiously rooting and with few light-brown elliptic fugacious scales; fronds conspicuously dimorphic, erect-ascending, scattered along the rhizome; stipes slender, greenish or tinged with brown; *sterile frond* to 13 dm. high, glabrous, thin-herbaceous, withering with frost; blades broadly triangular, deeply pinnatifid, the rachis winged; pinnae few, subopposite (especially the lowermost pinnae), oblong-lanceolate to elliptic-lanceolate, obtuse to acute, entire to undulate or the lower and sometimes the middle pinnae sinuately lobed; veins freely anastomosing; *fertile frond* to 8 dm. high, rigidly erect, persistent over winter; blades bipinnate, with the pinnae much-contracted; pinnules rolled into closed berrylike bodies (sporangia) and forming a narrow close panicle. In swamps, open flooded woodlands, meadows, sandy bogs, thickets along streams and about lakes, and on seepage slopes, widespread and rather frequent in the Timber Belt s. to Jefferson Co. in the Coastal Prairies, w. to apparently disjunct stations in Burnet Co. on the Edwards Plateau and Wilson Co. in the Rio Grande Plains; from Nfld. to Ont., Minn. and S.D., s. to n. Fla. and Tex.

10. WOODWARDIA SM. VIRGINIA CHAIN FERN

About 12 species found mainly in temperate regions of both hemispheres.

1. *Woodwardia virginica* (L.) Sm. Rather large coarse terrestrial plants; rhizome woody, ropelike, creeping-elongate and branching, black, to about 2 cm. thick, naked to densely chaffy (especially at apex) with brownish broadly lanceolate scales; fronds erect-ascending, uniform, borne at intervals along the rhizome, 4-15 dm. high; stipes

black to chestnut-brown at the base, green or reddish-brown above, glabrous, lustrous, 3-9 dm. long; blades broadly ovate to oblong-elliptic or elliptic-lanceolate, bluntly acute, pinnate-pinnatifid, subcoriaceous, 3-6 dm. long, 12-30 cm. wide; pinnae linear-lanceolate to elliptic-lanceolate, acuminate, with small brown scales along the midrib, 7.5-15 cm. long, 12-35 mm. wide, deeply pinnatifid; ultimate segments obliquely ovate to oblong-lanceolate, obtuse to acute, 5-6 mm. wide, with the margins somewhat reflexed; sori double, contiguous to confluent, borne on the transverse veins forming the outer side of the areoles, oblong-linear, chainlike. *Anchistea virginica* (L.) Presl. In sphagnun bogs, swamps, moist thickets and meadows, and along streams, rather generally distributed in the Timber Belt and in the extreme s.e. border cos. in the Coastal Prairies, w. to Gonzales, Lee and Milam cos. in the Blackland Prairies; from Fla. to Tex., n. to N. S., Ont. and Ill.; also Berm.

11. LORINSERIA PRESL CHAIN FERN

A monotypic genus.

1. *Lorinseria areolata* (L.) Presl. Slender herbaceous plants; rhizomes slender, widely creeping, chaffy with brown ovate-lanceolate to lanceolate scales, to 4 mm. thick; fronds dimorphic, scattered on the rhizome; *sterile fronds* spreading, to 75 cm. high; stipes slender, greenish or stramineous, sometimes purplish-brown toward the base, 15-35 cm. long; blades ovate-oblong to ovate-deltoid, acuminate, usually deeply pinnatifid, sometimes pinnate below, membranous, 1.5-4 dm. long; ultimate segments alternate, linear-lanceolate to oblong-lanceolate, acute to acuminate, lightly or sometimes deeply sinuate, serrulate, usually connected by wings on the rachis or the lower pairs free, to 13 cm. long and 2 cm. wide, the veins joined in the numerous hexagonal areoles; *fertile fronds* erect, usually surpassing the sterile ones; stipes stout, purplish-brown, lustrous, 3-6 dm. long; blades ovate-oblong, obscurely pinnatifid or pinnate, 1.5-3 dm. long; pinnae alternate, distant, linear, often connected by a slight wing along the rachis, mostly less than 5 mm. wide; sori linear to elliptic, in a single row on each side of the midrib. *Woodwardia angustifolia* Sm., *W. areolata* (L.) Moore. In sandy bogs and low sandy woods, swamps, marshes, thickets, on seepage slopes and along streams, generally distributed and rather frequent in the Timber Belt s. to Jefferson Co. in the Coastal Prairies and Bastrop and Gonzales cos. in the Blackland Prairies; from Fla. to Tex., Ark. and Mo., n. to N. S. and Mich.

12. POLYPODIUM L. POLYPODY

Small or large epiphytic or occasionally terrestrial or rock-inhabiting plants with slender much-branched scaly creeping rhizomes; fronds erect-ascending to pendent, articulate to knoblike prominences of the rhizome; stipes slender, wiry, scaly; blades simple to tripinnate, frequently only pinnatifid, glabrous to pubescent or scaly, ultimate segments entire, with the veins free and forking or variously areolate; sori orbicular to elliptic, large, depressed, terminal, dorsal on the tip of the vein branches, in a more or less distinct row on each side of the midrib; indusia wanting.

This genus comprises perhaps several hundred species that are found mainly in tropical and subtropical regions of both hemispheres.

1. Blades entire to only slightly sinuate 1. *P. erythrolepis*.

1. Blades deeply pinnatifid (2)

2(1). Plants usually growing on trees east of the Pecos River; scales of blades subentire to only sparingly and minutely ciliolate 2. *P. polypodioides* var.

Michauxianum.

2. Plants growing on rocks west of the Pecos River; scales of blade with the margins toothed or copiously ciliate 3. *P. thyssanolepis*.

1. *Polypodium erythrolepis* Weath. Fronds arising at short intervals on a slender creeping rhizome, suberect to arcuate-spreading, to 15 cm. long; blades usually lanceolate to oblanceolate or rarely ovate. Forming mats in soil along streams and on cliffs in

canyons, up to 6,500 ft. alt., rare in the Davis Mts. in Jeff Davis Co. in the Trans-Pecos; infrequent in w. Tex. and n. Mex. (s. to Dgo.).

2. *Polypodium polypodioides* (L.) Watt var. *Michauxianum* Weath. RESURRECTION FERN. Fronds distant on a slender creeping rhizome, to about 2 dm. long; blades oblong to triangular-oblong, to 5 cm. wide, deeply pinnatifid. Growing on various species of trees, especially oaks, occasionally on rock ledges, boulders, old buildings and mossy banks, usually in moderately shady and damp locations, at low elev., generally distributed and common in the Timber Belt, in the e. half of the Coastal Prairies, sparsely scattered in the Blackland Prairies and Cross Timbers n.w. to Parker Co. and s.w. to Atascosa Co. in the Rio Grande Plains and Uvalde Co. on the Edwards Plateau; from Md., Ill. and Mo. to Fla., Tex., Mex. and Guat.

3. *Polypodium thyssanolepis* Kl. Fronds distant on a slender creeping rhizome, to 6 dm. tall, usually about 15 cm. tall (in our region); blades ovate-oblong to triangular-lanceolate or oblong, to 25 cm. long and 12 cm. wide, deeply pinnatifid, the segments characteristically irregular in length and width. On rocky open slopes and in crevices of cliffs and boulders, up to 7,500 ft. alt., apparently confined to and rare in the Trans-Pecos; from w. Tex. to Ariz., Mex. and S. A.; also Jam. and Hisp.

13. ASPLENIUM L.* SPLEENWORT

Small or rather large delicate terrestrial or rock-inhabiting plants, often epiphytic (especially in tropical regions), with short-creeping to erect scaly rhizomes; fronds clustered, uniform or rarely slightly dimorphic, evergreen, erect to spreading; blades pinnate (in ours) or simple to quadripinnate or variously pinnatifid; pinnae or segments usually variously toothed or incised, occasionally subentire; veins nearly always free and forked, rarely casually anastomosing; sori produced along veinlets, linear to oblong-elliptic, straight or slightly curved, usually oblique, separate; indusia always present, lateral, characteristically membranous.

About 650 species of wide distribution, mainly in tropical and subtropical regions.

1. Pinnae roundish, not noticeably auriculate nor hastate at base, usually less than 6 mm. long at maturity1. *A. Trichomanes*.
1. Pinnae deltoid to oblong, more or less auriculate or hastate at base, usually more than 6 mm. long at maturity (2)
- 2(1). Some of the fronds with a prolonged naked apex bearing a proliferous bud; pinnae very irregularly and coarsely serrate2. *A. Palmeri*.
2. Fronds neither naked nor proliferous at apex; pinnae subentire to regularly serrate to crenate or crenulate, rarely incised (3)
- 3(2). Fronds all fertile, erect or ascending; margins of subcoriaceous pinnae subentire to crenulate; stipe and rachis blackish3. *A. resiliens*.
3. Fronds slightly dimorphic, the fertile erect, the sterile smaller and spreading; margins of herbaceous pinnae subentire to deeply serrate or incised; stipe and rachis chestnut-brown4. *A. platyneuron*.

1. *Asplenium Trichomanes* L. MAIDENHAIR SPLEENWORT. Fronds clustered, to 25 cm. tall, usually much smaller, arcuate-spreading; blades narrowly linear-oblong, to 2 dm. long and 15 mm. wide, pinnate; pinnae suborbicular to obovate or broadly elliptic, somewhat asymmetrically cuneate to truncate at base, minutely crenulate on the rounded margins. In sheltered crevices of ledges and cliffs, up to 7,800 ft. alt., rare in the Davis Mts. of the Trans-Pecos; from N. S. and Que., s. to Ga., w. to Ore. and Alas., and s.w. to Tex., N.M. and Ariz.; also Euras.

2. *Asplenium Palmeri* Maxon. Fronds clustered, arcuate-spreading, to 2 dm. tall; blades linear to linear-lanceolate, to 17.5 cm. long and 18 mm. wide, pinnate, the usually naked apex flagelliform and radican, giving rise to a new plant by means of a terminal proliferous bud; pinnae broadly triangular to oblong, usually with the margins crenate-serrate. On moist shaded slopes and in crevices of granite cliffs, localized in the Davis Mts. in the Trans-Pecos; from w. Tex., N.M. and Ariz. through Mex. to Guat.

* See Appendix.

3. *Asplenium resiliens* Kunze. LITTLE EBONY SPLEENWORT. Fronds clustered, to 35 cm. tall; blades subcoriaceous, linear-oblong to narrowly linear-oblong, to 28 cm. long and 3 cm. wide, pinnate; pinnae deltoid to linear-oblong, with the margins subentire or crenulate. *A. parvulum* Mart. & Gal. In crevices of cliffs, boulders or ledges of limestone, granite or in calcareous soils, usually in shaded dry situations, up to 7,000 ft. alt., widespread and frequent on the Edwards Plateau and in the Trans-Pecos, s. to Frio Co. in the Rio Grande Plains, n. to Palo Pinto Co. in the Cross Timbers and e. to Angelina Co. in the Timber Belt and Orange Co. (probably on shell mounds) in the Coastal Prairies; from s. Pa. s. to Fla., w. to Ill., Okla., N.M. and Ariz. into Mex.; also Jam.

4. *Asplenium platyneuron* (L.) D.C.Eat. EBONY SPLEENWORT. Fronds clustered, somewhat dimorphic, to 5 dm. tall; blades herbaceous, linear-lanceolate to narrowly elliptic-lanceolate, to 37 cm. long and 65 mm. wide, pinnate; pinnae oblong to lanceolate or triangular, with the margins essentially entire to crenate-serrate or serrate. *A. ebenum* Ait. Most frequent in sandy loam on rich wooded banks and slopes along streams and on the edge of flooded woodlands, also on hummocks in swamps, rotting logs, talus slopes, boulders, ledges and in thickets, rarely semiepiphytic, generally distributed and frequent in the Timber Belt, rather widely distributed but of local occurrence in the Blackland Prairies (n.w. to Parker Co. and s.w. to Wilson Co.), sparsely represented in the e. part of the Coastal Prairies; from Me. and Ont., s. to Fla., w. to Ia. and Tex., sporadically in Kan. and Colo.; also S. Afr.

14. ATHYRIUM ROTH LADY FERN

About 200 species that are in tropical and subtropical regions throughout the world.

1. *Athyrium Filix-femina* (L.) Roth var. *asplenioides* (Michx.) Farw. SOUTHERN LADY FERN. Rather large terrestrial plant; rhizome shortly creeping, with light-brown scales, about 7 mm. in diameter; fronds clustered, to 12 dm. high; stipes yellowish-green, often tinged with red or brown, stramineous when dry, sparingly scaly below; blades ovate-lanceolate to elliptic-lanceolate, acuminate, pinnate-pinnatifid to rarely subtripinnate (at least below), thin-herbaceous to subcoriaceous, essentially glabrous throughout, usually exceeding the length of the stipe, to 35 cm. wide; pinnae shortly stalked, elliptic-lanceolate to narrowly lanceolate, acuminate, spreading horizontally or curved-ascending with age, to 4 cm. wide; pinnules or ultimate segments mostly decurrent on the rachis, sometimes subpetiolate, oblong-lanceolate, obtuse to shortly acuminate, incised to serrate or lobulate with the lobules often again toothed; sori short, 3 to 10 pairs in each segment; indusia mostly curved, with gland-tipped cilia. *A. asplenioides* (Michx.) Eat. In sandy bogs, moist sandy woods, swamps, wet thickets and on stream banks, generally distributed and rather common in the Timber Belt and in several n. border cos. in the Coastal Prairies, w. to Williamson Co. in the Blackland Prairies; from Fla. to Tex., n. to e. Mass., Ind. and Mo.

15. WOODSIA R. BR. WOODSIA

Rather small plants of rock outcrops, rocky woods and fields with short tufted scaly rhizomes; fronds erect-ascending, clustered; stipes slender, sometimes jointed near the base, somewhat scaly; blades linear to narrowly elliptic-lanceolate, pinnate to bipinnate with the segments lobed or pinnatifid, membranous, glabrous to scaly, with the veins free and usually forked; sori round, borne on the back of the simply forked free veins; indusia basal, thin, roundish, early opening at the top and splitting into several spreading segments, the segments broad and subentire to filiform.

This genus includes about 40 species, mainly of temperate and boreal regions.

1. Indusial lobes broad, jagged but not long-laciniate at apex; plants mostly in the eastern half of Texas 1. *W. obtusa*.
1. Indusial lobes laciniate at least one-third of their length; plants apparently confined to the Plains Country and west of the Pecos River (2)

- 2(1). Indusial lobes with a broad base, deeply laciniate on the upper half; fronds typically glanduliferous2. *W. Plummerae*.
 2. Indusial lobes deeply laciniate to near the base into filamentous lobes; fronds normally eglandular3. *W. mexicana*.

1. *Woodsia obtusa* (Spreng.) Torr. **BLUNT-LOBED WOODSIA**. Fronds clustered, to 5 dm. tall; blades elliptic-lanceolate to broadly lanceolate, to 4 dm. long and 1.5 cm. wide, pinnate-pinnatifid to bipinnate (at least below). Among rocks or along rather dry shaded ledges, on rock outcrops and cliffs, commonly in sandstone and granite regions, also on well-drained wooded banks, roadside banks, talus slopes and sandy knolls in woods, usually at moderate or low elevations, generally distributed and rather frequent in the Timber Belt and Cross Timbers (n.w. to Montague Co.), in the e. part of the Edwards Plateau and apparently isolated in Hudspeth and Jeff Davis cos. in the Trans-Pecos; from Que. to Minn. and Neb., s. to Ga. and s.w. to w. Tex.

2. *Woodsia Plummerae* Lemm. Fronds clustered, to 35 cm. tall; blades elliptic-lanceolate, to 25 cm. long and 1 dm. wide, pinnate-pinnatifid to bipinnate. On moist shaded cliffs and ledges, talus slopes and at the base of boulders, usually on or about igneous rocks, up to 7,500 ft. alt., uncommon in the s. and w. parts of the Trans-Pecos, rare and isolated in Palo Duro Canyon, Randall Co., in the Plains Country; from w. Tex. to Ariz. and Chih.

3. *Woodsia mexicana* Fée. Fronds clustered, to 35 cm. tall; blades lanceolate, to 25 cm. long and 8 cm. wide, pinnate-pinnatifid to occasionally bipinnate. On shaded or sometimes sunny rock ledges and boulders, in moist soil on slopes and in crevices of cliffs, up to 7,000 ft. alt., uncommon in the Trans-Pecos; from w. Tex. to Ariz. and Mex. (s. to S. L. P. and Ver.).

16. CYSTOPTERIS BERNH.

Delicate plants of moist wooded slopes and rocky areas with slender creeping and branching scaly rhizomes; fronds several, clustered, weakly erect-spreading, more or less succulent; stipes slender, stramineous to reddish-brown; blades 1- to 4-pinnate, the ultimate segments cut-toothed, with few sparingly branched veins; sori roundish, borne on the back of veins near the base of shallow sinuses; indusia membranous, hoodlike, attached by a broad rounded base on the inner side partly under the sori, early withering to expose the sori.

This genus includes about 18 species that are found in temperate and boreal regions of both hemispheres.

1. Blade broadest at the base, long-tapering, commonly bearing bulblets beneath; most of the veins ending in a sinus; lower pinnules not decurrent on the midrib
1. *C. bulbifera*.
 1. Blade broadest above the base, not noticeably long-tapering; most of the veins ending in a tooth; lower pinnules decurrent on the midrib ..2. *C. fragilis*.

1. *Cystopteris bulbifera* (L.) Bernh. **BLADDER FERN, BULBLET FERN**. Fronds weak, usually clustered, commonly spreading or trailing, to 1 m. long or more; stipe slender, stramineous, 1-2 dm. long; blade narrowly lanceolate, often much-elongated and attenuate from a broad base, 1- or 2-pinnate, with the pinnae coarsely toothed or pinnatifid, the segments toothed or incised, typically bearing beneath fleshy bulblets in the axils of the pinnae and segments; bulblets often producing new plants when they fall on moist soil; indusia truncate. In pockets on ledges in narrow part of upper McKittrick Canyon, Guadalupe Mts.; from Nfld. to Ut., s. to Ga., Tex. and Ariz.

2. *Cystopteris fragilis* (L.) Bernh. **FRAGILE FERN**. Fronds clustered or somewhat distant, erect-spreading, delicate, to 45 cm. tall, usually much smaller; blades narrowly triangular-ovate to oblong-lanceolate, to 25 cm. long and 12 cm. wide, bipinnate to occasionally bipinnate-pinnatifid. In crevices of cliffs, on the walls of sink holes, on boulders, moist banks and wooded talus slopes, usually in sheltered areas, up to 8,000 ft. alt., local and rare in the Devil's Sink Hole, Edwards Co., on the Edwards Plateau, in the Trans-Pecos and s. Blackland Prairies. The species, in the broad sense, occurs

from Lab. to Alas., s. to Ga. and s.w. to Tex., N.M., Ariz., s. Calif. and n. Mex.; also S. A., Greenl., Icel. and Euras.

17. PHANEROPHLEBIA PRESL

Rather large terrestrial or saxicolous plants with short thick ascending to erect densely scaly rhizomes and fasciculate fronds; stipes shorter than the blades, provided with large pale-brown hair-pointed persistent spreading scales; blades imparipinnate or with a pinnatifid apex, coriaceous, glabrous, scaly (especially the rachis and costae); pinnae numerous, usually falcate, unlobed or auriculate on the upper side at the base, spinulose-toothed; veins several times forked, free or casually anastomosing but not forming regular areoles, not reaching the margin; sori dorsal on the veins, not confined to the anterior branches, in two or more rows on each side of the midrib; indusia peltate, persistent or caducous.

This genus consists of about 20 species that occur mostly in temperate or subtropical regions in America. Placed in the genus *Cyrtomium* by some authors.

1. Pinnae mostly auricled on the upper side at the base . . . 1. *P. auriculata*.
 1. Pinnae only cuneate at the base, not auricled 2. *P. umbonata*.

1. *Phanerophlebia auriculata* Underw. Fronds clustered, to 65 cm. tall; blades rigidly herbaceous, elliptic-lanceolate to lanceolate, pinnate, to 45 cm. long and 2 dm. wide. On damp shaded canyon walls, under overhanging ledges, and in cracks in granite cliffs and cavernous recesses, rare in several cos. in the Trans-Pecos; w. Tex. to Ariz. and n. Mex.

2. *Phanerophlebia umbonata* Underw. Fronds approximate, to 7 dm. tall; blades elliptic-lanceolate to lanceolate, subcoriaceous, to 5 dm. long and 28 cm. wide, pinnate. In damp places on canyon walls and cliffs, and in forested ravines along streams, rare in the Trans-Pecos; w. Tex. and n. Mex.

18. TECTARIA CAV.

About 200 species that are found mainly in the tropics of both hemispheres.

1. *Tectaria heracleifolia* (Willd.) Underw. HALBERD-FERN. Rather large saxicolous plants; rhizome stout, erect to curved-ascending, 1-2 cm. thick, the apex minutely brown-paleaceous; fronds several, clustered, erect-arching, 4-9 dm. high; stipes lustrous, sulcate, stramineous to dark-brown, with deciduous scales at the reddish-brown base, about equal to or longer than the blade; blades dark-green, deltoid-ovate, pinnately 3- or 5-lobed (very rarely 7-lobed), thick-herbaceous to subcoriaceous, glabrous except for the glandular-puberulent veins, 2-6 dm. long, 1.5-3 dm. wide; pinnae variable, typically deltoid-ovate to oblong-lanceolate, the terminal pinna symmetrical, the lateral pinnae more or less falcate, usually deeply lobed or the margins variously irregularly undulate-crenate to lobulate, broadly rounded at the base, acuminate to long-attenuate at apex, the lowermost pinnae petioled, to 3 dm. long and 12 cm. wide; veins prominent, the areoles rather large and often with simple or once-forked included veinlets; sori numerous, in 2 rows between the lateral veins, to 3 mm. in diameter; indusia orbicular, entire, centrally peltate, persistent, deciduously puberulent. In limestone sink-holes and caverns in limestone bluffs where exists partial shade and protection from extremes of heat and cold, occasionally in dark canyons, shaded rock outcrops and railroad tunnels, in several cos. on the Edwards Plateau where it is uncommon; from Fla. and s.-cen. Tex., throughout the W.I., from Mex. to C. R. and in Venez.

19. POLYSTICHUM ROTH

About 135 species, mainly in temperate and tropical regions in both hemispheres.

1. *Polystichum acrostichoides* (Michx.) Schott. CHRISTMAS FERN. Rather coarse terrestrial plants; rhizome stout, short-creeping and ascending, to 1 cm. thick, with

light-brown lanceolate acuminate scales; fronds clustered, essentially evergreen, to 7 dm. high; stipes rather stout, to 17 cm. long or more, densely chaffy with the scales continuing along the rachises; blades elliptic-lanceolate to lanceolate, acuminate, pinnate, rigidly herbaceous to subcoriaceous, 3-6 dm. long to 13 cm. wide; pinnae oblong-lanceolate to narrowly lanceolate, acute to subacuminate, distinctly auricled at the base on the upper margin or sometimes incised, the margins with appressed bristly teeth, to 65 mm. long and 15 mm. wide, the lowermost pinnae sterile or only fertile at the tips, the uppermost pinnae fertile and conspicuously contracted; sori crowded, in 2 to 4 rows, often confluent with age; indusia peltate, entire, persistent. On rocky rich wooded hillsides or steep banks of ravines along streams, along sandy creeks and in swamps and thickets, widespread and frequent throughout e. and s.e. Tex., w. to Waller Co. in the Blackland Prairies; from N. S. to Wisc., s. to Fla. and Tex.; also Mex.

20. NEPHROLEPIS SCHOTT SWORD FERN

About 30 species that are widely distributed mainly in tropical and subtropical regions of both hemispheres.

1. *Nephrolepis exaltata* (L.) Schott. Showy graceful epiphytic or terrestrial plants; rhizome short, more or less erect, provided with light-brown lance-setaceous scales, stoloniferous; stolons wiry, widely creeping; fronds erect-spreading or recurved-pendent from tree trunks and walls, to 2 m. long or more; stipe (and rachises) slender, wiry, brownish and lustrous, at first slightly scaly, the stipe short; blades linear-lanceolate, acuminate, firmly membranous, pinnate, to 16 cm. wide; pinnae numerous, sessile, horizontally placed, contiguous to subimbricate, the lowermost pinnae triangular-ovate and obtuse, the upper ones lanceolate and acuminate, upcurved-falcate, with the margins irregularly undulate-serrulate, auricled on the upper margin at the base, to 8 cm. long and 15 mm. wide near the middle; veins close, once- or twice-forked; sori submarginal; indusia firm, orbicular-reniform. In open woodlands, rocky banks and on trees, naturalized in e. Tex. and on the Edwards Plateau; from Fla. and Tex., through Mex., Bah. I., Berm., throughout the W. I., and in the Old World trop. and subtrop.

21. THELYPTERIS SCHMID.

Terrestrial plants of moist woodlands and rocky places, with stout or mostly slender strong long-creeping sparsely scaly rhizomes; scales of the rhizome ciliate, entire, fibrous; fronds erect-ascending, somewhat distant, deciduous; stipes stramineous, essentially scaleless, with two bundles at the base; blades uniform, thin-membranous, bipinnatifid to pinnate-pinnatifid or bipinnate-pinnatifid, pubescent with acicular hairs, rarely sparsely scaly; ultimate segments usually entire or nearly so, rarely serrate or coarsely toothed, ciliate; veins few, simple or once-forked, reaching the margins; sori dorsal on the veins, median or supramedial; indusia small or sometimes absent, reniform, usually glandular or ciliate.

A large world-wide genus of several hundred species that attains its optimum development in temperate and subtropical Asia.

- 1. Ultimate segments with the margins serrate or coarsely toothed 6. *T. Torresiana*.
- 1. Ultimate segments with the margins entire to crenate or nearly pinnatifid, never serrate (2)
- 2(1). Basal veins of the adjoining ultimate segments united below the sinus, with the resulting veinlet running to the sharp sinus 2. *T. dentata*.
- 2. Veins all free (except in *T. × versicolor*) (3)
- 3(2). Blades more or less triangular, pinnatifid; indusia wanting 5. *T. hexagonoptera*.
- 3. Blades lanceolate, pinnate; indusia present (4)
- 4(3). Veins forked; indusia glabrous 1. *T. palustris* var. *Haleana*.
- 4. Veins simple; indusia pubescent (5)

- 5(4). Basal veins of adjoining ultimate segments free 3. *T. Kunthii*.
 5. Basal veins of some adjoining ultimate segments united or arcuate so as to touch one another 4. *T. × versicolor*.

1. *Thelypteris palustris* Schott var. *Haleana* Fern. SOUTHERN MARSH FERN. Fronds erect from a slender rhizome, to 12 dm. tall; blades lanceolate to elliptic-lanceolate, to 2 dm. wide, pinnate-pinnatifid to rarely bipinnate, slightly pubescent (especially the rachis). *Dryopteris Thelypteris* var. *Haleana* (Fern.) Broun. In open sandy bogs, swamps and meadows, or in open low woodlands (especially along streams), rare in several cos. in the Timber Belt and in Jefferson Co. in the Coastal Prairies and Waller and Colorado cos. in the Post Oak Prairies; from Fla. to La. and e. Tex., n. to (?) Pa.

2. *Thelypteris dentata* (Forsk.) E. St. John. DOWNY SHIELD FERN. Fronds clustered, erect-ascending from a thick rhizome, to 12 dm. tall; blades ovate-oblong to lanceolate, to 8 dm. long and 28 cm. wide, pinnate-pinnatifid, shortly pilose throughout and minutely glandular on lower surface. *Dryopteris dentata* (Forsk.) C. Chr. On rocky wooded slopes, on hummocks in swamps, and along wooded streams, at low elev., rare in the Timber Belt; from Fla. to Tex., in part escaped from cult.; also from Mex. to Arg., the W. I., Asia and Afr.

3. *Thelypteris Kunthii* (Desv.) Morton. SOUTHERN SHIELD FERN. Fronds approximate in 2 rows on a creeping rhizome, erect or ascending, to 15 dm. tall; blades ovate-oblong to oblong-lanceolate or elliptic-lanceolate, to 4 dm. wide, pinnate-pinnatifid, glandular and whitish-pubescent on lower surface. *Dryopteris normalis* C. Chr., *D. augescens* var. *Lindheimeri* (A. Br.) Broun, *Thelypteris augescens Lindheimeri* (A. Br.) R. St. John, *T. normalis* (C. Chr.) Moxley. On the edge of sandy creeks, in swamps, low woods and deep canyons, on wet bluffs and ledges, especially at the base of dripping limestone bluffs, frequently associated with *Adiantum Capillus-Veneris*, rather widespread and frequent in the Timber Belt, less common in the Coastal and Blackland prairies, w. through the s. part of the Edwards Plateau to Terrell and Brewster cos. in the Trans-Pecos; from Fla. to S.C. and Tex.; also Bah. I., Berm. and the W. I.

4. *Thelypteris × versicolor* R. St. John. Plants that appear to be intermediates of *T. Kunthii* and *T. dentata* are here considered to be hybrids of those species. The basal venation in the material examined irregularly resembles either of its parent-species. *Dryopteris × versicolor* (R. St. John) Broun. Usually found associated with one or both of its putative parents; Fla., La. and s.e. Tex.

5. *Thelypteris hexagonoptera* (Michx.) Weath. BROAD BEECH FERN. Fronds distant, arising at short intervals on a slender creeping rhizome, to 8 dm. tall; blades broadly triangular, to 38 cm. long and broad, bipinnatifid, with the lower usually larger pair of segments directed downward and away from the rachis at a different angle from the upper segments. *Phegopteris hexagonoptera* (Michx.) Fée, *Dryopteris hexagonoptera* (Michx.) C. Chr. On sandy wooded slopes and in ravines along streams, in open rocky thickets, and on the edge of low swampy woods and bogs, at low elev., rare in the Timber Belt; from Fla. to e. Tex., n. to Que. and Minn.

6. *Thelypteris Torresiana* (Gaudich.) Alston. Fronds clustered on a stout rhizome, to 2 m. or more tall; blades deltoid-ovate to triangular-lanceolate, to 9 dm. or more long and 4 dm. wide, bipinnate-pinnatifid, membranous, setaceous with silvery-white hairs. *Thelypteris setigera* of auth., *Dryopteris setigera* of auth. Along streams in pinelands, in swamps, marshes and on moist wooded banks, in e. Tex.; nat. of Asia and adj. I., escaped from cult. and more or less established in cen. peninsula Fla., Ala., Tex. and trop. Am.

22. DRYOPTERIS ADANS.

Terrestrial or saxicolous plants of moist woodlands, bogs, and cliffs, with stout erect or short-creeping scaly rhizomes; scales of the rhizome glabrous, not ciliate, entire or toothed, fibrous; fronds erect, often approximate, commonly evergreen; stipes stramineous, with 3 to 7 free bundles; blades coriaceous to subcoriaceous, pinnate-pinnatifid to tripinnate; ultimate segments mostly toothed, often subspinulose, glabrous, not ciliate, sometimes capitate-glandular, sparingly or densely scaly; veins free, simple or mostly forked, ending short of the margin in elongate hydathodes; sori dorsal on the veins,

inframedial to submarginal; indusia reniform, large, persistent, glabrous, sometimes glandular on margin or back.

A large world-wide genus of about 150 species that are found mainly in tropical and subtropical regions of both hemispheres.

1. Scales of the rachises few, ovate- to elliptic-lanceolate, essentially entire; lowermost pinnae greatly reduced and broadly triangular 1. *D. cristata*.

1. Scales of the rachises many, filiform to narrowly lanceolate, usually serrate to lacerate; lowermost pinnae somewhat reduced and narrowly triangular-lanceolate 2. *D. Filix-mas*.

1. *Dryopteris cristata* (L.) Gray. CRESTED SHIELD FERN. Fronds inconspicuously dimorphic, clustered on a thick rhizome, thick-herbaceous, glabrous on upper surface, sparsely scaly on lower surface, to 12 dm. tall; sterile fronds broad and spreading, usually evergreen; fertile fronds narrow and erect; blades (of both types of fronds) linear-oblong to lanceolate or narrowly elliptic-lanceolate, to 8 dm. long and 15 cm. wide, pinnate-pinnatifid to nearly bipinnate. In marshes, bogs, swamps, thickets and meadows, and on springy wooded slopes, at low elevations, if extant only in the n.e. corner of the Timber Belt (Bowie Co., "margin of sandy bog near Texarkana," October 27, 1925, *E. J. Palmer 29404*, p. p.); from Nfld. to Ida., s. to e. Va., N.C., s.e. Ark., n.-cen. La. and n.e. Tex.

2. *Dryopteris Filix-mas* (L.) Schott. MALE FERN. Fronds clustered on a stout rhizome, to 12 dm. tall, ascending; blades oblong-lanceolate to elliptic-lanceolate, thin-herbaceous, up to 1 m. long and 3 dm. wide, pinnate-pinnatifid to almost bipinnate. In crevices and clefts of huge ledges and bluffs, on shaded talus slopes at base of cliffs, and in rich soil of cool rocky woods, up to 8,500 ft. alt., rare on Mt. Livermore and Sawtooth Mt. in the Davis Mts. of the Trans-Pecos; from Nfld. to B. C., s. to Vt., Mich., and in the mts. to w. Okla., w. Tex., N.M., Ariz., s. Calif. and Mex.; also Greenl. and Euras.

FAM. 12. PARKERIACEAE HOOK.

FLOATING FERN FAMILY

Aquatic or semiaquatic plants with roots on the stipes; stems creeping, sparsely scaly, reduced; fronds alternate, successive, viviparous, fleshy-herbaceous, dimorphic, reticulate-veined, floating or emergent; sporophylls erect, taller and more finely divided than the sterile fronds, the linear ultimate segments with the margins evenly and narrowly revolute; sporangia solitary.

Only one genus.

1. CERATOPTERIS BRONGN.

Characteristics of the family. Three species, mostly in the tropics and subtropics of both hemispheres; edible aquatic plants.

1. *Ceratopteris thalictroides* (L.) Brongn. Fronds erect, strict, to 75 cm. long, usually much smaller; stipes 4-27 cm. long; lamina of sterile frond narrowly deltoid to oblong, to 28 cm. long and 13 cm. wide, 1- or 2-pinnate or -pinnatifid with the pinnae ovate-lanceolate; segments linear-lanceolate to oblong, acute, to 25 mm. long and 5 mm. wide; sporophylls taller than the sterile fronds, the oblong lamina 2- to 5-pinnately divided with the pinnae and smaller divisions distant; ultimate segments flagelliform, 1-5 cm. long, the margins narrowly revolute to cover 1 or 2 rows of areolae and sporangia. Well-established in spring-fed back-waters of the San Marcos River in Hays Co. where it was originally introd. (probably about 1960); nat. apparently to both hemispheres; also in s. Fla.

It is quite possible that the other two species in this genus, *C. pteridoides* (Hook.) Hieron. and *C. deltoidea* Benedict, may be introduced in Texas rivers. In contrast to *C. thalictroides*, they both have broadly deltoid fronds. The sterile fronds of *C. pteridoides* are usually simple with broad basal lobes and short, often swollen, stipes that are widest at base of blade and tapered downward, while the sterile fronds of *C. deltoidea* are pinnately divided, with long, slender stipes.

DIVISION II. SPERMATOPHYTA

SEED-BEARING OR FLOWERING PLANTS

Plants producing seeds that contain the young plants in a dormant condition until germination. Sporophylls arranged in groups (flowers) of definite or indefinite numbers, heterosporous, those bearing microsporangia (anther sacs) termed stamens, those producing macrosporangia (ovules) carpels. The gametophytes very much reduced, the female being confined within the macrosporangia where its egg-cell is fertilized by the spermatozoid of the male gametophyte (pollen tube), the sporophyte thus beginning its development while still attached to the sporophyte of the preceding generation. Eventually detached in an embryonic stage, together with the enclosing tissues, as a seed.

The seed-bearing plants form the most numerous plant group in existence, more than 200,000 species being known. The seed-habit, now restricted to the Spermatophyta, is also known to have occurred in ancient fernlike plants. This category is now considered essentially one of convenience rather than distinction because of the apparent diverse ancestry of its component members.

CLASS I. GYMNASPERMAE³

Plants monoecious or dioecious, more or less resinous trees or shrubs; ovules and seeds not enclosed in an ovary, typically borne on scales that are arranged in a cone or strobilus, or sometimes terminal on naked or bracteate stalks; microsporangia mostly embedded in microphylls that are arranged in a cone or strobilus; male and female cones distinct, dissimilar.

The Gymnosperms comprise an ancient remnant of about 700 species of trees and shrubs that are considered to have been most abundant in the Mesozoic. The group contains such relicts as the Cycads, the Ginkgo tree, *Metasequoia* and Araucarias.

FAM. 13. PINACEAE LINDL.

PINE FAMILY

Resinous evergreen or rarely deciduous monoecious trees or shrubs, with whorled opposite or rarely alternate branches; leaves linear, needlelike or scalelike, arranged in spirals; flowers surrounded at base by the persistent bud scales, unisexual, the staminate consisting of many spirally arranged stamens with 2 pollen sacs, the ovulate of many scales that bear 2 pendent ovules on their inner surface; fruit a woody cone, maturing the first, second or third season; seeds with or without wings; embryo axile in the copious endosperm; cotyledons several.

A family of 10 genera and about 250 species that are widely distributed over the Northern Hemisphere. Our pines are of considerable economic importance in east Texas for timber, naval stores and pulpwood.

1. Leaves in bundles of 2 to 5 that are surrounded at base by a persistent or very rarely deciduous scaly sheath; cones maturing the second or third year
.....1. *Pinus*, p. 71.
1. Leaves not in sheaths, solitary, often appearing 2-ranked; cones maturing the first year2. *Pseudotsuga*, p. 74.

³Cf. D. S. Correll in C. L. Lundell, *Flora of Texas* I: 322-368. 1966 for a more detailed treatment.

1. PINUS L. PINE

Evergreen trees or rarely shrubs, with furrowed to laminate or thin scaly bark, rather hard or often soft wood; leaves of two kinds, the secondary forming the ordinary foliage leaves, needlelike, borne in clusters of 2 to 5 or rarely 1, terminating short rudimentary branchlets in the axils of scalelike primary leaves, surrounded at the base by a persistent or rarely deciduous membranous sheath, persistent from 2 to 8 years; staminate flowers clustered at the base of the season's growth, forming a distinct zone on the twig which becomes naked after the flowers have fallen, each flower subtended by an involucre of several scales, composed of many 2-celled anthers; ovulate flowers subterminal or lateral, solitary, in pairs or clustered, sessile or stalked, consisting of many ovule-bearing scales, subtended by nonaccrescent bracts and bearing 2 pendent ovules; fruit a woody cone, maturing the second year or sometimes the third year, opening and shedding the seeds at maturity or (in some species) remaining closed and persistent on the branches for years; cone-scales elongated, variously thickened and appendaged at the exposed apex (the *apophysis*), with the ends of the growth of the previous year appearing as terminal or dorsal brown protuberances or scars (the *umbo*); seeds usually obovoid, often with conspicuous membranous wings, their coats crustaceous; cotyledons 3 to 15 or sometimes more.

A genus of about 100 species widely scattered over the Northern Hemisphere. The genus includes species that are important for timber, paper pulp, and naval stores.

The vast forest of pines of southeastern United States reaches its southwestern limits in east Texas. The boundary of its westernmost extension in Texas is represented by its natural occurrence in the following counties, reading north to south: Fannin, Lamar, Franklin, Rains, Van Zandt, Henderson, Anderson, Leon, Madison, Brazos, Burleson, Lee, Bastrop, Fayette, Colorado, Wharton, Fort Bend and Brazoria. One or more species of eastern species of pines occur in each of the 59 counties in Texas including and lying to the east of the above-cited counties.

1. Distribution east and southeast Texas, west to Bastrop County (2)
1. Distribution from the west-central Edwards Plateau north into the Plains Country and west into the Trans-Pecos, east to Real and Uvalde counties (5)
- 2(1). Needles mostly 25 cm. long or more, consistently 3 in a bundle; bundle sheaths of new leaves on young twigs usually 25 mm. long or more; mature cones mostly over 15 cm. long; terminal buds silvery white1. *P. palustris*.
2. Needles usually much less than 25 cm. long, 2 or 3 in a bundle; bundle sheaths of new leaves on young twigs 20 mm. long or less; mature cones mostly less than 12 cm. long; terminal buds brownish (3)
- 3(2). Leaves about 10 (5-12) cm. long, mostly 2 but sometimes 3 in a bundle; bundle sheaths mostly less than 10 mm. long; mature cones 4-7 cm. long5. *P. echinata*.
3. Leaves about 17 (12-23) cm. long, mostly 3 but sometimes 2 in a bundle; bundle sheaths mostly more than 12 mm. long; mature cones usually 8 cm. long or more (4)
- 4(3). Leaves almost invariably 3 in a bundle; cones sessile2. *P. taeda*.
4. Leaves 2 or 3 in a bundle; cones short stalked3. *P. Elliottii*.
- 5(1). Needles 5 in a bundle; bundle sheaths early deciduous, 1.5-2 cm. long8. *P. strobiformis*.
5. Needles usually less than 5 in a bundle; bundle sheaths persistent, of various lengths (6)
- 6(5). Needles more than 100 mm. long, mostly 3 (only occasionally 2, 4 or 5) in a bundle; bundle sheaths more than 10 mm. long; mature cones more than 7 cm. long; seeds with prominent wings4. *P. ponderosa*.
6. Needles 25-45 mm. long, 2 or 3 (rarely 1) in a bundle; bundle sheaths about 5 mm. long; mature cones usually less than 5 cm. long; seeds wingless or essentially so (7)

- 7(6). Needles 2 (sometimes 1 or 3) in a bundle, stout, semicircular in transverse section, yellow-green; mature cones usually more than 4 cm. long; seeds typically soft-shelled6. *P. edulis*.
7. Needles 2 or 3 in a bundle, slender, often triangular in transverse section, dark blue-green; mature cones mostly less than 4 cm. long (8)
- 8(7). Needles mostly 3 in a bundle; seeds thick-shelled; distribution in the Trans-Pecos region7. *P. cembroides*.
8. Needles mostly 2 in a bundle; seeds thin-shelled; distribution mostly on the Edwards Plateau7. *P. cembroides* var. *remota*.

1. *Pinus palustris* Mill. LONGLEAF PINE, LONGLEAF YELLOW PINE. Tree to 30 m. tall, with a long clear trunk to 75 cm. in diameter and short stout branches to form a small open crown; twigs stout, orange-brown; buds large, invested by numerous silvery-white spreading fringed scales; bark orange-brown, composed of thin papery scales, usually plated on large trees; leaves in bundles of 3, in dense tufts at the ends of stout branchlets, subtended by a scarious bract, 20-45 cm. long, bright-green, slender, flexible, pendulous, 3-sided; bundle sheath 25 mm. or more long, persistent; bract symmetrically decurrent and rounded or truncated at base; male flowers dark-rose-purple, numerous in clusters; female flowers dark-purple, in clusters of 2 to 4; conelets with shortly mucronate scales; cones sessile, narrowly ovoid-elongate to cylindrical, essentially symmetrical, 15-25 cm. long, when deciduous usually leaving a few scales on the tree; cone-scales thin, flat, rounded at apex; apophysis reddish-brown, commonly wrinkled, somewhat elevated along a transverse keel, the prominent umbo with a small persistent reflexed prickle; seeds about 12 mm. long, mottled; seed-wing about 4 cm. long, semi-elliptic, somewhat irregular at apex, striped. *P. australis* Michx. f. Mostly in deep sands or coarse sandy loams in several cos. in extreme s.e. Tex.; in the Coastal Plain from s.e. Va. to cen. Fla., w. to s.e. Tex.

In southeastern United States this is an important timber tree and a leading world producer of naval stores.

2. *Pinus taeda* L. LOBLOLLY PINE, OLDFIELD PINE. Tree to 35 m. tall, with a long clear trunk 6-12 dm. in diameter and spreading and ascending branches to form a large open crown; twigs reddish-brown to dark-yellow-brown; buds with numerous narrow triangular reddish-brown scales that are often reflexed at their free tips; bark nearly black and scaly on young stems, dark-brown on older parts and to 5 cm. thick, divided into irregular scaly blocks; leaves in bundles of 3 or sometimes 2, subtended by a scarious bract, 12-23 cm. long, yellow-green to grayish-green, slender though somewhat rigid, sometimes twisted; bundle sheath 1.5-2 cm. long, persistent; bracts decurrent and somewhat constricted into an obliquely cuneate base; male flowers yellow, in large clusters; female flowers yellow, solitary or in clusters of 2 or 3; conelets erect, their scales subacuminate; cones sessile ovoid-cylindric to narrowly conical, essentially symmetrical, 7-12 cm. long; cone scales thin; apophysis tawny, sometimes lustrous, flattened, wrinkled, somewhat elevated along a transverse keel, the entire umbo forming a stout triangular spine with somewhat concave sides; seeds about 7 mm. long, pebbly to the touch, dark-brown, mottled with black; seed-wing about 2 cm. long, semiobovate, lustrous, yellowish-brown to somewhat grayish-black. In sands, sandy loams or gravelly soils in flatwoods, on ridges and hills, and savannahs in e. Tex., w. to Bastrop, Burleson, Leon, Anderson, Smith and Wood cos.; on the Coastal Plain and Piedmont from s. N.J. and Md., s. to cen. Fla. and w. to e. Tex. and n. in the Miss. Valley to s.e. Okla., Ark. and s. Tenn.

This species comprises the so-called "Lost Pines" of Bastrop County. This romanticism is misleading since the pines of Bastrop and Fayette counties are now known to be definitely connected with the main body of pines that are the principal component of the east Texas forest.

3. *Pinus Elliottii* Engelm. SLASH PINE, PITCH PINE, YELLOW SLASH PINE. Tree to 35 m. tall, with a tall tapering trunk to 1 m. in diameter and horizontal branches to form a rounded crown; twigs roughened with spreading scales; bark broken up into rather large flat flakes; leaves stout, dark green and lustrous, ascending in rather tight clusters to appear broomlike, borne in fascicles of 2 or 3, 12.5-27 cm. long; fascicle

sheaths 1-1.5 cm. long; cones stalked, 7.5-15 cm. long, usually falling from tree by the end of the second year, elongate and ovoid-conic when unopened, ovoid-conic when open; cone scales with lustrous tan faces, transversely keeled, each with an elongate umbo that bears a small recurved spine; seeds somewhat triangular, with a thin brittle shell, the wings dark-brown. *P. caribaea* of auth.

This species is commonly planted in reforestation. Plantations have been seen or are known to occur in Austin, Montgomery, Tyler, Jasper and Newton counties. It reproduces well and, in time, this species should become a naturalized element in the flora of Texas. Slash pine occurs on the Coastal Plain from s. S.C. to cen. Fla. and s.e. La.; planted and tending to escape in s.e. Tex.

4. *Pinus ponderosa* Laws. PONDEROSA PINE, WESTERN YELLOW PINE. Tree to about 35 m. tall, with a straight trunk 9-12 dm. in diameter and rather stout branches forming a pyramidal open crown; twigs short and congested, emitting a turpentine-like odor when bruised; bark blackish and furrowed on young trees, yellowish-brown to cinnamon-red and plated on old trunks; leaves usually in bundles of 3 but occasionally 2 on the same tree, rarely 4 or 5, subtended by a scarious bract, 1-3 dm. long, gray-green to dark-yellowish-green, flexible to somewhat rigid; bundle sheath 1.5-2 cm. long, persistent, the scales at first dull-brown but soon becoming blackish with age; bract about 3 mm. long after loss of the lanceolate fimbriate apical portion, the base umbonate and scarcely or not at all decurrent; male flowers yellow; female flowers clustered or in pairs, dark-red; cones essentially sessile, ovoid to ovoid-conic or ellipsoid, more or less symmetrical, light-reddish-brown, 8-15 cm. long, when deciduous usually leaving a few basal scales on the tree; cone scales thickish; apophysis diamond-shaped, tawny-yellow to dull-brown, lustrous, elevated along a transverse keel, the prominent umbo armed with a sharp usually persistent prickle; seeds ovoid, about 7 mm. long, somewhat compressed toward the apex, brownish-purple; seed wing about 25 mm. long, semiobovate. *P. brachyptera* Engelm. In canyons and on upper slopes of mts. in the Trans-Pecos; widespread from the mts. of w. Tex., w. to s. B. C. and w. and n.w. U.S. and s. to n.-cen. Mex.

This is an important timber tree in western United States. In the Chisos Mts. some specimens with 4 and 5 needles tend toward the var. *arizonica* (Engelm.) Shaw of northern Mexico, southern Arizona and southwestern New Mexico.

5. *Pinus echinata* Mill. SHORTLEAF PINE, SHORTLEAF YELLOW PINE. Tree to 30 m. tall, with a long clear trunk 6-9 dm. in diameter and rather short spreading branches to form a narrow pyramidal crown; twigs at first pale-green, usually with a bluish or purplish bloom, in time smooth and reddish-brown; buds with several slender red-brown scales; bark nearly black and roughened on young stems, reddish-brown and separated into irregular flat scaly plates on older parts; leaves in bundles of 2 or 3 on same branch, subtended by a scarious bract, 7-12 cm. long, dark-blue- or yellow-green, slender, flexible; bundle sheath 6-12 (-15) mm. long, persistent; bract irregularly decurrent with the decurrent portion soon exfoliated; male flowers yellowish-brown to pale-pink, in large clusters; female flowers light-pink, solitary or in clusters of 2 or 3; conelets with mucronate scales; cones sessile, releasing their seeds at maturity but remaining on the branches for many years, ovoid to conical, essentially symmetrical, 4-6.5 cm. long; cone scales thin, rounded at the apex; apophysis reddish-brown, thin or thickened along a transverse keel, the prominent umbo armed with a small sharp straight or curved often deciduous prickle; seeds nearly triangular, with rounded sides, about 7 mm. long, brown, usually mottled with black; seed wing about 12 mm. long, semiobovate, stramineous, sometimes streaked with yellow-brown. On well-drained hills, flatwoods and slopes in e. Tex., w. to Burleson and Henderson cos.; from s.e. N. Y. and N. J., s. to n. Fla. and s.w. to s. Mo., e. Okla. and e. Tex.

An important timber tree in southeastern United States.

6. *Pinus edulis* Engelm. PINYON, NUT PINE, COLORADO PINYON PINE. Small trees to 10 m. or more tall, with a short trunk 6 dm. or more in diameter and a compact globose spreading crown; bark furrowed into scaly ridges, gray to reddish-brown; needles 2 (sometimes 3 or rarely 1) in a bundle, stout, yellowish-green, with whitish lines on their outer rounded surface; bundle sheath about 5 mm. long, cones ovoid, 3.5-5 cm. long, light-brown or tan-color, with thick blunt scales; seeds brown, wingless, usually soft-shelled, about 13 mm. long, oily and edible. *P. cembroides* var. *edulis* (Engelm.) Voss.

On mt. slopes in extreme n. Trans-Pecos, also reportedly on breaks of the Prairie Dog Town Fork of the Red River in Deaf Smith Co. in the Plains Country; from Tex., w. to Colo., Ut., Ariz. and n. Mex., with several local areas in n.w. Okla., s.w. Wyo. and s.e. Calif.

E. L. Little, Jr. has observed that *P. edulis* is more or less consistently parasitized by *Arceuthobium* while *P. cembroides* is relatively immune. The edible seeds of this species are gathered from the wild and are sold as "pinyon nuts."

7. *Pinus cembroides* Zucc. MEXICAN PINYON, MEXICAN PINYON PINE, PINO PIÑONERO. Small trees to 10 m. or more tall, with a trunk 5 dm. or more in diameter and a compact globose spreading crown; bark deeply furrowed into scaly ridges, reddish-brown or blackish, with flattened plates on large trunks; needles 3 (sometimes 2) in a bundle, 25-45 mm. long, slender, dark-bluish green; bundle sheath about 5 mm. long; cones ovoid, 2.5-4 cm. long, reddish-brown, with thick blunt scales; seeds brown, usually hard-shelled, about 1 cm. long, oily and edible. On mesas and mt. slopes of s. half of Trans-Pecos Tex.; from Tex., w. to s.e. Ariz. and n. Mex.

Var. *remota* Little. This plant, which is somewhat remotely centered in the Edwards Plateau of west-central Texas, is characterized by having usually 2 needles in a bundle and thin-shelled seeds. According to Little, the trees have persisted on the Edwards Plateau at low elevations probably since the glacial periods when the distribution probably was continuous.

8. *Pinus strobiformis* Engelm. SOUTHWESTERN WHITE PINE, PINO ENANO. Tree to 25 m. tall, with a trunk to about 1 m. or more in diameter and rather slender branches forming a broad rounded crown; spring shoots reddish-brown and pubescent; twigs and branchlets tough and pliant, glabrous, usually with a glaucous bloom; buds with ovate-lanceolate loosely imbricated brownish scales having scarious margins; bark smooth and whitish-gray on young trunks, grayish or dark-brown and deeply furrowed on older trunks; leaves in bundles of 5, at first subtended by a scarious bract, 4-9 cm. long, bluish-green, slender, entire to very sparsely serrulate; bundle sheath 1.5-2 cm. long, early deciduous; bract from a swollen base not noticeably decurrent; male flowers reddish-brown in appearance, in short spikes; female flowers bright reddish-purple, several in a cluster; conelets smooth; cones short-stalked to subsessile, pendent, oval to subcylindric, symmetric, yellowish-brown, 7-25 cm. long, dehiscent at maturity; cone scales thick, rounded at apex; apophysis pale-tawny-yellow or yellow-ochre, lustrous, commonly prolonged and somewhat reflexed, the thickened apex and unarmed umbo raised above the surface of the cone; seeds oval, 5-12 mm. long, wingless or essentially so, reddish-brown mottled with black. *P. flexilis* of auth., *P. flexilis* var. *reflexa* Engelm., *P. reflexa* (Engelm.) Engelm. In canyons and on upper slopes of mts. in cen. and n. Trans-Pecos; from the mts. of w. Tex., w. to Ariz. and s. to cen. Mex.

2. PSEUDOTSUGA CARR.

Seven species in North America and eastern Asia.

1. *Pseudotsuga Menziesii* (Mirb.) Franco. DOUGLAS-FIR, BLUE DOUGLAS-FIR. Pyramidal evergreen trees with long whorled branches, usually drooping branchlets and rough furrowed bark, to 50 m. or more tall, with a straight trunk to about 15 dm. in diameter; the twigs somewhat roughened by the bases of fallen leaves, glabrous or pubescent; leaves short-stalked, linear, spreading on all sides of twigs or sometimes in 2 rows, 1.5-3 cm. long, about 1.3 mm. wide, flat, slightly grooved and dark-blue-green above, paler beneath, rounded at apex, falling away after from 6 to 8 years to leave a rounded sessile leaf scar; cones ellipsoid to ovoid-ellipsoid, reddish-brown, 4-7 cm. long, with thin rounded scales and long thin conspicuously 3-pointed bracts projecting beyond the scales; seeds dull-russet-brown with areas of white. *P. Douglasii* (Lindl.) Carr., *P. taxifolia* (Lamb.) Britt., *P. mucronata* (Raf.) Sudw. In canyons and on upper slopes in the mts. of the Trans-Pecos; from w. Tex. to Mont., Alta. and B.C., s. to Calif., Ariz. and n. Mex.

One of the most important timber trees that, according to the best authorities, has the largest total stand of any timber tree in the United States. Our plant is usually referred

to var. *glauca* (Mayr) Franco on the basis of its more compact habit and more ascending branches, the shorter more or less bluish-green leaves, and smaller cone (about 5 cm. long) with spreading and often reflexed bracts.

FAM. 14. TAXODIACEAE WARMING

TAXODIUM FAMILY

Deciduous or essentially evergreen trees with light-brown furrowed and scaly bark and upright or spreading branches; branchlets of two kinds, those near the apex of the shoot persistent and with axillary buds, those on the lower part of the shoot without axillary buds and deciduous; winter-buds globose, scaly; leaves alternate, subulate or flat and linear with stomatic bands below, those of the deciduous branchlets usually spreading in two ranks, those of the persistent branchlets spreading radially; staminate flowers ovoid, consisting of 6 to 8 stamens and forming terminal drooping panicles; pistillate flowers scattered near the ends of the branches of the preceding year, subglobose, consisting of 2-ovuled scales; fruit a short-stalked globose or ovoid cone that ripens the first year, consisting of many thick coriaceous peltate scales that are dilated from a slender stipe into an irregularly 4-sided often mucronate disk; each fertile scale with 2 unequally 3-angled seeds with 3 thick wings.

About 16 species in 10 genera in both hemispheres.

1. TAXODIUM RICH.

BALD CYPRESS

Trees with light-green deciduous leaves and slender leafy branchlets of the season that are deciduous in autumn, monoecious, often with erect columnar "knees" produced from the roots in areas of frequent flooding; flowers unisexual, the two kinds on the same branches; staminate flowers in panicles of short or slender spikes, with few stamens; filaments scalelike, peltate, bearing 2 to 5 anther cells; pistillate aments ovoid, in small clusters, scaly, with a pair of ovules at the base of each scale; cone closed, globular, composed of thick and angular somewhat peltate scales that bear two 3-angled seeds at their bases.

Three species in southern United States and Mexico. Important timber trees that are commonly grown for their ornamental qualities.

1. Distribution in Texas north of the Rio Grande Valley; deciduous; branches of staminate flowers short and crowded, the flowers commonly in short compact secondary branches1. *T. distichum*.
1. Distribution in Texas confined to the Rio Grande Valley; essentially evergreen; branches of staminate flowers long and slender, open, composed of single flowers or tight clusters of several flowers2. *T. mucronatum*.

1. *Taxodium distichum* (L.) Rich. BALD CYPRESS, SOUTHERN CYPRESS. Tree occasionally to 50 m. tall, with a tapering trunk strongly buttressed at the swollen base, pyramidal when young, in old age usually spreading to form a broad rounded head; bark reddish-brown or gray, with long fibrous or scaly ridges; young branchlets green, becoming brown the first winter; the 2-ranked feathery leaves linear to linear-lanceolate, flat, apiculate, 1-1.5 cm. long, soft bright-green to yellowish-green or whitish below, turning dull-orange-brown before falling; panicle of staminate flowers 10-12 cm. long; cone globose or obovoid, about 25 mm. across; disk of hard scales, rugose, usually without a mucro; seeds heavy, angular, about 1 cm. long. In swamps and along rivers and streams in e. Tex, w. from Brazoria Co. to Real and Uvalde cos. on the Edwards Plateau in cen. Tex.; from Del. to Fla., w. to Ill., Mo., Ark. and Tex.

Especially in wet and frequently inundated areas the roots produce woody cylindrical projections to 2 m. tall and 3 dm. in diameter that are called "cypress-knees." An important timber tree that is sometimes grown for its ornamental value. Individuals of this species exhibit some remarkable genetic differences. For example, near Saratoga two trees growing side by side have the appearance of two entirely different species. One, with open crown, has its branches ascending, while the other, with a dense closed crown, has spreading and descending branches.

2. *Taxodium mucronatum* Ten. MONTEZUMA BALD CYPRESS, SABINO, AHUEHUETE, CIPRÉS. Large tree with straight trunk enlarged near the base, up to 30 m. high; bark brownish-red, relatively smooth to shallowly furrowed, fibrous, more or less shredded; leaves linear, 6-12 mm. long, spreading in nearly 2-ranked sprays, these and some young branchlets falling with appearance of new growth; staminate cones small, ovoid, 1.5-2.5 mm. long, in slender spikes 5-15 cm. long; ovulate cones subglobose, 15-25 mm. in diameter; seeds dark-reddish-brown, 4-8 mm. long, irregularly angular because of crowding. Along the Rio Grande and occasionally along resacas in Cameron and Hidalgo cos. in the Rio Grande Valley; from s. Tex., s. on the Mex. tableland and along the coast of the Gulf of Mex.

This species is the famous large tree of Santa María del Tule, Oaxaca, Mexico, which, according to the best authority, has a height of about 39 meters and a trunk circumference of 52 meters, with the spread of its branches about 42 meters.

FAM. 15. CUPRESSACEAE BARTL.

CYPRESS FAMILY

Monococious or dioecious trees or shrubs, with imbricated opposite or whorled scalelike (or rarely linear) leaves, decurrent and thickly clothing the branchlets, or jointed at base; flowers small, unisexual, terminal on the branchlets or axillary; stamens with several pollen sacs attached at the lower half of the thin shieldlike connective; ovuliferous scales several, opposite or whorled, bearing at base 1 to many erect ovules; cones woody or fleshy, the scales shield-shape or imbricated; seeds often angled or winged; cotyledons 2 or more.

A family of about 19 genera and about 130 species widely distributed over both hemispheres.

1. Fruit a woody dehiscent cone, long-persistent; seeds winged, numerous under each scale; leaves scalelike, decussate1. *Cupressus*, p. 76.
1. Fruit an indehiscent berrylike cone, formed by the coalition of the scales, not long-persistent; seeds not winged, 1 or 2 under each scale; ovules 1 or 2
.....2. *Juniperus*, p. 76.

1. CUPRESSUS L.

Fifteen or more species native to warm temperate Asia, southern Europe, northern Africa, southwestern United States and Mexico.

1. *Cupressus arizonica* Greene. ARIZONA CYPRESS, CEDRO BLANCO. Resinous aromatic monoecious evergreen tree to about 25 m. tall, usually less than 10 m. tall, with a straight trunk usually 5 dm. or less in diameter and a conical or rounded crown; twigs numerous, stout, 4-angled, 1.5-2 mm. thick, branching nearly at right angles in all directions; bark on young or small trunks smooth and shedding in thin scales to expose the red inner bark, on older or larger trunks rough and thick and becoming furrowed and fibrous or checkered, often exfoliating, mostly gray or blackish; leaves scalelike, triangular-ovate, sharp-pointed, pale-blue-green, commonly with a whitish bloom, about 2 mm. long; cones short-stalked, globose, 2-2.5 cm. in diameter, hard and woody, gray, often glaucous, with 6 to 8 flattened scales bearing a hard point in center, remaining attached for several years; seeds purplish-brown, somewhat triangular, about 2 mm. long. Incl. var. *bonita* Lemm., *C. glabra* Sudw. In Tex. known only from high forested canyons in the Chisos Mts. in Brewster Co.; from w. Tex. and s.w. N.M. to s. Calif. and n. Mex.

Used mainly for fence posts, in shelterbelts and as an ornamental.

2. JUNIPERUS L.

More or less aromatic evergreen dioecious or sometimes monoecious trees or shrubs with thin shredded or thick checkered or furrowed bark and soft close-grained often reddish wood; branches often slender; leaves persistent for several years, scalelike or sometimes awl-shaped, sometimes jointed at base, opposite or in whorls of 3, decurrent at the base; flowers small, terminal; staminate flowers solitary or clustered, their scales

ovate or peltate, bearing 3 to 6 anther cells; ovulate flowers subglobose, of 2 to 3 series of scales; ovules 1 or rarely 2 to each scale; cones berrylike by the coalition of the fleshy scales; seeds 1 to several, wingless; cotyledons 2 to 6.

About 60 species that are widely distributed over the Northern Hemisphere.

Juniperus communis L., the common juniper, has been reported from the Plains Country and Trans-Pecos Texas, but these reports undoubtedly were based upon misidentified specimens.

In all species of *Juniperus* the juvenile leaves and frequently those on leading shoots are needlelike. Any one species may also have glaucous individual trees as well as those with bright-green foliage. A common teratological condition in *Juniperus*, caused by parasitic insects, is the exertion of the seed at the tip of the cone. This is known in several Texas species, and, according to Morton (*Rhodora* 43: 345. 1941), it is known altogether in about 16 species.

With few exceptions, cedars are trees and shrubs of poor dry soils. In Texas, they are especially common on breaks and rim rocks of mesas in the central and western parts of the state.

1. Leaf margins irregularly minutely cellular-serrulate or cellular-denticulate, not smooth (under magnification) (2)
1. Leaf margins entire and smooth, sometimes hyaline (under magnification) (6)
- 2(1). Mature fruits reddish or copper-colored; large hilum of seeds reaching about halfway up their surface (3)
2. Mature fruits blue or bluish-black; small hilum of seeds about one third way up their surface (5)
- 3(2). Seeds 1 or 2; cones without a bloom, usually less than 8 mm. in diameter, the pulp usually resinous and soft; leaves frequently in threes; leaf gland usually prominent and more or less swollen and elevated, round; bark of trunk furrowed 2. *J. Pinchotii*.
3. Seeds 3 or 4; cones more or less glaucous, usually more than 8 mm. in diameter, the pulp dry and solid; leaves usually in pairs, opposite; leaf gland usually inconspicuous and flat, depressed or rounded with the leaf curvature, oval to elliptic; bark of trunk furrowed or checkered (4)
- 4(3). Bark of trunk checkered; twigs rather thick and spreading; leaf gland frequently ruptured 1. *J. Deppeana*.
4. Bark of trunk furrowed, not checkered; twigs thin and drooping; leaf gland rarely ruptured 1. *J. Deppeana* var. *Sperryi*.
- 5(2). Cones mostly 4-7 mm. long when mature; seed solitary or rarely some in pairs, sometimes flattened, prominently ridged and obtuse; leaf gland elliptic and flat or depressed; plants of the Trans-Pecos region and Plains Country 3. *J. monosperma*.
5. Cones mostly 7-8.5 mm. long when mature; seeds 1 or 2, not flattened when solitary, ridgeless and pointed at the tip; leaf gland (when evident) round and somewhat swollen; plants confined to the Edwards Plateau of central Texas 4. *J. Ashei*.
- 6(1). Species in the Trans-Pecos region and Plains Country of west and northwest Texas; leaf gland elliptic, elongate, rarely oval; mature leaves always paired and only slightly (if at all) overlapping the ones directly above (7)
6. Species of central and east Texas; leaf gland usually small and oval or round, rarely elliptic, much shorter than the distance from the gland to the leaf tip; mature leaves in pairs or occasionally with some in threes, usually overlapping to some degree the ones above (8)
- 7(6). Cones red-brown or grayish-brown, usually more than 8 mm. in diameter, 4- to 12-seeded; branchlets drooping; leaves sharply acuminate; leaf gland shorter than or nearly equal the distance from the gland to the leaf tip; apparently confined to the Chisos Mountains 5. *J. flaccida*.
7. Cones bright-blue, usually less than 8 mm. in diameter, 1- or 2-seeded; branchlets not noticeably drooping; leaves bluntly obtuse to subacute; leaf gland as long as or mostly longer than the distance from the gland to the leaf tip; distribution north of the Chisos Mountains 6. *J. scopulorum*.

- 8(6). Branches mostly pendulous; ultimate twigs usually less than 1 mm. thick; leaves bluntly obtuse to acute, mostly less than 1.5 mm. long; cones mostly ovoid and 3-5 mm. long; distribution in extreme southeast Texas
7. *J. silicicola*.
8. Branches typically horizontally spreading; ultimate twigs usually 1 mm. thick or more; leaves acute to acuminate, 1.5-2 mm. long; cones essentially globose and 5-8 mm. in diameter; distribution rather general in east Texas
8. *J. virginiana*.

1. *Juniperus Deppeana* Steud. ALLIGATOR JUNIPER, WESTERN JUNIPER. Small dioecious tree to about 15 m. high, usually much smaller, with a short thick trunk to about 1 m. in diameter and stout spreading branches that form a broad-pyramidal or round-topped crown; bark thick, grayish or dark-brown, deeply furrowed into checkered or square plates; branchlets and leafy twigs slender; leaves on mature fruiting or flowering branches opposite, closely appressed, rhombic-ovate, broadly obtuse to acute and sometimes apiculate at apex, 1.5-3 mm. long, the margins minutely cellular-serrulate or cellular-denticulate, glandular on the somewhat keeled back, often with whitish drops of resin, bluish-green and often more or less glaucous; staminate cones ellipsoid, green-brown, up to 6 mm. long; mature fruit reddish-brown to tan or sometimes purplish-red, glaucous, subglobose to broadly ellipsoid, 8.5-12 mm. in diameter, maturing the second year, the mealy brownish pulp drying tightly around the seeds; seeds 1 to 5 (usually 4) per fruit, about 7 mm. long, light-chestnut-color or tannish. Incl. var. *pachyphloea* (Torr.) Martinez, *J. pachyphloea* Torr. On grassy open rocky hills and slopes and in scrub oak areas in the mts. and foothills of the Trans-Pecos; from w. Tex., w. to cen. Ariz. and s. to cen. Mex.

The wood of this species is used for fence posts and fuel.

Var. *Sperryi* Correll. This plant, which is rare in the Davis and Guadalupe mts., is characterized by having bark longitudinally furrowed and scaly; branches and branchlets flaccid and drooping; twigs slender; leaves usually sparsely sprinkled with glistening specks and the inconspicuous dorsal gland rarely ruptured; fruit dry and similar to that of var. *Deppeana*.

2. *Juniperus Pinchotii* Sudw. RED-BERRY JUNIPER, PINCHOT JUNIPER. Large dioecious or rarely monoecious shrub or small tree with shrubby aspect, to about 6 m. high, usually with several or numerous stems arising from the base to form a dense clump; bark thin, ashy-gray, longitudinally fissured into persistent scales; branches somewhat rigid, their slender tips erect or ascending; wood with nearly white sapwood and light-brown-reddish tinged heartwood; leaves on mature fruiting or flowering branches in twos and threes, closely appressed, triangular-ovate, acute, 1.5-2.5 mm. long, the margins minutely cellular-serrulate or cellular-denticulate, usually with a roundish gland on the somewhat thickened back, yellowish-green; mature fruit variable in size and color, reddish- or copper-brown, with very little or no bloom, subglobose to slightly ellipsoid, with a thick dryish sweetish pulp, 6-10 mm. in diameter; seeds 1 or 2 per fruit, about 5 mm. long, broadly ovoid, pointed, indistinctly ridged, lustrous-chestnut-brown; hilum somewhat bilobed and covering the seed for about one-half its length from the base. *J. erythrocarpa* Cory, *J. texensis* Van Melle, *J. monosperma* var. *Pinchotii* (Sudw.) Van Melle. In gravelly or rocky soils on open flats and dry hills, in arroyos and canyons, on caprocks and talus slopes, commonly about limestone and in gypseous soils from cen. Tex., n. to Plains Country and w. to the Trans-Pecos; from cen. Tex. to s.e. N.M. and w. Okla.

This species has a remarkable viability for sprouting from charred or cut stumps after burning or cutting. The sprouts grow very rapidly at first and are willowy. In addition to their difference in fruit-color, the branchlets of *J. Pinchotii* tend to be more slender and erect than those of *J. Ashei* which are usually stiffish and recurved. This species is used locally for fuel and fence posts but it is considered to be only moderately durable when in contact with soil.

3. *Juniperus monosperma* (Engelm.) Sarg. ONE-SEEDED JUNIPER, CHERRY-STONE JUNIPER. Large dioecious shrub or small tree with shrubby aspect, to about 6 m. high, usually with several small trunks arising from the base or branched near the base, forming a low open and bushlike crown; bark light-ashy-gray, ridged, divided into thin shreddy fibrous scales; branchlets slender, tetragonal; leaves on mature fruiting and

flowering branches in pairs or rarely in threes, closely appressed or sometimes slightly spreading, ovate, acute to acuminate, often rough to the touch, 2-3 mm. long, the margins minutely cellular-serrulate or cellular-denticulate, with or without a conspicuous elliptic and flat or depressed gland on the usually thickened and rounded back, grayish-green; staminate cone brownish, ovoid-ellipsoid, about 4 mm. long; mature fruit dark- or pale-blue to purplish-violet and glaucous, subglobose or globose-ovoid, with a thin sweetish resinous pulp, 4-7 mm. long; seeds mostly 1 or rarely 2 or 3 per fruit, pale-chocolate- or chestnut-brown, ovate, obtuse, prominently ridged, sometimes flattened; hilum whitish, covering the seed for about one-third its length from the base. Incl. f. *gymnocarpa* (Lemm.) Rehd., *J. gymnocarpa* (Lemm.) Cory, *J. mexicana* var. *monosperma* (Engelm.) Cory. Mostly on steep slopes and broken ground about rimrocks and breaks, in eroded soils of arroyos and plains and in brushlands, in the n. Plains Country and Trans-Pecos; from n.w. Okla. and w. Tex. to Ut., Nev., s.e. Ariz. and n. Mex.

The multistemmed plant that produces small bluish or bluish-black, commonly glaucous, fruits and that occurs in the Trans-Pecos and in the northern Panhandle is what we consider to be this species.

4. *Juniperus Ashei* Buchh. ROCK CEDAR, POST CEDAR, MEXICAN JUNIPER, MOUNTAIN CEDAR. Large dioecious shrub or small tree with shrubby aspect, to 6 m. high, usually with several trunks arising from a short furrowed main trunk or sometimes branching from the ground, rarely with a single trunk, forming a broad globular or open irregular crown; bark thin, ashy-gray, in long narrow persistent shreddy scales; wood heavy, with pale-brown heartwood and a broad zone of nearly white sapwood; branches spreading, their tips often recurved, the twigs grayish with age; leaves on mature fruiting or flowering branches in pairs or less frequently in threes, closely appressed, triangular-ovate, acute, 1-2 mm. long, to 1 mm. wide, the margins minutely cellular-serrulate or cellular-denticulate, with or without an oval or roundish more or less swollen gland on the back, dark-gray-green; staminate cones with about 12 overlapping peltate scarious scales that are brownish at the obtuse to rounded erose tips; mature fruit dark-blue, glaucous, globose-ovoid, with a thin sweet resinous pulp, 7-8.5 mm. long, 6-7.5 mm. wide; seeds one or sometimes two per fruit, broadly ovate, pointed, not flattened when single, 5-6 mm. long, 3.5-4.5 mm. wide, light-yellow-brown to chocolate-brown, without ridges or angles but with several very shallow grooves extending lengthwise; hilum smooth, whitish, covering the seed for about one-third its length from the base. *J. mexicana* of auth., *J. sabinoides* (H.B.K.) Nees (not Griseb.), *Sabina sabinoides* (H.B.K.) Small. In rocky soil in canyons, ravines, arroyos and about rimrocks and breaks, and on eroded slopes and flats, often forming thickets or "cedar brakes," centered on the Edwards Plateau, extending s. to Zavala Co., n.e. to Dallas Co., w. to Terrell Co. and n. to Nolan, Taylor and Stephens cos.; from s. Mo. and n. Ark., s.w. to Tex., s.e. N.M. and n. Mex.

In central and west Texas the wood of this species is the main source of fence posts which are extremely durable when in contact with the soil. As far as known, the cedar-apple rust does not occur on this species.

5. *Juniperus flaccida* Schlecht. WEEPING JUNIPER, DROOPING JUNIPER, MEXICAN DROOPING JUNIPER, TASCATE. Small dioecious trees to 9 m. high, with a short furrowed trunk and spreading branches and slender drooping branchlets to form a globose crown; twigs leathery and drooping; leaves on mature fruiting and flowering branches opposite, narrowly ovate, commonly spreading at the acuminate apex, with entire margins, with or without a more or less elliptic gland on the back; fruit dark- or dull-reddish-brown, with a bloom, subglobose, 8.5-12 mm. in diameter, with a mealy pulp interspersed with resinous glomerules that dries tightly about the seeds, resin often conspicuous on outer coat of fruit; seed 4 to 12, pinkish. On forested or open rocky slopes of the Chisos Mts. in the Trans-Pecos; from w. Tex. to s. Mex., with a doubtful locality in Real Co. on the Edwards Plateau.

6. *Juniperus scopulorum* Sarg. ROCKY MOUNTAIN JUNIPER. Large or shrubby dioecious tree to 12 m. high, with a short stout trunk to about 9 dm. in diameter that is often divided to near the ground into several slightly spreading stems and stout spreading-ascending branches to form an open irregularly round-topped crown; bark thin, dark-reddish-brown or gray tinged with red, divided by shallow fissures into narrow flat connected ridges that break up on the surface into persistent shredded fibrous scales; branchlets slender and 4-angled, becoming terete with age; leaves on mature fruiting

and flowering branches opposite and in pairs, closely appressed but usually not noticeably overlapping, ovate to ovate-elliptic, obtuse to acute, about 2 mm. long, the margins smooth, usually with a somewhat obscure elongate-elliptic gland on the back, dark-green or sometimes pale and glaucous; staminate cone subglobose to ellipsoid, 2-4 mm. long; mature fruit developed in 2 years, bright-blue, covered with a glaucous bloom, globose, with a sweet resinous pulp, 5.5-8.5 mm. in diameter; seeds one or usually two per fruit, rarely more, ovate, acute, prominently grooved and angled, about 5 mm. long, lustrous light-chestnut-brown; hilum small, 2-lobed. In rocky areas in canyons and on breaks in the Guadalupe Mts. of the Trans-Pecos and in the n. Plains Country; from N. D. and Mont., w. to B. C., Wash., Nev. and Ariz., s. to Tex. and in extreme w. Okla.

This species is very closely allied to *J. virginiana* but it tends to have larger fruits that take 2 years to mature, less acute and less overlapping leaves that have a longer dorsal gland, and more fibrous-shredded reddish-brown or grayish-brown bark. In spite of these differences, when they are found in proximity they are extremely difficult to distinguish one from the other.

7. *Juniperus silicicola* (Small) Bailey. SOUTHERN RED CEDAR, SAND CEDAR, COAST JUNIPER. Medium-sized dioecious tree to 10 m. high or more, with a short single trunk to 6 dm. in diameter and ascending or spreading branches to form a dense pyramidal or somewhat irregular rounded crown; bark thin, reddish-brown, exfoliating in fibrous shreds; branchlets and twigs slender, terete or 4-angled, typically pendulous, the ultimate twigs mostly less than 1 mm. thick; leaves on mature fruiting or flowering branches opposite in pairs or sometime in threes or more, imbricate and closely appressed, ovate or triangular-ovate, blunt to acute at apex, 1-2 mm. long, dark-bluish-green, the margin smooth, with an oval-oblong gland on the back; staminate cones ellipsoid, to 5 mm. long, yellowish-brown; fruits blue, with a waxy glaucous bloom, 5 mm. or less in diameter, subglobose to ellipsoid-ovoid, with a soft resinous pulp; seed usually solitary, ovoid, acute, usually prominently grooved. *J. barbadensis* of auth., *J. lucayana* of auth., *Sabina silicicola* Small. Usually in sandy soils in s.e. Tex.; on the Coastal Plain mostly near the coast from s.e. N. C., s. to cen. Fla. and w. to s.e. Tex.

This species is very similar to *J. virginiana* but it typically has more slender, elongated and pendulous branches and branchlets, smaller and more blunt leaves and smaller cones.

8. *Juniperus virginiana* L. EASTERN RED CEDAR. Medium-sized to large dioecious or sometimes monoecious trees to 30 m. high but usually much smaller, with an erect solitary trunk to about 1 m. in diameter and numerous spreading or erect branches to form a dense pyramidal to almost columnar crown; bark thin, reddish-brown, fibrous and shredding into long narrow fringed scales; wood with a red fragrant heartwood; twigs rounded or 4-angled, slender; leaves on mature fruiting and flowering branches opposite or rarely in threes, closely appressed and nearly always overlapping the leaf above, rhombic-ovate, acute to acuminate, sometimes apiculate, 1.5-2 mm. long, the margins smooth, with or without a rounded or oval gland on the back, dark-bluish-green; staminate scales tipped with yellow at the rounded smooth apex; mature fruit developed in one year, dark-blue or bluish-purple, glaucous, globose to subglobose or sometimes ovoid, with a dry resinous pulp, 5-8 mm. in diameter; seeds one or two or rarely more per fruit, ovate to subglobose, bluntly pointed, yellowish-brown, 2-4 mm. long, 1.5-3 mm. wide, very shallowly pitted; hilum small, inconspicuous. A field and pasture tree of dry sandy and rocky soils, commonly in old fields, along fence-rows and on the edge of forests in e. Tex. and the n. Plains Country in the Tex. Panhandle; from s.w. Me., w. to n. N. Y., s. Can. and s.w. N.D., s. to Kan., w. Okla., n.w. and e. Tex., and Ga.

An important source of fence posts. Also a source of timber for chests, paneling and for cedar-leaf oil. Commonly cultivated.

FAM. 16. EPHEDRACEAE DUM.

EPHEDRA FAMILY

Shrubs or viny shrubs with jointed opposite or fascicled branches, usually dioecious; leaves scalelike, opposite or whorled, mostly reduced to membranaceous sheaths that are more or less connate at base, persistent or tardily deciduous; flowers unisexual, with decussate persistent bracts; stamens monadelphous, subtended by a membranous 2-lobed calyxlike perianth; anthers dehiscent by terminal pores: ovulate flowers composed of one

or two erect ovules enclosed in an urn-shaped perianth that becomes hardened in fruit; seed-coats 1, separating into 2 and ending in an elongated stylelike micropyle; embryo axillary, surrounded by copious endosperm; cotyledons 2.

A single genus with representatives in the arid regions of the Northern Hemisphere.

1. EPHEDRA L. MORMON-TEA. MEXICAN-TEA

Desert shrubs with jointed *Equisetum*-like photosynthetic stems and branches, and persistent or deciduous scalelike leaves.

A geologically ancient genus of about 40 species that are distributed over the desert or semidesert regions of Asia, northern Africa and North America. An Old World species produces the drug, "ephedrine," that has proved to be somewhat efficacious in the treatment of nasal colds, asthma and hay fever. Although they are not the most palatable of browse, they are often heavily grazed in times of emergency, at which times they attain much importance.

- 1. Leaves and bracts of cones in threes; bracts of ovulate cones clawed (2)
- 1. Leaves and bracts of cones in twos, very rarely with some in threes; bracts of ovulate cones not clawed (3)
- 2(1). Leaves 5 mm. long or more, their tips rigid and awnlike, with age becoming gray and shredded, persistent; terminal buds spinose . 1. *E. trifurca*.
- 2. Leaves less than 5 mm. long, their tips flat and recurved, with age remaining firm or falling off; terminal buds not spinose 2. *E. Torreyana*.
- 3(1). Plants erect, yellowish to tan-colored or bright-green, usually somewhat glaucous, typically with clusters of straight stems that are closely parallel to form a broom-like appearance; leaf bases somewhat swollen, brown to blackish and persistent (4)
- 3. Plants typically sprawling, spreading or climbing, dull- to grayish-green, the stems and branches rarely forming parallel clusters; leaf bases not noticeably swollen, grayish or with a thin dark-brown central line or tan basal line encircling the stem, not long-persistent (5)
- 4(3). Ovulate cone sessile or on a short scaly peduncle; bracts of ovulate cone thin, broadly rounded, the inner ones membranous or herbaceous; seed solitary or occasionally with some paired; staminal column noticeably exceeding the bracts; connate portion of most leaves about as long as the free portion; distribution in Trans-Pecos Texas and in extreme western part of the Edwards Plateau 3. *E. aspera*.
- 4. Ovulate cone on a long naked peduncle that has a pair of bracts only at its base and summit; bracts of ovulate cone firm, acute, the inner ones becoming fleshy; seeds paired; staminal column usually scarcely exceeding the bracts; connate portion of most leaves much shorter than the free portion; distribution in Edwards Plateau and Panhandle in Texas 4. *E. Coryi*.
- 5(3). Stems stout and stiffish, spreading; peduncles (when present) of mature cones concealed by bracts; seed solitary or rarely with some paired; connate portion of leaves prominent, mostly about as long as or longer than the free portion; anthers sessile (or essentially so) on staminal column 5. *E. antisiphilitica*.
- 5. Stems usually slender and somewhat contorted, more or less climbing or trailing; peduncles of mature cones more or less exposed; seeds always paired; connate portion of leaves abbreviated, mostly much shorter than the free portion; anthers definitely stipitate 6. *E. pedunculata*.

1. *Ephedra trifurca* Torr. LONGLEAF EPHEDRA, CAÑATILLA. Erect shrub to 2 m. high; branches rigid, hard, terete, to 3.5 mm. thick, solitary or whorled at the nodes; internodes 3-9 cm. long; young stems pale-green, almost smooth, with numerous small longitudinal furrows, becoming yellow, then gray-green; bark of older stems cinereous, cracked and somewhat irregularly fissured longitudinally; terminal buds 1 cm. long, spinose; leaves ternately whorled, 5-13 mm. long, subspinously tipped from a dorsomedian thickening, connate for one-half to three-fourths their total length; sheath at first membranaceous, later fibrous, shredded and grayish, persistent; cones sessile or shortly scaly-pedunculate,

solitary or numerous in a whorl at the nodes of the young branches, elliptic to obovate; staminate cones 6-9 mm. long; staminate bracts ternate, in 8 to 12 whorls, obovate, slightly clawed, 3-4 mm. long, 2-3 mm. broad, membranaceous, reddish-brown, the lower whorls empty; perianth almost equaling the subtending bract, staminal column 4-5 mm. long, one-fourth exserted, with 4 to 5 short-stipitate anthers; ovulate cones 10-14 mm. long; ovulate bracts ternate, in 6 to 9 whorls, orbicular, clawed, 8-12 mm. long and broad, translucent except for the reddish-brown center and basal portion, margins entire; seed solitary or (occasionally) two or three, usually tetragonal, light-brown, smooth, 9-14 mm. long, 1.5-3 mm. wide, equaling the bracts; tubillus straight, twisted, about 1 mm. long, conspicuously exserted. Sandy and gravelly soils on hills and plains, along dry creek beds in arroyos and in desert scrub areas in w. Tex., e. to Loving, Ward and Pecos cos.; from w. Tex. and s. N.M., w. to Calif. and adj. Mex.

This species is easily recognized by its yellowed and spinosely-tipped branches and the frayed but persistent spinose leaves of the older stems.

2. *Ephedra Torreyana* Wats. TORREY EPHEDRA, TORREY JOINT-FIR. Erect shrub to 1 m. high; branches rigid, hard, terete, to 3.5 mm. thick, solitary or whorled at the nodes; internodes 2-5 cm. long; young stems pale-blue-green, glaucous, almost smooth, with many small longitudinal furrows, becoming gray; bark of older stems cinereous, cracked and irregularly fissured; terminal buds less than 4 mm. long, conical but not spinose; leaves ternately whorled, 2-5 mm. long, obtusely or occasionally acutely pointed from a brownish-green dorsomedian thickening, connate for one-third to two-thirds their total length, in age spreading and recurved; sheath at first membranaceous, later thickened and grayish, subpersistent; cones sessile, solitary to several in a whorl at the nodes of the young branches, ovate; staminate cones 6-8 mm. long; staminate bracts ternate, in 6 to 9 whorls, ovate, slightly clawed, 2-3.5 mm. long, 2-3 mm. broad, membranaceous, cream-colored to pale-yellow, the lower whorls empty; perianth exceeding the subtending bract; staminal column 2.5-4 mm. long, one-fourth to one-half exserted, with 5 to 8 sessile or short-stipitate anthers; ovulate cones 9-13 mm. long; ovulate bracts ternate, in 5 to 6 whorls, obovate, clawed, 6-9 mm. long, 6-10 mm. broad, hyaline except for the orange-yellow to greenish-yellow center and basal portion, the margins minutely toothed and undulate; seeds solitary or two, occasionally three, trigonal or tetragonal, light-brown to yellow-green, scabrous, 7-10 mm. long, 1.6-3 mm. wide, equaling or slightly exceeding the bracts; tubillus straight, somewhat contorted, about 1 mm. long, conspicuously exserted. On breaks and dry rocky or sandy hills and slopes, frequently in gypseous soils, in w. Trans-Pecos and the n.w. Panhandle, with isolated stations in Howard Co.; from w. Colo. to w.-cen. Tex., w. to n. Ariz. and Nev.

3. *Ephedra aspera* Engelm. BOUNDARY EPHEDRA, POPOTILLO. Erect shrub to 13 dm. high; branches rigid, firm, terete, to 3 mm. thick, opposite or whorled at the nodes; internodes 1-5.5 cm. long; young stems pale- to dark-green, strongly asperous to smooth and glaucous, with numerous small longitudinal furrows, with age becoming yellow; bark of older stems cinereous, cracked and fissured; terminal buds about 1.5 mm. long, obtuse-conical; leaves opposite, very rarely with some ternately whorled, 1-2.5 mm. long, obtusely tipped from a dorsomedian thickening, connate for one-half to seven-eighths their length; sheath splitting but the parts subpersistent; cones sessile or short- and scaly-pedunculate, paired or sometimes solitary or whorled at the nodes of the younger branches; staminate cones elliptic-ovate, 4-7 mm. long; staminate bracts opposite, in 6 to 10 whorls, obovate, about 3 mm. long and 2 mm. broad, membranaceous, yellow to red-brown, the lower whorl empty; perianth slightly exceeding the subtending bract; staminal column 4-5 mm. long, one-third exserted, with 4 to 6 sessile or very short-stipitate anthers; ovulate cones ovate, 6-10 mm. long; ovulate bracts opposite, in 5 to 7 whorls, orbicular, 2-5 mm. long and broad, thickened, red-brown, the margins membranaceous; seed solitary, in cross section circular to slightly trigonal, with a minute indentation at the tip between the angles, smooth to slightly roughened, tan to light-brown or chestnut, 5-8 mm. long, 2.5-4 mm. broad, exceeding by one third to one half the bracts; tubillus almost straight, contorted, about 0.5 mm long, slightly exserted.

E. Reedii Cory, *E. nevadensis* Wats. var. *aspera* (Engelm.) L. Benson. On rocky hills and in dry ravines and arroyos, on gravelly plains and arid talus slopes, and arid flats on the w. edge of the Edwards Plateau and in the Trans-Pecos, with disj. stations in Webb Co. in the Rio Grande Plains; in s.w. U. S. and n. Mex.

The swollen persistent somewhat roughened blackish leaf bases of this species and *E. Coryi* separate them from all other species found in Texas. In turn, the essentially sessile 1-seeded ovulate cones and long-connate leaves distinguish *E. aspera* from *E. Coryi*.

4. *Ephedra Coryi* E. L. Reed. CORY EPHEDRA. Erect shrubs, growing from spreading rhizomes, to 1 m. high; branches terete, to 2.5 mm. thick, opposite or whorled at the nodes; internodes 2-4.5 cm. long; young stems almost herbaceous, bright-green, slightly asperous, with numerous small longitudinal furrows, with age becoming yellow; bark of older stems red-brown, cracked and fissured irregularly; terminal buds 1-3 mm. long, obtusely conical; leaves opposite, acutely tipped from a dorsomedian thickening, connate for one-third to three-fourths their length; sheath membranaceous-margined, soon falling to leave the brown to blackish thickened and persistent base; cones usually noticeably pedunculate, paired to numerous at the nodes of the young branches; staminate cones obovate, 4-7 mm. long; staminate bracts opposite, slightly connate at the base, in 5 to 9 whorls, ovate, 2-4 mm. long, 2-3 mm. broad, membranaceous, light-yellow, the lower whorl empty; perianth slightly exceeding the subtending bracts; staminal column 2-4 mm. long, one-fourth exerted, with 5 to 8 sessile or short-stipitate anthers; ovulate cones obovate to spherical, 7-15 mm. long; ovulate peduncle 3-20 mm. long, with two pairs of bracts, one basal, the other subterminal; ovulate bracts opposite, in 3 to 4 whorls, ovate-acute at first, with age becoming yellow, fleshy and orbicular at maturity; seeds paired, trigonal, brown to chestnut or sometimes purplish and glaucous, smooth, 5-7 mm. long, usually equaling or slightly exceeding the bracts; tubillus somewhat recurved, about 1 mm. long, slightly exerted, early deciduous. Usually in loose sands or sandy soils in dune areas and on dry prairies in the s. Plains Country in w. Tex.; also s.e. N. M.

5. *Ephedra antisiphilitica* C. A. Mey. CLAPWEED, JOINT-FIR, POPOTE, CAÑATILLA. Erect or spreading shrub to 1 m. high; branches stiff, hard, terete, up to 4 mm. thick, alternate or whorled at the nodes; internodes 2-5 cm. long; young stems green, glaucous, almost smooth, with many small longitudinal furrows, with age becoming yellow-green, then gray-green; bark of older stems cinereous, slightly cracked and fissured; terminal buds 2-3 mm. long, obtusely pointed; leaves binate, 1-3 mm. long, obtusely tipped from a dorsomedian herbaceous thickening, connate for two-thirds to nine-tenths their total length; sheath membranaceous, later splitting and falling; cones essentially sessile, solitary or paired or sometimes several at the nodes of the young branches; staminate cones elliptic, 5-8 mm. long; staminate bracts in 5 to 8 pairs, obovate, one-eighth connate at the base, 2-3.5 mm. long, 2-3 mm. broad, slightly thickened, the margins membranaceous, pale-green to reddish, the lower pair empty; perianth slightly exceeding the subtending bract; staminal column 4-5 mm. long, one-half exerted, with 4 to 6 sessile or very short-stipitate anthers; ovulate cones elliptic, 6-11 mm. long; ovulate bracts in 4 to 6 pairs, orbicular-ovate, 3-6 mm. long, one-eighth to seven-eighths connate, the inner pairs becoming red and fleshy-succulent when ripe; seed solitary or rarely some paired, trigonal or occasionally tetragonal, light-brown to chestnut, smooth, 6-9 mm. long, 2-3.5 mm. broad, conspicuously exerted; tubillus straight, somewhat contorted, about 0.5 mm. long, slightly exerted. Incl. var. *brachycarpa* Cory, *E. texana* E. L. Reed. In gravelly or rocky soil on plains, hills, breaks, rimrocks, and in arroyos, ravines and canyons, in most of the s. Panhandle, Edwards Plateau and Rio Grande Plains, with some apparently isolated stations in the cen. and s. Trans-Pecos; from s.w. Okla. through most of the w. two-thirds of Tex., s. to n.e. Mex.

This coarse plant is readily distinguished from all other species found in Texas by the very narrow pale-orange-yellow or tannish band that encircles the stem at the very base of the connate leaves.

6. *Ephedra pedunculata* Engelm. VINE JOINT-FIR, COMIDA DE VÍBORA. Vinelike shrub, trailing on ground or clambering over bushes, trees and rocks, often to a height of 7 m.; branches lax, firm, terete, to 3 mm. thick, alternate, opposite or sometimes whorled at the nodes; internodes to 7 cm. long; young stems gray-green, glaucous, almost smooth, with several moderately deep longitudinal furrows, with age becoming more green, then yellow-green; bark of older stems cinereous, slightly cracked and fissured; terminal buds 1-3 mm. long, narrowed; leaves binate, to 3 mm. long, obtusely tipped from a dorsomedian herbaceous thickening, connate below the middle; sheath membranaceous, splitting with age; cones with a peduncle to 2 cm. long, solitary or several at the nodes of the young branches; staminate cones suborbicular to broadly elliptic, 4-8 mm. long;

staminate bracts in 6 to 12 pairs, obovate, free or one-eighth connate at the base, 1.5-3.5 mm. long, 1.5-3 mm. broad, slightly thickened, the margins membranaceous, pale-yellow to reddish, the lower pair empty; perianth slightly exceeding the subtending bract; staminal column 3-5 mm. long, one-half exserted, with 4 to 6 definitely stipitate anthers; ovulate cones elliptic, 6-10 mm. long; ovulate bracts in 3 to 6 pairs, ovate, one-eighth to seven-eighths connate, the inner parts becoming red and fleshy-succulent when ripe; seeds paired, trigonal, light-brown to chestnut, smooth, 4-9 mm. long, 2-3.5 mm. broad, conspicuously exserted; tubillus slightly kinked, somewhat contorted and exserted, about 0.5 mm. long. Widely sprawling or climbing over trees, shrubs, fences and boulders from Howard Co., s. through the w. Edwards Plateau to Hidalgo Co. in the Rio Grande Plains; from s.w. Tex. e. of the Pecos River, s. to S. L. P.

This species is readily separated from *E. antisiphilitica*, with which it is often confused, by its clambering vinelike habit, its 2-seeded ovulate cones that are commonly borne on a somewhat naked peduncle, and the definitely stipitate anthers.

CLASS 2. ANGIOSPERMAE

Plants diverse in habit, structure, form, size, habitat and sexualization; ovules and seeds borne enclosed in carpels that are at the center of flowers and which are interpreted as fertile fronds with megasporangia on the upper surfaces, these fronds are loosely folded along a median zone in such a way that the margins meet to form a more or less firmly sealed ventral (adaxial) suture; carpels either free (constituting a simple pistil) or often several united into a compound pistil; ovule-bearing portion of the pistil (the ovary) maturing into the fruit; gametophytic stage of the plant of very short duration (a matter of only a few hours) as compared to the gymnospermous counterparts, and the male gamete reaching the female gamete (in the ovule) by means of a tube that penetrates the tissues of the carpel; fertilization consisting of a double process: not only does the sperm-nucleus fertilize the egg-nucleus to form a diploid zygote which develops into the embryonic sporophyte in the seed, but another simultaneous fertilization in the same female gametophyte results in a triploid or higher polyploid nucleus which in many members of the class produces a nutritive tissue called endosperm closely associated with the embryonic sporophyte.

A stupendous array of about 200,000 species including all the most important sources of food and fiber, and including all the plants which the man in the street calls flowers.

SUBCLASS 1. MONOCOTYLEDONEAE

Cotyledons usually solitary; embryonic radicle usually developing only to a very limited extent, most of the roots being adventitious on the lower part of the stem, resulting in a so-called fibrous root system; vascular strands of the stem usually not in any cylindrical pattern, the stem-transsection revealing a number of scattered strands; vascular strands (nerves, veins) of the leaves usually not forming a network but parallel for most of their length; sepals, petals, stamens and carpels usually in multiples of three, but many exceptions.

Plants with long, narrow leaves such as grasses, sedges and lilies are characteristic of this subclass; but such bizarre plants as palms, yuccas and century plants also belong here. About 50,000 species, roughly a fourth of all angiosperms, fall into this group.

FAM. 17. TYPHACEAE JUSS.

CAT-TAIL FAMILY

Aquatic or paludal monoecious perennial herbs with a creeping rhizome and distichously arranged erect leaves; leaves sessile, linear, nerved, glabrous, sheathing the base of the simple jointless stems; flowers unisexual, in a long dense cylindrical spike terminating the stem, without proper floral envelopes; staminate flowers forming the upper portion of the spike, consisting of stamens inserted directly on the axis and intermixed

with long hairs or slender bracts; pistillate flowers forming the lower portion of the spike, consisting of stipitate 1-celled fertile or abortive ovaries with their stipes provided with ascending or spreading slenderly clavellate bristles that form the copious down of the fruit; ovary 1-celled and 1-ovuled, with usually persistent linear style and elongated 1-sided linear or linear-lanceolate stigma; fruit a long-stalked minute nutlet; seed suspended, anatropous.

A solitary genus.

1. TYPHA L.⁴ CAT-TAIL

Characters of the family. About 15 species of worldwide distribution.

1. Staminate and pistillate portions of spike usually contiguous; stigmas ligulate to lanceolate; sterile ovary ellipsoid, tipped at the rounded apex by a rudimentary style; leaves flat on back1. *T. latifolia*.
1. Staminate and pistillate portions of spike usually separated by an interval; stigmas linear to fliform; sterile ovary not ellipsoid; leaves commonly convex on back (2)
- 2(1). Leaves 5-8 mm. wide, dark-green; sterile ovary cuneate, with a rudimentary style on the truncate-flattened apex2. *T. angustifolia*.
2. Leaves 7-15 mm. wide, light yellowish-green; sterile ovary obovoid, the rounded apex tipped by a short rudimentary style3. *T. domingensis*.

1. *Typha latifolia* L. COMMON CAT-TAIL, TULE ESPADILLA. Plant coarse and stout, to about 3 m. tall; pith of the stem base white; leaves essentially flat; sheathing, pale- or grayish-green, 6-23 mm. wide, often exceeding the stem; sheaths cylindrical but open to base, the scarious upper margin tapering to blade, rarely truncate or slightly auricled; the staminate and dark-brown pistillate parts of the spike usually contiguous, the staminate portion to 12 cm. long, the pistillate portion to 2 dm. long, when in fruit 15-35 mm. thick, its surface (when magnified) appearing minutely pebbled with crowded persistent stigmas and scarcely bristly; pistillate flowers without bractlets among the bristles; stigma ovate-lanceolate, fleshy, persistent; pollen grains in fours; denuded axis of old spike retaining slender pedicels that are 1-2 mm. long. In marshes or shallow water and along streams throughout most of Tex., Mar.-May; from Nfld. to Alas., through most of the U. S. into Mex.

2. *Typha angustifolia* L. NARROW-LEAVED CAT-TAIL. Plant slender, to about 15 dm. tall, the stem pith white; leaves mostly less than 10, somewhat convex on back, dark-green, 3-7 mm. wide; sheaths appearing cylindrical below but actually open to base, usually conspicuously auriculate above, rarely with some sheaths tapering to the blade, the auricles scariously-margined; pistillate and staminate parts of spike usually separated by a short interval; pistillate portion of spike reddish-brown, in fruit to 15 cm. long and 15 mm. thick, its surface minutely bristly with persistent linear stigmas; staminate portion of spike to 2 dm. long; pollen grains simple; pistillate flowers with a linear fleshy stigma and usually with a hairlike bractlet with dilated blunt tips among the bristles; the denuded old axis covered with stout blunt compound papillate pedicels that are 0.5-0.7 mm. long. In coastal and inland marshes in s. Tex.; from N. S. and s. Me. to s. Que. and Ont., s. to S. C., W. Va., Ky., Mo., Neb. and Tex.; also Calif. and Euras.

3. *Typha domingensis* Pers. TULE. Plant slender, to about 3 m. tall, the stem pith white; leaves 6 to 10, usually flat, yellowish-green, firm or coriaceous, 7-15 mm. wide, usually shorter than the inflorescence; sheaths tapering at throat to the blade, scariously-margined above; staminate portion of spike 2-4 dm. long, more or less separated (sometimes by as much as 6 cm.) from the whitish-brown pistillate portion; surface of spike similar to that of *T. angustifolia*; stigmas linear, interspersed with many apiculate-bladed bractlets, soon deciduous; compound pedicels 0.5-0.8 mm. long. *T. truxillensis* H.B.K. In brackish or fresh marshes and pools throughout most of Tex., Apr.-May; from Fla. to Tex. and s. Calif., n. along the coast to Del. and e. Md. and inland to Kan., Ut., Nev. and n. Calif.; also trop. Am.

⁴ Adapted from Neil Hotchkiss and Herbert L. Dozier in Am. Midl. Nat. 41:237-254. 1949.

FAM. 18. SPARGANIACEAE RUDOLPHI

BUR-REED FAMILY

Perennial marsh or aquatic monoecious plants with horizontal rootstocks and alternate sessile 2-ranked linear leaves on an erect simple or branched stem; flowers in distant somewhat regularly disposed globular sessile or pedunculate heads on the upper part of the stem or its branches; upper heads bearing sessile staminate naked flowers and minute scales irregularly interposed; lower heads composed of numerous sessile or shortly pedicelled pistillate flowers with a calyxlike perianth of 3 to 6 linear to spatulate or obovate-flabellate scales; bracts caducous or the lower ones persisting and leaflike; ovary 1- to 2-celled; achenes suborbicular to obovoid to fusiform, 1- to 2-seeded.

A monotypic family.

1. SPARGANIUM L.

BUR-REED

Characters of the family. Pistillate heads becoming burlike from the divergent beaks but the pistils at maturity falling away separately in summer and autumn.

About 20 species in the temperate and cold regions of both hemispheres.

1. Leaves firm and rigid; inflorescence commonly branched, the branches jointed and bearing 3 or more staminate heads; bracts ascending; fruiting heads 25-35 mm. thick; achenes subsessile, the body usually constricted at middle, the stipe about 1 mm. long, the beak 3-4 mm. long; receptacle fimbriate-alveolate 1. *S. androcladum*.
1. Leaves soft and flaccid; inflorescence simple or the branches strict and bearing no more than 2 staminate heads; bracts mostly spreading; fruiting heads 15-25 mm. thick; achenes stipitate, the body not constricted, the stipe 4-5 mm. long, the beak about 5 mm. long; receptacle scarcely alveolate 2. *S. americanum*.

1. *Sparganium androcladum* (Engelm.) Morong. Plants stout, to 12 dm. tall; leaves stiffish, strongly ascending, elongate, nearly flat but keeled below, to 15 mm. wide; lower bracts similar to the leaves, slightly scarious-margined at base; inflorescence branched or rarely simple, the primary axis with 1 to 4 mostly sessile axillary pistillate heads and 4 to 10 staminate heads, the 1 to 3 filiform strongly arched geniculate branches with 3 to 8 staminate heads and rarely 1 pistillate head; stigma filiform, 2-4 mm. long; achenes lustrous, the body 5-6 mm. long and 2.5-3 mm. thick; anthers 1-1.5 m. long. In swamps and shallow water of streams in e. Tex., Apr.-June; from Que. to Minn., s. to Va., e. Ky., Ill., Mo., Okla. and Tex.

2. *Sparganium americanum* Nutt. Plants stout to slender, to 1 m. tall; leaves soft, thin, flat, translucent, loosely ascending or occasionally floating, to 2 cm. wide; lower bract similar to leaves, spreading-ascending, scarious-margined at base; inflorescence simple or sometimes branched, the heads or branches axillary, the primary axis with 1 to 5 pistillate heads and 5 to 9 staminate heads, the branches (when present) with 1 to 6 staminate heads and 1 to 3 (rarely 0) pistillate heads; stigma linear-oblong to lanceolate, 1-2 mm. long; achenes dull or but slightly lustrous, the body 4-5.5 mm. long and about 2 mm. thick; anthers about 1 mm. long. In shallow water in e. Tex., Apr.-June; from Nfld. to Ont., Wisc., Minn. and N. D., s. to Fla., Ala., Tex. and Mo.

FAM. 19. POTAMOGETONACEAE DUM.⁵

PONDWEED FAMILY

Aquatic herbs of fresh water; leaves alternate or imperfectly opposite, those immersed thin, those above water often leathery, sheathing at the base, the sheath free or partially adnate to the petiole; flowers bisexual, small, arranged in pedunculate axillary spikes; peduncle surrounded by a sheath at the base; bracts absent; perianth comprised of 4 free rounded shortly clawed valvate segments; stamens 4, inserted on the claws of the

⁵ Adapted from Eugene C. Ogden in C. L. Lundell, *Flora of Texas* I: 369-382. 1966.

segments; anthers extrorse, 2-celled, sessile; gynoecium of 4 sessile free 1-celled carpels; stigmas sessile or on short styles; ovule solitary, attached to the adaxial angle of the carpel, campylotropous; fruiting carpels sessile, free, 1-seeded, indehiscent; seeds without endosperm, the embryo with large 'foot', the plumule enclosed by the cotyledon.

A family of two widespread genera, the following and *Groenlandia*.

1. POTAMOGETON L. PONDWEED

Annual or perennial aquatic herbs propagated from seeds, winter-buds (hibernacula) or rhizomes; stems variable in length according to water depth, branched or unbranched, terete or flattened; leaves all submersed or with both submersed and floating blades; submersed leaves usually flaccid, sessile or petioled, linear or orbicular, acute to obtuse at apex, the margins entire to denticulate or serrate, the nerves 1 to 35; stipules fused to form a single structure with 2 midveins, arising from the axil of the stem and leaf, free or adnate to the leaf base, often sheathing the stem and sometimes with the outer margins partially fused (connate); floating leaves usually coriaceous, petioled, elliptic to ovate, cuneate to rounded or cordate at base, the nerves 3 to 51, the margins entire, the stipules like those of submersed leaves but never adnate nor connate; peduncles about same diameter as stem, terete, sometimes clavate at tip; inflorescence a spike with 1 to 20 whorls of flowers, compact or moniliform, with 2 to 4 flowers in each whorl, mostly buoyed above the water surface; flowers bisexual, perianth of 4 free rounded short-clawed greenish segments; stamens 4; anthers sessile on the claws, 2-celled, extrorse; carpels 4, free, sessile; fruits dryish drupelets or achenes with spongy mesocarp and bony endocarp, one-seeded, embryo coiled, cotyledon one, endosperm absent.

A genus of 90 to 100 species found in all parts of the world, except the polar regions, but mostly in the north temperate areas. Nearly 40 species occur in North America, all but one being indigenous; about half of these are widespread, common and often locally abundant. The species are found primarily in shallow ponds and quiet rivers and are important as food for wild waterfowl and cover for fish.

1. Leaf margins finely and irregularly dentate3. *P. crispus*.
1. Leaf margins entire (2)
 - 2(1). Submersed leaves linear, mostly more than 10 times as long as wide (3)
 2. Submersed leaves lanceolate to ovate, mostly less than 10 times as long as broad (11)
 - 3(2). Stipules united with the base of the leaf for a distance of 7 mm. or more; floating leaves absent; embryo coil less than 1 revolution (4)
 3. Stipules free from the leaf or (if united) then for a distance of less than 6 mm. and with embryo coil more than 1 revolution (5)
 - 4(3). Leaves 2-7 mm. wide, the apex rounded to broadly obtuse and apiculate, the veins 3 to 71. *P. latifolius*.
 4. Leaves 0.2-1 (1.5) mm. wide, the apex sharp-pointed, the veins 1 to 32. *P. pectinatus*.
 - 5(3). Floating leaves absent; stipules free from the base of the leaf; seed not coiled more than 1 revolution, the coil not evident through the thick pericarp (6)
 5. Floating leaves often present; stipules free or united with the base of the leaf for a distance of less than 6 mm.; seed coiled more than 1 revolution, the coil evident through the thin pericarp (10)
 - 6(5). Fruits with dorsal keel prominent, thin, alate, undulate or toothed (7)
 6. Fruits with dorsal keel rounded or acute but never thin and alate (8)
 - 7(6). Leaves 1.4-2.7 mm. wide, the veins 3 to 5; fruits 2-2.5 mm. long4. *P. foliosus* var. *foliosus*.
 7. Leaves 0.3-1.5 mm. wide, the veins 1 to 3; fruits 1.8-2.3 mm. long4. *P. foliosus* var. *macellus*.
 - 8(6). Fruits tuberculate, especially at base, 2.5-2.8 mm. long, the lateral keels prominent6. *P. clystocarpus*.
8. Fruits smooth, 2-2.5 mm. long, the lateral keels rounded or obscure (9)

- 9(8). Stipules connate when young; peduncles 1.5-8 cm. long; spikes 6-12 mm. long, of 3 to 5 separated whorls 5. *P. pusillus*.
9. Stipules not connate; peduncles rarely more than 3 cm. long; spikes 2-8 mm. long, of 1 to 3 contiguous whorls 7. *P. Berchtoldii* var. *tenuissimus*.
- 10(5). Submersed leaves 0.4-1.5 mm. wide, the apex subobtuse to acute; stipules 6-30 mm. long; floating leaves 10-40 mm. long, 3-20 mm. wide, with 5 to 15 veins, the apex rounded; submersed peduncles 1-4 mm. long 8. *P. diversifolius* var. *diversifolius*.
10. Submersed leaves 0.1-0.6 mm. wide, the apex setaceous; stipules 3-12 mm. long; floating leaves 7-26 mm. long, 1-15 mm. wide, with 3 to 7 veins, the apex acute to acutish or mucronulate; submersed peduncles 3-13 mm. long 8. *P. diversifolius* var. *trichophyllus*.
- 11(2). Apex of submersed leaves acute to sharp-pointed, sometimes mucronate; stipules of submersed leaves firm and persistent; stem with endodermis cells unevenly thickened, interlacunar bundles present 11. *P. illinoensis*.
11. Apex of submersed leaves acute but not sharp-pointed; stipules of submersed leaves usually delicate and decaying early; stem with endodermis cells evenly thickened, interlacunar bundles absent (12)
- 12(11). Floating leaf blades usually cordate, rarely rounded at base, with 21 to 29 (sometimes more) veins; submersed leaves tapering rather abruptly to a sessile base or short petiole to 1.5 cm. long; mature fruit light-brown to olive-green, 3-3.5 mm. long; stem with stele of the prototype pattern 9. *P. pulcher*.
12. Floating leaf blades cuneate or rounded at base, with 9 to 21 veins; submersed leaves tapering gradually to a petiole 2-13 cm. long; mature fruit usually reddish, 3.5-4 mm. long; stem with stele of the triotype pattern 10. *P. nodosus*.

1. *Potamogeton latifolius* (Robbins) Morong. WESTERN PONDWEED. Rhizome creeping, rooting freely at the nodes; stem whitish, simple below, repeatedly branched above; stele of the one-bundled-type or oblong-type; endodermis of U-cells; interlacunar bundles present in the outer interlacunar circle; subepidermal bundles absent; pseudohypodermis absent or partly 1 cell thick; leaves all submersed, linear, entire, green to bronze, rather opaque, to 7 cm. long and 7 mm. wide, the apex obtuse to rounded or shortly apiculate to acutish on the upper leaves; nerves 3 to 5, with strong crossveins making a rectangular pattern; stipules prominent, 8-12 mm. long, adnate to the base of the leaf to form a broad sheath, hyaline along the margin, the free portion 1-4 mm. long; peduncles 2-25 cm. long; spikes with 4 to 6 whorls, contiguous when young but soon becoming moniliform; basal internodes 5-12 mm. long, the upper shorter, in fruit 2-4 cm. long; flowers sessile; perianth semiorbicular, slightly wider than long, up to 5.2 mm. wide; anthers about 1.8 mm. long; fruits obliquely obovate, the sides convex but somewhat compressed, 3-4 mm. long, 2-4 mm. wide; dorsal keel obscure, lateral keels rounded; beak facial, slightly recurved, about 1 mm. long; exocarp olive-green to fulvous; endocarp loop solid or with a spongy area; apex of seed pointing above the basal end. In quiet or flowing fresh or brackish water, in Tex. collected once at the now defunct Comanche Springs, Ft. Stockton, flowers and mature fruit from June to Sept.; rare in s.w. U.S.

2. *Potamogeton pectinatus* L. SAGO PONDWEED. Rhizome creeping, much-branched, 1-1.5 mm. in diameter, bearing terminal tuberous bulblets; stem terete or slightly compressed, about 1 mm. in diameter, mostly simple near base but abundantly branched near summit; stele with the oblong pattern or one-bundled in slender branches; endodermis of U-cells; interlacunar bundles present; subepidermal bundles present or absent; pseudohypodermis 1 or 2 cells thick; leaves all submersed, filiform to narrowly linear, entire, to 15 cm. long and 1 mm. wide, occasionally wider on robust forms, the apex tapering to a narrowly acute point (sometimes obtuse on young seedlings); nerves 1 to 3, with strong crossveins, the lateral nerve usually marginal; stipules prominent, 2-5 cm.

long, the base adnate to the leaf to form a sheath slightly wider than the stem, greenish or whitish, the free portion less than half the length of the sheath; peduncles 3-25 cm. long, flexuous; spikes with 2 to 5 whorls of flowers, soon becoming widely and unequally spaced (moniliform), in fruit to 5 cm. long; flowers sessile or nearly so; perianth greenish, the blades orbicular to elliptical, 1-2 mm. wide; anthers 0.5-1 mm. long; fruits obliquely obovate, plump, narrow at base, rounded on the dorsal side, 2.5-4 mm. long, 2-3 mm. wide; dorsal keel absent, the lateral keels obscure; beak facial, usually recurved, about 0.6 mm. long; exocarp light tan, yellowish or pale-olive-green; endocarp loop solid, apex of seed pointing toward the basal end or slightly above. In alkaline, brackish or saline water of ponds, quiet rivers, marshes and ocean shores, throughout Tex. except perhaps the e. Timber Belt and Blackland Prairies, mature fruit from May to Oct.; throughout much of e. half of U. S. and Can.

3. *Potamogeton crispus* L. Rhizome buff or reddish, about the same thickness as the stem; stem simple or branched, laterally compressed and somewhat 4-angled with the broader sides furrowed, 0.5-2.5 mm. in greatest diameter; stele of the oblong-type pattern with but 1 central bundle and 1 lateral bundle on each side; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles absent; pseudohypodermis 1 cell thick; leaves all submersed, bright-green to dark-green or occasionally slightly reddish, translucent, linear-oblong to linear-oblongate, up to 1 dm. long and 1 cm. wide, the apex broadly rounded, the base semiclasping; nerves 3 to 7, the laterals close to the margin; lacunae of 1 or 2 rows on each side of midrib; margins finely and irregularly dentate and often undulate; stipules 5-15 mm. long, slightly adnate at base, the upper part fraying early to leave papery or shreddy bases; peduncles 2-7 cm. long; spikes of 3 to 5 whorls of flowers, compact or moniliform, in fruit 1-2 cm. long, 1-1.3 cm. wide; flowers sessile or on very short pedicels; perianth blades orbicular, 1.2-2.1 mm. wide; anthers 0.7-1.3 mm. long; fruits ovate, 2-3.6 mm. long (excluding beak), 1.5-2.8 mm. wide; keels obtuse but prominent, the dorsal one strongly developed below and with a small tooth near the base; beak prominent, straight or incurved, as long as the fruit body; exocarp dark-olive or brownish; endocarp loop solid and near the base; apex of seed pointing toward the basal end; winter-buds burlike, hard and horny, 1-2.5 cm. thick. In ponds and streams, often abundant in quiet muddy calcareous water; seldom found fruiting but does not produce fruits in shallow warm non-fluctuating water, in n.-cen. Tex. (recently reported from Hemphill Co. in the Panhandle). Introd. into N. A. from Eur., it has reached Tex. during the last quarter-century but is still not common. When thoroughly established may become an aggressive weed. Fruiting plants unknown in Tex. but elsewhere the fruits are produced earlier in the growing season than most other species in the genus.

4. *Potamogeton foliosus* Raf. Rhizome freely branching, rooting at the nodes; stem subsimple below, much branched above, filiform, laterally compressed, usually without glands at the nodes; stele of the one-bundled-type; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles present; pseudohypodermis absent; leaves all submersed, narrowly linear, green to bronze, up to 1 dm. long and 2.7 mm. wide, slightly tapering to a sessile base, entire-margined, acute or subacute at apex; nerves 3 to 5, the midrib prominent, without bordering lacunae or with 1 to 3 rows on each side at the base, lateral nerves joining the midrib 1 to 3 leaf-widths below the apex, in broad leaves with 5 nerves the marginal ones may join the laterals farther down; stipules 7-18 mm. long, with connate margins when young to form tubular delicately fibrous blunt sheaths, soon tearing and deciduous; peduncles slightly thickened upward, to 3 cm. long; spikes subcapitate or cylindrical, of 1 to 3 contiguous whorls of 2 flowers each; perianth blades flabellate, brownish, 0.6-1 mm. long; fruits obliquely suborbicular, laterally compressed, 2-2.5 mm. in diameter; dorsal keel with a thin undulate to dentate wing; lateral keels obscure; beak erect, broad at base, 0.2-0.4 mm. long; exocarp fulvous or olive-brown; embryo with apex pointing toward the basal end or slightly above; winter-buds sessile in the axils or on short branches. In fresh (mostly calcareous) or brackish water of ponds and slow or swift streams, common in the Trans-Pecos, occasional elsewhere, n.e. to the Panhandle and e. to e.-cen. Tex., mature fruit from May to Oct.; throughout Can. and the U.S. to Mex. and the W.I.

Var. *macellus* Fern. Similar to var. *foliosus* but smaller and more bushy-branched; leaves bright-green, to 7 cm. long and 1.5 mm wide; nerves 1 to 3; midrib without adjacent lacunae or with a single row on each side below the middle; fruits green,

obliquely obovoid, 1.8-2.3 mm. long, the body longer than broad; beak slender, 0.3-0.8 mm. long; winter-buds terminating elongate branches. Same habitats as var. *foliosus*. This poorly-marked variety that differs only in size is apparently rare in Tex.

5. *Potamogeton pusillus* L. Plants often with winter-bud at base; rhizome absent; stem usually much-branched, slender, terete or slightly compressed, usually with a pair of small translucent glands at the nodes; branches (late in the season) often terminated by winter-buds; stele of the one-bundled-type or oblong-type; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles present; pseudohypodermis absent; leaves all submersed, linear to linear-setaceous, entire, light green, to 7 cm. long and 3 mm. wide, acute to obtuse at apex; nerves 3 to 5, the lateral nerves obscure in narrow extremes, joining the midrib one-half to 2 leaf-widths below the tip; midrib usually not bordered by lacunae but they are sometimes evident on the young uppermost leaves; stipules scarious-membranaceous, 6-17 mm. long, clasping the stem and with margins united at base to above the middle, this union tearing with age; peduncles axillary, filiform, 1.5-8 cm. long; spikes cylindrical, with 3 to 5 separated few-flowered whorls, 6-12 mm. long; flowers with perianth round-flabelliform and with slender claw, 1.2-2 mm. long; anthers 0.5-0.8 mm. long; fruits obliquely obovoid, 1.9-2.8 mm. long, 1-1.8 mm. wide; dorsal keel obscure, very low and broad; lateral keels absent; beak facial, prominent, erect or slightly recurving, 0.2-0.6 mm. long; exocarp olive-green, smooth; endocarp loop solid; apex of seed pointing slightly above the basal end or between the base and the middle of the opposite side. In neutral or slightly alkaline or slightly brackish water of ponds and rivers, throughout Tex., mature fruit from May to Oct.; throughout much of e. U.S. and Can., s. to e. Mex.

6. *Potamogeton clystocarpus* Fern. Stem much-branched, slender, terete or slightly compressed, usually with a pair of small translucent glands at the nodes; stele of the one-bundled-type; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles present; pseudohypodermis absent; leaves all submersed, linear, entire, light-green, translucent to subopaque, to 9 cm. long and 3 mm. wide, the acute apex often with a sharp mucro; nerves 3 (5), often obscure, laterals joining the midrib near the apex or disappearing in the apical area; midrib bordered on each side by one or two rows of lacunae; stipules hyaline to subherbaceous, 0.5-1 mm. long, usually clasping the stem but with margins free, becoming lacerate at the apex; peduncles filiform, 15-65 mm. long; spikes short-cylindric, 8-10 mm. long, with 2 or 3 whorls of flowers; flowers with perianth broad-flabelliform and with slender claw, 2.5-3 mm. long, 1.5-2.5 mm. wide; anthers 0.8-1.2 mm. long; fruits obliquely obovate to suborbicular, with 2 or more verrucose protuberances near the base, 2.5-2.8 mm. long, 1.8-2 mm. wide; dorsal keel rounded to prominently developed and gibbous at base; lateral keels rounded or obscure; beak facial, recurved, 0.2-0.5 mm. long; exocarp dark-olive-green; endocarp loop solid; apex of seed pointing slightly above the basal end or between the base and the middle of the opposite side. In quiet pools and flowing streams, known only from Little Aguja Canyon, Davis Mts. in the Trans-Pecos where it is endemic, in fruit from May to Oct. and perhaps later.

7. *Potamogeton Berchtoldii* Fieb. var. *tenuissimus* (Mert. & Koch) Fern. Plants often with winter-bud at base; rhizome absent; stem usually much-branched, slender, terete or nearly so, usually with a pair of small translucent glands at the nodes; branches (late in the season) often terminated by winter-buds; stele of the one-bundled-type; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles present; pseudohypodermis absent; leaves all submersed, linear to linear-setaceous, acute at apex, entire, light-green to deep-green, translucent and flaccid, up to 85 mm. long and 1 mm. wide; nerves 3, laterals often obscure and (when not evanescent) joining the midrib one-fourth to 2 leaf-widths below the tip; midrib bordered on each side (at least in the lower half) by a single row of lacunae; stipules hyaline to subherbaceous, 3-14 mm. long, usually clasping the stem but with margins free (or adhering because of adhesive materials in the water); peduncles axillary, filiform, to 3 (rarely - 4.5) cm. long; spikes subglobose, with 1 to 3 few-flowered whorls, 2-8 mm. long; flowers with perianth round-flabelliform and with slender claw, 1-2 mm. long; anthers 0.5-0.8 mm. long; fruits obliquely obovoid, 2-2.5 mm. long, 1.2-1.9 mm. wide; dorsal keel obscure, very low and broad; lateral keels absent; beak facial, prominent, erect or slightly recurving, 0.1-0.5 mm. long; exocarp dark-olive-green, smooth

or faintly rugulose when dry; endocarp loop solid; apex of seed pointing slightly above the basal end or between the base and the middle of the opposite side. In neutral to acid water of ponds and rivers, known from one locality in n.e. Tex. (Bowie Co.) but probably elsewhere along the n. border, probably in fruit from May to Oct.; throughout much of N. A.

8. *Potamogeton diversifolius* Raf. var. *diversifolius*. Rhizome freely branching, rooting at the nodes; stem filiform, terete, much-branched; stele of the oblong-type with one or two median bundles; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles absent or occasionally with faint mechanical strands; pseudohypodermis present or absent; submersed leaves narrowly linear, entire, pale-green, mostly 2-6 cm. long, 0.5-1.5 mm. wide, slightly tapering to a sessile base, acute to obtuse at apex; nerves 3, laterals inconspicuous; midrib usually bordered by 1 to 4 rows of lacunae; stipules delicately fibrous, adnate to the base of the leaf blade; floating leaves coriaceous, elliptic to oval or narrowly obovate, rounded at apex, cuneate or rounded at base; petioles usually shorter than the blades; blades to 4 cm. long and 2 cm. wide; nerves 5 to 15; stipules free from the petioles, 6-30 mm. long, delicately fibrous, persistent; peduncles usually slender, often clavate, 1-4 mm. long from the axils of submersed leaves and 2-30 mm. long from the axils of floating leaves, ascending or arching; submersed spikes few-flowered, subglobose; emerged spikes elongate, 5-20 mm. long, in fruit 3-4 mm. wide; flowers sessile or nearly so; perianth suborbicular to broadly rhombic, 0.7-1 mm. long, with a short claw; fruits suborbicular, the sides flattened or slightly concave and often cochleate-sulcate, 1-1.5 mm. in diameter; dorsal keel prominent, alate, 0.2-0.4 mm. wide, undulate or with a few very low teeth; lateral keels low and fine but evident, entire or slightly dentate; beak facial, minute but usually definite; exocarp greenish to brownish, endocarp with loop solid; embryo coil more than one complete revolution; winter-buds may form late in the growing season, being short branches with crowded internodes. In pools, tanks and small streams, common in e. Tex. and in the mts. of the Trans-Pecos, freely fruiting throughout the summer; mostly in s. U.S. and Mex.

Var. *trichophyllus* Morong. Similar to var. *diversifolius* except submersed leaves flaccid, setaceous or setaceous-linear, 0.1-0.6 mm. wide, tapering to an acute apex, the nerves 1 or obscurely 3; stipules delicate, free or partially adnate to the base of the leaf blade, deciduous with age; floating leaves lance-elliptic to oval-elliptic, acutish or (if rounded) at least submucronate at apex; blades 7-26 mm. long, 1-10 mm. wide; nerves 3 to 9; stipules 3-10 mm. long; peduncles 1-4 mm. long from the axils of submersed leaves and 2-30 mm. from the axils of floating leaves; fruits with dorsal keel entire or with 3 to 12 small teeth. Common in e. Tex. in the same habitats as var. *diversifolius*.

9. *Potamogeton pulcher* Tuckerm. Rhizome pale-buff, often with dark-red spots; stem simple, terete, 1-2.5 mm. in diameter, usually conspicuously dark-spotted; stele with the prototype pattern; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudohypodermis mostly 1 cell thick; submersed leaves of two intergrading types, those of the lower part of the stem semiopaque and oblong with rounded apices, those of the upper part of the stem translucent and lanceolate to lance-linear, with an acutish but not sharp-pointed apex, both types tapering at base to petioles to 35 mm. long; blades entire, to 18 cm. long and 35 mm. wide, usually smaller; nerves 11 to 21, the outer ones marginal; lacunae 4 to 8 rows on each side of midrib; floating leaves coriaceous, ovate to rotund, rounded to bluntly mucronate at apex, cordate or rounded at base; petioles 4-18 cm. long; blades to 11 cm. long and 85 mm. wide, with 19 to 35 nerves; stipules of the submersed leaves decaying early, those of the floating leaves persistent, narrowly triangular, obtuse when young, acutish with age, 2-5 cm. long, 2-keeled; peduncles 5-11 cm. long; spikes with about 10 whorls, in fruit 2-3.5 cm. long, 8-11 mm. thick; flowers sessile or nearly so; perianth greenish, blades orbicular to elliptical and 1.2-3 mm. wide; anthers 0.8-1.4 mm. long; fruits obliquely ovate, rounded or cuneate at base, the sides flat or slightly concave, 2.7-4 mm. long, 2.3-3.4 mm. wide; keels usually prominent, acutish, the dorsal one often strongly developed and sometimes with a basal lobe projecting below the point of attachment; beak often prominent, up to 0.8 mm. long; exocarp light-brown to olive-green; endocarp with 3 prominent acutish and somewhat muricate keels; beak linear, facial, about 1 mm. long; loop solid; apex of seed pointing 0.5-1.2 mm. above the basal end. In muddy pools, boggy streams, lakes and occasionally

in clear water in sandy bottom (Carrizo outcrop), in Tex. only in the Timber Belt, flowers in Apr. and May, mature fruit by mid-May; in the e. half of U.S.

10. *Potamogeton nodosus* Poir. Rhizome white, suffused or spotted with rusty red; stem simple, terete, often pressing very flat, 1-2 mm. in diameter; stele with the triotype pattern, with the phloem on the inner face of the trio-bundle appearing as one patch; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudohypodermis absent; submersed leaves thin, linear-lanceolate to broadly lance-elliptic, to 2 dm. long and 35 mm. wide, tapering gradually at base into a petiole 2-13 cm. long, tapering gradually to an acutish but not sharp-pointed apex; nerves 7 to 15; lacunae of 2 to 5 rows along the midrib; margin of young blades with fugacious translucent denticles; floating leaves coriaceous, with long petioles; blades lenticular to elliptic, cuneate or somewhat rounded at base, acutish to rounded at apex and sometimes with an obtuse mucro, to 11 cm. long and 45 mm. wide; nerves 9 to 21; lacunae rarely present; stipules of submersed leaves brownish, often delicate and decaying early, linear, acute or obtuse, 3-9 cm. long, those of the floating leaves similar but usually broader at base and more or less 2-keeled; peduncles usually thicker than the stem, 3-15 cm. long; young spikes compact but becoming loose at anthesis, of 10 to 17 whorls of flowers, at maturity usually not densely fruited, 3-7 cm. long, 8-10 mm. thick; flowers sessile; perianth greenish or brownish, orbicular or elliptical, 1.4-2.6 mm. wide; anthers 1-1.4 mm. long; fruits obovate, 3.5-4.3 mm. long, 2.5-3 mm. wide; keels prominent, the dorsal strongly developed (especially upward), the laterals often muricate; beak facial, short; exocarp of mature fruits brownish or reddish; endocarp with keels strongly developed, the dorsal often 0.5 mm. wide, the laterals strongly muricate; beak linear, erect, to 1 mm. long; loop solid; apex of seed pointing a little above the basal end. *P. americanus* Cham. & Schlecht. In streams and lakes throughout Tex., mature fruits in late spring and summer; in much of the U.S., Can. and n. Mex.

11. *Potamogeton illinoensis* Morong. Rhizome buff, spotted or suffused with red; stem simple or branched, terete, 1-5 mm. in diameter; stele with the prototype, triotype or oblong-type pattern; endodermis of U-cells; interlacunar bundles in the outer interlacunar circle, sometimes a few in the next to the outer circle; subepidermal bundles present or absent; pseudohypodermis absent or of 1 cell thick; submersed leaves thin, elliptic to lanceolate, often somewhat arcuate; blades to 2 dm. long and 45 mm. wide, sessile or tapering into a petiole to 4 cm. long, acute and usually somewhat mucronate at apex; nerves 7 to 19; lacunae of 2 to 5 rows along midrib and larger nerves; margin entire or with fugacious 1-celled translucent denticles; floating leaves (often absent) more or less coriaceous, transition to submersed leaves usually gradual; blades elliptic to ovate-elliptic or oblong-elliptic, to 19 cm. long and 65 mm. wide, obtuse-mucronate at apex, cuneate or rounded at base; petioles 2-9 cm. long, shorter than the blade; nerves 13 to 29; lacunae of 2 or 3 rows of cells along midrib, sometimes obscure; stipules persistent, divergent and conspicuous, obtuse, those of the submersed leaves 1-8 cm. long and 3-12 mm. wide at base, prominently 2-keeled, with 15 to 35 finer nerves; those of the floating leaves broader; peduncles as thick as or thicker than the stem, 4-30 cm. long; spikes in anthesis compact, of 8 to 15 whorls of flowers, at maturity cylindrical and crowded, 2.5-7 cm. long, 8-10 mm. thick; flowers sessile or on pedicels up to 0.5 mm. long; perianth orbicular to oval, 1.3-3.2 mm. wide; anthers 0.6-2 mm. long; fruits obovate to orbicular or ovate, 2.5-3.6 mm. long (excluding beak), 2.1-3 mm. wide, the sides flat; keels prominent and acute, the dorsal strongly developed above and below, the laterals less strongly developed but often each with a projecting knob at the base; beak facial, short, erect or curved toward the back; exocarp gray-green to olive-green or brownish, sometimes reddish; endocarp with keels low but prominent or with dorsal keel thin and very weak; beak deltoid and weak, about 0.5 mm. long; loop solid; apex of seed pointing at the middle of the opposite side or between middle and base. *P. lucens* L., *P. angustifolius* Bercht. & Presl. In quiet or flowing water of ponds and rivers in s.-cen. Tex., especially on the Edwards Plateau and in the Guadalupe Mts., fruiting by early May; throughout much of U.S. and Can.

A variable species due, in part, to habitat. Hybrids may occur between this species and *P. nodosus*, especially where the two are found together.

The following species of *Potamogeton* have been reported from Texas, but they are excluded on the basis that no material of any of them has been seen: *P. capillaceus* Poir. (*P. hybridus* of auth., not Michx.), *P. fluitans* Roth, *P. granineus* L. var. *graminifolius* Fries (*P. heterophyllus* Schreb.), *P. natans* L., *P. panormitanus* Biv.

FAM. 20. ZANNICHELLIACEAE DUM. HORNED PONDWEED FAMILY

Submerged aquatic dioecious or monoecious herbs, with a slender creeping rhizome; leaves alternate or opposite or crowded at the nodes, linear, sheathing at the base, the sheaths mostly ligulate at the apex, the floral leaves sometimes reduced to sheaths; flowers minute, bisexual or unisexual, axillary, solitary or in cymes; perianth of 3 small free scales or absent; stamens 1 to 3, the anthers 1- or 2-celled and opening lengthwise; pollen globose or threadlike; gynoeceium of 1 to 9 free carpels; style short or long, simple and with a capitate to peltate or spatulate stigma, sometimes 2- to 4-lobed; ovule solitary, pendulous; fruiting carpels sessile or stipitate, indehiscent; seed pendulous, without endosperm.

Widely distributed, mainly in salt or brackish water; 3 genera and 6 species.

1. Pollen spheroid; carpels several, free; plants of fresh or brackish water; leaves filiform1. *Zannichellia*, p. 93.
1. Pollen threadlike; gynoeceium 1- or 2-carpellate; plants of marine habitats (2)
- 2(1). Leaves flat, tridentate at apex; styles simple; one anther attached higher than the other2. *Halodule*, p. 93.
2. Leaves terete or semiterete, acute or pointed at apex; styles 2- to 4-lobed; anthers at an equal height3. *Cymodocea*, p. 94.

1. ZANNICHELLIA L.

HORNED PONDWEED

A genus of two species, the other in Africa.

1. *Zannichellia palustris* L. COMMON POOLMAT. Submerged aquatic plant, monoecious, rooted on bottom and floating below surface of water; stem simple or much-branched; leaves mostly opposite, linear-filiform, entire, to 1 dm. long, acute or almost pungent at the apex, 1-nerved; stipules scarious, free from the leaf bases, scarcely 2 cm. long; flowers unisexual, sessile, usually both kinds from the same axil, enclosed in a hyaline deciduous spathe, the perianth wanting; staminate flower consisting of a single 2- to 4-celled anther on a slender filament; pistillate flowers sessile at first, often pedicellate after anthesis; carpels 2 to 8, flask-shaped, ribbed or toothed on the margins, or sometimes smooth; style recurved, persistent; mature fruit 2-4 mm. long, rarely pitted, flattened, slightly incurved, smooth or slightly dentate on the convex back, the body 2-3 mm. long, the beak to 1.5 mm. long. In fresh or brackish water in pools, streams and irrigation canals, in Tex. mainly in the Edwards Plateau and in the Trans-Pecos, Apr.-July; nearly throughout N. A., except the extreme n., also S. A., Euras. and Afr.

2. HALODULE ENDL.

Several species of marine waters mainly in tropical regions.

1. *Halodule Beaudettei* (den Hartog) den Hartog. Submerged dioecious perennial, with creeping rootstocks; rootstocks branching, articulated and rooting at the nodes, the roots often terminating in fleshy starchy tuberlike swellings, with a short erect stem at each node; internodes 5-40 mm. long; scales elliptic, 5-10 mm. long; sheaths 1.5-6 cm. long; leaves mostly crowded on short erect lateral branches, all linear, grasslike, more or less narrowed and sheathing at the base, 5-20 cm. long, 0.8-1.2 mm. wide, midrib conspicuous, widening and often furcate near the tip; leaf tip with a very prominent acute median tooth which is 1 to 10 times as long as the narrow linear lateral teeth;

flower unknown. *Diplanthera Beaudettei* den Hartog, *D. Wrightii* of auth., *Halodule Wrightii* of auth. In salt water of bays along the Gulf Coast in Tex., frequent in sea drift; widely distributed in the Carib. and also in the Gulf of Mex., along the Atl. Coast of N.A. n. to N.C.; also along the Pac. Coast of Pan. and Nic.

3. CYMODOCEA KÖNIG

Several species of marine waters mainly in tropical regions. Sometimes placed in a separate family, Cymodoceaceae.

1. *Cymodocea filiformis* (Kütz.) Correll. **MANATEE-GRASS**. Submerged acaulescent dioecious perennial, with creeping rootstocks branching and rooting at the nodes; leaves all submerged, grasslike, terete or semiterete, acute at the apex and sheathing at the base, the sheaths more or less auriculate, to 35 cm. long and 2 mm. wide; stipular sheaths completely surrounding the leaf bases, scarious, to 45 mm. long; flowers unisexual, solitary or in simple or dichotomous cymes; staminate flowers consisting of two anthers on the end of a long pedicel, the anthers equally attached, both the same height, 2-celled; pistillate flower of 2 carpels, without perianth but subtended by a hyaline perianthlike bract; style 2- to 4-lobed; stigmas 2, hairlike; mature fruit 1-seeded, 3 mm. long and beaked by the persistent style. *Cymodocea manatorum* Asch., *Syringodium filiforme* Kütz. In shallow salt water of bays along the Gulf Coast of Tex., frequent in sea drift; from Fla. and Tex. to Berm., Cuba and Martinique.

FAM. 21. RUPPIACEAE HUTCHINS. DITCH-GRASS FAMILY

Aquatic herbs of brackish or saline waters; stems simple or branched, submerged; leaves opposite or alternate, linear or setaceous, with a stipular sheath at the base; flowers perfect, small, few, arranged in terminal spikes that are at first enclosed by the sheathing leaf bases, at length much-elongated to the surface of the water; bracts absent; perianth wanting; stamens 2, opposite each other, with very short broad filaments; anthers extrorse, the 2 cells reniform and separated by the connective; carpels 4, with peltate or umbonate stigmas; ovule solitary, pendulous from the apex of the carpel, campylotropous; nutlets long-stipitate, with spirally twisted stalks, indehiscent; seeds pendulous, without endosperm.

Only one genus distributed throughout temperate and subtropical regions.

1. RUPPIA L.

Characters of the family; 2 species.

1. *Ruppia maritima* L. **WIDGEON-GRASS**. Stem whitish or green, to 1 m. long; leaves all submerged, threadlike, entire, 1-nerved, to 1 dm. long and 0.3 mm. wide, with a sharp pointed or more or less pungent apex; stipular sheath 6-10 mm. long, membranous, the free part very short or wanting; flowers on a short peduncle that elongates after anthesis and ultimately becomes a loosely coiled spiral; stamens without a filament, early deciduous; anthers 2, sessile, 2-celled; mature carpels ovoid, equilateral or gibbous and oblique, about 2 mm. long, long-stipitate; style short and stout or finely attenuate, straight or hooked; pedicellate stipe of the black nutlet to 3 cm. long. On the Gulf Coast and in saline waters of pools, rivers and marshes in the interior, Apr.-July; from Can. s. to Mex.

FAM. 22. NAJADACEAE JUSS. WATER-NYMPH FAMILY

Submerged annual monoecious or dioecious herbs of fresh or brackish waters, with fibrous roots; stems slender, much-branched; internodes spiny or unarmed; leaves small, sessile, subopposite to somewhat alternate or verticillate, with a sheathing base and

linear entire or toothed blade; within the sheath a pair of minute scales; flowers unisexual, very small, borne at the base of the branches; staminate flowers with 1 stamen, mostly subsessile and included in a spathe, the perianth bilabiate at the apex; anther sessile, 1- to 4-celled, opening by slits lengthwise; pistillate flowers without a perianth or this very thin and adhering to the carpel; ovary of 1 carpel, 1-celled, with 2 to 4 linear stigmas; ovule solitary, erect from the base, anatropous; nutlet usually embraced by the leaf sheath, indehiscent, enclosed in a loose and separable membranous coat, smooth and shining or reticulate with angled or roundish areolae.

Contains only the following genus and about 50 species widely distributed in temperate and warm regions. See note regarding *Posidonia* at end of *Najas*.

1. NAJAS L. WATER-NYMPH

Characters of the family.

1. Male and female flowers on different plants; leaves coarsely toothed; internodes and back of the leaf spiny 1. *N. marina*.
1. Male and female flowers on same plant; leaves minutely denticulate; internodes and back of leaf unarmed 2. *N. guadalupensis*.

1. *Najas marina* L. HOLLY-LEAVED WATER-NYMPH. Plants brittle; stems branched, sometimes dichotomously so, armed with brownish spinulose teeth on the internodes; leaves linear, opposite to somewhat alternate, stiffish or recurved, to 45 mm. long and 3 mm. wide, with toothed margins and sometimes dorsally toothed on the midrib, the usually triangular teeth apiculate and 1 mm. long or more; basal leaf sheaths rounded, without teeth or rarely with a few short teeth; male and female flowers on different plants; staminate flowers 3-4 mm. long, the anther 4-celled; pistillate flowers 3-4 mm. long; stigmas 3, sometimes one shorter than the others; mature seeds ovoid, apparently tessellated in dried specimens, smooth when fresh. In lakes and ponds, rare in s. Tex., May-July; from N.Y. to Calif., s. to Fla., Tex., Mex. and Cuba; also Euras. and Austral.

2. *Najas guadalupensis* (Spreng.) Magnus. COMMON WATER-NYMPH. Plants monoecious, flaccid; stems slender, branched, to about 6 dm. long; leaves all submerged, linear, to 25 mm. long and 2 mm. wide, acute to obtuse at apex and usually tipped with 1 or 2 spines, the 20 to 40 marginal teeth inconspicuous or often apparently wanting; basal leaf sheaths sloping or rounded, not auriculate, spinulose; male and female flowers on same plant; staminate flowers 2-3 mm. long, the anthers 4-celled; pistillate flowers 2-3 mm. long; mature fruit crowned with 2 or 3 stigmas and usually with 1 or 2 spiny sterile stigmatic processes; seeds ellipsoid, dull, reticulate with numerous 4-sided areolae. Attached to bottom and floating just below surface of water in ponds, lakes, springs, ditches and streams, often forming large mats, rather common throughout Tex., Apr.-June; from Pa. w. to Ore., s. to Fla., Tex., Mex., C. A., the W.I., Jam. and Guadeloupe.

The Eurasian marine species, *Posidonia oceanica* König, sometimes placed in the Najadaceae or Potamogetonaceae and more recently, and apparently more correctly, in a separate family, the Posidoniaceae, is represented in Texas by plants being washed up on the beaches in the Brownsville area. It is characterized by the rhizome and stem being densely covered with the persistent fibrous leaf bases; leaves linear, rounded at apex, up to 5 dm. long and 7 mm. wide, about 13-nerved; inflorescence a 3-flowered spike, 2 flowers of which are perfect and one staminate; staminal connective broad, abruptly long-aristate; fruit semioval, fleshy, indehiscent.

FAM. 23. ALISMATACEAE VENT.

WATER PLANTAIN FAMILY

Annual or perennial aquatic or marsh plants with fibrous roots from a usually somewhat thickened rootstock and a cluster of basal leaves with their long petioles sheathing a scape; leaves at first typically bladeless but soon developing either a linear or sagittate type of blade with prominent nerves and transverse veinlets; scape erect or arching, with

a simple or branched bracteate inflorescence; flowers perfect or unisexual, regular, borne in verticils; perianth segments imbricate or involute in bud; sepals 3, green, persistent; petals 3, deciduous; stamens 6 to many, included, the filaments distinct, the anthers 2-celled and dehiscing by longitudinal slits; carpels numerous, distinct, 1-celled and mostly 1-ovuled, arranged in a ring or crowded on a receptacle to produce a headlike fruit of flat or turgid achenes.

A family of about 13 genera and 90 species of worldwide distribution.

1. Achenes arranged in a single ring on the receptacle, strongly flattened; stamens 6 1. *Alisma*, p. 96.
1. Achenes densely crowded over the surface of the receptacle; stamens more than 6 (2)
- 2(1). Flowers all perfect; achenes plump; fruiting heads simulating a bur 2. *Echinodorus*, p. 96.
2. Flowers perfect or unisexual, the upper ones mostly staminate; achenes flattened; fruiting heads not burlike 3. *Sagittaria*, p. 97.

1. ALISMA L. WATER PLANTAIN. MUD PLANTAIN

About 10 species mostly in the North Temperate Zone.

1. *Alisma subcordatum* Raf. Erect perennial herb with a basal cluster of erect long-petioled laminated leaves surrounding a scape, essentially glabrous; leaf blades ovate to elliptic, cuneate to cordate at base, abruptly acute at apex, to 12 cm. long and 8 cm. wide, usually shorter than the petioles; scape to 6 dm. tall, with whorled paniced branches of small white or pinkish flowers; bracts lanceolate, acuminate, about 1 cm. long; pedicels filiform; flowers perfect, numerous; sepals broadly ovate to suborbicular, obtuse, up to 2.5 mm. long; petals to 2 mm. long; anthers spherical, 0.3-0.5 mm. long; ovaries many in a simple circle on a small flattened receptacle; style 0.2-0.4 mm. long; fruiting heads 3-4 mm. across; achenes obliquely obovate, 1.5-2 mm. long, dorsally keeled, the minute beak ascending. *A. parviflorum* Pursh, *A. Plantago-aquatica* var. *parviflorum* (Pursh) Farw. Usually in shallow water of marshes, streams and ponds in n.e. Tex. and the Panhandle, June-Sept.; Ont., N.E. and N.Y., w. to Minn. and Neb., s. to Fla. and Tex.

2. ECHINODORUS RICH. BURHEAD

Annuals or short-lived perennials of wet habitats, with basal leaves and naked erect or repent scapes that are sparingly branched or occasionally simple; flowers pedicellate, perfect, usually in remote whorls; sepals 3, persistent; petals 3, imbricated in the bud, white, deciduous; stamens 6 to usually many more; filaments elongate, usually exceeding the anthers in length; achenes forming a head, turgid, ribbed or ridged, beaked or beakless.

A dozen or more species in America, Europe and Africa.

1. Achenes 20 or fewer in a loose head, essentially beakless; stamens 9; anthers basifixed 1. *E. parvulus*.
1. Achenes 30 or more in a dense tight head, prominently beaked; stamens 12 or more; anthers versatile (2)
- 2(1). Sepals with papillose ridges; scape erect when young but soon repent; achenes with summit or keel often crested and the beak ascending; pellucid lines of leaves mostly 1 mm. or more apart and rarely exceeding 1 mm. in length 3. *E. cordifolius*.
2. Sepals with smooth veins; scape rigidly erect at maturity; achenes with keel entire and the beak erect or nearly so; pellucid lines of leaves mostly less than 1 mm. apart and often several mm. long (3)
- 3(2). Plants robust, usually much more than 2 dm. tall; leaves typically broadly ovate, broadly cuneate to cordate at base; beak of achenes 1.2-2 mm. long 2. *E. rostratus*.

3. Plants delicate, rarely more than 2 dm. tall; leaves typically lanceolate, narrowly cuneate to somewhat rounded at base; beak of achenes 0.5-1 mm. long
 2. *E. rostratus* var.

lanceolatus.

1. *Echinodorus parvulus* Engelm. Plants small and delicate, with the shoots often creeping and proliferous; scapes to 1 dm. tall, supporting a single umbellate inflorescence of 2 or more flowers; leaves with a petiole to 5 cm. long, the blade (to 3 cm. long and 8 mm. wide) narrowly elliptic and acutely tapered at both ends; pedicels slender, to 3 cm. long, reflexed in fruit; flowers white, about 6 mm. across; achenes 8-ribbed, reddish-brown, glandless, *E. tenellus* var. *parvulus* (Engelm.) Fassett, *Helianthium parvulum* (Engelm.) Small. Among grasses in wet sandy soils about ponds in s. Tex., Mar.-Sept.; from Fla. and Tex., locally n. to Mass., Ill. and Mo.

2. *Echinodorus rostratus* (Nutt.) Engelm. Plants usually coarse; scapes rigidly erect, to 6 dm. tall, exceeding the leaves; leaves broadly ovate, cordate to broadly rounded-cuneate at base, obtuse at apex, to 15 cm. long, and often as broad; umbels proliferous, in a branched panicle; flowers white, about 1 cm. across; achenes with 2 glands at base of the conspicuous erect beak; seeds brown, obliquely oval, with rows of murications. *E. cordifolius*, misapplied; *E. Berteroi* (Spreng.) Fassett, as to descr. In mud and shallow water about lakes, ponds and along streams mostly in s. Tex. but sparingly throughout most of the state, May-Oct.; from Ont., w. to Calif. and s. to Fla., Tex. and Mex.

Var. *lanceolatus* Engelm. Plants small and delicate, with typically lanceolate leaves. *Echinodorus Berteroi* var. *lanceolatus* (Engelm.) Fassett, as to descr. Habitat and distribution similar to that of var. *rostratus*.

3. *Echinodorus cordifolius* (L.) Griseb. Plants coarse and usually stout; scapes prostrate, arching and creeping, to 12 dm. long, proliferous and bearing numerous whorls of flowers, also sometimes producing leaves with the flowers; leaves with a petiole to 2 dm. or more long, the blade (to 2 dm. long and nearly as broad) broadly ovate and truncately cordate at base and obtuse at apex; flowers white, 12 mm. or more across; achenes with the keeled back denticulate. *E. radicans* (Nutt.) Engelm. In mud and shallow water of ponds and quiet streams in e. Tex., Apr.-June; from s.e. Va., Ill., Mo. and Kan., s. to Fla., Tex. and Mex.

3. SAGITTARIA L.⁶ ARROWHEAD

Paludal or aquatic mostly perennial erect or lax stoloniferous herbs, with milky juice, monoecious or rarely dioecious, sometimes tuber-bearing; leaves submersed or emersed, with long cellular petioles, bladeless (i.e., phylloids) or with unlobed or sagittate blades; scapes erect or laxly ascending, sheathed at base by the bases of the leaf petioles, supporting a narrow verticillate inflorescence that is simple or sparingly branched; flowers produced all summer, pedicellate, in whorls of three, mostly unisexual, subtended by membranous bracts, the staminate flowers typically uppermost in the inflorescence; sepals 3, persistent, in fruit appressed, loosely spreading or reflexed; petals 3, white or rarely pink, imbricated in the bud, usually exceeding the sepals, deciduous; stamens whorled, mostly numerous; carpels numerous, spirally arranged in a crowded spherical head on a dome-shaped receptacle, 1-celled and 1-ovuled; achenes flattened, membranous-winged, more or less beaked.

About 20 species, mostly in America.

1. Pistillate flowers (in fruit) with sepals appressed or spreading and pedicels recurved and noticeably thickened. 1. *S. montevidensis*.
 1. Pistillate flowers (in fruit) with reflexed sepals and pedicels ascending or (if recurved) not noticeably thickened (2)
 2(1). Filaments pubescent or minutely scaly (3)
 2. Filaments smooth (5)

⁶ Adapted from C. Rogin in Mem. N. Y. Bot. Gard. 9(2):179-233. 1955.

- 3(2). Bracts of inflorescence thinly membranous, smooth, more or less connate; filaments dilated (4)
3. Bracts of inflorescence somewhat thickened, papillose or coarsely ridged, nearly free; filaments linear 4. *S. lancifolia*.
- 4(3). Pistillate pedicels ascending, if recurved the achene beak less than 0.3 mm. long; leaves typically narrow 2. *S. graminea*.
4. Pistillate pedicels recurved; subulate beak of mature achenes 0.3 mm. or more long; leaves typically broad 3. *S. platyphylla*.
- 5(2). Bracts of inflorescence papillose; leaves never sagittate 5. *S. papillosa*.
5. Bracts of inflorescence smooth or at most pubescent; leaves sagittate (6)
- 6(5). Achene beak laterally inserted, more or less projecting horizontally (7)
6. Achene beak apically inserted, more or less erect (8)
- 7(6). Bracts of inflorescence almost plane, at least not cymbiform, acuminate or attenuate, membranous, never pubescent; achene beak less than 0.5 mm. long 6. *S. longiloba*.
7. Bracts of inflorescence cymbiform, obtuse or acute, rather firm, sometimes pubescent; achene beak 0.5 mm. or more long 7. *S. latifolia*.
- 8(6). Achene usually with one narrow facial wing or keel, the beak somewhat curved and 0.5 mm. or more long 8. *S. brevirostra*.
8. Achene face wingless, typically with a large resin duct, the minute to obsolescent beak erect 9. *S. cuneata*.

1. *Sagittaria montevidensis* Cham. & Schlecht. Leaves erect-spreading; leaf blades broadly ovate, sagittate, to 2 dm. or more long and wide; scape erect or reflexed, simple or occasionally branched below, with up to 10 whorls; bracts membranous, ovate to ovate-lanceolate, acute to attenuate, connate, about 1 cm. long; pistillate flowers usually with a ring of functional stamens; sepals orbicular-ovate, concave, about 13 mm. long, covering most of the fruiting head; stamens with linear pubescent filaments; heads of carpels to 2 cm. in diameter; achenes cuneate-obovate, to 2.5 mm. long and 1.3 mm. wide, the faces usually with a resin duct, the horizontal or oblique beak about as long as the breadth of the achene and narrowly winged on the margin. *S. calycina* Engelm., *Lophocarpus calycinus* (Engelm.) J. G. Sm. Sloughs, lakes and ponds in e., cen. and w. Tex., June-Oct.; O. and Mich., w. to N.D., Calif. and N.M., s. to Va., Tenn., La. and Tex.

Our plants have been segregated as subsp. *calycina* (Engelm.) Bogin.

2. *Sagittaria graminea* Michx. Leaves erect, either represented by thin broadly linear (strap-shaped) acute to shortly acuminate phyllodia or with the slender petioles bladeless or with narrowly lanceolate tapering blades to 2 dm. long and 25 mm. wide; scape simple, usually surpassed by the leaves, with as many as 10 whorls, the flowers with filiform ascending or spreading pedicels to 3 cm. long, the lower one or two whorls of pistillate flowers or sometimes all staminate; bracts ovate, obtuse to subacute, to 6 mm. long, more or less connate, membranous; sepals ovate, obtuse, to 5 mm. long; petals white or rarely pinkish, to 6 mm. long; stamens with dilated pubescent filaments to 1 mm. long; fruiting heads to 1 cm. in diameter; achenes obovate, to 2 mm. long and 1.2 mm. wide, the narrow-winged back strongly rounded to a high shoulder, the sides plane or with 1 or 2 narrow ridges, the subulate beak to 0.3 mm. long, obliquely inserted below the summit of the achene. *S. cycloptera* (J. G. Sm.) Mohr. Rooted in mud or in shallow water of ditches, ponds, marshes and streams in e. and s.-cen. Tex., flowering throughout the year but mostly Apr.-Nov.; throughout e. N. A., w. to the Great Plains; also Cuba.

3. *Sagittaria platyphylla* Engelm. Leaves erect, overtopping the scape; leaf blades ovate to elliptic or lanceolate, unlobed, to 18 cm. long and 8 cm. wide; scape simple, with as many as 8 whorls, the 1 to 4 lower whorls pistillate and with their thickish pedicels to 25 mm. long and soon recurving; bracts ovate, obtuse, scarious, strongly connate, to 8 mm. long; stamens with dilated pubescent filaments that are mostly longer than the anthers; fruiting heads to 15 mm. in diameter; achenes cuneate-obovate, to 2 mm. long and 1.2 mm. wide, the dorsal keel rounded to the subtruncate summit, the

faces with 1 to 3 narrow ridges; beak subulate, 0.3 mm. or more long, obliquely ascending. *S. graminea* var. *platyphylla* (Engelm.) J. G. Sm. In mud or shallow water of marshes, streams, sloughs, swamps and ponds in e. Tex., Apr.-Oct.; Mo., w. to Kan., s. to Tex. and Ala.; adv. in the Pan. Canal Zone.

4. *Sagittaria lancifolia* L. Leaves erect; leaf blades ovate to elliptic or narrowly lanceolate, unlobed, tapering to both ends, firm, to 4 dm. long and 1 dm. wide; scapes simple or branching at lower nodes, the main axis with as many as 10 whorls, the lower 1 to 4 whorls pistillate with pedicels to 25 mm. long, the staminate pedicels to 35 mm. long; bracts ovate, obtuse, strongly papillose, up to 15 mm. long, connate; sepals more or less papillose; stamens with slender arachnoid filaments that are longer than the anthers; fruiting heads about 15 mm. in diameter; achenes cuneate-oblongate, falcate, to 2.5 mm. long and 1 mm. wide, dorsally narrowly winged, usually with 1 or 2 low facial ridges; beak obliquely inserted; subulate from a thick base, to 0.8 mm. long, ascending. *S. falcata* Pursh. In fresh-water and brackish tidal marshes, swamps, and along streams in s.e. Tex., May-Nov.; Fla. to Tex., n. to Del.; also Mex. and C. A.

Our plants, as described here, have been segregated as subsp. *media* (Mich.) Bogin.

5. *Sagittaria papillosa* Buch. Leaves erect; leaf blades linear to narrowly lanceolate, to 25 cm. long and 5 cm. wide; scapes typically branching from the lowest whorl, the main axis with as many as 10 whorls, the lower 1 to 4 whorls pistillate with pedicels much shorter than those of the staminate; bracts ovate, obtuse, somewhat connate, densely papillose, to 1 cm. long; sepals to 6 mm. long, more or less papillose; petals about twice as long as the sepals; stamens with linear glabrous filaments to 1.6 mm. long; fruiting heads about 1 cm. in diameter; achenes cuneate, to 1.5 mm. long and 1 mm. wide, with the remotely crested dorsal wing about 0.2 mm. wide and the ventral wing somewhat narrower, the faces plane; beak broad-based, laterally inserted above the middle of the achene body, more or less recurving, about 0.2 mm. long. In swamps, marshes, bogs, ditches, small ponds and depressions in prairies in e. and s. Tex., Mar.-Nov.; Ark., La. and Tex.

6. *Sagittaria longiloba* Engelm. FLECHA DE AGUA. Leaves erect or erect-spreading; leaf blades ovate-triangular, acute at apex, sagittate, the portion above the basal lobes to 15 cm. long and 1 dm. wide, the conspicuously long linear to lanceolate basal lobes always longer than and commonly twice as long as the body of the blade; scapes commonly branching at the lowest whorl, the main axis with as many as 12 whorls; pedicels to 35 mm. long, ascending; bracts ovate-lanceolate to narrowly lanceolate, attenuate, to 25 mm. long, connate at base; stamens with glabrous linear filaments to 3 mm. long and exceeding the anthers; fruiting heads to 12 mm. in diameter; achenes obovate, to 2.3 mm. long and 1.3 mm. wide, the narrow dorsal wing to 0.3 mm. wide, the ventral wing nearly obsolete, the faces commonly 1-winged; beak laterally inserted, triangular, to 0.15 mm. long or obsolete. In shallow water of sloughs, ditches, ponds and swamps, especially common in roadside ditches in s. Tex. and extending to n. and w. Tex., Apr.-Nov.; Ariz., Calif., Colo., Kan., Neb., Okla., Tex. and Mex.

7. *Sagittaria latifolia* Willd. WAPATO, DUCK-POTATO. Leaves erect or erect-spreading; leaf blades triangular-ovate, obtuse to acute at apex, sagittate, the portion above the basal lobes to 25 cm. long and wide, the linear to ovate-triangular basal lobes one half as long as or longer than the body of the blade; scapes angled, occasionally branching from the lowest whorls, the main axis with as many as 10 whorls, with one or more of the lower whorls pistillate or all unisexual; pedicels of pistillate flowers typically shorter than those of the staminate flowers; sepals to 1 cm. long, glabrous to densely pubescent; bracts cymbiform, distinctly or only slightly connate, thin, somewhat scarious, obtuse to acute, glabrous to densely pubescent; stamens with slender filaments that are usually longer than the anthers; fruiting heads to 25 mm. in diameter; achenes obovate, to 3.5 mm. long and 3 mm. wide, with broad marginal wings but no facial keels; beak broad-based, subhorizontal to slightly incurved, up to 2 mm. long. Incl. var. *obtusata* (Muhl.) Wieg. In water or wet places from s.e. to n. Tex., May-Aug.; throughout most of the U.S. and much of Latin Am.

Both the entirely glabrous widespread var. *latifolia* and the southern var. *pubescens* (Muhl.) J. G. Sm. (*S. pubescens* Muhl.), with densely pubescent bracts and calyx, are rare in Texas.

8. *Sagittaria brevirostra* Mack. & Bush. Leaves erect; leaf blades broadly ovate to lanceolate, obtuse to acute at apex, sagittate, the portion above the basal lobes to 2 dm. long and usually about as wide, the ovate to ovate-lanceolate and acute basal lobes about equaling the body of the blade; scapes simple or branched at base, the main axis with as many as 12 whorls, the lower 2 to 6 whorls pistillate with pedicels to 2 cm. long, the staminate with slightly longer pedicels; bracts firm, lanceolate, long-attenuate, to 25 mm. long; stamens with slender glabrous filaments about as long as the anthers; fruiting heads depressed, not noticeably echinate, to 2 cm. in diameter; achenes cuneate-obovate to quadrate, to 3 mm. long and 2 mm. wide, with an often dentate or serrate dorsal keel and usually with a narrow facial ridge; beak broad-based, obliquely ascending, to 1.5 mm. long, terminating the straight ventral margin. *S. Engelmanniana* J. G. Sm. subsp. *brevirostra* (Mack. & Bush) Bogin. Along rivers, ditches and sloughs in cen. Tex., June-Aug.; O. and Mich., w. to S.D. and s. to Tex.

9. *Sagittaria cuneata* Sheld. Leaves erect or erect-spreading; leaf blades broadly ovate to ovate-triangular, obtuse to acute at apex, sagittate, the portion above the basal lobes to 15 cm. long and 1 dm. wide, the deltoid basal lobes somewhat smaller than the body of the blade; scapes erect or arching, simple or sometimes branched, the main axis with as many as 7 whorls, the lower 1 or 2 (or sometimes all) whorls pistillate and sessile or on pedicels to 2 cm. long, the staminate pedicels somewhat longer; bracts narrowly ovate to lanceolate, acute to attenuate, usually connate at base, to 2 cm. long; stamens with glabrous subulate filaments that about equal the anthers; fruiting heads to 15 mm. in diameter; achenes obovate, to 2.5 mm. long and 2 mm. wide, the wide dorsal keel rounded, the faces usually with a low narrow ridge; beak subulate, usually recurved, erect to suberect, to 0.4 mm. long, terminating the strongly rounded ventral keel. Along rivers and streams in the High Plains, June-Aug.; n.e. Can., s. to N.E., N.Y., O., Ind., Ill., Ia., Kan., Tex., N.M., Ariz. and Calif.

FAM. 24. BUTOMACEAE RICH.

FLOWERING-RUSH FAMILY

Perennial aquatic or marsh herbs with stout short or elongate rhizomes and usually with milky juice; leaves cauline or basal; flowers perfect, in involucrate umbels or solitary; sepals 3, persistent; petals 3, showy; stamens 6 to many, free, the outer ones usually sterile; anthers basifixed, 2-celled, laterally dehiscent; pistils 4 to 8, free or basally coherent, with numerous ovules attached over the inner surface; fruit a many-seeded follicle, dehiscing on the inner side; seeds without endosperm.

Several genera containing about 10 species, mostly of warm regions.

1. HYDROCLEYS RICH.

Characteristics of family. Four species, all native to Brazil.

1. *Hydrocleys nymphoides* (Willd.) Buch. WATER-POPPY. Rhizomes rooting at the nodes; leaves alternate, long-petioled; leaf blades broadly ovate, cordate at base, rounded at apex, 5 cm. long or more, entire, glossy on upper surface, somewhat spongy along the midrib and sparsely pubescent on lower surface, usually floating; flowers axillary on long peduncles, raised well above the water and lasting only one day; petals light-yellow, obovate, 2-3 cm. long; stamens numerous, the outer ones sterile, fertile stamens purple or violet-color; pistils usually 6, gradually tapering into the style. Cult. in ponds and pools in s. U.S., including e. Tex., and becoming somewhat naturalized, summer; nat. of Braz. Included here on the basis of Muenscher's report of its occurrence in Texas; we have seen no specimens.

FAM. 25. HYDROCHARITACEAE JUSS.* FROG'S-BIT FAMILY

Fresh- or salt-water herbs, partly or wholly submerged, monoecious or dioecious, with terrestrial or floating roots; leaves radical and crowded or dispersed on elongated stems,

* See Appendix.

alternate to opposite or whorled; flowers regular, usually unisexual, arranged in a bifid spathaceous bract or within 2 opposite bracts, the staminate usually more than 1, the pistillate solitary; spathe sessile to long-pedunculate, the peduncle sometimes spirally twisted; perianth segments free to the base, 1- or 2-seriate, 3 or rarely 2 in each series, the outer often green and valvate, the inner imbricate and petaloid; stamens 1 to numerous; anthers with 2 parallel cells that open by longitudinal slits; rudimentary ovary present in the staminate flowers; staminodes sometimes present in the pistillate flower; ovary inferior, sometimes beaked, 1-celled, with 3 to 6 or rarely more parietal placentas that sometimes protrude nearly to the middle of the ovary; styles as many as placentas, entire or 2- or 3-branched; ovules numerous on the placentas; fruit globose to linear, dry or pulpy, rupturing irregularly; seeds numerous, without endosperm; embryo straight, with a thick radicle and usually inconspicuous plumule.

About 16 genera and 80 species, mainly of tropical and warm temperate regions.

1. Fresh-water plants that are pollinated at or above the surface of the water; pollen spheroid (2)
1. Marine plants that are pollinated beneath the surface of the water; pollen confervoid or united in strings (4)
- 2(1). Plant floating; leaves broadly ovate to reniform, distinctly petiolate, emersed or floating; spathe composed of 1 or 2 free bracts1. *Limnobium*, p. 101.
2. Plants attached to bottom; leaves linear or straplike, without a petiole, submersed; spathe composed of 2 bracts connate into a tube (3)
- 3(2). Leaves in approximate whorls on an elongated stem, less than 5 cm. long; petals well-developed and much larger than the sepals . . .2. *Egeria*, p. 101.
3. Leaves clustered at the base, straplike, more than 15 cm. long; petals rudimentary and much smaller than the sepals3. *Vallisneria*, p. 102.
- 4(1). Leaves alternate on a short stout concealed stem, ribbonlike, more than 1 dm. long; spathe composed of 2 bracts connate at the base to form a tube4. *Thalassia*, p. 102.
4. Leaves opposite at summit of slender nearly naked stem, mostly oblong-elliptic, less than 5 cm. long; spathe composed of 2 free bracts . .5. *Halophila*, p. 103.

1. LIMNOBIUM RICH.

AMERICAN FROG'S-BIT

Three species centered in tropical America.

1. *Limnobium Spongia* (Bosc.) Steud. **COMMON FROG'S-BIT.** Floating aquatic with pendent roots and stolons; leaves in a basal rosette, erect or ascending, with petioles to 15 cm. long, ovate to suborbicular or the earlier ones reniform, to 5 cm. broad, obtuse at the apex, truncate to cordate at base, entire, faintly 5-nerved, purplish and spongy beneath; flowers unisexual; staminate scapes to 1 dm. long, producing 3 or more flowers, filiform, the lance-ovoid spathe 3-5 cm. long; pistillate scapes 2-leaved, with 1 or 2 short-pedicelled flowers, about 25 mm. long in flower, stout, strongly recurved and elongated in fruit; sepals 3, 7-10 mm. long; petals 3, 8-10 mm. long; stamens represented by 3 to 6 subulate rudiments; anthers linear, apiculate, 2-4 mm. long; ovary inferior, 6- to 9-celled; stigmas filiform, as many as the cells, deeply 2-parted, 1-1.5 cm. long, papillose-ciliate; berry ovoid, many-seeded, 1-1.5 cm. long, on a stout recurved peduncle. In shallow mostly stagnant water of quiet lakes, ponds, lagoons and ditches in e. Tex., June-Oct.; from Ont. and N.J., s. to Fla., Tex., Mo. and Ill.

2. EGERIA PLANCH.

Two species that are native to South America.

1. *Egeria densa* Planch. Perennial submerged aquatic herb of fresh water, dioecious, rooting on the bottom or drifting when broken loose; stems terete, slender, 2-3 mm.

thick, ascending, simple or sparingly dichotomously branched; lower leaves opposite or in whorls of 3; middle and upper leaves in whorls of 4 to 8, sessile, crowded, pellucid, linear-elliptic to linear-lanceolate, subobtusate to acuminate, serrulate, to 4 cm. long and 5 mm. wide, much longer than the internodes; flowers unisexual; *staminate* spathes funnel-form, sessile, 2- to 4-flowered, borne in the upper axils, to 12 mm. long and 3.5 mm. broad, cleft on one side, the apex bifid; flowers stipitate, borne to the surface of the water on a thread-like hypanthium 3-6 cm. long; sepals 3, herbaceous, elliptic-oblong, 3-4 mm. long; petals 3, white, obovate to suborbicular, membranous, about 1 cm. long and 8 mm. wide; stamens 9, distinct; anthers loculicidal; filaments glandular-papillose above; nectary central, 3-lobed, small; *pistillate* plants not seen. *Elodea densa* (Planch.) Casp., *Anacharis densa* (Planch.) Vict. In lakes, ponds, pools, ditches and quiet streams in cen. and e. Tex., Apr.-June; a nat. of S. A. that has escaped from cult. in various places in the U.S. and Eur.

3. VALLISNERIA L. TAPEGRASS. EELGRASS

Two species, one native to America, another in the Old World.

1. *Vallisneria americana* Michx. WATER-CELERY. Aquatic dioecious submerged plant from perennial stoloniferous rootstocks with fibrous roots and fleshy propagating buds; leaves in basal clusters, linear, obtuse, thin, ribbonlike, flaccid, entirely submerged or with the upper part floating, to about 6 dm. long and 2 cm. wide, somewhat nerved and netted-veined, often minutely denticulate on the margin; staminate spathes 2- or 3-parted, bluntly acuminate, 1-2 cm. long, on thick clavate scapes to 5 cm. long; staminate flowers numerous, crowded on a short-pedunculate spadix, enclosed in the spathe, detached at maturity and floating and expanding on the surface of the water; perianth of 3 sepals; stamens 1 to 3; peduncles of the pistillate plant to 1 m. long, curved but scarcely spirally twisted in fruit; spathe 2-cleft, 2-2.5 cm. long, rather loose; pistillate flowers solitary in the spathe, floating on the water; hypanthium linear-cylindric, in flowers 2.5-3 cm. long, fully 2 mm. thick, in fruit about 1 dm. long; sepals 3, fused to the inferior ovary, oval, 5-6 mm. long, rounded at the apex; petals 3, about 2 mm. long; ovary 1-celled, cylindric; stigmas 3, large, about 5 mm. long, 2-cleft to near the base with each division obliquely obovate and abruptly short-acuminate; fruits cylindric, indehiscent, 8-12 cm. long. *V. spiralis* of auth. In lakes and beds of flowing streams, rare in the e. half of Tex., Apr.-July; from N. B., w. to N.D., s. to Fla. and Tex.

4. THALASSIA SOLAND. TURTLE-GRASS

Several species in marine waters of tropical and warm temperate regions.

1. *Thalassia testudinum* König. PALMAS DEL MAR. Submersed perennial herb with thick creeping scaly rhizome 3-5 mm. thick, dioecious; the short stems covered by the fibrous remains of old leaves; leaves several, 2-ranked, clustered on short erect branches, sheathing at base, linear, to 35 cm. long and 1 cm. wide, glabrous, minutely serrulate at the obtuse-rounded apex, withering-persistent; scapes arising from the leaf axils, bearing a solitary unisexual flower in a 2-cleft tubular spathe whose lobes are elliptic and papillose-dentate on the margins; staminate flowers pedicelled; pistillate flower nearly sessile in the spathe; perianth lobes 6, in both kinds of flowers oblong, rounded above, 1-1.2 cm. long; stamens 9; anthers about 8 mm. long, linear, opening laterally; stigmas 9 to 12, linear-filiform, pilose, grooved on the inside, about 1 cm. long; fruit oval to ellipsoid-fusiform, short-stalked and short-beaked, densely warty-mammillate, opening by valves, 2 cm. or more long. In shallow salt water along the Gulf Coast where it forms dense and extensive marine meadows in bays and about reefs, occasional in beach drift; from Fla. to Tex., s. to n. S. A.

5. HALOPHILA THOU

Several species widespread in marine waters of tropical and warm temperate regions.

1. *Halophila Engelmannii* Asch. Submersed perennial with horizontal slender creeping scaly branching stoloniferous stems 1-1.5 mm. thick that root at the nodes and produce short erect leafy branches; internodes 2-4 cm. long; scales and leaves in pairs, opposite; scales broadly obovate, glabrous, to about 1 cm. long; erect shoots 2-4 cm. long, with 1 pair of scales at the middle and 2 or 3 pairs of leaves clustered at the summit; leaves sessile or with a very short thick petiole 2 mm. long or less, linear-oblong to oblong-elliptic, obtuse to subacute at apex, tapering at base, to 4 cm. long and 8 mm. wide, rather thick, faintly 3-ribbed and with 6 to 8 pairs of lateral veins, reticulate-roughened, finely serrulate on the margins; flowers 1 or 2 enclosed in a bifoliate sheath, both kinds often in the same sheath; *pistillate flowers* sessile in the axils of the leaves; hypanthium ovoid, 3-4 mm. long, its neck about 5 mm. long; sepals 3, minute; stigmas 3, filiform, sessile, channeled and with usually 2 rows of papillae; fruit a membranous capsule with 3 parietal placentae, enclosed in the sheath; seeds numerous; *staminate flowers* not seen. In shallow salt water along the Gulf Coast, occasional in beach drift; from Fla. to Tex., the Bah. I. and W. I.

FAM. 26. GRAMINEAE JUSS.⁷

GRASS FAMILY

Herbs or less commonly woody reedlike plants; roots fibrous; leaves distichous, each with a more or less sheathing lower portion ("sheath") and a terminal usually more or less linear blade, often at the juncture of sheath and blade an adaxial fringe- or scalelike structure ("ligule"); in each axil often a small 2-nerved asymmetric (in transection often H-shaped) structure ("prophyll"); leaves often with a meristem near the ligule that permits continued elongation; flowers (florets) very much reduced, perfect or neuter, less commonly staminate or pistillate, usually aggregated distichously in small clusters known as spikelets, each flower comprising the genitalia (when present) at the base of which are usually 2 minute bulbs or scales ("lodicules"), this floret subtended usually by a minute adaxial prophyll-like bract scale (palea) and a slightly larger abaxial bract scale (lemma); lemmas (when more than one present) distichous on the spikelet axis (rachilla); base of spikelet usually with 2 empty bract scales (glumes), or one of these sometimes obsolete or rarely both glumes absent; perianth absent; stamens 1 to 6 (usually 3); ovary a usually dorsiventrally flattened 1-celled uniovulate structure; style deeply divided into 2 (rarely 3) long feathery stigmas; fruit ("grain," "caryopsis") an achene-like structure but with the ovary wall usually tightly coherent to the solitary endosperm-containing seed (ovary wall apparently not persistently tightly adherent to seed in *Sporobolus*, *Blepharoneuron*, *Calamovilfa*, *Eleusine* and some species of *Muhlenbergia*), or in some genera (e.g., *Stipa*, *Aristida*, *Panicum*, etc.) the word "fruit" is used to refer to the lemma and its contents since in these plants the lemma tightly and persistently clasps the grain and thus constitutes a spurious outer fruit layer. Poaceae Barnh.

One of the largest families of flowering plants, the Gramineae are the most important economically as measured by several criteria. They produce the dietary staples of most of the world's population. One species, rice, is the most important of all the grasses, and probably the single most important plant species in the world.

1. Uppermost lemma of a firmer texture than the bract scales below it, usually cartaceous or thin-cartilaginous or of the texture of finger nails, usually convex and its margins (at least laterally) fitting around the margins of the flattish palea (which usually has the same texture) and enclosing the perfect floret; uppermost lemma subtended by a variable number of bract scales, usually 1 or 2 glumes and a sterile lemma with or without a membranous palea (2)

⁷ Many data have been derived from the work of A. S. Hitchcock, "Manual of the Grasses of the United States," U.S. Dept. Agric. Miscell. Publ. No. 200, 2nd ed. revised by Agnes Chase, 1051 pp. (1950). The arrangement of genera is one designed by Walter V. Brown.

1. Uppermost lemma usually of a texture much like that of the other bract scales or thinner than them and hyaline (17)
- 2(1). Spikelets in 2 rows, appressed and sunken into a niche on one side of an erect, tough, fleshy, articulated rachis53. *Stenotaphrum*, p. 153.
2. Spikelets not sunken in the rachis (3)
- 3(2). Spikelets subtended or surrounded by 1 to many distinct or more or less connate bristles that form an involucre (see also a few species of *Panicum* in which some of the spikelets are subtended by solitary bristles) (4)
3. Spikelets not subtended by bristles (occasionally the pedicels pilose) (5)
- 4(3). Bristles persistent, the spikelets deciduous62. *Setaria*, p. 184.
4. Bristles (burs) falling with the enclosed spikelet(s) at maturity
.....63. *Cenchrus*, p. 187.
- 5(3). Glumes or sterile lemma awned (awn reduced and concealed in the silky hairs of the spikelet in *Rhynchelytrum*, reduced to a mere point in *Echinochloa colonum*) (6)
5. Glume(s) and sterile lemma awnless (8)
- 6(5). Spikelets long-silky-pubescent48. *Rhynchelytrum*, p. 147.
6. Spikelets not long-silky-pubescent (7)
- 7(6). Blades lanceolate, broad; culms creeping60. *Oplismenus*, p. 182.
7. Blades elongate; culms not creeping61. *Echinochloa*, p. 183.
- 8(5). Fertile (uppermost) lemma with thin hyaline margins readily visible over the dorsal side of the palea which they clasp and almost cover; "fruit" (i.e., fertile lemma and its enclosures) usually dark-colored (9)
8. Fertile lemma with margins not readily visible over the dorsum of the palea, seeming to be inrolled or revolute, the apparent margins of the lemma just barely clasping the sides of the palea most of which is therefore exposed; "fruit" usually pallid, often essentially white (12)
- 9(8). Spikelets in racemes, usually short-pedicelled in 2 rows along one side of the raceme rachis (10)
9. Spikelets longer-pedicelled in open panicles (11)
- 10(9). Racemes digitately or subdigitately disposed; spikelets rarely long-silky-pubescent51. *Digitaria*, p. 149.
10. Racemes panicle; spikelets usually silky-pubescent ..50. *Trichachne*, p. 148.
- 11(9). Panicles narrow; upper lemma cymbiform49. *Anthraenantia*, p. 147.
11. Panicles very open and diffuse; upper lemma merely slightly concavo-convex
.....52. *Leptoloma*, p. 152.
- 12(8). Spikelet with the convex dorsum of the uppermost (fertile, firm) lemma turned away from the axis to which it is appressed, the dorsum of the flattish palea (flat side of spikelet) appressed to the axis in most spikelets of the panicle (13)
12. Spikelets turned the other way, with the convex side of spikelet toward the axis, or the panicle so diffuse that this orientation cannot be determined (15)
- 13(12). That portion of the rachilla between the minute first glume and the well-developed second glume swollen into a minute "callus"
.....54. *Eriochloa*, p. 153.
13. Lower rachilla internode not swollen (14)
- 14(13). First glume present (next to the raceme axis); racemes racemously arranged along the main panicle axis55. *Brachiaria*, p. 155.
14. First glume absent; racemes digitate or subdigitate ..56. *Axonopus*, p. 155.
- 15(12). Second glume gibbous basally59. *Sacciolepis*, p. 182.
15. Second glume not gibbous at base (16)
- 16(15). First glume usually absent; spikelets in rows along one side of a raceme axis ..
.....57. *Paspalum*, p. 156.

16. First glume present; spikelets rarely in racemes58. *Panicum*, p. 164.
- 17(1). Uppermost lemma usually minute, flat, often hyaline in texture over most of its area, often awned from the summit, subtended by a similarly small hyaline sterile lemma (both lemmas surpassed by the much larger and firmer usually flattish or concavo-convex awnless glumes); spikelets in pairs along a rachis, the usual arrangement being that one spikelet in the pair is nearly sessile, the other definitely pedicelled (18)
17. Uppermost lemma usually at least slightly laterally compressed or folded along the midrib and usually surpassing the glumes, or if not then the spikelets not arranged in pairs as described above (31)
- 18(17). Spikelets all alike, all perfect (19)
18. Spikelets not all alike, at least some not perfect (21)
- 19(18). Lemma awnless64. *Imperata*, p. 189.
19. Lemma awned (20)
- 20(19). Spikelets paired65. *Erianthus*, p. 190.
20. Spikelets not paired, each subtended by a bristle representing the pedicel of a spikelet that has been wholly reduced71. *Sorghastrum*, p. 200.
- 21(18). All spikelets unisexual (22)
21. At least some (usually the lower spikelet of each pair but the upper in *Trachypogon*) spikelets perfect (23)
- 22(21). Staminate and pistillate spikelets both in the same androgynous terminal spike-like raceme76. *Tripsacum*, p. 203.
22. Staminate spikelets borne at the top of the plant, pistillate ones in lateral cobs77. *Zea*, p. 203.
- 23(21). Each sessile spikelet sunken in a niche at the bottom of a sculptured internode of a much thickened subcylindric rachis75. *Manisuris*, p. 202.
23. Spikelets not sunken in niches in the rachis (24)
- 24(23). Pedicel (of the pedicellate spikelet of the pair) thickened and appressed to the thickened rachis joint74. *Elyonurus*, p. 202.
24. Pedicels and rachis joints not thus thickened (25)
- 25(24). Pedicellate spikelet perfect, the sessile one infertile73. *Trachypogon*, p. 201.
25. Sessile spikelet perfect, the pedicellate one infertile (26)
- 26(25). Lower part of raceme bearing pairs of staminate spikelets and remaining intact, the upper part bearing pairs of spikelets (and the upper part of the raceme rachis eventually disarticulating at the lower part of each internode, the hairy internode thus remaining at the bottom of the spikelet as a hairy "callus")72. *Heteropogon*, p. 201.
26. Racemes uniform through their full length; callus absent (27)
- 27(26). Racemes reduced to one or few joints, these mostly peduncled in a subsimple or compound terminal panicle70. *Sorghum*, p. 199.
27. Racemes of several to many joints, solitary, digitate or aggregated in panicles (28)
- 28(27). Racemes solitary on each peduncle; rachis joints oblique and hollow at the summit66. *Schizachyrium*, p. 191.
28. Racemes 2 to numerous on each peduncle (29)
- 29(28). Racemes 2 to several on each peduncle, digitate; rachis joints slender, sometimes with a shallow groove on one side67. *Andropogon*, p. 192.
29. Racemes few to numerous in a leafless panicle usually on a relatively long axis (several cm. long usually), the rachis joints (and usually the pedicels) flat (30)
- 30(29). Pedicels of pedicellate spikelets with a translucent groove or thin area in the center68. *Bothriochloa*, p. 194.
30. Pedicels without a translucent groove69. *Dichanthium*, p. 198.

- 31(17). Spikelets 5-8 cm. long 1. *Arundinaria*, p. 112.
31. Spikelets (not including awns, if any) considerably less than 5 cm. long (32)
- 32(31). Spikelets in terminal dense ovoid or spikelike panicles, the panicle axis centrally located in the dense mass; spikelets strongly laterally compressed, the plane of the glumes perpendicular or at an angle to the panicle axis, the edge of a spikelet-transsection thus median-tangential to the panicle .. 47. *Phalaris*, p. 146.
32. Spikelets either not in such dense panicles, or not strongly laterally compressed, or not uniformly oriented as in *Phalaris* (33)
- 33(32). Spikelets all unisexual, falling entire, 1-flowered, the pistillate ones terete or nearly so (34)
33. At least some spikelets perfect and/or not falling entire and/or several-flowered or not terete (36)
- 34(33). Terminal panicles with staminate spikelets, subterminal ones with pistillate spikelets 4. *Hydrochloa*, p. 113.
34. Both staminate and pistillate spikelets in the same panicle (35)
- 35(34). Lower part of panicle with spreading branches bearing staminate spikelets, the upper part with ascending or appressed branches bearing pistillate spikelets 2. *Zizania*, p. 112.
35. Staminate and pistillate spikelets intermingled in most parts of the panicle 3. *Zizaniopsis*, p. 112.
- 36(33). Spikelets falling entire, 1-flowered, very flat, the lemma and palea about equal (both keeled); glumes small or absent (37)
36. Glumes either persistent on the pedicels or if the spikelet falling entire then the glumes relatively well-developed (38)
- 37(36). Glumes minute; lemma mucronate or awned 6. *Oryza*, p. 114.
37. Glumes absent; lemma awnless 5. *Leersia*, p. 113.
- 38(36). Spikelets 1-flowered (or the staminate ones 2-flowered), in groups of 2 to 5, these spikelet groups in a spikelike terminal raceme with the groups falling entire as a unit; lemma and palea thinner than the glumes (39)
38. Spikelets not as above (40)
- 39(38). Second glume of lower spikelets of the group bearing hooked spines, the group of spikelets forming a little bur 110. *Tragus*, p. 253.
39. Spikelets not with hooked spines, the second glume mostly cleft and awned 109. *Hilaria*, p. 252.
- 40(38). Spikelets 1-flowered, each sunken in a niche at the bottom of a thick sculptured rachis joint 13. *Parapholis*, p. 118.
40. Spikelets either not sunken in rachis niches or if so (as in *Lolium*) then more than 1-flowered (41)
- 41(40). Low stoloniferous perennials forming mats; flowers and spikelets all unisexual; staminate spikelets and pistillate spikelets borne on separate culms (42)
41. Not as above (43)
- 42(41). Pistillate lemmas each with 3 very long fine awns; staminate panicles 4-6 cm. long, loosely spikelike, not secund 78. *Scleropogon*, p. 203.
42. Pistillate lemmas not awned; staminate panicles about 1 cm. long, comblike, the spikelets secund 104. *Buchloë*, p. 249.
- 43(41). Spikelets 1- to several-flowered, sessile on opposite sides of a jointed or continuous axis forming symmetrical spikes (not 1-sided, but spikelets turned to one side in some species) [*Hordeae*] (44)
43. Spikelets 1- to several-flowered but not arranged in symmetrical spikes as described for the *Hordeae* (50)
- 44(43). Spikelets solitary at each node of the spike (rarely 2 in species of *Agropyron* but never throughout the spike) (45)

44. Spikelets in two's or three's at each node of the spike (solitary at some nodes of some spikes in some species of *Elymus*) (48)
- 45(44). Perennials; natives 29. *Agropyron*, p. 135.
45. Annuals; introduced (46)
- 46(45). Spikelets turgid or cylindric 35. *Aegilops*, p. 139.
46. Spikelets compressed (47)
- 47(46). Glumes ovate, 3-nerved 32. *Triticum*, p. 138.
47. Glumes subulate, 1-nerved 34. *Secale*, p. 139.
- 48(44). Spikelets in three's at each node, the central one largest, the lateral ones in most species reduced 31. *Hordeum*, p. 137.
48. Spikelets paired at each node (49)
- 49(48). Rachis continuous (rarely tardily disarticulating); glumes broad or narrow, entire 30. *Elymus*, p. 136.
49. Rachis readily disarticulating at maturity; glumes extending into long awns, these and the awns of the lemma making the spike very bristly 33. *Sitanion*, p. 138.
- 50(43). Spikelets 1-flowered; lemma indurated and its lower part nearly terete and tightly enveloping the palea (often reduced) and the floret, its apex often extended into one awn or 3 awns (51)
50. Spikelets 1- to several-flowered but when only 1 the lemma not enveloping the floret which is usually not terete (54)
- 51(50). Lemma apex 3-awned (the lateral awns occasionally minute) 115. *Aristida*, p. 255.
51. Lemma apex 1-awned (52)
- 52(51). Lemma awn not twisted but short, fragile and readily deciduous 14. *Oryzopsis*, p. 118.
52. Lemma awn twisted and bent (53)
- 53(52). Edges of lemma meeting or overlapping, thus hiding the dorsum of the palea which is membranous 16. *Stipa*, p. 119.
53. Edges of lemma scarcely meeting, exposing part of the back of the palea which is of the same texture as the lemma 15. *Piptochaetium*, p. 118.
- 54(50). Spikelets usually crowded (not in *Schedonnardus*) and attached in 2 rows along one side of the continuous usually somewhat flattened spike or "raceme" rachises (in *Bouteloua uniflora* the spikelets solitary, cf. also 23. *Catapodium* and 27. *Lamarckia*) (55)
54. Spikelets not so arranged (69)
- 55(54). Panicles diffuse, the spikes 3 to 12, 1-15 cm. long (the lower ones much longer than the upper), the spikelets remote, scarcely or not at all overlapping 98. *Schedonnardus*, p. 237.
55. Panicles not as above; spikelets mostly densely crowded (56)
- 56(55). Spikelets 1-flowered (occasionally the rachilla prolonged above the floret but rudimentary upper florets absent) (57)
56. Spikelets 2- to several-flowered, often the upper ones reduced or rudimentary (59)
- 57(56). Zone of abscission at the base of the spikelet, thus the spikelet falling entire 105. *Spartina*, p. 249.
57. Zone of abscission between the glume node and the lowest lemma node, thus the glumes persistent (58)
- 58(57). Spikes digitate; rachilla prolonged 96. *Cynodon*, p. 237.
58. Spikes racemose along the main axis; rachilla not prolonged 97. *Willkommia*, p. 237.
- 59(56). Spikelets with 2 or more perfect florets (60)
59. Spikelets with one perfect floret plus 1 or more infertile ones above the perfect one (65)

- 60(59). Spikes solitary 93. *Tripogon*, p. 236.
60. Spikes 2 to numerous (occasionally only 1 in depauperate *Eleusine*) (61)
- 61(60). Lemmas long-white-hirsute on the lateral nerves, the hairs as much as 1 mm. long 92. *Trichoneura*, p. 235.
61. Lemmas glabrous or only short-pubescent on the lateral nerves (62)
- 62(61). Each lower lemma with 3 awns, the central awn 5-15 mm. long, the lateral ones less than half as long as the central one 101. *Trichloris (pluriflora)*, p. 243.
62. Lemmas 1-awned or awnless (63)
- 63(62). Spikes 4 to 90, racemose on an elongate axis (except in one species) 91. *Leptochloa*, p. 233.
63. Spikes (1 or) 2 to 7, digitate or nearly so (cf. also *Leptochloa chloridiformis*) (64)
- 64(63). Rachis of spike not extending much if at all beyond the spikelet-bearing zone; the strong 3 nerves of the lemmas close together to form a keel 94. *Eleusine*, p. 236.
64. Rachis of spike extending beyond the spikelets; lateral lemma nerves near the margin and indistinct 95. *Dactyloctenium*, p. 236.
- 65(59). Spikes digitate or nearly so (66)
65. Spikes racemose along the main panicle axis (67)
- 66(65). Lemmas each with 3 awns about 1 cm. long 101. *Trichloris (crinita)*, p. 243.
66. Lemmas 1-awned or awnless 100. *Chloris*, p. 238.
- 67(65). Spikelets appressed, not crowded; spikes slender, elongate 99. *Gymnopogon*, p. 238.
67. Spikelets crowded, not appressed; spikes relatively short and stout (68)
- 68(67). Stoloniferous mat-forming perennials; each spike with 3 spikelets, the terminal spikelet with a basal pistillate floret and above that a rudiment of 2 reduced florets, the other 2 spikelets staminate or neutral; in Trans-Pecos Texas 103. *Cathestecum*, p. 248.
68. Various in habit and spike-makeup but not with the above combination of characters; widespread 102. *Bouteloua*, p. 243.
- 69(54). Floret solitary, the spikelet thus usually with 4 scales (2 glumes, 1 lemma, 1 palea) (cf. also species of *Eragrostis*) (70)
69. Florets 2 to numerous per spikelet (rarely seemingly reduced to 1 floret as in a few species of *Eragrostis*) (80)
- 70(69). Lemma on back (below the middle) bearing a twisted once-geniculate awn .. 45. *Alopecurus*, p. 145.
70. Lemma awned above the middle or awnless (71)
- 71(70). Lemma at base with a callus bearing a beard of soft white hairs 4-5 mm. long 86. *Calamovilfa*, p. 217.
71. Lemma at base not with a long-bearded callus (72)
- 72(71). The three nerves of the lemma and a median band on the palea-dorsum densely short-villous 88. *Blepharoneuron*, p. 223.
72. Bract scales variously glabrous or pubescent but not as described for *Blepharoneuron* (73)
- 73(72). Zone of abscission immediately below the glumes of the individual spikelets causing them to fall individually (see also *Agrostis semiverticillata* in which there are 2 zones of abscission, 1 just above and 1 just below the glume node; and cf. *Lycurus* and 2 species of *Muhlenbergia* whose spikelets fall in pairs) (74)
73. Zone of abscission either above the glume node and below the lemma node or on the branchlet such that 2 spikelets fall together (76)
- 74(73). Glumes coalescent at the base and each awned .. 42. *Polypogon*, p. 144.
74. Glumes free, awnless (75)

- 75(74). Lemma body 3-4 mm. long, bifid, from between the 2 teeth bearing a once-geniculate twisted awn 4-12 mm. long 44. *Limnodea*, p. 145.
75. Lemma body 5.5-6 mm. long, dorsally just below the tip bearing a minute awn (use lens!) 43. *Cinna*, p. 144.
- 76(73). Body of second glume longer than lemma body (77)
76. Lemma body surpassing glume bodies (78)
- 77(76). Glumes equal, each with a firm sharp keel prolonged into a short spreading awn 46. *Phleum*, p. 146.
77. Glumes not as above 41. *Agrostis*, p. 142.
- 78(76). Pedicellary branchlets very short, borne in pairs, unequal, with a zone of abscission at the base of each pair, the spikelet on the shorter pedicel infertile, the other fertile 89. *Lycurus*, p. 224.
78. Pedicellary branchlets not as above, if the spikelets falling in pairs then both of the pair fertile (79)
- 79(78). Grain at maturity falling from the lemma and palea; seed not tightly adherent to the fruit wall which usually opens when ripe or when moistened 87. *Sporobolus*, p. 217.
79. Grain not usually falling from the lemma and palea at maturity; seed closely adherent to fruit wall 90. *Muhlenbergia*, p. 224.
- 80(69). Panicle more or less spikelike with numerous short spreading branches each of which has a secund fascicle of 4 to 5 (rarely 6) appressed spikelets of 2 kinds, in each fascicle one central fertile spikelet (rarely 2) and the rest sterile 27. *Lamarckia*, p. 134.
80. Inflorescence not as described for *Lamarckia* (81)
- 81(80). Spikelets in terminal lax spikes, each in a niche in a thickened sculptured internode; first glume obsolete and adaxial 21. *Lolium*, p. 130.
81. Inflorescence not as described for *Lolium* (82)
- 82(81). Canes or reeds (1-) 2-6 m. tall, with very hairy panicles (83)
82. Grasses less robust or if as robust then the panicles nearly glabrous (84)
- 83(82). Rachilla densely hairy, abscising at the upper part of each node (base of each internode); lemmas glabrous 7. *Phragmites*, p. 114.
83. Rachilla glabrous, abscising at lower part of each node (top of each internode); lemmas long-pilose 8. *Arundo*, p. 115.
- 84(82). Flowers all unisexual, the staminate ones borne on some culms (or plants), the pistillate on others; plants colonial by means of rhizomes and/or stolons (see also *Poa* spp.) (85)
84. Flowers not all unisexual or both kinds borne on the same culm (except in some species of *Poa*); habit various (87)
- 85(84). Low-growing, the mats usually 5-10 (-15) cm. tall; panicles reduced to solitary 3- to 5-flowered spikelets, appearing terminal and embedded in the masses of leaves 113. *Monanthochloë*, p. 254.
85. Usually taller; panicles conspicuous with several to numerous spikelets (86)
- 86(85). Rhizomes absent; long thick stolons present; blades flat, elongate; pistillate spikelets about twice as large as staminate ones 111. *Allolepis*, p. 253.
86. Rhizomes present; stolons rare or absent; blades narrow, involute, pungent; pistillate and staminate spikelets not greatly disparate in size 112. *Distichlis*, p. 254.
- 87(84). Lemmas 1-awned from the back (not from the apical margin); spikelets 2- or 3-flowered (cf. also species of *Bromus* in which the awn is dorsal but the spikelets are several-flowered) (88)
87. Lemmas either awnless or awned from the apex (90)
- 88(87). Glumes about equaling the lowest lemma body in length 38. *Trisetum*, p. 141.
88. Glumes surpassing the bodies of the lemmas (89)

- 89(88). Glumes (spikelets) 20-30 mm. long 40. *Avena*, p. 142.
 89. Glumes only 2-2.5 mm. long 39. *Aira*, p. 141.
- 90(87). Lemmas divided at summit into 9 to 15 awns or awnlike lobes which at the tip are often ciliate or plumose (91)
 90. Lemmas not so divided (93)
- 91(90). Cleistogamous panicles usually present in lower sheaths; rachilla with a zone of abscission just below each lemma node 106. *Cottea*, p. 251.
 91. Cleistogamous panicles absent; rachilla with only one zone of abscission which is just above the glume node (92)
- 92(91). Spikelets 4- or 5-flowered, the lower 1 or 2 (or 3) fertile, the rest reduced; lemma awns 13 or 15, not plumose 107. *Pappophorum*, p. 251.
 92. Spikelets 3-flowered, only the lowest one fertile; lemma awns 9, plumose 108. *Enneapogon*, p. 251.
- 93(90). Lateral 2 nerves of lemma or the zone between the 2 lateral nerves and the margins with some pubescence conspicuous under a lens either near the base or the middle (94)
 93. Lateral veins or marginal zones of lemma essentially glabrous (see also *Tridens albescens*) (100)
- 94(93). Inflorescence a few-flowered head or capitate panicle overtopped or at least partially concealed by the leaves (95)
 94. Inflorescence an exerted open to spike-like panicle (97)
- 95(94). Plants mat-forming annuals; lateral nerves with a tuft of hairs near the middle 84. *Munroa*, p. 216.
 95. Plants perennial; lateral nerves hairy more extensively (not just in the middle) (96)
- 96(95). Plants tufted, 6-18 cm. tall 82. *Blepharidachne*, p. 215.
 96. Plants stoloniferous, mat-forming 83. *Erioneuron (pulchellum)*, p. 215.
- 97(94). Lemmas awnless, rarely emarginate, 5-nerved (but this obscure even under a lens) 24. *Poa*, p. 131.
 97. Lemmas usually either emarginate or rather deeply cleft, the midnerve usually excurrent in the sinus as a point or awn (98)
- 98(97). Palea long-silky-pubescent from the distal margin and in the distal third of the length; annuals 85. *Triplasis*, p. 217.
 98. Palea either glabrous or with a different length or distribution of the pubescence; perennials (99)
- 99(98). Leaves not usually crowded at the base; blades mostly flat, elongate, marginally not white-cartilaginous 81. *Tridens*, p. 213.
 99. Leaves crowded at the base; blades short, folded and keeled, falcate, marginally white-cartilaginous 83. *Erioneuron*, p. 215.
- 100(93). Spikelets 2- or 3- (rarely 4-) flowered, each lemma with a densely silky-pilose callus at base and 3 glabrous nerves; rachilla abscising just above each node 80. *Redfieldia*, p. 213.
 100. Spikelets not as in *Redfieldia* (with a tuft of flexuous hairs basally in some species of *Poa*) (101)
- 101(100). Lemmas apically with 2 setaceous teeth and from between the teeth the midnerve prolonged into a long darkly pigmented basally twisted geniculate awn 9. *Danthonia*, p. 115.
 101. Lemmas from entire to bifid at apex, the awn (if present) not as described for *Danthonia* (102)
- 102(101). Panicle narrow, erect, with few ascending branches each of which bears at apex a very dense aggregation (about 1 cm. thick) of secund nearly sessile fascicles of spikelets 28. *Dactylis*, p. 135.
 102. Inflorescence not as above (103)

- 103(102). Spikelets falling entire (zone of abscission just below the glumes) or entire and in groups (104)
103. Glumes persistent on panicle, the spikelet rachilla in most cases disarticulating at the lemma nodes (105)
- 104(103). Lower panicle branches with all spikelets intact, falling entire (zone of abscission at base of lower panicle branch)22. *Sclerochloa*, p. 130.
104. Spikelets falling entire from a zone of abscission just below the glumes37. *Sphenopholis*, p. 140.
- 105(103). Glumes equal, membranous with narrow white margins, about three fourths to four fifths as long as the remainder of the spikelet10. *Schismus*, p. 116.
105. Glumes not as in *Schismus*, usually proportionately much shorter (longer in *Melica*) or unequal (106)
- 106(105). Lower (1 or) 2 to 6 lemmas empty, the fertile florets thus near the middle (or upper) portions of the spikelet (107)
106. Lower lemma(s) enclosing fertile florets in at least some spikelets (108)
- 107(106). Rhizomatous plants with culms 10-25 dm. tall, growing in coastal loose sand11. *Untola*, p. 116.
107. Plants 3-10 (-15) dm. tall, sometimes rhizomatous but growing in woodlands12. *Chasmanthium*, p. 116.
- 108(106). Spikelets secund on the lower side of the panicle branches, these branches numbering 10 to 20 and (in turn) secund on the flattened and slightly zigzag main axis23. *Catapodium*, p. 130.
108. Panicle branches and spikelets not so disposed (109)
- 109(108). Grain beaked, nearly as long as the lemma at maturity and so large that the spreading floret gapes26. *Diarrhena*, p. 134.
109. Grain proportionately smaller, not beaked (110)
- 110(109). Lemmas 3-nerved, this in most species readily apparent (cf. also species of *Poa* and *Briza* in which some of the nerves are so obscure the lemma appears 3-nerved on cursory examination)79. *Eragrostis*, p. 204.
110. Lemmas 5- to 9-nerved as determined by examination of transection (111)
- 111(110). Lemmas about as broad as long, 1.5-2 mm. long, spreading and with margins outspread, basally auriculate and overlapping each other; spikelets pendulous from the ultimate capillary pedicels at the periphery of the very diffuse panicle25. *Briza*, p. 134.
111. Lemmas longer than broad (except in a few species of *Bromus*) and the lemmas and panicles otherwise (112)
- 112(111). Panicles densely spike-like (either continuous or somewhat interrupted)36. *Koeleria*, p. 139.
112. Panicles more open or diffuse (113)
- 113(112). Lemmas dorsally keeled (somewhat rounded in some species of *Poa*) (114)
113. Lemmas dorsally rounded (somewhat keeled toward the summit in species of *Festuca*, *Vulpia* and *Bromus*) (115)
- 114(113). Lemmas awned from a minutely bifid apex (awnless or nearly so in *B. unioloides*); spikelets large19. *Bromus*, p. 123.
114. Lemmas awnless; spikelets small24. *Poa*, p. 131.
- 115(113). Glumes papery; lemmas firm, strongly nerved, scarious-margined; upper florets sterile, often reduced to a club-shaped rudiment infolded by the broad upper lemmas17. *Melica*, p. 121.
115. Glumes not papery; upper florets not unlike the others (116)
- 116(115). Each lemma long-tapered to a point (in some cases this appearance due to involution of lemma) (117)
116. Lemmas broader, not long-tapered to apex (118)

- 117(116). Perennials 20a. *Festuca*, p. 127.
 117. Annuals 20b. *Vulpia*, p. 128.
 118(116). Perennials with slender fragile short rhizomes and occasionally short fragile stolons (these often with cleistogamous flowers in the lower sheaths); spikelet scarcely compressed laterally, essentially glabrous and unawned 114. *Vaseyochloa*, p. 255.
 118. Annuals or perennials with a combination of characters different from those for *Vaseyochloa* (119)
 119(118). Nerves of lemma parallel, not converging toward summit or but slightly so . . . 18. *Glyceria*, p. 122.
 119. Nerves of lemma converging toward the summit, the lemmas narrowed at apex (120)
 120(119). Lemmas awned or awn-tipped from a minutely bifid apex 19. *Bromus*, p. 123.
 120. Lemmas awnless or if awned the apex not bifid 24. *Poa*, p. 131.

1. ARUNDINARIA MICHX.

About 150 species in warmer parts of the world; one species in Texas.

1. *Arundinaria gigantea* (Walt.) Muhl. GIANT CANE. Mostly glabrous robust rhizomatous cane-grass forming dense brakes; primary aerial culms perennial (not usually freezing back), 2-8 m. tall, 2-20 mm. thick, erect, with some ascending or appressed branches along the length; sheath margins ciliate; small sheath auricles usually with a few spread-and bristles; blades very shortly petiolate, of two size-classes, larger ones on the primary aerial culms 12-20 cm. long and 10-25 mm. broad, smaller ones on the branches; inflorescences narrowly paniculate, the lower pedicels mostly included in the sheath and the upper ones free (most of them nearly as long as their spikelets); spikelets few, 5-8 cm. long, about 8 mm. broad, 9- to 13-flowered, lax enough so that the internodes of rachis are often visible; zone of abscission at lower part of each lemma node; lower lemmas 22-25 mm. long, cymbiform, finely pubescent, obscurely 11-nerved, with fine awnlike tips. Locally forming brakes in low areas near sloughs, bayous and rivers, e. and s.e. Tex., s.w. to Wharton Co., spring; s.e. U. S., n. to N. C., O. and Ind.

Giant cane formerly covered many square miles in east and southeast Texas but with the introduction of domestic stock it has almost disappeared and is now relatively rare.

2. ZIZANIA L. WILDRICE

A genus of 2 species in North America and one in Asia; we have one species.

1. *Zizania texana* Hitchc. TEXAS WILDRICE. Coarse perennial; culms long-decumbent and rooting at nodes, stoloniform, distally ascending, 1-3 m. long, 3-13 mm. thick; ligule a scale 5-15 mm. long; blades 12-110 cm. long, 5-23 mm. broad, flat, forming long streamers beneath surface of water; panicle 2-3 dm. long, the lower portion with spreading branches bearing staminate spikelets, the upper part with ascending or appressed branches bearing pistillate spikelets; zone of abscission below the floret or spikelet; spikelets consisting of a single naked floret (glumes obsolete or absent); *staminate spikelets* pendulous, 7-9 mm. long, 1.5 mm. broad, not indurated nor awned; *pistillate spikelets* erect, about 10 mm. long and 1 mm. broad, terete or at least not laterally compressed, the lemma indurate at maturity and bearing an awn 10-23 mm. long. In clear cool fast-flowing spring-water in the San Marcos River, Hays Co., where it is becoming rare, fall-spring, usually early spring; endemic.

3. ZIZANIOPSIS DOELL & ASCH.

A genus of 4 species in North America and South America; we have one species.

1. *Zizaniopsis miliacea* (Michx.) Doell & Asch. SOUTHERN WILDRICE. Coarse perennial from creeping rhizomes 5-11 mm. thick; culms 9-30 dm. long, 5-15 mm. thick, rooting

at some of the lower nodes, mostly erect and unbranched; ligule a scale 5-15 mm. long; blades 15-100 cm. long, 8-22 mm. broad, flat; panicle 3-6 dm. long, 10-17 cm. broad, the main branches verticillate and ascending, much verticillately rebranched with each branchlet bearing some pistillate spikelets and some staminate ones, both kinds ascending and appressed and superficially similar; zone of abscission below the floret; each spikelet consisting of a single naked floret (glumes obsolete or absent), 6-8 mm. long, ellipsoidal, acuminate, not at all laterally compressed; lemma 7-nerved, mucronate or with an awn 2-3 mm. long. At the edges of streams, s.e., e. and n.-cen. Tex., Edwards Plateau and extreme n. Rio Grande Plains, locally abundant, spring-fall; Coastal States, Md. to Tex., n. to Ky., Ark. and Okla.

4. HYDROCHLOA BEAUV.

A monotypic genus of southern United States.

1. *Hydrochloa caroliniensis* Beauv. Mostly submerged bottom-rooted aquatic perennial; culms 3-10 dm. long, about 0.5 mm. thick, often rooted at most nodes, somewhat branched; ligule a scale of 0.5-1 mm. long; blades floating near surface or usually emergent a few cm., 2-4 (-6) cm. long, 2-3 (-5) mm. broad; panicles 5-20 mm. long, racemiform, few-flowered, the terminal ones with staminate spikelets, the subterminal axillary ones with pistillate spikelets; zone of abscission below the floret; each spikelet consisting of a single naked floret (glumes obsolete or absent), not indurated and scarcely compressed; staminate floret about 4 mm. long, pistillate ones about 2 mm. long. Ponds, lakes and slow-flowing streams in e. Tex., rare, late summer; Coastal States, N. C. to Tex.

This is a very inconspicuous grass and may well be more common than is indicated by the few collections.

5. LEERSIA Sw.

Perennials with few slender wiry culms; inflorescences lax open panicles with capillary branches; zone of abscission at the base of the spikelet; spikelets secund along the abaxial sides of the distal portions of the branchlets, overlapping, each consisting of a solitary naked fertile floret (glumes or sterile florets absent), laterally compressed (both lemma and palea keeled), cartilaginous, with obscure or conspicuous nerves.

About 15 species in warmer regions of the world.

1. Floret only 1 to 1.5 times as long as broad (2)

1. Floret at least twice as long as broad (3)

2(1). Floret 4-5 mm. long, pubescent 1. *L. lenticularis*.

2. Floret 1-1.5 mm. long, essentially glabrous 5. *L. monandra*.

3(1). Spikelets 2.5-3 mm. long, closely imbricate and usually parallel with the branches of the panicle 4. *L. virginica*.

3. Spikelets about 4 mm. long, loosely imbricate and usually pendulous and pectinately arranged at an angle to the branches of the panicle (4)

4(3). Panicles 10-20 cm. long, open, the branches diverging 2. *L. oryzoides*.

4. Panicles 5-10 cm. long, narrow, the branches ascending or appressed 3. *L. hexandra*.

1. *Leersia lenticularis* Michx. CATCHFLY GRASS. Perennial with short scaly rhizomes (these seldom present on prepared specimens); aerial culms 7-15 dm. long, 1-3 mm. thick, erect or often sprawling and distally ascending; ligule a tough scale about 0.5 mm. long; blades 13-40 cm. long, 1-2 cm. broad, flat; panicle 1-2 dm. long, very open and subpyramidal, often nodding, the branches naked about half their length; florets 4-5 mm. long, nearly or quite as broad as long, sparsely pubescent, the keels comb-toothed. Sloughs, bayous and marshy prairies in e. and s.e. Tex., infrequent or locally abundant, late summer-fall; Md. to Minn., s. to the Gulf States.

2. *Leersia oryzoides* (L.) Sw. RICE CUTGRASS. Perennial with short slender scaly rhizomes; culms 7-15 dm. long, 2-3 mm. thick, often decumbent and rooting at the lower nodes or erect, shortly bearded at the nodes; ligule a firm scale about 0.5 mm. long; blades (3-) 7-25 cm. long, 6-11 mm. broad, flat; panicle 1-2 dm. long, open, the branches diverging, naked for less than half their length; florets 3.7-5.5 mm. long, about 2.5 times as long as broad, pubescent, the keels comb-toothed. Near and along creeks in e. and n.-cen. Tex., Edwards Plateau, n.w. part of Rio Grande Plains and Plains Country, infrequent, mostly spring-fall; most of U. S. n. to Que. and B. C. (not known from Mont., Wyo., Nev. or Mex.)

3. *Leersia hexandra* Sw. Perennial with short slender scaly rhizomes; culms 5-10 dm. long, 1.5-3 mm. thick, usually long-decumbent and rooting at the lower nodes, shortly bearded at the nodes; ligule a firm scale about 0.5 mm. long; blades 5-18 cm. long, 3-7 (-10) mm. broad, flat; panicle 5-9 (-12) cm. long, 1-2 cm. broad, the few branches ascending or appressed, naked for less than half their length; florets 3.3-4.5 mm. long, about 2.5 times as long as broad, sparsely pubescent, the keels minutely comb-toothed. Near creeks, rivers and resacas in e. and s.e. Tex. and coastal parts of the Rio Grande Plains, infrequent, spring-fall; widely distributed in warmer parts of the world, in Am. n. to Va. and the Gulf States.

4. *Leersia virginica* Willd. WHITE GRASS. Perennial with short rhizomes 2-4 mm. thick (these seldom present on prepared specimens); culms 25-120 cm. long, 1-1.5 mm. thick, often geniculate and rooting at a few of the lower nodes but mostly ascending or erect, upper nodes minutely bearded; ligule a scale about 1 mm. long; blades 4-10 (-13) cm. long, 3-8 mm. broad, flat; panicle 5-10 (-18) cm. long, the very few branches diverging, naked for more than half their length; florets 2.5-3 mm. long, closely appressed and parallel to the branches, 2 to 3 times as long as broad, microscopically pubescent on sides and keels. Swamps and bogs in e., s.e. and n.-cen. Tex., infrequent to rare, spring-fall; e. U. S. w. to S. D., Neb., Kan., Okla. and Tex.

5. *Leersia monandra* Sw. Tufted perennial; culms 3-10 dm. long, about 1 mm. thick, erect; ligule a hyaline scale 1-3 mm. long; blades 5-15 cm. long, 2-5 mm. broad, flat, tapered to both ends; panicle 6-12 cm. long, open, few-branched, the branches naked for most of their length; florets 1-1.5 mm. long, nearly as broad, essentially glabrous and smooth even on the keel. In well-drained calcareous loam, usually in leaf-mold beneath brush, often in dense shade, Rio Grande Plains, infrequent or rare, late summer-fall; W. I., s. Fla., Tex., Tam. and N. L.

6. ORYZA L.

About 25 species in the Old World tropics and subtropics; we have one.

1. *Oryza sativa* L. RICE. Robust annual; culms 6-20 dm. long, 4-20 mm. thick, erect, often rooting from lower nodes; ligule a firm lacerate scale 2-6 mm. long; blades 1-6 dm. long, 4-14 mm. broad, flat; inflorescence an open branched drooping panicle 15-40 cm. long, each branch bearing a number of large spikelets; zone of abscission below each spikelet; spikelets sessile or usually on very short pedicels, appressed to the branches, slightly laterally compressed; lowermost parts of spikelets (interpreted either as two sterile lemmas or two glumes) small, lance-subulate, scalelike, 2-3 mm. long; fertile floret solitary; lemma and palea fitting closely together, 7-10 mm. long, pubescent, brownish, shining, cartilaginous-indurate, the lemma mucronate (or in some varieties awned). Volunteering in ditches and other muddy and seasonally flooded areas in s.-cen. and s.e. Tex., late summer-fall; warmer parts of the world, indigenous to Old World trop.; in Am. n. to Va. and the Gulf States.

Economically and for the direct use of mankind this is undoubtedly the single most important plant species in the world.

7. PHRAGMITES TRIN.

A genus of 3 species, cosmopolitan; we have one.

1. *Phragmites communis* Trin. COMMON REED. Perennial reed with thick rhizomes; culms 1-3 m. tall, 5-15 mm. thick; ligule a short tough lacerate fringe; blades flat, 1-4

cm. broad; panicle a large terminal plume, many-branched and densely flowered; spikelets few-flowered, the lower flowers empty or merely staminate, the rest perfect; rachilla abscising at the upper part of each node, the fragments thus consisting of one floret with a portion of the densely long-silky-villous rachilla below (not above) the node; glumes lanceolate, shorter than the lowest lemma; lemmas lanceolate, glabrous, about 11 mm. long. Locally abundant in marshes, seeps, along rivers, at streamsides and canal banks, scattered throughout the state, fall; in most of the warmer parts of the world.

8. ARUNDO L.

About 8 species in the Old World tropics; we have one.

1. *Arundo Donax* L. GIANT REED, GEORGIA CANE, CARRIZO. Canelike grass from thick short rhizomes, forming large clumps; aerial culms 2-6 m. long, to 5 cm. thick, erect, rarely branched, perennial or in the northern extremes mostly freezing down annually or every few years; ligule a short scale; blades mostly 3-6 dm. long, 2-5 cm. broad or larger, often glaucous, firm; inflorescence a thick narrowly ellipsoid buffy-white panicle 3-6 dm. long; spikelets 13-15 mm. long, usually 3-flowered; rachilla glabrous, with zones of abscission at lower part of each node; glumes subequal, cymbiform, thin, nearly as long as the spikelet, each 3-nerved; lemmas (including the small calloused base) long-pilose, 3-nerved, thin, cymbiform, obscurely round-keeled, long-attenuate to very fine points. Sand bars and levees of the Rio Grande in Rio Grande Plains, w. to the Trans-Pecos and near rivers and lakes in s.e. and cen. Tex., summer-fall; widespread in warmer areas, nat. to Old World, adv. in Tex.

Planted for erosion control along roads and in dune areas.

9. DANTHONIA LAM. & DC. OATGRASS

Tufted perennials; culms 2-10 dm. long, erect; leaves mostly clustered at the base, the blades mostly folded or involute; panicles erect, few-flowered, 2-13 cm. long, either nearly loosely spikelike or else slightly flabellate with a few somewhat diverging branches, the pedicels short; spikelets appressed, erect, only very slightly laterally compressed, 4- to 10-flowered, all the florets perfect except the uppermost one reduced; rachilla abscising at the lower part of each node; glumes persistent, membranous or papery, lanceolate, acute, not at all keeled, far-surpassing the rest of the spikelet except some of the upper lemma awns; lemmas broadly ovate, slightly convex dorsally, becoming chartaceous medially and papery marginally, obscurely several-nerved, apically bifid (the teeth setaceous) with the midnerve between the teeth prolonged into a long darkly pigmented basally twisted and geniculate awn.

About 10 species in warm regions.

1. Panicles 6-13 cm. long; glumes 15-18 mm. long; lemmas dorsally with a long silky-pilose pubescence that becomes even longer and fuzzier toward the distal margin 1. *D. sericea*.
1. Panicles 2-6 cm. long; glumes 11-15 mm. long; lemmas dorsally with a short even pubescence that becomes shorter and sparser toward the distal margin 2. *D. spicata*.

1. *Danthonia sericea* Nutt. Culms 5-10 dm. long; panicles 6-13 cm. long, often somewhat flabellate; glumes 15-18 mm. long; spikelets 7- to 10-flowered; lemmas dorsally with a long silky pubescence that becomes more dense and longer near the distal margin. Rare in woods in extreme n.e. corner of Tex. (Bowie Co.), spring; Coastal States, Mass. to Tex.; also Ky. and Tenn.

2. *Danthonia spicata* (L.) Beauv. POVERTY OATGRASS. Culms 30-75 cm. long; panicles 2-6 cm. long, usually spikelike; glumes 11-15 mm. long; spikelets mostly 3- to 7-flowered; lemmas dorsally rather shortly and evenly pubescent, the pubescence shortest toward the distal margin. Woods on sandy soils, infrequent in e. Tex., rare in n.-cen. Tex., spring; e. Can. and e. U. S., w. to Minn., Ia., Kan., Okla. and Tex.; also in mts. in Wash., Ore., Ida., Mont., Wyo., S. D., Colo. and N. M.

10. SCHISMUS BEAUV.

About 5 species in warm parts of the Old World; we have one.

1. *Schismus barbatus* (L.) Thell. Densely tufted annual; culms 5-35 cm. long, often slightly geniculate at the nodes, mostly ascending; ligule a fringed scale; blades short and slender, mostly loosely involute; inflorescence a panicle 2-4 cm. long, dense, usually obovoid, with a few very short ascending branches in the lower part (these densely secundly flowered on the abaxial side); lateral spikelets nearly sessile; spikelets 4- to 8-flowered, all but the terminal floret perfect and fertile, scarcely at all laterally compressed; rachilla abscising above the glumes and at the lower part of each node; glumes equal, lanceolate, acute, membranous with narrow white margins, about three fourths to four fifths as long as the remainder of the spikelet, glabrous, prominently 5- to 7-nerved, the nerves acrodrome; lemmas broadly obovate, 1.8-2.4 mm. long, about 9-nerved, membranous, apically notched, the 8 lateral nerves appearing to terminate near the broad white-hyaline distal margin but the midnerve excurrent as a mucro; midnerve, lateralmost nerves and base of lemma minutely ascending-hispidulous. Infrequent or rare in desert flats of the Trans-Pecos, Mar.-Apr.; nat. to Medit. region, now widely introd. in arid parts of the world.

11. UNIOLA L.⁸

A genus of 2 species of seashores in the warmer parts of the Americas; we have one.

1. *Uniola paniculata* L. SEA OATS, ESPIGA DEL MAR. Essentially glabrous strongly rhizomatous perennial; rhizomes stramineous, 3-15 mm. thick; aerial culms in few-culmed tufts at the nodes of the rhizomes, 1-2 m. tall, 5-10 mm. thick, erect; sheaths longer than the internodes, tightly clasping; blades 2-5 dm. long, fairly broad but mostly tightly involute and arcuate; panicles cylindrical to ovoid, terminal, 2-5 cm. long, much-branched (the branches except the lower ones strictly ascending), densely 40- to 200-spikeletted; ultimate branchlets only 5-8 mm. long; spikelets very strongly laterally compressed, 14- to 20-flowered (the lower few florets sterile), 20-37 mm. long, 10-15 mm. broad, the rachis remaining intact (or said by some authors to disarticulate below the glumes); glumes subequal, 5-6 mm. long, 1.5-2 mm. broad, cymbiform, shorter than the lowest lemma; lemma broadly lanceolate to narrowly ovate, 12-14 mm. long, 5-6 mm. broad, unfolded, (7- to) 9- (to 13-) nerved, apically slightly incurved, when unfolded emarginate and mucronate, stramineous, very firm, the keels antrorsely scabrous; palea slightly shorter than the lemma and of the same texture and color, lanceolate, acute, 2-keeled, the keels minutely pectinate-scabrous; flowers perfect, triandrous; lodicules 2, fleshy, cuneate, lobed-truncate; grain linear, 3-5 mm. long, 1-1.5 mm. broad, enclosed between the scarcely changed lemmas and paleas. Frequent in loose sand of coastal dunes all along the coast, July-Aug.; Atl. and Gulf shores; W.I., s. to Tab. and Cuba.

12. CHASMANTHIUM LINK⁹

Tufted or colonial rhizomatous perennials; culms herbaceous, usually simple; blades flat, serrate, long-linear to linear-lanceolate or broadly linear-lanceolate; ligule a fringe of hairs or a hyaline ciliate membrane; spikelets becoming tawny to brown at maturity, 2- to many-flowered, laterally compressed, the rachilla disarticulating above the glumes and between the florets; glumes 2, equal to subequal, shorter than the lemmas, acute to acuminate, 3- to 7-nerved, compressed-keeled, the keel serrate to serrulate; lemmas (lower 1 to 4 empty) acuminate, entire or bifid, 5- to 15-nerved, compressed-keeled, the keels serrate or ciliate; paleas shorter than to exceeding the lemmas, bowed out at the base, 2-keeled, the keel wings serrate; flowers perfect, monandrous, sometimes cleistogamous in *C. latifolium*; lodicules 2, fleshy, cuneate, lobed-truncate, 2- to 4-nerved, the

⁸ Adapted partly from Harris O. Yates, Southwest. Nat. 11: 372-394. 1966.

⁹ Adapted from Harris O. Yates, Southwest. Nat. 11: 415-455. 1966.

nerves unbranched; grain ovate to elliptical, laterally compressed, asymmetrical, reddish brown or black.

A North American genus of 5 species, of which we have 3.

1. Flowers 6 to 26 per spikelet; spikelets ovate to elliptical in overall outline as seen from the side, drooping1. *C. latifolium*.
1. Flowers 2 to 5 (to 7) per spikelet; spikelets flabelliform-cuneate in overall outline as seen from side, not drooping (2)
- 2(1). Culms 1-3 mm. thick; sheaths apically densely pilosulous2. *C. sessiliflorum*.
2. Culms 0.5-1 mm. thick; sheaths essentially glabrous ...3. *C. laxum*.

1. *Chasmanthium latifolium* (Michx.) Yates. INLAND SEA OATS. Essentially glabrous rhizomatous perennial; rhizomes short, indurated, forming mats; culms rising singly from the mats, 5-13 dm. long, 1.5-3 mm. thick, usually purplish, reclining and geniculate below, above erect, simple and stramineous, terete; sheaths considerably shorter than the internodes and tightly clasping them; blades lanceolate, 1-2 dm. long, 8-16 mm. broad, divergent, acute, striate-veined; panicles very lax, 15-30 cm. long, of 10 to 30 (to 50) large spikelets drooping at the ends of mostly naked capillary branches 3-10 cm. long; spikelets very strongly laterally compressed, 12- to 18-flowered, 25-45 mm. long, 13-16 mm. broad; rachis of spikelet with zone of abscission at the lower part of each node; glumes subequal, 5-7 mm. long, about 1 mm. broad, cymbiform, shorter than the lowest lemma; lemmas broadly lanceolate, 9-13 mm. long, 5-7 mm. broad when unfolded, apically slightly incurved and acutish, grayish to bluish-green, firm, marginally very narrowly hyaline with 3 to 6 nerves on each side, minutely scabrellate, on the keels minutely pectinately scabrous; paleas only two thirds as long as the lemmas and of the same texture, doubly strongly keeled (the keels minutely pectinate), falcate; grain laterally compressed, black, rough, about 3 mm. long. *Uniola latifolia* Michx. Locally abundant in moist loamy soils of creek bottoms in e. and s.e. Tex., less common w. to n.-cen. Tex., e. Edwards Plateau and n. part of Rio Grande Plains, summer-fall; most of s.e. U. S., n. to Pa., O., Ill. and Neb.; also N. L.

2. *Chasmanthium sessiliflorum* (Poir.) Yates. Tufted perennial or occasionally bases slightly loosened due to elongation of the rhizomes; culms 70-125 cm. long, 1-3 mm. thick, grayish or yellowish-green; sheaths longer than the internodes and tightly clasping them, usually densely pilosulous apically, more sparsely so dorsally; blades lance-linear, 15-35 cm. long, 4-8 mm. broad, often pilosulous or hirsutulous, ascending; panicles strictly erect, spikelike, 2-5 dm. long, with a few short erect branches in the lower part; spikelets strongly laterally compressed, 3- to 5-flowered (the lowest flower reduced, rudimentary), 5-7 mm. long, 4-6 mm. broad; rachis of spikelet with a zone of abscission at the lower part of each node (except the node of the sterile lemma); first glume about 1 mm. long, the second about 1.5 mm. long, ovate; lowest (sterile) lemma about 2 mm. long, ovate when unfolded; other lemmas about 4 mm. long, broadly lanceolate, acute, firm, striate, often strongly falcate-contorted; palea about 3 mm. long, ovate, 2-keeled, scabrous on the keels and margins; grain laterally compressed, rough, black, about 2 mm. long. *Uniola sessiliflora* Poir. Frequent in sandy woods in e. and s.e. Tex., summer; s.e. U. S., n. to Va., Tenn., Mo. and Okla.

3. *Chasmanthium laxum* (L.) Yates. Essentially glabrous tufted perennial or occasionally the bases slightly loosened due to elongation of the rhizomes; culms 65-100 cm. long, 0.5-1 mm. thick, strictly erect, grayish-green; sheaths longer than their internodes, tightly clasping them; blades linear, 15-40 cm. long, 3-5 mm. broad, ascending; panicles strictly erect, spikelike, 15-25 cm. long, with a few short erect branches near the base; spikelets erect, appressed, strongly laterally compressed, 3- to 4-flowered (the lowest flower reduced, rudimentary), 4-5 mm. long, 3-5 mm. broad, rachis of spikelet with zone of abscission at the lower part of each node (except the node of the sterile lemma); glumes 1.5-2.5 mm. long (the lower one the shortest); lowest (sterile) lemma 2.5-3 mm. long, lanceolate; other lemmas about 4 mm. long, broadly lanceolate, firm, striate, the keels essentially smooth; paleas ovate, 2-keeled, about 2.5 mm. long; grain laterally compressed, black, rough, about 2 mm. long. *Uniola laxa* (L.) B.S.P. Infrequent in e. and s.e. Tex. in moist sandy soil, summer-fall; s.e. U.S., n. to L. I., Ky., Mo. and Okla.

13. PARAPHOLIS C. E. HUBB.

A genus of 4 species in the Old World.

1. *Parapholis incurva* (L.) C. E. Hubb. SICKLEGRASS. Tufted annual; culms 1-3 dm. long, decumbent most of their length, terminally arcuate upward; internodes short; sheaths loose, departing from and revealing the internodes which they only slightly exceed in length; blades of upper leaves shorter than their sheaths; inflorescences not fully exerted, arcuate, terminal, lax, nearly terete or somewhat compressed-cylindrical; spikes 3-10 cm. long and only about 3 mm. thick; rachis of spikes eventually abscising at the lower part of each node, the internodes sculptured, each with a niche for a spikelet; spikelets 2-ranked, solitary at each node, 1-flowered, the only parts visible being the halves of the 2 strongly nerved lanceolate-acute glumes; lemma adaxial, flattened, fitting into the niche of the internode, 4-7 mm. long. *Pholiurus incurvus* (L.) Schinz & Thell. Brackish shores and ditches, coastal s.e. Tex., s.w. to San Patricio Co., spring; nat. of Eur., now established in many coastal areas of N. A.

14. ORYZOPSIS MICHEX.

RICEGRASS

Perennials with paniculate inflorescences; spikelets one-flowered, the rachis disarticulating above the persistent hyaline glumes; lemma indurated, tightly involute, nearly terete, apically with a short fragile readily deciduous awn; palea narrow, indurated, enclosed by and as long as the lemma, the lemma and its enclosures fall together and constitute the "fruit".

About 50 species of North Temperate and subtropical regions. Ricegrasses are grazed but being local and infrequent have only limited forage value.

1. Panicle branches nearly straight 1. *O. micrantha*.

1. Panicle branches curved and flexuous 2. *O. hymenoides*.

1. *Oryzopsis micrantha* (Trin. & Rupr.) Thurb. Tufted perennial; culms erect, 3-7 dm. long, about 1 mm. thick, unbranched; ligule a scale about 1 mm. long; blades few, 10-30 cm. long, basally mostly flat, 1-2 mm. broad, otherwise mostly involute and tapering to a very fine involute point; panicle 15-20 cm. long, erect or commonly weak and nodding, very diffuse when mature, the branches 2-6 cm. long, weak, naked in the lower part, the spikelets crowded toward the tips; glumes 2.5-3 mm. long; lemma 2 mm. long, about 1 mm. thick, glabrous or nearly so; awn 5-11 mm. long, readily deciduous. Canyons in the Plains Country where locally frequent, summer; Sask. and Mont. s. to Nev., Ariz., N. M. and Tex.

2. *Oryzopsis hymenoides* (R. & S.) Ricker. INDIAN RICEGRASS. Tufted perennial; culms erect, not branched, 25-60 cm. long, 1-2 mm. thick; ligule a scale 2-7 mm. long; blades 10-25 cm. long, involute; panicle 5-15 cm. long, very diffuse and open, the branches dichotomous and flexuous, the ultimate branches about 1 cm. long and each bearing a single spikelet; glumes 6-8 mm. long, acuminate and pointed; lemma 3-5 mm. long, elliptical, with long white silky antrorse hairs that equal the glume tips; awn 4-7 mm. long, promptly deciduous. Dry, usually loose sandy soil, infrequent in the w. Plains Country, rare in the Trans-Pecos, summer; all of w. U. S. e. to N. D., S. D., Neb., Kan., Okla. and Tex.

15. PIPTOCHAETIUM J. PRESL.

PINYON RICEGRASS

A genus of 20 species in North America and South America; we have only a single species. The genus should perhaps be considered merely a subgenus of *Stipa*.

1. *Piptochaetium fimbriatum* (H.B.K.) Hitchc. Densely tufted perennial; culms erect, unbranched, 25-75 cm. tall, 1 mm. thick; ligule a scale 1-3 mm. long; blades mostly basally clustered, 5-25 cm. long, mostly closely involute, even when flat less than 1 mm. broad, weak and sprawling; panicle 5-15 cm. long, erect or often weak and nodding, the branches basally naked, few-flowered, weak; glumes about equal, 4-5 mm. long,

elliptical, scarious, persistent; rachis disarticulating above the glumes, liberating the single floret at maturity (the lemma and its enclosures and appendages constituting the fruit); lemma indurate, involute and tightly enveloping the palea and the sex organs, nearly terete, ellipsoidal, 3-4 mm. long, about 2 mm. thick, dark brown and shining at maturity, finely antrorsely sordidly pubescent, apically with a persistent obscurely twice-geniculate awn 9-18 mm. long; palea indurate and brown like the lemma, linear, a little longer than the lemma and protruding as a minute point at the base of the awn. Incl. var. *confine* I. M. Johnst., *Stipa fimbriata* H. B. K. Pine forests on rocky slopes of usually igneous rocks in Trans-Pecos mts., locally abundant, Aug.-Sept.; Colo. to Ariz. and s. to cen. Mex. Said to be a valuable forage species.

16. STIPA L. NEEDLEGRASS. SPEARGRASS

Perennials with paniculate inflorescences; spikelets one-flowered, relatively large; glumes broadly lanceolate to linear, usually very thin, even hyaline in some species; rachis disarticulating above the persistent glumes; lemma indurated, tightly involute, nearly terete, with a basal callus and an apical usually twice-geniculate more or less persistent awn; palea entirely enclosed by and shorter than the lemma, membranous; lemma and its enclosures and appendages fall together and constitute the "fruit."

A genus of 300 species in warm, usually dryish areas of the world. Some of the species have value as forage, especially before heading out; the calluses of the "fruits" cause mouth wounds.

1. Lemma about 2 mm. long. 8. *S. tenuissima*.
1. Lemma much longer than 2 mm. (2)
- 2(1). Lemma longer than 12 mm.; awn longer than 1 dm., often deciduous (3)
2. Lemma shorter than 12 mm.; awn shorter than 1 dm., persistent (4)
- 3(2). Ligule 2-5 mm. long; lemma 13-15 mm. long; awn glabrous or its hairs less than 1 mm. long 10. *S. comata*.
3. Ligule shorter than 1 mm.; lemma 15-18 mm. long; terminal part of awn with silky white hairs more than 1 mm. long 11. *S. neomexicana*.
- 4(2). Apical 1 mm. segment of the lemma cylindrical, cartilaginous, less than 1 mm. thick; leaves densely hairy 9. *S. leucotricha*.
4. Apex of lemma not so differentiated; leaves not densely hairy (5)
- 5(4). Panicle dense and spikelike (6)
5. Panicle diffuse, sometimes narrow but not at all spikelike (9)
- 6(5). Awn 4-5 cm. long 7. *S. arida*.
6. Awn shorter than 4 cm. (7)
- 7(6). Awns 10-20 mm. long; apex of lemma shortly bilobed 3. *S. lobata*.
7. Awns 20-38 mm. long; apex of lemma truncate (8)
- 8(7). Culms 1.5-2.5 mm. thick toward the base of the plant; auricles of sheaths nearly glabrous; ligule less than 1 mm. long 4. *S. columbiana*.
8. Culms 3-6 mm. thick toward the base of the plant; auricles of sheaths pubescent; ligule 1-4 mm. long 5. *S. robusta*.
- 9(5). Awns less than 3 cm. long 2. *S. Pringlei*.
9. Awns more than 3 cm. long (10)
- 10(9). Lemma 4-6 mm. long 6. *S. eminens*.
10. Lemma 8-10 mm. long 1. *S. avenacea*.

1. *Stipa avenacea* L. BLACKSEED NEEDLEGRASS. Softly tufted perennial; culms erect, unbranched, 35-80 cm. long, 1-1.5 mm. thick; ligule a scale 2-4 mm. long; blades mostly basally clustered, 5-30 cm. long, involute or often flat, about 1 mm. broad; panicle 1-2 dm. long, open, erect or often weak and nodding, the branches basally naked, few-flowered, weak; glumes 10-13 mm. long; lemma 8-10 mm. long, dark brown and shining

when mature, with a dense dark antrorse beard near the basal callus, above on the sides nearly glabrous and at the summit with a few short erect dark hairs; awn 35-70 mm. long, obscurely twice-geniculate. *Piptochaetium avenaceum* (L.) Parodi, *Sorghastrum nutans* (L.) Nash. Sandy soils in e. Tex. forests, frequent, Mar.-May; Mass. to Mich. and s.w. to Tex.

2. *Stipa Pringlei* Scribn. Softly tufted perennial; culms erect, unbranched, 5-10 dm. long, 1.5-2 mm. thick; ligule a scale 1-3 mm. long; blades mostly in a basal cluster, 9-30 cm. long, 1.5-2 mm. broad, mostly flat even to the apex; panicle 1-2 dm. long, open, erect, often weak and nodding, the branches naked basally, few-flowered, weak; glumes 9-11 mm. long; lemma 7-8 mm. long, dark brown and shining when mature, laterally with sparse antrorse sordid hairs, apically with a ring of such hairs and an oblique point; awn 20-27 mm. long, obscurely twice-geniculate. *Piptochaetium Pringlei* (Scribn.) Parodi. Rocky slopes and pine woods in the Davis Mts. at 5,000-7,000 ft. elev., infrequent, Aug.-Sept.; N.M. to Ariz. and s. to Chih.

3. *Stipa lobata* Swall. Tufted perennial; culms erect, unbranched, 4-10 dm. long, 1.5-5 mm. thick; ligule a minute scale 0.2-0.5 mm. long; blades 15-50 cm. long, 2-4 mm. broad at the very base, almost as broad as the auriculate sheath, long-tapering to a fine involute point; panicle 15-25 cm. long, narrow, spikelike; glumes 8-13 mm. long; lemma 6-7 mm. long, pubescent with silky-white antrorse hairs about 1 mm. long and with a ring of such hairs (1-2 mm. long) at the summit, the summit prolonged laterally into 2 lobes 0.5-1.5 mm. long; awn from between the lobes 1-2 cm. long, obscurely twice-geniculate. Closely related to *S. columbiana* and *S. robusta*. Rocky grassy slopes in Trans-Pecos mts. at 4,500-7,000 ft. elev., June-Sept.; also N. M.

4. *Stipa columbiana* Macoun. COLUMBIA NEEDLEGRASS. Tufted perennials; culms erect, unbranched, 5-10 dm. long, 1.5-2.5 mm. thick; ligule obsolete or a minute scale 0.5-1 mm. long; blades 1-3 dm. long, 1-3 mm. broad at the very base, considerably narrower than the auriculate sheath, long-tapering to a fine involute point; panicle 15-35 cm. long, narrow, spikelike; glumes 7-13 mm. long; lemma 6-7 mm. long, sparsely covered on the sides with antrorse appressed silky-white hairs and at the summit with a ring of such hairs but not lobed; awns 20-35 mm. long, obscurely twice-geniculate. Reported as being in the Trans-Pecos; nearly throughout w. U.S., e. to w. S.D., Colo. and N.M., chiefly at high alt.; also s.w. Can.

5. *Stipa robusta* (Vasey) Scribn. SLEEPY GRASS. Tufted perennial; culms erect, unbranched, 7-15 dm. tall, 3-6 mm. thick; ligule a scale 1-4 mm. long; blades 25-50 cm. long, 3-8 mm. broad at the very base near the ligule, nearly as broad as the auriculate sheath that bears some soft hairs at the corners; panicles 20-35 cm. long, 1.5-2 cm. thick, dense, spikelike, often interrupted basally; glumes 8-13 mm. long; lemma 6-8 mm. long, sparsely covered laterally with antrorse appressed silky-white hairs and at the summit with a ring of such hairs but not lobed; awn 20-38 mm. long, obscurely twice-geniculate. *S. Vaseyi* Scribn. Reported as being in the Trans-Pecos mts.; Colo., Ariz., N.M. and n. Mex., chiefly at moderate alt., among oaks and pines.

Said to cause narcosis in animals, especially horses, when eaten, hence the common name.

6. *Stipa eminens* Cav. Tufted perennial; culms erect but weak, often growing up through shrubs, unbranched, 6-12 dm. long, 1-1.5 mm. thick; ligule a lacerate scale 2-5 mm. long; blades 1-3 dm. long, the basal portion flat, about 2 mm. broad, the distal portion tapering to a fine involute point; panicle narrow but diffuse and open, not at all spikelike; glumes 7-12 mm. long, with broad hyaline margins; lemma 4-6 mm. long, densely pubescent with very short white antrorse hairs; awns 3-6 cm. long, twisted basally and obscurely twice-geniculate. Rocky slopes, deserts and grassy areas in the Trans-Pecos, locally abundant where not overgrazed, summer-fall; Tex. to Ariz. and s. to Mex.

7. *Stipa arida* M. E. Jones. Tufted perennial; culms stiffly erect, sparingly or not branched, 60-85 cm. long; ligule a lacerate scale 0.5-1 mm. long; blades 8-21 cm. long, involute, curved; panicle 11-25 cm. long, dense and spikelike; glumes 10-12 mm. long, lemma 6 mm. long, toward the base very sparsely pubescent with short white antrorse hairs; awns 4-5 cm. long, barely twisted and obscurely twice-geniculate. Reported to occur on rocky slopes in Tex.; in Colo., Ut., Ariz. and s.e. Calif.

8. *Stipa tenuissima* Trin. Tufted perennial; culms erect, unbranched, 3-7 dm. long, about 1 mm. thick; ligule obsolete or a scale 2-4 mm. long; blades 10-35 cm. long, stiffly erect, involute, about 0.5 mm. thick, very scabrous; panicle 1-3 dm. long, about 1 cm. thick, erect or slightly nodding; glumes 2-5 mm. long; lemma 2 mm. long, ellipsoidal, glabrous except for the bearded callus; awn 35-80 mm. long, about 0.1 mm. thick. Open woods on rocky flats and slopes in Trans-Pecos mts. at 5,000-7,000 ft. elev., locally abundant, June-Sept.; N. M. to cen. Mex.; also Arg.

9. *Stipa leucotricha* Trin. & Rupr. TEXAS SPEARGRASS, TEXAS WINTER-GRASS. Tufted perennial; culms erect or often weak and sprawling, 2-8 dm. long, 0.5-1.5 mm. thick, shortly hairy at the nodes; ligule obsolete or a minute scale shorter than 0.5 mm., rarely longer; blades 5-35 cm. long, straight, involute or usually flat at least basally, 2-4 mm. broad, densely furnished with antrorse and somewhat rough white hairs; panicle 5-20 cm. long, often weak and nodding, the branches usually appressed or eventually somewhat spreading, weak, naked in the basal part; glumes 12-18 mm. long; lemma 9-12 mm. long, linear, glabrous in the upper half, the apical 1 mm. segment formed by a cylindrical white cartilaginous crown 0.5-0.8 mm. thick; awn 45-100 mm. long, obscurely once- or twice-geniculate. Prairies, brushy areas, roadsides and other disturbed areas, usually on fine calcareous soils, abundant in n.-cen. Tex. and Edwards Plateau, infrequent in e. Plains Country and e. and s.e. Tex. and n. Rio Grande Plains; Okla. s. to Coah. and N. L.

The calluses of the "fruits," when the latter are properly thrown, easily penetrate clothing and stick into skin. The plants, therefore, are of considerable recreational value to boys.

10. *Stipa comata* Trin. & Rupr. Tufted perennial; culms erect, unbranched, 5-12 dm. long, 2-3 mm. thick; ligule a scale 3-5 mm. long; panicle erect or commonly somewhat nodding, the lower branches usually erect and appressed, naked in the basal part; glumes 22-32 mm. long, hyaline; lemma 13-15 mm. long, brownish when fully mature, the sides above the bearded callus sparsely covered with short white antrorse hairs; awn 10-18 cm. long, obscurely twice-geniculate, often deciduous. Prairies and grassy dry slopes, locally abundant in the Plains Country, rare in the Trans-Pecos, May-July; w. U. S. e. to Mich., Ia., Kan. and Tex.

11. *Stipa neomexicana* (Thurb.) Scribn. NEW MEXICAN FEATHER GRASS. Tufted perennial; culms erect, 4-8 dm. long, 1-1.5 mm. thick; ligule obsolete or only 0.5 mm. long; blades 15-40 cm. long, involute, erect, very narrow; panicle 1-2 dm. long, the branches erect and appressed, naked in the lower part, few-flowered; glumes 35-55 mm. long, very thin; lemma 15-18 mm. long, brown when mature, linear, the callus bearded and the sides very sparsely pubescent with short sordid antrorse hairs; awns 12-18 cm. long, obscurely twice-geniculate, the terminal half furnished with soft silky-white antrorse hairs more than 1 mm. long, the awn readily deciduous. Rocky usually limestone slopes in the Trans-Pecos and w. Plains Country, infrequent, Apr.-July; Wyo. s. to Ariz. and Coah.

17. MELICA L. MELIC-GRASS

Tufted or shortly rhizomatous perennials, in some species with bulbous enlargements basally; ligule a long erose hyaline scale; blades mostly soft and flat or only the tip loosely involute; panicles terminal, loosely oblong to spikelike, few-flowered; spikelets with 1 to 4 fertile (perfect) florets and in addition a terminal rudiment representing several sterile ones; rachilla tardily disarticulating at the nodes, the spikelets falling entire (except in *M. bulbosa*); glumes 3- to 5-nerved; lemmas several-nerved, usually with hyaline margins.

A genus of 70 species in North and South Temperate regions, excluding Australia.

1. Culms with bulbous basal enlargements; rachilla of spikelet abscising at lower part of each node 1. *M. bulbosa*.
1. Culms sometimes slightly enlarged basally but not bulbous; rachilla not abscising (spikelet falling entire) (2)

- 2(1). Spikelets usually with 4 perfect florets plus a rudiment 2. *M. Porteri*.
 2. Spikelets with 1 to 3 perfect florets plus a rudiment (3)
 3(2). Spikelets with 1 perfect floret; blades mostly involute 5. *M. Montezumae*.
 3. Spikelets with 2 (rarely 3) perfect florets; blades mostly flat (4)
 4(3). Spikelets longer than broad; lemmas not cucullate distally but with broad hyaline margins; rudiment narrowly obovoid, not truncate 3. *M. nitens*.
 4. Spikelets not much longer than broad; lemmas cucullate distally, with narrow hyaline margins; rudiment broadly obovate, truncate 4. *M. mutica*.

1. *Melica bulbosa* Port. & Coult. ONION GRASS. Culms with bulbous enlargements basally, 3-6 dm. long, erect; panicle interrupted, spikelike, 8-20 cm. long, 5-10 mm. thick, with some appressed branches; lateral spikelets on pedicels about 2 mm. long and erect-appressed, 5- to 6-flowered, 7-15 mm. long; rachilla abscising at the nodes. Reported to occur in Jeff Davis Co. in the Trans-Pecos; if present then probably rare at the highest elev., summer; Mont. to B. C., s. to Calif., Nev., Ut. and Colo.

2. *Melica Porteri* Scribn. Culms 4-10 dm. long, often basally decumbent; panicles open with spreading branches 4-9 cm. long; spikelets on pedicels about 1 mm. long, drooping or pendent, with usually 4 perfect florets plus a rudiment, falling entire but the rachilla then tardily abscising at the nodes. Infrequent in higher parts of the Trans-Pecos (Mt. Livermore, Davis Mts.), late summer; Colo., Ariz., N. M. and Tex.

Our plants seem to belong to the var. *laxa* Boyle, with more spreading panicle branches and purple-tinged spikelets.

3. *Melica nitens* (Scribn.) Piper. Culms 45-100 cm. long, usually erect from the base or only very shortly decumbent, 1.5-4 mm. thick; blades 4-7 (-15) mm. broad, flat; panicle open, with spreading branches; spikelets longer than broad, on pedicels about 1 mm. long, drooping or pendent, with 2 (very rarely 3) perfect florets plus a rudiment, falling entire but the rachilla then tardily abscising at the base of the upper fertile floret; lemma elongate with broad hyaline margin, not cucullate; rudiment obovoid. Abundant in calcareous or sandy loam along roads, bluffs, streamsides, often in partial shade, Edwards Plateau and n.-cen. Tex., rare w. to the Trans-Pecos and e. to w. part of e. Tex., spring; interior U.S. from Pa. and Va. w. to Ia. and Kan., thence s. to Coah. and N. L.

In most of its range in the U. S., north and east of Texas, this species is called "Three-flower Melic," but the name is very inappropriate for our plants.

4. *Melica mutica* Walt. Culms 3-7 dm. long, usually rather long-decumbent (sub-rhizomatous) basally, about 1 mm. thick; blades 2-4 mm. broad, flat; panicle usually nearly simple, very few-flowered; spikelets about as broad as long, on pedicels about 1 mm. long, cernuous or pendent, with 2 perfect florets plus a rudiment, falling entire; lemma not elongate, markedly cucullate apically with narrow margin; rudiment broadly obconic, truncate. Infrequent in forests on sandy soil in e. Tex., spring; s.e. U. S. n. to Md., W. Va., Ind., Ill. and Ia., w. to Okla. and Tex.

5. *Melica Montezumae* Piper. Culms 3-7 dm. long, usually erect from the base, about 1.5 mm. thick; blades mostly loosely involute (tightly so near tip); panicle with a few short branches; spikelets longer than broad, on pedicels about 1 mm. long, ascending or merely slightly nodding, with 1 perfect floret plus a rudiment, falling entire; lemma elongate, with very broad hyaline margins; rudiment narrow, inconspicuous. Locally abundant in juniper-pinyon woods or dry limestone slopes in the Trans-Pecos (Pecos and Brewster cos.), spring; also Coah. and Chih.

One collection from Brewster Co. combines the habit of this species with the 2-flowered spikelets of *M. nitens*.

18. GLYCERIA R. BR.

MANNA-GRASS

Perennials, tufted or in one species also subrhizomatous; ligule a hyaline scale; blades flat, thin; panicles open; spikelets turgid or only slightly laterally compressed, 3- to 14-flowered; all flowers perfect or the terminal one usually abortive or rudimentary; glumes scarious to hyaline, the first usually shorter, acutish and 1-nerved, the second obtuse, almost equalling the lowest lemma and obscurely 3-nerved; rachilla eventually abscising

at the lower part of each node; lemmas firm to membranous, green, broadly ovate or obovate, usually blunt and scarious-margined apically, usually awnless, 7-nerved, the nerves not converging to the apex but terminating severally near the distal margin.

About 40 species, cosmopolitan in distribution.

1. Panicle branches weak and flexuous; lemmas 1.5-2.1 mm. long; spikelets 3- to 7-flowered 1. *G. striata*.

1. Panicle branches rather short and rigid; lemmas 2.5-4 mm. long; spikelets 10- to 14-flowered (2)

2(1). Lemmas 2.5-3.5 mm. long 2. *G. arkansana*.

2. Lemmas 3.5-5 mm. long 3. *G. septentrionalis*.

1. *Glyceria striata* (Lam.) Hitchc. FOWL MANNA-GRASS. Perennial forming mats by means of short rhizomes; panicles 1-2 dm. long, with numerous slender ascending-diverging branches about 0.2 mm. thick (in turn bearing even more slender floriferous branchlets); pedicels 0.5-1 mm. long, appressed; spikelets 3- to 7-flowered, ovate in outline; lemmas 1.5-2.1 mm. long. Rare at the margins of clear permanent streams in limestone areas in the Trans-Pecos (Guadalupe Mts). and e. part of Edwards Plateau, spring-summer; most of the temp. parts of N. A.

2. *Glyceria arkansana* Fern. Tufted perennial; culms stout, 10-15 dm. long, erect; panicles 35-50 cm. long, with a number of ascending floriferous branches 0.4-1 mm. thick, rather rigidly straight; spikelets 10- to 14-flowered, nearly sessile, appressed, remote; lemmas 2.5-3.5 mm. long, minutely pubescent. Probably only a form of *G. septentrionalis*. Reported to occur in e. Tex.; if present then rare in marshy areas, roadside ditches, etc., spring-summer; also La. and Ark.

3. *Glyceria septentrionalis* Hitchc. Like *G. arkansana* but lemmas merely minutely scabrous and 3.5-5 mm. long. Reported to occur in marshy areas and roadside ditches in e. and s.e. Tex., spring-summer; e. N. A. w. to Wisc., Ia., Mo., Ark. and Tex.

19. BROMUS L. CHESS. BROME

Plant diverse in habit; inflorescence an open or dense panicle; spikelets diverse, large, either strongly compressed or turgid, several-flowered with all the flowers perfect; rachilla glabrous, abscising above the glumes and below the florets; glumes 1- to 5-nerved, shorter than the lower lemma; lemmas basally not calloused or else with a glabrous callus, 5- to 9-nerved, apically narrowed or bifid, the nerves converging toward the summit, mucronate or awned either between the teeth or from the back shortly below the apex. *Anisantha* C. Koch, *Ceratochloa* Beauv., *Zerna* Panz.

A genus of about 150 species in temperate regions. Some European authors split *Bromus* into several genera, perhaps justly.

1. Lemmas lanceolate, apically bifid, basally calloused (2)

1. Lemmas mostly broader or if lanceolate then either not bifid or not calloused (4)

2(1). Awns 3-5 cm. long 15. *B. rigidus*.

2. Awns shorter (3)

3(2). Awns 12-14 mm. long; panicle open 14. *B. tectorum*.

3. Awns 18-24 mm. long; panicle dense 13. *B. rubens*.

4(1). Lemmas sharply keeled (spikelets strongly laterally compressed) even at maturity (5)

4. Lemmas not keeled or somewhat so only when immature and along part of the length (7)

5(4). Awns absent or to 3 mm. long 12. *B. unioloides*.

5. Awns longer (6)

6(5). Awns 3-6 mm. long; foliage hispidulous; lemmas essentially glabrous 10. *B. polyanthus*.

6. Awns 7-15 mm. long; foliage essentially glabrous; lemmas hirsute toward the margin 11. *B. arizonicus*.

- 7(4). Weedy annuals of disturbed areas with usually turgid spikelets (8)
 7. Tufted perennials of relatively undisturbed places with slightly compressed spikelets (11)
- 8(7). Panicles 4-10 cm. long, 15-30 mm. broad, dense; lemmas densely pilose and hispidulous9. *B. molliformis*.
 8. Panicles mostly more than 10 cm. long, not dense (9)
- 9(8). Panicle branches elongate, drooping; lemmas mostly 5-6 mm. broad, at first membranous, eventually becoming slightly chartaceous and only the lower part of the margin becoming revolute8. *B. japonicus*.
 9. Panicle branches relatively short, ascending; lemmas mostly 6-8 mm. broad, at first membranous, quickly becoming chartaceous and the margin partly revolute (10)
- 10(9). Awns 1-5 mm. long; lemmas early in maturation becoming chartaceous-indurate and the margins totally and broadly revolute around the palea and grain
7. *B. secalinus*.
 10. Awns 5-12 mm. long; lemmas early in maturation becoming chartaceous and the lower two-thirds of the margin narrowly revolute around the palea
6. *B. commutatus*.
- 11(7). Plant of the mountains in Trans-Pecos Texas (12)
 11. Plants in other parts of the state (14)
- 12(11). First glume 1-nerved, the second 3-nerved; lemmas pubescent near the lateral margins but the median portion glabrous5. *B. Richardsonii*.
 12. First glume 3-nerved, the second 5-nerved; lemmas finely pubescent all over the dorsum (use lens) (13)
- 13(12). Body of lemma 7-10 mm. long, the awn 2-3 mm. long
4. *B. anomalus*.
 13. Body of lemma 10-13 mm. long, the awn 3-4 mm. long
3. *B. lanatipes*.
- 14(11). Panicles 15-25 cm. long; blades 5-17 mm. broad ..1. *B. pubescens*.
 14. Panicles 7-14 cm. long; blades 3-6 mm. broad2. *B. texensis*.

1. *Bromus pubescens* Muhl. Tufted perennial; culms 5-12 dm. long, basally decumbent, mostly erect, 2-4 mm. thick; sheaths often densely retrorsely hispidulous; blades 5-17 mm. broad, the lower corners near the ligule with minute round auricles; panicles nodding, 15-25 cm. long, very open, few-flowered; spikelets 5- to 9-flowered; first glume 1-nerved, the second 3-nerved; lemmas not at all keeled, cymbiform with a body 11-14 mm. long and an awn 5-10 mm. long, densely finely pubescent all over the dorsum. Our plants have usually (incorrectly) been called *B. purgans* L. Usually on moist banks in e. and n.-cen. Tex. and e. part of Edwards Plateau, spring-summer; e. U. S. w. to N. D., S. D., Neb., Kan., Okla. and Tex.

2. *Bromus texensis* (Shear) Hitchc. Tufted perennial; culms 4-9 dm. long, erect (or ascending through bushes), about 2 mm. thick; sheaths densely retrorsely hispidulous; blades 3-6 mm. broad; panicles 7-14 cm. long, very open and few-flowered, nearly erect to slightly drooping; spikelets 4- to 8-flowered; first glume 1-nerved, the second 3-nerved; lemmas not at all keeled, cymbiform with a body 8-11 mm. long and an awn 4-8 mm. long, densely finely pubescent all over the dorsum. Probably no more than a variety of *B. pubescens*. Infrequent to rare and local, in n. parts of Rio Grande Plains, w. to s. part of s.e. Tex. and Edwards Plateau, spring; endemic.

3. *Bromus lanatipes* (Shear) Rydb. Tufted perennial; culms 4-9 dm. long, 2-3 mm. thick, erect except shortly decumbent (subrhizomatous) at the base, simple; sheaths usually densely retrorsely grayish-woolly-pubescent; blades 3-8 mm. broad, mostly flat; panicles nodding, 8-17 cm. long, few-flowered; spikelets 5- to 9-flowered; first glume 3-nerved, the second 5-nerved; lemmas not at all keeled (except when very immature), cymbiform with a body 10-13 mm. long and an awn 3-4 mm. long, pubescent all over

the dorsum but the hairs longer toward the lateral margin. *B. anomalus* var. *lanatipes* (Shear) Hitchc. Frequent in mts. of the Trans-Pecos, summer; Colo. to Ariz. and s. to Coah.

4. *Bromus anomalus* Fourn. Tufted perennial; culms 3-9 dm. long, 1-2 mm. thick, erect except shortly decumbent (subrhizomatous) at the very base, simple; sheaths nearly glabrous or very shortly retrorsely woolly-pubescent; blades 2-5 mm. broad, mostly flat; panicles nodding, 8-16 cm. long, few-flowered; spikelets 5- to 9-flowered; first glume 3-nerved, the second 5-nerved; lemmas not at all keeled (except when very immature), cymbiform with a body 7-10 mm. long and an awn 2-3 mm. long, pubescent all over the dorsum but the hairs longer toward the lateral margin. *Zerna anomala* (Fourn.) Henr. Frequent in mts. of the Trans-Pecos, summer; also Mex.

5. *Bromus Richardsonii* Link. Tufted perennial; culms 4-8 dm. long, about 2 mm. thick, often decumbent in the lower part and geniculate; sheaths usually glabrous; blades 5-15 mm. broad, mostly flat, the lower corners (where joining sheath) minutely round-auricled; panicles nodding, 1-2 dm. long, very open and diffuse; spikelets 6- or 7-flowered; first glume 1-nerved, the second 3-nerved; lemmas not at all keeled (except when very immature), cymbiform with a body 10-13 mm. long and an awn 3-5 mm. long, densely pubescent near the lateral margins but the median portion glabrous. *Zerna Richardsonii* (Link) Nevskii. These plants have usually been called *B. ciliatus* L. Infrequent in higher parts of mts. in the Trans-Pecos, summer; Rocky Mts. and s. to Tex.

6. *Bromus commutatus* Schrad. Annual; culm 4-9 dm. long, ascending, mostly 1.5-3 mm. thick; sheaths mostly densely retrorsely hispidulous; blades 4-12 mm. broad, mostly flat, often pilose above; panicles 1-2 dm. long, 3-6 mm. thick, the whole panicle nodding slightly but the individual branches mostly appressed or only divergent at low angles; spikelets rather turgid; lemma with a body 7-9 mm. long and 6-7 mm. broad, the awn 5-12 mm. long, not at all keeled, roundly cymbiform, at first membranous with hyaline margins (broadly overlapping the next lemma), eventually becoming chartaceous and the lower part of the margin revolute around the sides of the palea which is conspicuously shorter; anthers 1.3-1.9 mm. long. Infrequent in e. and n.-cen. Tex., Plains Country and Edwards Plateau, spring; Euras., introd. and a volunteer in scattered parts of N. A.

7. *Bromus secalinus* L. CHESS. Annual; culms 3-6 dm. long, ascending, slender; sheaths and blades glabrous or usually hispidulous; panicle narrowly ovoid, few-flowered, 7-20 cm. long, often 1-sided, the longer ones nodding, with a few ascending few-flowered branches; spikelets 12-20 mm. long (not including awns), ascending, turgid, 7- to 9-flowered, when very immature the lemmas broadly overlapping; lemmas 7-nerved, with a body 6-9 mm. long and an awn 1-5 mm. long, glabrous or pubescent during the maturation of the spikelet, at first cymbiform but very quickly from base to apex becoming revolute and indurate, the margin tightly enclosing the palea which is equal in length; rachilla tardily abscising at the upper part of each node. Infrequent in e. and n.-cen. Tex. and Plains Country, rare in Rio Grande Plains, spring-summer; introd. from Eur., escaping from wheat fields.

Some of our plants show the delayed and less severe induration and rolling of the lemma which characterizes *B. commutatus*, and might better be referred to by that name.

8. *Bromus japonicus* L. JAPANESE CHESS. Annual; culms 3-8 dm. long ascending, slender, sheaths and blades usually shortly pilose; blades mostly 2-5 mm. broad; panicle 1-2 dm. long, 1-sided, (when mature) nodding with several long curved drooping few-flowered branches at the base; spikelets turgid, 7- to 10-flowered; lemmas with awns 5-11 mm. long, (at first straight or eventually slightly curved and spreading) and bodies 7-9 mm. long and 5-6 mm. broad, broadly overlapping, the thin margins conspicuous and eventually (very late in maturation) becoming chartaceous and the margins revolute to clasp the palea which is conspicuously shorter; anthers 0.6-1.2 mm. long. Abundant weed in scattered parts of Tex. (rare in Trans-Pecos), spring; widespread in temp. parts of Euras. and N. A.

9. *Bromus molliformis* Lloyd. Annual; culms 1-3 dm. long, 1-2 mm. thick; sheaths densely retrorsely short-pilose; blades 1-3 mm. broad, flat; panicles 4-10 cm. long, 15-30 mm. broad, few-flowered, with pedicels 2-8 mm. long; spikelets slightly compressed, with 8 to 10 closely imbricated florets; lemmas with awns 3-7 mm. long and bodies

about 8 mm. long, marginally narrowly hyaline, medially green, membranous and densely pilose and hispidulous (use lens). Very likely no more than a form of *B. mollis* L. Rare along roadsides and in gardens, e. and n.-cen. Tex. (Brazos and Limestone cos.), probably not persistent, spring; Euras., introd. in Calif. and Tex.

10. *Bromus polyanthus* Scribn. Tufted perennial; culms 35-60 cm. long, erect, 1-2 mm. thick; sheaths shortly and densely hispidulous at least on the upper part; blades 2-5 mm. broad, pubescent like the upper part of the sheaths at least on the lower part of the blade, panicle 5-20 cm. long, very narrow, few-flowered, with a few mostly ascending branches; spikelets 5- to 6-flowered, strictly ascending, strongly laterally compressed, lemmas strongly sharply keeled, essentially glabrous (or microscopically scabrous), shiny, with a body 10-15 mm. long and an awn 3-6 mm. long. Infrequent in Chisos and Davis mts. in the Trans-Pecos, summer; most of w. U. S. e. to Mont., Wyo., Colo. and N. M.; our race occurs in Tex. and Coah.

Our plants may possibly prove to be an undescribed species or variety; typical *B. polyanthus* of the Rocky Mts. comprises more robust plants with nearly glabrous foliage.

11. *Bromus arizonicus* (Shear) Steb. Ephemeral annual; culms 3-6 dm. long; foliage essentially glabrous; panicle stiffly erect, narrow; spikelets 5- to 7-flowered, strongly laterally compressed; lemmas strongly sharply keeled, mostly glabrous but hirsute toward the margin, with an awn 7-15 mm. long. Reported to occur in w. Tex.; if present very rare, spring; Ariz., Calif. and Baja Calif.

12. *Bromus unioloides* H.B.K. RESCUE GRASS. Annual; culms 5-40 cm. long, simple, erect or slightly geniculate basally and ascending; sheaths glabrous to densely retrorsely hispidulous; blades highly variable, 2-10 mm. broad, flat; panicle 3-25 cm. long, usually eventually inclined or nodding with a very few spreading-ascending mostly naked branches at the base bearing a very few spikelets; spikelets strongly laterally compressed, ascending, mostly 8- to 10-flowered, elongate-ovate in outline; first glume about 5-nerved, second glume 7- to 9-nerved; lemmas very broad, compressed-keeled, 7- to 11-nerved, with narrow chartaceous margins, 9-15 mm. long, glabrous to usually minutely scabrous in lines to minutely strigose (especially in the internerve stripes), mucronate or with an awn to 3 mm. long. *Ceratochloa Haenkeana* Presl. Our plants for a long time passed under the name *B. catharticus*. Throughout the state, spring-summer; nat. of S. A., now common in the U.S.

A valuable forage grass, but now also a weed and pest along roadsides and in lawns and gardens.

13. *Bromus rubens* L. FOXTAIL CHESS. Annual; culms 15-40 cm. long; sheaths and blades minutely pubescent; panicle erect, obovoid, rather dense (spikelets touching), 3-7 cm. long (including awns) with an axis only half as long, usually purplish; spikelets 4- to 11-flowered, erect; lemmas with awns 18-24 mm. long and elongate lanceolate bodies 12-16 mm. long, bifid apically, basally calloused. *Anisantha rubens* (L.) Nevskii. Infrequent to rare along roads and in draws in the Trans-Pecos and w. part of Edwards Plateau, spring; Eur., introd. widely in w. U.S.

14. *Bromus tectorum* L. DOWNY CHESS. Annual; culms 15-50 cm. long, erect or ascending; sheaths and blades minutely pubescent; panicle 4-15 cm. long, usually slightly one-sided and nodding, rather dense (but the spikelets not in close contact); spikelets 4- to 6-flowered, more or less drooping; lemmas elongate-lanceolate, densely pubescent (or rarely glabrous) with an awn 12-14 mm. long, with an apically bifid and basally calloused body 10-12 mm. long. Incl. var. *glabratus* Spenner, *Anisantha tectorum* (L.) Nevskii. Infrequent to rare along roadsides and in pastures in the Trans-Pecos, Plains Country, Edwards Plateau and e. to n.-cen. Tex.; frequent on Pac. coast, scattered throughout rest of U.S., s. to Va., Miss. and Tex.

15. *Bromus rigidus* Roth. RIPCUT. Annual; culms 3-7 dm. long, erect; sheaths and blades pilose; panicle 1-2 dm. long, usually slightly nodding, the lower branches 3-7 cm. long or less; spikelets 3- to 6-flowered; lemmas with awns 3-5 cm. long and scabrous, with apically bifid and basally calloused bodies 25-33 mm. long. *Anisantha rigida* (Roth) Hylander. Rare and not persistent in e. Tex. and the Edwards Plateau (one record for each area), spring; Euras., introd. in N.A.

The east Texas plants belong to the var. *Gussonei* (Parl.) Coss. & Dur., characterized by having more open panicles and stiffer, more spreading lower branches as much as 10-12 cm. long.

20a. FESTUCA L. PERENNIAL FESCUE

Tufted perennials 1-11 dm. tall; spikelets very slightly if at all laterally compressed, 2- to 8-flowered, most of the flowers perfect and chasmogamous but the uppermost staminate or rudimentary; lower glume usually well-developed, 1-nerved; upper glume usually merely pointed though less commonly awned, usually 3-nerved (but the lateral nerves obscure); spikelet rachilla disarticulating at the lower part of each node (i.e., top of each internode); lemmas usually ovate or elliptic, blunt to acute, awned or awnless, cymbiform and/or convex, not keeled (except slightly in *F. rubra*), revolute, 5-nerved (lateral nerves obscured); anthers 3, free, exerted; grains ellipsoid or ovoid.

A moderately large genus of temperate regions of the world.

1. Ligule a scale 3-3.5 mm. long5. *F. ligulata*.
1. Ligule shorter or obsolete (2)
- 2(1). Blades involute; lemmas lanceolate, with awns 1-4 mm. long (3)
2. Blades flat for at least a part of their length; lemmas elliptical, awnless or with awns shorter than 1 mm. (4)
- 3(2). Culms about 1.5 mm. thick6. *F. arizonica*.
3. Culms 0.5-1 mm. thick7. *F. rubra*.
- 4(2). Spikelets 5- to 8-flowered; lower panicle branches floriferous nearly to their bases4. *F. elatior*.
4. Spikelets 2- to 4-flowered (rarely 5-flowered); lower panicle branches naked in the basal half (5)
- 5(4). Lemmas 5-7 mm. long3. *F. versuta*.
5. Lemmas 3.5-5 mm. long (6)
- 6(5). Lower panicle branches naked for at least the basal two-thirds to three-fourths their length1. *F. obtusa*.
6. Lower panicle branches naked only for about the basal half2. *F. paradoxa*.

1. *Festuca obtusa* Biehler. NODDING FESCUE. Tufted perennial; culms 5-11 dm. long, 1-2 mm. thick, basally shortly decumbent, usually geniculate at the lower nodes; blades 3-8 mm. broad, flat at least part of their length; panicles 12-25 cm. long, usually less than half as thick, more or less open, nodding, with several branches, the long lower ones naked in at least the basal two-thirds to three-fourths their lengths; pedicels 2-4 mm. long, appressed; spikelets turgid, 2- to 5-flowered; lemmas elliptical, not at all keeled, convex, marginally thin, eventually revolute, the lowest lemmas 3.5-4.5 mm. long, awnless, apically acute (the angle broad, blunt), eventually turning greenish-stramineous, the lateral nerves very obscure. Scarce in woods, e. Tex., spring; e. U.S., w. to N.D., S.D., Neb., Kan., Okla. and Tex.

2. *Festuca paradoxa* Desv. Tufted perennial; culms 5-11 dm. long, 1-2 mm. thick, basally shortly decumbent, usually geniculate at the lower nodes; blades 3-9 mm. broad, flat at least part of their length; panicles 8-15 cm. long, usually about half as broad, open, drooping, with several branches, the lower ones longest and naked in the basal half, the upper ones shorter and floriferous nearly to the base; pedicels 2-4 mm. long, appressed; spikelets very slightly laterally compressed, 2- or 3-flowered; lemmas narrowly elliptical, not at all keeled, convex, marginally thin, revolute, the lowest lemmas 4-5 mm. long, awnless, rounded apically, eventually chartaceous and brownish, 1-nerved. Perhaps only a form of *F. obtusa*. Rare in e. Tex., summer; most of e. U.S. w. to Wisc., Ia., Kan., Okla. and Tex.

3. *Festuca versuta* Beal. Tufted perennial; culms 5-10 dm. long, 1-2 mm. thick, basally very shortly decumbent, otherwise erect; blades 2-7 mm. broad, flat at least part of their length; panicles 8-25 cm. long, usually less than half as thick, open, nodding, with several branches, the longer lower ones naked for at least the basal half to two-thirds their length; pedicels 3-20 mm. long, appressed or usually slightly divergent; spikelets slightly laterally compressed, 2- to 4-flowered (rarely 5-flowered); lemmas elliptical, not at all keeled, convex, marginally thin, revolute, the lowest ones 5-7 mm. long, awnless but

apically very shortly acuminate, acute and rarely mucronate, eventually turning brownish, the lateral nerves obscure. Infrequent along creeks and in rich woods of river bottoms, s.e. margin of Edwards Plateau (Bexar to Travis cos.), spring; Ark., Okla. and Tex.

4. *Festuca elatior* L. MEADOW FESCUE. Tufted perennial; culms 5-11 dm. long, often basally shortly decumbent or even subrhizomatous, otherwise erect, 1-2 mm. thick; blades 3-9 mm. broad, flat at least part of their length; panicles 12-30 cm. long, usually only 2-4 cm. broad, with a few short branches floriferous nearly to the base; pedicels 2-4 mm. long, mostly appressed; spikelets turgid or only very slightly laterally compressed, 5- to 8-flowered; lemmas elliptical, not at all keeled, convex, marginally thin, revolute, the lowest ones mucronate or with awns to 1 mm. long and apically acute bodies 6-7 mm. long, eventually becoming papery. Incl. var. *arundinacea* (Schreb.) Wimm., *F. arundinacea* Schreb. Infrequent to rare in e. and s.e. Tex., and cult. elsewhere (tending to volunteer along roads), spring; nat. of Euras., now widely escaped in temp. N. A.

5. *Festuca ligulata* Swall. Tufted perennial; culms 5-8 dm. long, 1-2 mm. thick, basally very shortly decumbent or even subrhizomatous, otherwise erect; blades involute, terminally subspinose; ligule a hyaline scale 3-3.5 mm. long; panicle 6-16 cm. long, narrow, with a very few branches in the lower part that are ascending and basally naked; pedicels 1-2 mm. long, appressed; spikelets turgid, 2- or 3-flowered; lemmas elliptical, not at all keeled, convex, marginally thin, revolute, apically acute (the angle blunt), awnless, the lowest ones 5-6 mm. long, slightly exceeded by the palea, eventually becoming thin-chartaceous. Grassy slopes in the higher parts of the Trans-Pecos mts., summer; endemic.

6. *Festuca arizonica* Vasey. Tufted perennial; culms 5-8 dm. long, about 1.5 mm. thick, erect; ligule a thin scale 1-1.5 mm. long; blades each 1 mm. broad, closely involute; panicle usually interrupted-spikeletlike, occasionally more lax, with some ascending or appressed branches in the lower part floriferous nearly to the base; pedicels about 2 mm. long, appressed; spikelets somewhat laterally compressed, 5- to 7-flowered; lemmas lanceolate, not at all keeled, cymbiform, marginally thin, revolute, apically long-tapered, acute, mucronate or with an awn about 1 mm. long, the lowest ones with bodies 6-7 mm. long, eventually becoming chartaceous. Higher parts of mts. in the Trans-Pecos, summer; Colo. to Tex. and w. to Nev. and Ariz.

7. *Festuca rubra* L. RED FESCUE. Tufted perennial; culms 1-5 dm. long, 0.5-1 mm. thick, usually decumbent at the base, reddish-fibrillose and subrhizomatous, otherwise erect; ligules extremely short to obsolete; panicles interrupted-spikeletlike (or more lax with a few very short ascending branches in the lower part floriferous nearly to their bases), 4-12 cm. long; pedicels 1-2 mm. long, appressed; spikelets laterally compressed, 3- to 5-flowered; lemmas lanceolate, very slightly (if at all) keeled near the apex, marginally thin and revolute, apically long-tapered, acute with an awn 1-4 mm. long, the lowest with bodies 5-7 mm. long. Rare in highest parts of Madera Canyon, Davis Mts. in the Trans-Pecos, summer; widespread in the cooler parts of the N. Hemis., in Am. s. in the mts. to S.C., Ala. and Mex.

20b. VULPIA C. C. GMEL.

ANNUAL FESCUE

Spring annuals; spikelets slightly laterally compressed, 4- to 13-flowered, most of the flowers perfect and cleistogamous but the uppermost staminate or rudimentary; lower glume 1-nerved, often greatly reduced, the upper one usually 3-nerved (but the lateral nerves very obscure), frequently awned; spikelet rachilla disarticulating at the lower part of each node (top of each internode); lemmas slender, long-attenuate to long-awned, cymbiform and/or convex but not keeled, revolute, 5-nerved (but the lateral nerves very obscure); anther usually solitary, appressed to the lemma or the included stigmas; grains linear-cylindric, attenuate to top and to base.

A small genus of Europe, North Africa, Southwestern Asia and temperate North and South America, weakly distinguished from the perennial fescues (*Festuca*).

1. Lowest lemmas with bodies 2.8-3.5 mm. long and awns 6-11 mm. long
- 2. *V. Elliotea*.
1. Lowest lemmas with bodies more than 3.5 mm. long (2)

- 2(1). Body of lemma with a few minute cilia on the upper margin (use strong lens) 3. *V. megalura*.
 2. Body of lemma not marginally ciliate (3)
 3(2). Awns 0.3-7 mm. long 1. *V. octoflora*.
 3. Awns 7-22 mm. long (4)
 4(3). First glume less than half as long as the second . . . 4. *V. myuros*.
 4. First glume more than half as long as the second 5. *V. dertonensis*.

1. *Vulpia octoflora* (Walt.) Rydb. SIX-WEEKS FESCUE. Tufted annual; culms 5-30 cm. long, 0.2-0.6 mm. thick, numerous, simple, often geniculate at the lower nodes, otherwise erect; blades 0.5-1 mm. broad, usually involute; panicles interrupted-spikelike or rarely looser; spikelets laterally compressed, 5- to 13-flowered; lemmas not at all keeled, cymbiform, with capillary awns 0.3-7 mm. long and lanceolate bodies 3.6-5.5 mm. long, either glabrous, scabrous or minutely pubescent dorsally, marginally membranous, quickly becoming revolute, eventually the whole becoming chartaceous. Incl. the trivial forms which have been called var. *tenella* (Willd.) Fern., var. *glauca* (Nutt.) Fern. and var. *hirtella* (Piper) Henr., *Festuca octoflora* Walt. Nearly throughout Tex. (rare in Rio Grande Plains), spring; temp. N.A.

2. *Vulpia Elliptea* (Raf.) Fern. Tufted annual; culms 1-5 dm. long, 0.5-1.2 mm. thick, few, simple, slightly geniculate at the lower nodes, mostly erect; leaves mostly crowded at the very base of the plant; blades 0.3-0.9 mm. broad, mostly involute, filiform; panicles interrupted-spikelike; spikelets laterally compressed, 4- to 6-flowered; lemmas not at all keeled, cymbiform, the lowest ones with capillary awns 6-11 mm. long and lanceolate bodies 2.8-3.5 mm. long, usually minutely scabrous toward the tip and marginally very thin, almost hyaline, becoming revolute and eventually slightly chartaceous. *Festuca sciurea* Nutt. Infrequent in open woods on sandy soil, e. Tex. and n. parts of Rio Grande Plains, spring; Coastal States, N.J. to Tex., inland to Mo. and Okla.

3. *Vulpia megalura* (Nutt.) Rydb. FOXTAIL FESCUE. Tufted annual; culms 15-60 cm. long, often shortly decumbent at the base and geniculate at the lower nodes, otherwise erect, simple, 1-2 mm. thick; blades 1-2.5 mm. broad, mostly involute; panicles interrupted-spikelike; spikelets laterally compressed, 4- to 6-flowered; first glume less than half as long as second glume; lemmas not at all keeled, cymbiform, the lowest ones with awns 14-17 mm. long and lanceolate bodies 5-8 mm. long, dorsally scabrous and marginally revolute and hyaline and near the apex with a few longer cilia (use lens!), becoming chartaceous. *Festuca megalura* Nutt. Probably only a form of *V. myuros*. Rare in disturbed roadsides in sandy soil, e. Tex., spring; Wash. and Ida., s. to Calif. and Ariz.; Tex., Ark., N.J., Me., Guat. and S. A.

4. *Vulpia myuros* (L.) C. C. Gmel. Tufted annual; culms 15-45 mm. long, often shortly decumbent basally and geniculate at the lower nodes, otherwise erect, simple, about 1 mm. thick; blades 1-2.5 mm. broad, mostly involute; panicles interrupted-spikelike; spikelets laterally compressed, 4- to 6-flowered; first glumes less than half as long as second; lemmas not at all keeled, cymbiform, the lowest ones with awns 7-22 mm. long and lanceolate bodies 4-7 mm. long, dorsally scabrous and marginally revolute, hyaline (not ciliate), becoming chartaceous. *Festuca myuros* L. Rare and probably not persistent in disturbed soil, n.-cen. Tex. and n. part of Rio Grande Plains, spring; Atl. and Pac. Coastal States, Wisc., O., La., Tex., Ariz., and Nev.; Mex. and S. A.; introd. from Eur.

5. *Vulpia dertonensis* (All.) Volk. Loosely tufted annual; culms 1-8 dm. long, 0.2-2 mm. thick, shortly decumbent basally and geniculate at the lower nodes, otherwise erect, simple; blades 0.3-2 mm. broad, mostly involute; panicles either shortly interrupted-spikelike or often with a few stout branches at the base diverging at low angles; spikelets laterally compressed, 4- to 6-flowered; first glume more than half as long as second; lemmas not at all keeled, cymbiform, the lowest ones with awns 9-13 mm. long and lanceolate bodies 5-8 mm. long, dorsally scabrous toward the apex and marginally revolute and hyaline (not ciliate), becoming chartaceous. *Festuca dertonensis* (All.) Asch. & Graebn. Reported to have been introd. in n.-cen. Tex.; if so rare and probably not persistent, spring; nat. of Eur., adv. in Pac. States.

21. LOLIUM L.

Inflorescences elongate, terminal, lax spikes; axis sculptured with a niche for a spikelet on one side of each internode, the axis remaining intact; spikelets 2-ranked, solitary, each fitting within the niche of the internode, slightly if at all laterally compressed, 5- to 20-flowered, all the florets perfect except the terminal one; rachilla eventually abscising above the glume(s) and at the lower part of each node; first glume obsolete or much-reduced, adaxial when present (thus hidden except on terminal spikelet), 3- to 5-nerved; second glume abaxial, strongly 5- to 7-nerved, membranous, obtuse; lemmas broadly ovate, 5- to 7-nerved, eventually marginally revolute.

A genus of perhaps 12 species in temperate Eurasia.

1. Glume shorter than the rest of the spikelet or if nearly as long then only 6-10 mm. long; plant perennial 1. *L. perenne*.
1. Glume equaling or exceeding the rest of the spikelet, 10-20 mm. long; plant annual ..
..... 2. *L. temulentum*.

1. *Lolium perenne* L. RYEGRASS. Tufted perennial; culms 3-10 dm. long, mostly erect; spikes 7-25 cm. long, compressed; spikelets 4- to 20-flowered; second (only) glume 6-10 (-14) mm. long, from less than a third to nearly as long as the rest of the spikelet; lemmas awnless or short-awned. *L. multiflorum* Lam. Scattered in lawns and other disturbed areas over most of the state except the Rio Grande Plains, spring; nat. of Eur., now widely introd. in temp. parts of N. A. and S. A.

2. *Lolium temulentum* L. DARNEL. Annual; culms 4-10 dm. long, mostly erect; spikes 1-3 dm. long; spikelets 5- to 8-flowered; second (or only) glume 1-2 cm. long, equaling or exceeding the remainder of the spikelet; lemmas short-awned. Weed in lawns in n.-cen. Tex., apparently a repeated waif but not persistent, spring; nat. of Eur., now widely introd. in temp. N. A.

22. SCLEROCHLOA BEAUV.

A monotypic Eurasian genus.

1. *Sclerochloa dura* (L.) Beauv. Densely tufted annual; culms very numerous, 2-8 cm. long, ascending, simple, the sheaths loose; ligule an acute hyaline scale; blades short, flat or folded, apically bluntly pointed; panicles dense, secund, ovate in outline, with a flattened zigzag axis 1-2 cm. long; the upper of the attached ascending branches 1 mm. long (bearing only solitary spikelets), the lower again branched, with glomerules of 2 to 5 nearly sessile spikelets; each of these branches eventually abscising at the juncture to the main axis, falling entire with the 1 to 5 spikelets still attached; spikelets 3-flowered (upper floret sterile), moderately laterally compressed, about 7 mm. long; rachilla remaining intact; glumes unequal, both firm medially and hyaline marginally, the first 3- to 5-nerved, the second 5- to 7-nerved, larger and not equaling the lowest lemma; lower lemma about 5 mm. long, firm and green medially, hyaline marginally, blunt and awnless, with 5 prominent nerves and often other obscure intermediate nerves, these not or only slightly converging apically, appearing to terminate severally near the distal margin. Rare in disturbed areas near roads in n.-cen. Tex. and the Edwards Plateau, spring; Eur., now introd. and scattered over parts of the U.S.

23. CATAPODIUM LINK

A genus of 2 species in Europe and the Mediterranean region.

1. *Catapodium rigidum* (L.) C. E. Hubb. Loosely tufted annual; culms 5-20 cm. long, 0.6-1 mm. thick, usually shortly decumbent basally, mostly ascending; sheaths shorter than their internodes; ligule a hyaline scale; blades short, flat or usually mostly involute-falcate; panicles 2-9 cm. long, 5-19 mm. broad, of 10 to 20 ascending branches, secund on the flattened and slightly zigzag axis, each 4-17 mm. long and floriferous to the base; pedicels 1 mm. long, appressed; spikelets secund on the lower side of the branches, 4- to 10-flowered, linear; florets all perfect except the terminal 1 or 2 which are staminate or rudimentary; rachilla very tardily breaking at the lower part of each node (not the

upper part as stated in manuals); first glume about 1 mm. long, 1-nerved, acutish; second glume about 2 mm. long, 3-nerved, acutish; lemmas elliptic, not at all keeled, convex, apically acute, 5-nerved (but all the nerves extremely obscure), marginally revolute, the lower ones about 2 mm. long; palea equaling lemma. *Scleropoa rigida* (L.) Griseb., *Demazeria rigida* (L.) Tutin. Local in disturbed areas, e., s.e. and n.-cen. Tex. and e. part of Edwards Plateau, spring; introd. from Euras., now scattered in N. A.

24. POA L. BLUEGRASS

Inflorescence paniculate; spikelets 2- to several-flowered, laterally compressed, all the flowers functional except usually the terminal one reduced, in some species the flowers unisexual and in some the male and female flowers on separate plants (at least in some populations); rachilla abscising above the glumes and at the lower part of each node; glumes usually shorter than first lemma, thin (marginally often hyaline), keeled, the first usually 1-nerved, the second 3-nerved; lemmas keeled, ovate-lanceolate, awnless, thin (marginally often hyaline), 5-nerved (or often appearing only 3-nerved, one pair of nerves being obscure).

A genus of about 300 species in cool and temperate regions of the world.

1. Lowest node of panicle with a whorl of 5 to 7 branches (2)
1. Lowest node of panicle with 1 to 3 (rarely 4) branches (3)
- 2(1). Creeping rhizomes 1-2 mm. thick; panicles 5-13 cm. long; lowest lemma 3-4 mm. long 4. *P. pratensis*.
2. Rhizomes absent; panicles more than 10 cm. long; lowest lemma 2.5-3 mm. long 8. *P. sylvestris*.
- 3(1). Lemmas merely microscopically scabrous, with no pubescence 6. *P. involuta*.
3. Lemmas pubescent at least minutely on some of the nerves (4)
- 4(3). Culms basally long-decumbent, stoloniform or subrhizomatous, strongly compressed and with 2 longitudinal keels 5. *P. compressa*.
4. Culms sometimes slightly compressed but never 2-keeled (5)
- 5(4). Keel of lemma basally with a tuft of flexuous silky white hair (6)
5. Lemma not tufted (sometimes weakly so in *P. annua*) (9)
- 6(5). Lowest lemmas 5-6 mm. long; fragile rhizomes 1-2 mm. thick 2. *P. arachnifera*.
6. Lowest lemmas 3-4 mm. long; rhizomes absent (7)
- 7(6). Tufted summer perennial; lemmas firm, buffy-stramineous 9. *P. interior*.
7. Tufted spring annual; lemmas thin, greenish with white margin (8)
- 8(7). Panicles about 1 cm. thick, 5-15 cm. long, interrupted-spike-like 10. *P. Bigelovii*.
8. Panicles broader, more open, 1-7 cm. long 12. *P. Chapmaniana*.
- 9(5). Nonrhizomatous plants of east, southeast and north-central Texas, rarely to Edwards Plateau (10)
9. Rhizomatous or subrhizomatous plants of Trans-Pecos Texas and the Plains Country (11)
- 10(9). Annual 3-30 cm. tall; lowest lemmas 3-3.5 mm. long; panicle 1-7 cm. long 11. *P. annua*.
10. Perennial 30-60 cm. tall; lowest lemmas 3.5-5 mm. long; panicle 7-20 cm. long 7. *P. autumnalis*.
- 11(9). Lower part of the internerve area of the lemma finely pubescent (use strong lens!); lower panicle branches naked in the lower quarter to a third their length; Plains Country 3. *P. arida*.
11. Lower part of the internerve area of the lemma glabrous; lower panicle branches floriferous nearly to the base; Trans-Pecos mountains 1. *P. Fendleriana*.

1. *Poa Fendleriana* (Steud.) Vasey. MUTTON-GRASS. Tufted perennial with fragile whitish rhizomes 1-2 mm. thick and 5-15 cm. long (these usually detached during collecting); culms 1-4 dm. long, mostly erect; lower sheaths white-stramineous; blades of midculm often equaling or exceeding the panicle, folded and marginally very narrowly involute or rarely partially flat, apically subspinulose; upper blades greatly reduced; panicles 2-10 cm. long, narrowly ovoid to interrupted-spikelike, rather dense with a few short ascending branches floriferous nearly to the base; lowest node with 2 or 3 branches; pedicels about 1 mm. long; spikelets laterally compressed, 4- to 7-flowered, whitish-stramineous, the florets perfect or unisexual with male and female flowers on separate plants; lemmas dorsally keeled, very thin, almost hyaline, minutely appressed-pubescent on the lower part of the midnerve and marginal nerves, the intermediate nerves obscure, the internerve area glabrous even at the base; basal flexuous coma absent; lower lemmas 4-5 mm. long, apically blunt; palea narrow, acute, nearly equaling the lemma. Rocky slopes in Trans-Pecos mts., infrequent, spring (rarely again in late summer-fall); most of w. U.S. e. to N.D., S.D., Neb., Colo., N.M. and Tex.; also n. Mex.

2. *Poa arachnifera* Torr. TEXAS BLUEGRASS. Tufted perennial with fragile rhizomes 1-2 mm. thick and 5-20 cm. long, staminate or pistillate; aerial culms 30-75 cm. long, mostly erect; blades rarely equaling the panicle, mostly much shorter, 2-4 mm. broad, flat or less commonly folded; panicles 5-16 cm. long, 15-50 mm. thick, occasionally interrupted-spikelike or usually broader, ellipsoid or ovoid, usually dense; lowest node with (2) 3 or 4 branches floriferous nearly to the base; spikelets unisexual, nearly sessile, 5- to 9-flowered, laterally compressed; lemmas acute, very thin, nearly hyaline, apically short-pointed, 5-nerved, dorsally keeled; lemmas of *pistillate plants* about 6 mm. long, the midnerve and marginal nerves pubescent in the lower part and basally with a tuft of flexuous silky-white hairs as long as the lemma or longer, the internerves glabrous even at the base; lemma of the *staminate plants* about 5 mm. long, the nerves glabrous and the base with only a weakly developed short tuft. Plains Country, n.-cen. Tex. and Edwards Plateau, parts of e. Tex. and the Trans-Pecos, occurring only on relatively undisturbed prairies, thus now very rare and local, spring; Kan., Okla. and Tex.; introd. elsewhere in the Gulf States.

3. *Poa arida* Vasey. PLAINS BLUEGRASS. Tufted perennial with rhizomes 0.6-2 mm. thick and to 15 cm. long; aerial culms 2-6 dm. long, mostly erect; ligule a thin pointed scale; blades 2-3 mm. broad, usually folded and marginally very narrowly involute, rarely partially flat, sharp-pointed; panicles 5-12 cm. long, very narrow or somewhat open-conical, the lower whorls of branches remote, ascending, usually naked in the lower one-fourth to one-third the length; lowest node usually with 2 or 3 branches; pedicels 1-3 mm. long; spikelets only slightly laterally compressed, 4- to 8-flowered, the flowers perfect; lemmas 3-4 mm. long, the midnerve and marginal nerves minutely pubescent in the lower part, the intermediate nerves obscure, the internerve areas basally finely pubescent; tuft absent. Prairies in Plains Country, infrequent, spring; N.D. to Mont., s. to Tex. and N.M.

4. *Poa pratensis* L. KENTUCKY BLUEGRASS. Tufted perennial with fragile rhizomes 1-2 mm. thick and to 2 dm. long; aerial culms 3-6 dm. long, mostly erect, slightly flattened but not two-keeled; ligule a short usually erose scale; blades thin, 2-4 mm. broad, flat or folded, basally not markedly broader than the top of the sheath; panicles 5-13 cm. long, conical, usually open and with a whorl of 5 flexuous basally naked branches at the lowest node, the successively higher nodes with fewer branches; pedicels 0.5-1.5 mm. long; spikelets somewhat laterally compressed, crowded, 4- to 6-flowered; lowest lemma 3-4 mm. long, green with a broad thin whitish margin, dorsally keeled, 5-nerved, the lower part of the midnerve and marginal nerves pubescent, the intermediate nerves and internerve area glabrous, basally with a long tuft of flexuous silky hairs. Meadows and tame pastures, n.-cen., e. and Trans-Pecos Tex., infrequent and probably not persistent, spring; nat. of Euras., now widely introd. in moist temp. areas of N. A. and S. A.

5. *Poa compressa* L. CANADA BLUEGRASS. Perennial; culms basally long-decumbent, stoloniform or subrhizomatous, strongly compressed, 1-2.5 mm. broad, with 2 longitudinal keels; aerial culms ascending, somewhat geniculate; lower sheaths shorter than the internodes; blades 3-12 cm. long, 1-3 mm. broad, flat or folded; panicles conic-cylindric, 3-10 cm. long, open, with few short branches per whorl rather strikingly

ascending; pedicels 5-10 mm. long; spikelets crowded, laterally compressed, 3- to 6-flowered; lowest lemma 2-3 mm. long, firm, green-stramineous, keeled, 5-nerved, the lower part of the midnerve and marginal nerves minutely pubescent, the very obscure intermediate nerves and internerve areas glabrous, basally with very short scant tuft of silky hair or this absent. Tame pastures, n.-cen. Tex. and the Rio Grande Plains, probably elsewhere, not persistent but repeatedly introd., spring; nat. of Eur., now widely introd. in Am.

6. *Poa involuta* Hitchc. Tufted perennial; culms basally shortly decumbent and sub-rhizomatous or rarely stoloniform, otherwise erect, 0.5-1 mm. thick; blades 1-2 mm. broad, tightly involute for most of the length, ascending; panicles open, 1-2 dm. long, 3-8 cm. broad, usually with 2 basally naked branches at each node; pedicels 5-10 mm. long; spikelets 3- to 5-flowered, laterally compressed; lowest lemmas 2.3-3.5 mm. long, green with broad thin white margins, 5-nerved, merely microscopically scabrous (with no other pubescence); tuft absent. Grassy slopes in Chisos Mts. of the Trans-Pecos, at elev. above 6,000 ft., summer; endemic.

7. *Poa autumnalis* Ell. Tufted perennial; culms 3-6 dm. long, 1-2 mm. thick, erect; blades 1-4.5 mm. broad, mostly flat; panicles open, 7-20 cm. long, 3-9 cm. broad, the lowest node with usually 2 long branches that are naked for two-thirds to four-fifths their length; spikelets 4- to 6-flowered, laterally compressed; lowest lemmas 3.5-5 mm. long, green, with broad thin white margins, keeled, 5-nerved, the midnerves and marginal nerves pubescent at least in the lower part, the intermediate nerves glabrous, the internerve areas glabrous or minutely pubescent; basal tuft completely absent. Rich woods, e. and s.e. Tex., infrequent, spring; e. and s. U.S., n. to Pa. and Mich., w. to Ill., Ark. and Tex.

8. *Poa sylvestris* Gray. Tufted perennial; culms 3-60 cm. long, 1-2 mm. thick, erect; blades 2-5 mm. broad, flat; panicles open, 10-15 cm. or more long, conical, the lowest node with 5 to 7 spreading branches that are naked a little more than half their lengths; spikelets laterally compressed, 2- to 4-flowered; lowest lemmas 2.5-3 mm. long, green with narrow thin white margins, keeled, 5-nerved, the midnerves and marginal nerves pubescent at least in the lower part, the intermediate nerves glabrous, the internerve areas glabrous or minutely pubescent, the base with a long tuft of silky white flexuous hair. Reported to occur in e. Tex.; if present then rare in rich woods, spring; most of e. U.S. w. to Neb., Kan. and Okla.

9. *Poa interior* Rydb. Tightly tufted perennial; culms numerous, 2-5 dm. long, about 1 mm. thick, strictly erect; blades short, about 1 mm. broad, flat, erect; panicles 4-8 cm. long, 1-2 cm. broad, rather dense, almost spiciform, strictly erect, the lower node with 2 (rarely 3) strictly erect basally naked branches; spikelets crowded, laterally compressed, 2- to 4-flowered; lowest lemmas 3-4 mm. long, keeled, stramineous, firm, 5-nerved, the midnerve and marginal nerves pubescent at least in the lower part, the intermediate nerves very obscure, the internerve areas glabrous, the base with a weak tuft of long flexuous silky white hair. Reported to occur in Tex.; if present then rare at highest elev. in the Trans-Pecos mts., summer; forested mt. slopes, Que. to B. C. and s. in the mts. to Ariz. and N.M.

10. *Poa Bigelovii* Vasey & Scribn. Tufted annual; culms 6-35 cm. long, about 1 mm. thick, mostly erect (slightly geniculate below); blades thin, 2-5 mm. broad, flat; panicles 5-15 cm. long, about 1 cm. thick, interrupted-spiciform or slightly looser, the lower branches floriferous most of the length; spikelets laterally compressed, 3- to 5-flowered; lowest lemmas 3-4 mm. long, stramineous-green with white-hyaline margins, 5-nerved, the midnerves and lower part of marginal nerve minutely pubescent, the intermediate nerves obscure and glabrous, the internerve areas minutely pubescent or glabrous, basally with a tuft of silky white flexuous hairs. Common in crevices and under shrubbery on north-facing slopes in the Trans-Pecos, rare e. to n.-cen. Tex. (waif), spring; Nev., Ut., Colo. and Okla. s. to Chih. and Coah.

11. *Poa annua* L. Tufted annual; culms 3-30 cm. long, 0.5-1 mm. thick, mainly erect (slightly geniculate below); blades 1.5-4 mm. broad, flat, thin; panicles 1-7 cm. long, conical, open, the branches spreading, the lowest node with 1 or usually 2 basally naked branches; spikelets laterally compressed, 3- to 6-flowered; lowest lemmas 3-3.5 mm. long, keeled, greenish with broad white-hyaline margins, 5-nerved, minutely pubescent on the

lower part of all 5 nerves, the internerve areas glabrous, the keel basally with a few slightly long hairs but lacking a long flexuous tuft. Crevices of sidewalks and flagstone patios, flower-beds, lawns and rich woods, e., s.e. and n.-cen. Tex. and Edwards Plateau, spring; nat. of Eur., now widely established in temp. N. A. and S. A.

12. *Poa Chapmaniana* Scribn. Tufted annual; culms 3-30 cm. long, 0.5-1 mm. thick, mostly erect (slightly geniculate below); blades 1.5-4 mm. broad, flat, thin; panicles 1-7 cm. long, conical, open, the branches spreading, the lowest node with 1 or usually 2 basally naked branches; spikelets laterally compressed, 3- to 5-flowered; lowest lemmas about 3 mm. long, keeled, greenish with narrow white-hyaline margins, 3-nerved, minutely pubescent on the 3 nerves, the keel also basally with a short tuft of silky flexuous hairs. Said by some authors to be merely a form of *P. annua*. Rare in e. and n.-cen. Tex., spring; most of e. U.S. w. to Neb., Kan., Okla. and Tex.

25. BRIZA L. QUAKING GRASS

A genus of 20 species in temperate North America and South America; we have only a single species. Another species, *B. maxima* L., the big quaking grass, is occasionally cultivated but does not persist or escape.

1. *Briza minor* L. LITTLE QUAKING GRASS. Annual; culms 1-4 dm. long, erect or at the very base shortly decumbent; ligule a long hyaline scale; sheaths shorter than the internodes, having an inverted V-shaped juncture to the blade; blades 5-10 mm. broad, flat; panicle broadly ovoid, 5-12 cm. long, about as broad, open, diffuse, with ascending-spreading branches that are twice trichotomous and naked; spikelets pendulous from the ultimate capillary pedicels at the periphery of the panicle, 3-5 mm. long, 6- to 8-flowered, broader than long, markedly tapered, only very slightly laterally compressed; glumes 2, very broad, spreading, 3-nerved, with broad hyaline margins; lemmas 1.5-2 mm. long, spreading, cymbiform, 5-nerved, marginally broadly hyaline, basally auriculate and thus basally overlapping each other; rachilla abscising above the glumes and at the lower part of each node. Infrequent in swales and in woods or open sandy soil in e. and s.e. Tex., spring; nat. of Eur., widely introd. in the U.S.

26. DIARRHENA BEAUV.

A monotypic genus.

1. *Diarrhena americana* Beauv. Perennial from short slender scaly rhizomes; aerial culms erect, 45-130 cm. long, simple, slender; ligule a short scale; blades soft, 8-18 mm. broad, flat; panicle terminal, long-exserted, 9-25 cm. long, mostly narrowly interrupted-spike-like or with a few weak drooping branches toward the base, few-flowered; spikelets appressed to the axis and branches, 3- or 4-flowered, 8-15 mm. long, glabrous, all flowers perfect or the pistil of the terminal one often abortive; glumes very short, much shorter than the lowest lemma; rachilla abscising above the glumes and at the lower part of each lemma node; lemmas ovate, 7-10 mm. long, abruptly acuminate and apiculate, chartaceous, 3-nerved, the nerves converging to the apex of the subulate or awnlike apex; grain large, beaked, at maturity forcing open the floret. Rare in deep mature beech-maple woods, n. part of e. Tex., summer-fall; Va. to Mich. and S.D., s. to Tenn. and Tex.

27. LAMARCKIA MOENCH

A monotypic genus; originally spelled *Lamarkia*.

1. *Lamarckia aurea* (L.) Moench. GOLDENTOP. Densely tufted annual; culms 1-4 dm. long; foliage soft; ligule a pointed hyaline scale; panicles erect, thickly spike-like, 2-7 cm. long, 1-2 cm. thick, consisting of numerous short spreading secund branches (each having a fascicle of 4 to 5 (rarely 6) appressed spikelets of 2 kinds); each fascicle with one (rarely 2) central fertile spikelet and the rest sterile; fascicles falling entire; fertile spikelet short, consisting of one stalked fertile floret and one minute stalked sterile floret, the lemma of each with a capillary awn from just below the apex; sterile spikelets

elongate, linear, with numerous unawned lemmas. Rare in desert areas in the Trans-Pecos, spring; a Medit. species, introd. and escaped in Calif., Ariz., Tex. and n. Mex.

28. DACTYLIS L.

A genus of 5 species indigenous to temperate Eurasia.

1. *Dactylis glomerata* L. ORCHARD GRASS. Densely tufted perennial; culms geniculate, ascending, 6-10 dm. long; ligule a lacerate hyaline scale; sheaths and blades soft, the blades flat and mostly aggregated toward the base; panicles long-exserted, mostly narrow, erect, with few mostly ascending branches, each of which bears apically a very dense aggregation (about 1 cm. thick) of secund nearly sessile fascicles of spikelets; spikelets few-flowered, laterally compressed; rachilla abscising at the lower part of each node; glumes and lemmas keeled, the keels hispid; lemmas 5-nerved, about 7 mm. long, narrowly lanceolate, mucronate. Rare in farm pastures and roadsides in Plains Country (Lubbock Co.), spring-summer; widespread in temp. areas, nat. to Euras.

29. AGROPYRON GAERTN.

WHEATGRASS

Perennials; corners of base of blades discolored and minutely auriculate or pointed; inflorescences spikelike, the axis usually slightly zigzag, unbranched, remaining intact; spikelets several-flowered, solitary (rarely in pairs) at each node, sessile, laterally compressed, turned with one side appressed to the rachis (or to the next spikelet above when crowded); all florets perfect or usually the terminal 1 or 2 reduced; rachilla abscising above the glume and at the lower part of each node; glumes lanceolate, acute, persistent, roundly keeled, equal, firm, several-nerved (the nerves obscure in some species); lemmas roundly keeled, 5- to 7-nerved (nerves obscure in some species at some stages of maturity), firm to subindurate, lanceolate, acute or in some species awned, eventually the lateral margins revolute.

A genus of about 100 or more species in temperate regions.

1. Internodes of spike about 1 mm. long 1. *A. cristatum*.
1. Internodes longer (2)
- 2(1). Lower lemmas with outwardly-curved awns 12-20 mm. long 2. *A. arizonicum*.
- 2. Lower lemmas awnless or with awns only 1-3 mm. long (3)
- 3(2). Bases of the aerial culms clumped, erect; slender rhizomes present (but fragile and easily detached); spikes densely flowered (spikelets often overlapping more than half their lengths) 3. *A. Smithii*.
3. Rhizomes very rarely developed but bases of culms always shortly decumbent; spikes 10-22 cm. long, the spikelets overlapping for less than half their lengths (4)
- 4(3). Glumes about 2.5 mm. broad, about two thirds as long as the spikelet at maturity 4. *A. trachycaulum*.
4. Glumes about 2 mm. broad, about half as long as the spikelet at maturity (or less) ..
..... 5. *A. inerme*.

1. *Agropyron cristatum* (L.) Gaertn. CRESTED WHEATGRASS. Rhizomes absent; culms geniculate; spikes short and very dense, the internodes only about 1 mm. long; lemma with short awns. Rarely or infrequently planted in the Plains Country, persisting but not spreading, summer; introd. from Russ., widely but sparingly scattered in N. A.

Very similar and to be expected also is *A. desertorum* (Fisch.) Schult., in which the plants are slightly more robust and the awns of the lemma average shorter.

2. *Agropyron arizonicum* Scribn. & Sm. Culms decumbent at the base but creeping rhizomes in the usual sense absent; spikes often nodding, the axis flexuous and the internodes increasing in length from bottom to top (rather than decreasing as in the other species); spikelets remote; lower lemma with outcurving awns 12-20 mm. long. *Elymus arizonicus* (Scribn. & Sm.) Gould. Frequent in higher parts of mts. in the Trans-Pecos, summer; Calif., Nev., Ariz. to Tex. and n. Mex.

The typical populations in Arizona have lemmas with longer awns than ours.

3. *Agropyron Smithii* Rydb. WESTERN WHEATGRASS. Forming large colonies by means of slender fragile easily detached rhizomes, the aerial culms erect even at the base; spikes strictly erect, rather dense, the spikelets overlapping usually more than half their lengths. *Elymus Smithii* (Rydb.) Gould. Abundant (formerly) in the prairies of the higher parts of the Plains Country, infrequent e. to n.-cen. Tex. and w. to the Trans-Pecos, late spring-summer; w. U.S. e. to O., Ky., Tenn., Ark. and Tex.

This species apparently tends to disappear under grazing.

4. *Agropyron trachycaulum* (Link) Malte. SLENDER WHEATGRASS. Rhizomes absent but basal parts of aerial culms shortly decumbent; spikes long and slender, the spikelets overlapping less than half their lengths; glumes lance-ovate, broader than the spikelet is thick at maturity, prominently veined when immature, about two thirds as long or as long as the spikelet at maturity. *Elymus trachycaulus* (Link) Shinnars. Reported to occur in the Plains Country; if present then exceedingly rare, summer; s. Can. and n. U.S. s. to W.Va., O., Ind., Ill., Mo., Kan., N.M., Ariz. and Calif.

5. *Agropyron inerme* (Scribn. & Sm.) Rydb. Rhizomes absent but basal parts of aerial culms shortly decumbent; spikes long and slender, the spikelets not or only shortly overlapping; glumes narrowly lanceolate, about half as long as the spikelet at maturity. Frequent in mts. in the Trans-Pecos, summer; B. C. and n.w. U.S. s. to Nev., Ut., Colo. and Tex.

Our plants are tentatively referred to by this name.

30. ELYMUS L. WILD-RYE.

Perennials; culms slender; minute pointed auricles present at juncture of blade and sheath; inflorescence a terminal spike, the axis slender with short internodes, remaining intact; spikelets collaterally paired at each node, each basally only slightly laterally compressed and with one side toward the axis but each distally (due to contortion of rachilla) with 1 keel toward the axis; spikelets 2- to 6-flowered, all the flowers perfect except the terminal 1 or 2; glumes equal, firm to subindurate, lanceolate to subulate, 1- to several-nerved; lemmas lanceolate, cymbiform, not keeled, eventually subindurate, obscurely 5-nerved, awned from the tip in most species.

A genus of about 70 species in temperate North America and South America.

1. Rhizomes present; awns of lemmas 0-2 mm. long 1. *E. triticoides*.
1. Rhizomes absent but base of culm usually decumbent; awns of lemmas 5-45 mm. long (2)
- 2(1). Glumes basally discolored, indurate, roundish in transection and diverging from the axis at a large angle, becoming broader and flatter toward the middle and then tapering to the awn 4. *E. virginicus*.
2. Glumes basally flat, neither discolored, indurate nor rounded, diverging at a low angle, broadest near the base and tapering the full length to the awn (3)
- 3(2). Glumes basally 0.2-0.5 (-0.7) mm. broad 2. *E. interruptus*.
3. Glumes basally 0.7-1.4 mm. broad 3. *E. canadensis*.

1. *Elymus triticoides* Buckl. Perennial from creeping rhizomes; aerial culms erect, 6-12 dm. long; spikes erect, 7-20 cm. long, slender, the spikelets of successive nodes overlapping only a sixth to a half their lengths; spikelets paired; glumes subulate, much shorter than the body of the lemma; lemma tapering into a mucro or awn only 1-2 mm. long. Reported to occur in the Plains Country and Trans-Pecos; if present exceedingly rare and probably not nat., spring; abundant in Pac. States, less frequent e. to the mts. of Mont., Wyo., Colo. and N.M.

This species is apparently more closely related to species included in the genus *Agropyron* than it is to the other 3 species of *Elymus* below.

2. *Elymus interruptus* Buckl. Perennial; culms basally decumbent, mostly ascending, 6-10 dm. long; peduncles typically 2-3 dm. long (that is, the length from the uppermost culm node to the lowermost spike node); spikes 5-12 (-15) cm. long, mostly erect, less commonly nodding; internodes 10-12 mm. long except the lowermost which is 15-20 mm.

long; glumes basally 0.2-0.5 (0.7) mm. broad, ridge-keeled to flat abaxially, straight and diverging at a low angle, produced into a scabrous awn, never becoming indurate; lemmas glabrous, with scabrous awns mostly 15-22 mm. long and bowed outward slightly. Rare or infrequent in creek canyons on the Edwards Plateau and in the Trans-Pecos, spring; Tex., Ark. and N.M.

Some plants appear to combine characters of this species and of *E. canadensis* and/or *E. virginicus*, apparently as a result of past and perhaps continuing crossing.

3. *Elymus canadensis* L. CANADA WILD-RYE. Perennial; culms basally decumbent, mostly ascending, 8-15 dm. long; peduncles (at maturity of the spike!) typically 25-45 cm. long, spikes 8-15 cm. long, nodding; spikelets usually paired or less commonly in threes at each node; glumes basally 0.7-1.2 (-1.4) mm. broad, ridge-keeled and fairly straight and diverging at a low angle, tapering into a slender scabrous outbowed awn, never becoming completely indurate but remaining flexible; lemmas glabrous to pubescent, with awns mostly 20-35 (-45) mm. long that diverge or curve away from the axis slightly or greatly. Incl. forms that have been called var. *brachystachys* (Scribn. & Ball) Farw., var. *robustus* (Scribn. & Sm.) Mack. & Bush and var. *villosus* (Muhl.) Shinnars (*E. villosus* Muhl.). Nearly throughout the state except s. part of Rio Grande Plains, commonest on wooded slopes near streams, spring (less commonly summer); nearly throughout temp. N. A. (except Ala., Ga., Fla. and S.C.).

This species is somewhat variable and grades into both *E. virginicus* and *E. interruptus*.

4. *Elymus virginicus* L. Perennial; culms basally erect or very shortly decumbent, mostly erect, 6-12 dm. long, peduncles (at maturity of the spike!) 7-30 cm. long; spikes 3-12 cm. long, mostly erect or at least ascending; spikelets paired; glumes linear-elliptic, at the very base discolored, tending to be terete in transection, strongly indurate and diverging at a large angle from the axis but upward broader, flatter and less thoroughly indurate, 1.2-2.2 mm. broad near the middle and becoming more erect, tapered upward to a straightish ascending or slightly divergent awn 5-25 mm. long. Incl. forms that have been called var. *australis* (Scribn. & Ball) Hitchc., var. *glabriflorus* (Vasey) Bush and var. *intermedius* (Vasey) Bush. Frequent in e., s.e. and n.-cen. Tex., less abundant in n. parts of Rio Grande Plains, Edwards Plateau and Plains Country, spring-summer; e. U.S. w. to Wash., Ida., Ut. and n. N.M., rare to n. Ariz.

This species is highly variable. Many plants referred here show some characters of *E. canadensis*, with which this species undoubtedly intergrades.

31. HORDEUM L. BARLEY

Tufted annuals (1 species a weak perennial); inflorescences dense terminal spikes; rachis abscising at the lower part of each node except in *H. vulgare*; spikelets in threes at each node, the central one largest, the lateral ones reduced except in *H. vulgare* and *H. leporinum* and pedicellate except in *H. vulgare* and some specimens of *H. pusillum*, 1-flowered; lemma contorted so that its back is abaxial; rachilla produced beyond the lemma node as a point; glumes setaceous, produced into awns; lemmas cymbiform or flatter, not keeled, obscurely 5-nerved, tapering into an awn.

A genus of about 20 species of temperate regions.

1. All 3 spikelets at each node sessile and perfect; axis of spike remaining intact; lemmas 4-6 mm. broad across the dorsum4. *H. vulgare*.
1. Lateral spikelets shortly pedicelled, staminate or rudimentary; axis of spike abscising at the lower part of each node (2)
 - 2(1). Lemmas of lateral spikelets longer than those of the central spikelet3. *H. leporinum*.
 2. Lemmas of lateral spikelets reduced (3)
 - 3(2). Awns of glumes and lemmas 5-15 mm. long2. *H. pusillum*.
 3. Awns of glumes and lemmas 25-60 mm. long1. *H. jubatum*.

1. *Hordeum jubatum* L. FOXTAIL BARLEY. Short-lived perennial or often behaving as a spring annual; culms basally decumbent, mostly ascending, 30-65 cm. long; spikes 2-11

cm. long (not including awns) and about 1 cm. thick (not including awns), nodding, dense, the rachis abscising at the lower part of each node; spikelets in threes at each node, the lateral ones pedicelled and with slightly smaller lemmas than the central one and merely staminate; awns of the various glumes and lemmas not curved at maturity, 25-60 mm. long. Infrequent weed in Plains Country and Trans-Pecos, spring; w. U.S. e. to Plains States and as a weed e. to N. E.

2. *Hordeum pusillum* Nutt. LITTLE BARLEY. Annual; culms 1-4 dm. long, geniculate in the lower part, mostly ascending; spikes 2-9 cm. long, 7-8 mm. thick, dense, the rachis eventually abscising at the lower part of each node; size-reduction and degree of pedicellation of lateral spikelets only slight; awns of lemmas (etc.) only 5-15 mm. long, ascending. Abundant weed in n.-cen. Tex. and the Plains Country, less abundant in e., s.e. and Trans-Pecos Tex. and the Rio Grande Plains, spring; nearly all states except N. E.

3. *Hordeum leporinum* Link. Tufted annual; culms 12-60 cm. long, geniculate in lower part, mostly ascending; spikes 3-10 cm. long, 10-15 mm. thick, dense, the axis eventually abscising at the lower part of each node; lemmas of pedicellate lateral spikelets nearly half again as big as those of the fertile sessile central spikelet; awns of lemmas (etc.) 10-35 mm. long, ascending. Infrequent weed in the Plains Country, Edwards Plateau and Trans-Pecos, spring; nat. of Eur., now widespread in scattered parts of N. A.

4. *Hordeum vulgare* L. BARLEY. Annual; culms 5-10 dm. long, mostly ascending; pointed auricles conspicuous at juncture of blade and sheath; spikes 5-10 cm. long (not including awns) and about 1 cm. thick, dense, the axis remaining intact; all 3 spikelets at each node sessile and fertile, nearly equal in size; bodies of the lemmas broadly ovate, eventually indurate, passing into stiffly ascending stout awns 8-15 cm. long. A few plants have been collected at scattered points as waifs near barley fields, not persistent; introd. from the Old World.

32. TRITICUM L.

A genus of about 20 species in Eurasia and the Mediterranean region.

1. *Triticum aestivum* L. WHEAT. Tufted annual; culms 3-10 dm. long, usually shortly decumbent basally; sheaths loose; blade with minute pointed auricles at the lower corners; inflorescence a terminal erect dense spike 5-12 cm. long, about 1 cm. thick; axis unbranched, slender, with internodes 2-4 mm. long, remaining intact; spikelets solitary at each node, 2-ranked, laterally compressed with 1 side appressed to the axis, eventually indurate, 2- to 5-flowered (only the lower 2 or 3 flowers perfect); glumes broadly ovate, equal, keeled, 3-nerved, in some varieties awned; lemma keeled, lopsided, acute or in some varieties awned. Wheat occurs as a waif along roads in wheat-growing areas but apparently does not persist, spring; introd. from the Old World.

33. SITANION RAF.¹⁰

SQUIRREL-TAIL

A genus of 4 species in temperate western North America, very weakly distinguished from *Elymus*; we have one species.

1. *Sitanion longifolium* J. G. Sm. Tufted short-lived perennial; culms 1-5 dm. long, ascending; minute pointed auricles present at the juncture of the sheath and blade; blades slender, flat or loosely involute, ascending; inflorescence a spike 3-9 cm. long (excluding awns), about 1 cm. thick (excluding awns), the rachis slightly flexuous, eventually abscising at the lower part of each node; spikelets paired at each node, 2- or 3-flowered, the upper florets reduced; glumes about 0.5 mm. broad basally, each slightly tapered upward into a long outcurved awn; lemmas cymbiform, not or obscurely keeled, at length the margins strongly revolute, obscurely 5-nerved, tapered upward into a scabrous eventually outcurved awn 2-10 cm. long. Abundant in disturbed areas in the Trans-Pecos and Plains Country, less frequent e. to Edwards Plateau, spring-summer; w. U. S. e. to S. D., Neb., Kan., Okla. and Tex. s. to Mex.

¹⁰ Adapted from F. Douglas Wilson in *Brittonia* 15: 303-323. 1963.

34. SECALE L.

A genus of 4 species in Eurasia and Africa.

1. *Secale cereale* L. RYE. Tufted annual; culms 5-10 dm. long, erect; blades not noticeably auricled basally; inflorescence a terminal dense spike 5-12 cm. long and about 1 cm. thick; axis unbranched, with slender internodes 2-4 mm. long, remaining intact; spikelets solitary at each node, 2-ranked, laterally compressed, with 1 side appressed to the axis, eventually chartaceous, usually 2-flowered (both flowers perfect); glumes equal, keeled, narrowly lanceolate with a subulate awnlike tip and only a solitary median nerve; lemma lance-ovate, keeled, 5-nerved, shortly and finely pectinate-ciliate at the exposed margins, with a scabrous awn 5-60 mm. long. A waif along roadsides and in disturbed areas, especially near rye fields, not persistent, spring; introd. from the Old World.

35. AEGILOPS L.

A genus of 25 species in western Asia.

1. *Aegilops cylindrica* Host. GOATGRASS. Tufted annual; culms 3-5 dm. long, erect; blades with minute pointed auricles at the lower corners; inflorescence a terminal rigidly erect dense nearly cylindrical spike 5-10 cm. long (not including awns) and about 3 mm. thick; axis unbranched, with thick sculptured internodes 7-10 mm. long, each with a niche to accommodate the spikelet of the subtending node, the axis eventually abscising at the lower part of each node; spikelets solitary at each node, fitting in the niche of the internode, only very slightly laterally compressed (one side being exposed), eventually subcoriaceous, 2- to 5-flowered (upper florets reduced); glumes lanceolate, equal, keeled, several-nerved, those of the uppermost spikelets awned; lemmas several-nerved, keeled, lopsided, acute or those of the uppermost spikelets with scabrous awns 3-6 cm. long. Roadsides and other disturbed areas, n.-cen. Tex. and the Plains Country, spring-early summer; introd. from Euras., now rather widespread in N. A.

36. KOELERIA PERS.

Tufted annuals or perennials; inflorescence a terminal erect dense or interrupted spiciform panicle; spikelets sessile, laterally compressed, 3- to 6-flowered, the terminal 1 or 2 flowers reduced, the lower ones perfect; rachilla abscising above the glumes and at the lower part of each node, extending beyond the uppermost lemma node as a bristle; glumes persistent, the first slightly shorter and much narrower than the second, 1-nerved; second glume obscurely 3-nerved, nearly equaling the lowermost lemma in length, with broad thin margins; lemmas ovate, very obscurely 5-nerved, awnless or short-awned from the apex, with broad subhyaline margins.

About 55 species in temperate regions in the world.

1. Perennial of grassy uplands; spikelets merely scaberulous, not pubescent 1. *K. pyramidata*.
 1. Annual of disturbed areas near the coast; spikelets with some pubescence (use lens) 2. *K. Gerardi*.

1. *Koeleria pyramidata* (Lam.) Beauv. JUNEGRASS. Tufted perennial; culms 25-60 cm. long, erect; leaves mostly clustered at the base of the tuft; panicle 5-15 cm. long, 6-20 mm. thick, often tapered above; spikelets mostly 2- to 4-flowered, nearly glabrous or merely minutely scaberulous; second glumes and lowest lemmas 3-6 mm. long, the lemmas acute but rarely awned. *K. macrantha* (Ledeb.) Spreng., *K. gracilis* Pers., *K. cristata* Pers. (Persoon's names are illegit.) Infrequent in grassland at considerable elev. in the Trans-Pecos, rare in grasslands in the Plains Country and n.-cen. Tex., summer; widespread in temp. areas of the N. Hemis.

2. *Koeleria Gerardi* (Vill.) Shinners. Tufted annual; culms 8-30 cm. long, slightly geniculate and somewhat branched in the lower part, mostly simple and erect; panicle 2-7 cm. long, 5-8 mm. thick, slightly tapered above; spikelets mostly 4- to 6-flowered, with some pubescence on the glume and lemmas; second glumes and lowest lemmas 2.5-3

mm. long, the lemmas shortly awned from the bifid apex. *K. phleoides* (Vill.) Pers. (an illegit. name), *Lophochloa cristata* (L.) Hylander. Rare waif in coastal areas near Galveston, probably not persistent, spring; nat. of Eur., introd. in various temp. areas.

37. SPHENOPHOLIS SCRIBN.

WEDGEGRASS

Soft tufted perennials; culms ascending; inflorescence a terminal panicle with much-branched main branches, these usually appressed or at least ascending; pedicels abscising just below the spikelets; spikelets slightly laterally compressed, 2- or 3-flowered, all flowers perfect (?); rachilla extended beyond the last lemmas as a bristle; first glume linear-filiform, green; second glume usually slightly exceeding the first in length, broadly obovate, truncate to slightly acute apically, marginally broadly hyaline or at least thin, medially trunc and obscurely 3- to 5-nerved, the median nervate portion in some species coriaceous or even thickly verrucose and scabrous along the veins, clasping the second lemma; first lemma lanceolate, thin-chartaceous or marginally hyaline, shiny, in almost all species perfectly glabrous; second lemma shorter than the first, similar in texture but in several species scabrous (at least toward the tip), often cellulose under high magnification; paleae hyaline, as long as the lemmas, shiny.

A North American genus of about a dozen species.

1. Lowest lemma 3.5-3.8 mm. long 1. *S. longiflora*.
1. Lowest lemma 1.9-3.3 mm. long (2)
- 2(1). Leaves crowded toward the base of the plant; blades only 1-2 mm. broad, loosely involute 3. *S. filiformis*.
2. Leaves broader, mostly flat (3)
- 3(2). Panicle very open and relatively few-flowered, 10-50 mm. broad, a 1-cm. transection near the middle enclosing 8 to 15 spikelets; first glume 2.2-3 mm. long 2. *S. nitida*.
3. Panicle somewhat open to dense, 5-20 mm. broad, a 1-cm. transection near the middle enclosing 15 to 75 spikelets; first glume 1.3-2.4 mm. long (4)
- 4(3). Lowest lemma 2.7-3.2 mm. long; a 1-cm. transection near the middle of the panicle enclosing 15 to 30 spikelets 4. *S. intermedia*.
4. Lowest lemma 1.9-2.7 mm. long; a 1-cm. transection near the middle of the panicle enclosing (20-) 30 to 75 spikelets, the panicle so dense as to be nearly spikelike .
..... 5. *S. obtusata*.

1. *Sphenopholis longiflora* (Vasey) Hitchc. Perennial; culms 50-75 cm. long, basally about 2 mm. thick, shortly decumbent, geniculate at the lowest nodes, mostly erect; blades 8-18 cm. long, 3-8 mm. broad, flat; panicles 15-20 cm. long, 15-25 mm. thick, rather open, the pedicels flexuous and 2-4 mm. long, a 1-cm. transection near the middle enclosing about 15 to 30 spikelets; spikelets mostly widely gaping, entirely glabrous and shining, remaining soft even at maturity; first glume 3-3.5 mm. long; second glume 3.2-3.5 mm. long, blunt or very slightly pointed; lowest lemma 3.5-3.8 mm. long. *S. obtusata* var. *major* Gray. Infrequent or rare in streamside forests on sandy soil in e. and s.e. Tex., spring; also Ark. and probably La.

2. *Sphenopholis nitida* (Biehler) Scribn. Perennial; culms 35-65 cm. long, basally about 1.5 mm. thick and very shortly decumbent, mostly erect; leaves mostly aggregated toward the base; sheaths usually softly and minutely pubescent; blades 2-4 mm. broad, flat; panicles 9-21 cm. long, 1-5 cm. broad, very open, the pedicels flexuous and 1-2 mm. long, a 1-cm. transection near the middle enclosing about 8 to 15 spikelets; spikelets gaping, shining; glumes mostly quite smooth and thin, the first 2.2-3 mm. long, the second blunt and 2.5-3.2 mm. long; lowest lemma becoming chartaceous, microscopically pustulate-roughened, 2.6-3.3 mm. long; second lemma rougher than the first, toward the apex the pustules with microscopic antrorse-appressed hairs. Infrequent to rare in deep forests on sandy soil in e. Tex., spring; e. U.S. w. to Mich., Mo., Ark. and Tex.

3. *Sphenopholis filiformis* (Chapm.) Hitchc. Perennial; culms 20-55 cm. long, erect, about 1 mm. thick basally; leaves crowded at the very base of the plant, with only 1 or 2 of them along the main length of the culm; blades 1-2 mm. broad, mostly involute,

stiffly ascending; panicles 5-15 cm. long, 5-10 (-20) mm. broad, the pedicels 0.2-0.5 (-1) mm. long, a 1-cm. transection near the middle of the panicle enclosing about 6 to 13 spikelets; spikelets gaping, shining; glumes smooth, the first 1.5-2.3 mm. long, the second blunt and 1.8-2.5 mm. long; lowest lemma becoming very thin-chartaceous, microscopically smooth or pustulate-cellulose, 2.2-2.6 mm. long, mostly minutely pustulate-roughened, toward the apex with microscopic antrorse-appressed hairs. Infrequent to rare in pine woods on sandy soil in e. and s.e. Tex., spring; Coastal States, Va. to Tex.; also Ark. and Tenn.

4. *Sphenopholis intermedia* (Rydb.) Rydb. Perennial; culms leafy, 3-10 dm. long, basally 1-2 mm. thick, very shortly decumbent basally, slightly geniculate at the lower nodes, mostly erect; blades 2-7 mm. broad, flat; panicles 8-20 cm. long, 1-2 cm. thick, with pedicels 0.5-2 mm. long, fairly open, a 1-cm. transection near the middle enclosing about 15 to 30 spikelets; spikelets only narrowly gaping, shining; first glume 1.7-2.4 mm. long; second glume subacute to acute, neither verrucose nor chartaceous medially but only firm and subchartaceous, 2.3-3 mm. long; lowest lemma smooth or microscopically cellulose-pustulate, 2.7-3.2 mm. long. Reported to occur in extreme e. Tex.; if present rare on heavily wooded moist banks, spring; most of U. S.

5. *Sphenopholis obtusata* (Michx.) Scribn. PRAIRIE WEDGESCALE. Perennial; culms leafy, 1-10 dm. long, basally 1-2.5 mm. thick, shortly decumbent, geniculate at the lower nodes, mostly ascending or erect; blades 3-12 mm. broad, flat; panicle dense, usually interrupted-spiciform or slightly more open, 3-18 cm. long, 5-20 mm. broad, with pedicels about 0.5 mm. long, a 1-cm. transection through the middle enclosing about (20) 30 to 75 spikelets; spikelets rarely gaping, usually yellowish; first glume 1.3-2.3 mm. long; second glume very blunt, almost cucullate, with a distinct line separating the chartaceous to subcoriaceous convex median portion from the flat thin margins, 1.7-2.4 mm. long; lowest lemma usually microscopically cellulose-pustulate or scaberulous toward the apex, 1.9-2.7 mm. long; second lemma often more scabrous than the first. Essentially all parts of the state, in moist swales, spring; s. Can. and nearly all of U. S. and higher parts of Mex.

38. TRISETUM PERS.

A genus of 75 species on temperate regions.

1. *Trisetum interruptum* Buckl. Tufted annual; culms 7-60 cm. long, erect, simple; blades mostly rather short, subensiform to erect, mostly flat basally, folded above; panicle interrupted-spikelike, 2-15 cm. long, 3-15 mm. thick, tapered toward the tip, with numerous very short branches, the spikelets at each node often paired with one nearly sessile and one short-pedicelled, each pedicel eventually abscising just below the glumes (this occurring in nature usually after the abscission at the nodes of the spikelet); spikelets about 5 mm. long (not including the awn), slightly laterally compressed, 2- to 3-flowered, the upper (third) floret often rudimentary; rachilla abscising at the lower part of each node, pubescent and prolonged as a point above the uppermost lemma-node; glumes subequal, about equaling the lowest lemma, the first narrower than the second and obscurely 3-nerved, the second 5-nerved, both with a firm green median portion and thin pale margins; lemmas obscurely 5-nerved, minutely pustulate-cellular to pustulate-scabrous, apically bifid (the teeth acute) and bearing on the back shortly below the notch a geniculate awn 4-8 mm. long. Infrequent nearly throughout the state except in extreme e. parts of e. and s.e. Tex. and extreme s. part of Rio Grande Plains, spring; Ariz., Colo., N. M. and Tex.

39. AIRA L.

A genus of about 12 species in temperate regions; some widely scattered as weeds.

1. *Aira elegans* Gaud. Tufted annual; culms 10-35 cm. long, slender, simple, erect; blades very narrow, usually involute-filiform, erect; panicles much-branched, very open and diffuse, ovoid, 5-10 cm. long, 3-10 cm. broad; spikelets 2-2.5 mm. long, 2-flowered, both flowers perfect, the lemma eventually abscising at the lower parts of both nodes; glumes subequal, ovate, acute, hyaline, apparently each with a single median nerve,

slightly surpassing the bodies of the lemma; lemmas minutely pustulate-scaberulous in the small median-basal green-membranous areas, marginally broadly white-hyaline, bifid, the lower one essentially awnless, the second one bearing from near the middle of the back a geniculate awn barely exerted from the spikelet. Infrequent in e. Tex., spring; Coastal States, Md. to Tex.; also Ark., Calif. and Ore.

40. AVENA L.

A genus of about 70 species in temperate regions of the Old World.

1. *Avena fatua* L. OATS. Tufted annual; culms 40-75 cm. long, often geniculate at some lower nodes, mostly ascending; panicles open and diffuse, 15-25 cm. long, 3-10 cm. broad, few-flowered, the capillary branches weak and sharply flexuous; spikelets slightly laterally compressed, with 2 perfect florets and in some plants a third rudimentary one; rachilla pubescent, abscising just below the lowest lemma node but usually not or only tardily at second lemma node; glumes 2-3 cm. long, surpassing the bodies of the lemmas, broadly lanceolate, attenuate, acute, cymbiform (not keeled), white-membranous, with 7 to 9 green nerves terminating severally near the distal margin; lemmas firm to indurate, lanceolate, 5- to 9-nerved, bifid, the lateral margins revolute, bearing from near the middle of the back either a short relatively straight awn or a very long geniculate darkly-pigmented one. Disturbed areas in e., s.e. and n.-cen. Tex. and the Edwards Plateau, locally abundant, spring; nat. to Eur., now widely introd.

The so-called wild oats (var. *fatua*) has long awns; the usual cultivated plant [subsp. *sativa* (L.). Thell.] has short awns, hairy lemmas and usually lacks the rudimentary third floret.

41. AGROSTIS L. BENTGRASS

Blades flat; inflorescences paniculate; spikelets one-flowered, very slightly laterally compressed; zone of abscission between the glumes and the lemma (in *A. semiverticillata* a zone of abscission also in the pedicel below the glumes); lemma shorter than the glumes, awned or awnless.

A genus of 150 to 200 species, chiefly in the North Temperate Zone.

- 1. Lemma awned (2)
- 1. Lemma not awned (3)
- 2(1). Glumes 3-4 mm. long 1. *A. avenacea*.
- 2. Glumes 1.2-2.2 mm. long 2. *A. Elliottiana*.
- 3(1). Longest glume shorter than 2 mm. (4)
- 3. Longest glume longer than 2 mm. (5)
- 4(3). Panicle very dense with short scabrous branchlets that are many-flowered nearly to the base; stolons present 9. *A. semiverticillata*.
- 4. Panicle very diffuse; branchlets long and naked most of their length, the spikelets crowded toward the tips; stolons absent 3. *A. hyemalis*.
- 5(3). Tufted perennials without rhizomes or stolons; panicles open and diffuse, the branches mostly naked (6)
- 5. Perennials with stolons or rhizomes or the lower internodes reclining and sub-rhizomatous; panicles sometimes open but not diffuse, the branches bearing flowers for at least half their length (7)
- 6(5). Panicle at maturity irregularly rounded, the main branches branched above the middle, the pedicels short, the spikelets crowded and appressed near the ends of the branches 4. *A. scabra*.
- 6. Panicles at maturity subpyramidal, the main branches branched near the middle or slightly above, the ultimate pedicellary branchlets divaricate, the spikelets not crowded; plants of east Texas, flowering mainly in October 5. *A. perennans*.

- 7(5). Panicles more than 25 mm. broad, the branches spreading; rhizomes present, 2-3 mm. thick6. *A. stolonifera*.
7. Panicles less than 25 mm. broad, the branches ascending or appressed; rhizomes absent but stolons often present (8)
- 8(7). Palea present; plants of southeast Texas, near the coast7. *A. palustris*.
8. Palea absent; plants of Trans-Pecos mountains8. *A. exarata*.

1. *Agrostis avenacea* J. F. Gmel. Tufted perennial; culms 2-6 dm. long, 1-2 mm. thick, erect or the lowest internodes reclining, leafy; ligule a scale 2-5 mm. long; blades 5-15 cm. long, 1-2.5 mm. broad, flat; panicle 15-30 cm. long, diffuse, open; glumes 3-4 mm. long; lemma and palea 0.5-2 mm. long, the former minutely pubescent, with a mid-dorsal once-geniculate awn 3-5 mm. long. Collected May, 1902 at Kent, Culberson Co. in the Trans-Pecos as a waif near the railroad, probably no longer a member of our flora; introd. in scattered parts of the U.S.; Pac. Is.

2. *Agrostis Elliottiana* Schult. Annual; culm 1-3 (-4) dm. long, 0.3-1 mm. thick, erect, leafy; ligule a scale 1.5-3 mm. long; blades 2-6 cm. long, about 1 mm. broad, flat; panicle 6-22 cm. long, very open and diffuse at maturity, the branches capillary, mostly naked; spikelets crowded toward the ends of the branchlets; glumes 1.2-2.2 mm. long; lemma 1.1-2 mm. long, usually bearing dorsally just below the tip a fragile flexuous curly white awn 4-8 mm. long; palea absent. Sandy soils, fields, roadsides and other openings in forested areas in e. Tex. and the granitic flatrocks of Llano and Burnet cos. in cen. Tex., locally abundant, Mar.-Apr.; s.e. U.S. n.e. to Me., s.w. to Tex.; also Yuc.

3. *Agrostis hyemalis* (Walt.) B.S.P. SPRING BENTGRASS. Tufted perennial; culms 1-6 dm. long, 0.5-1 mm. thick, leafy, erect or the lowermost internodes reclining; ligule a thin scale 1-4 mm. long; blades 3-9 cm. long, 1-2 mm. broad, flat; panicle 5-30 cm. long, at least half as broad at maturity, open and very diffuse, the long branches capillary and mostly naked, branched in the outer third; spikelets crowded at the ends of the branchlets, appressed; glumes 1.5-2.1 mm. long, subequal; lemma 1-1.3 (-1.5) mm. long, awnless; palea absent. Usually moist sandy soil, roadsides and other open places in most of Tex. except w. Plains Country, scattered, Mar.-May, rarely to June; e. U.S. w. to Kan., Okla. and Tex.

4. *Agrostis scabra* Willd. Similar to *A. hyemalis* but the glumes 2-2.6 mm. long, some of them on any plant at least 2.2 mm. long; lemma 1.3-1.6 mm. long, rarely as short as 1.2 mm.; palea absent. *A. hyemalis* var. *tenuis* (Tuckerm.) Gl. Moist soil, openings in forests, at elev. of 6,000-8,300 ft. in the Trans-Pecos mts. where probably nat., also scattered in other parts of the state (Dallas, Hardin and Harris cos., etc.) where introd., July-Sept. in the mts., Apr.-May elsewhere; most of cool temp. N. A.

5. *Agrostis perennans* (Walt.) Tuckerm. AUTUMN BENTGRASS. Tufted perennial; culms 25-100 cm. long, 0.5-2.5 mm. thick, leafy, erect or the lowest internodes reclining; ligule a scale 1-3 mm. long; blades 5-22 cm. long, 1-6 mm. broad, flat; panicle 1-3 dm. long, about half as broad, often subpyramidal, very diffuse, open, some of the main branches branched near the middle or slightly above, the pedicellary branchlets appressed or often more divaricate; glumes 2-3.2 mm. long; lemma shorter, awnless (in ours, elsewhere rarely awned); palea absent. Moist sandy soils along streams in e. Tex., infrequent, Oct.; Que. and e. U. S. w. to Neb., Kan., Okla. and Tex.; also Mex.

6. *Agrostis stolonifera* L. REDTOP BENTGRASS. Perennial from rhizomes 2-3 mm. thick; aerial culms 35-100 cm. long, 1.5-2.5 mm. thick, the lower internodes usually decumbent, leafy; ligule a thin scale 4-8 mm. long; blades 6-20 cm. long, 3-8 mm. broad, flat; panicle 12-25 cm. long, less than half as broad, the branches spreading; glumes equal, 2-3 mm. long, gaping; lemma nearly as long as the glumes, not awned; palea about two thirds as long as lemma. Often called *A. alba* L. but that name pertains to a species of *Poa*. *A. gigantea* Roth. Wet meadows and stream banks, e. and n.-cen. Tex., the Plains Country and Trans-Pecos mts., scattered, mostly in tame pastures, summer; widespread in temp. N. A., introd. from Euras.

7. *Agrostis palustris* Huds. CREEPING BENTGRASS. Perennial; culms decumbent, often long-stoloniferous, the aerial ones erect, 3-5 dm. long, 1-2 mm. thick, leafy; ligule a thin scale 2-4 mm. long; blades 4-10 cm. long, 1-3.5 mm. broad, flat; panicles 5-15 cm. long,

1-2 cm. thick, the short branches ascending; glumes 2-3 mm. long; lemma about two thirds as long as the glumes, not awned; palea about two thirds as long as the lemma. Fresh-water shores, s.e. Tex., scattered or rare, summer; widely introd. in temp. N. A. from Euras.

8. *Agrostis exarata* Trin. SPIKE BENTGRASS. Tufted perennial; culms 3-9 dm. long, 1-2 mm. thick (in ours; more robust elsewhere), leafy, mostly erect or the lower internodes reclining and substoloniferous; ligule a scale 3-5 mm. long; blades 4-20 cm. long, 2-8 mm. broad, flat; panicle 1-3 dm. long, 10-25 mm. thick, rather lax and often somewhat interrupted toward the base, the branches many-flowered, appressed; glumes 2.5-3 mm. long, narrowly acuminate; lemma 1.7-2.3 mm. long, not awned (in ours; elsewhere apically awned); palea absent. Wet places at high elev. in Trans-Pecos mts., rare, late summer; w. Can. and w. U. S. (including Alas.), e. to S. D., Neb. and in the mts. to w. Mex.

9. *Agrostis semiverticillata* (Forsk.) Christ. WATER BENTGRASS. Stoloniferous perennial freely rooting at the nodes; aerial culms 2-5 dm. long, 1-2 mm. thick, leafy; ligule a thin scale 2-7 mm. long; blades 4-14 cm. long, 2-7 mm. broad, flat; panicle 3-10 cm. long, 1-3 cm. thick, ellipsoidal, very dense; swollen zone of abscission present on the scabrous pedicellary branchlets below the spikelets; glumes 1.3-2 mm. long, scabrous; lemma about 1 mm. long or shorter, truncate; palea narrow, as long as lemma. *Polypogon semiverticillatus* (Forsk.) Hylander. At the edges of streams in calcareous mud, n.-cen. Tex., Edwards Plateau, Plains Country and Trans-Pecos, locally abundant, Apr.-June and continuing now and then into Nov.; warmer parts of the world, in N. A. n. to Wash., Nev., Ut., Colo., and Tex., introd. from the Old World.

42. POLYPOGON DESF.

Lower internodes reclining on mud, the nodes with adventitious roots; panicles dense; zone of abscission below the glumes; glumes nearly equal, both persistent, awned, united at the very base, scabrous or pubescent; lemma much shorter than glumes, involute, ellipsoidal, with a dorsal readily deciduous awn; palea membranous, enclosed by the lemma.

A genus of about 15 species in warm regions of the world.

1. Awns of glumes more than 4 mm. long 1. *P. monspeliensis*.
 1. Awns of glumes less than 4 mm. long 2. *P. interruptus*.

1. *Polypogon monspeliensis* (L.) Desf. RABBITFOOT GRASS. Annual; culms often rooting at the lower nodes or less commonly totally erect, 1-7 dm. long, 1-3 mm. thick; ligule a scale 3-10 mm. long; blades 4-16 cm. long, 2.5-11 mm. broad, flat; panicle 2-15 cm. long, 1-2 cm. thick, either narrow and spikelike or broader and ellipsoidal and somewhat interrupted, stramineous at maturity; glumes 2 mm. long, apically notched and in the notch each bearing an awn 5-9 mm. long; lemma less than 1 mm. long, with a deciduous awn less than 1 mm. long. Moist soil near fresh water, all parts of the state except the Rio Grande Plains, scattered and local, Mar.-July; Eur., introd. and now widespread in temp. N. A.; of local forage value.

2. *Polypogon interruptus* H.B.K. Perennial; culms rooting at the lower nodes, 2-10 dm. long, 1-4 mm. thick; ligule a scale 4-10 mm. long; blades 4-22 cm. long, 2-12 mm. broad; panicle 3-20 cm. long, 1-5 cm. thick, occasionally narrowed and somewhat spikelike but usually broad, interrupted, with whorled branches 1-5 cm. long; glumes 2 mm. long, apically entire, each bearing an awn about 2 mm. long; lemma a little longer than 1 mm. with a deciduous awn 2-3 mm. long. Calcareous mud on Edwards Plateau, rare (known only from Val Verde Co.), Apr.; widespread in temp. N. A. and S. A., n. to B. C. and Neb.

43. CINNA L. WOODREED

A genus of 4 species in Eurasia, North America and South America; we have one species.

1. *Cinna arundinacea* L. STOUT WOODREED. Clumped perennial with short thick rhizomes; aerial culms erect, 7-15 dm. tall, 2-5 mm. thick, leafy; ligule a stramineous

scale 2-3 mm. long centrally and with long auricles laterally; blades 15-37 cm. long, 7-14 mm. broad near the middle, tapering to both ends, flat; panicles 15-32 cm. long, ellipsoidal, the numerous branches ascending or rarely spreading, densely-flowered; zone of abscission just below the glumes; spikelets one-flowered, falling as a unit, strongly laterally compressed, with keeled scales; first glume 4-4.5 mm. long; second glume 5-5.5 mm. long; lemma 5.5-6 mm. long, bearing dorsally just below the tip a minute awn equaling the tip of the lemma (use lens). Moist usually sandy soil, floodplains and stream banks in forests of e. Tex., infrequent, Aug.-Sept.; all of e. U. S. w. to S. D., Neb., Kan., Okla. and Tex.

44. LIMNODEA L. H. DEWEY

A monotypic genus.

1. *Limnodea arkansana* (Nutt.) L. H. Dewey. Annual; lowermost internodes often prostrate; otherwise culms erect, not or rarely branched, 15-60 cm. long, 0.5-2 mm. thick; ligule a scale about 1 mm. long; blades 2-12 cm. long, 1.5-8 mm. broad, flat; panicles 4-20 cm. long, often weak and slightly nodding, usually about 1 cm. thick and dense, less commonly the branches weak and lax and panicles broader and more diffuse, branches 5-50 mm. long, naked in the lower part; spikelets 1-flowered, deciduous as a unit by an abscission layer just below the glumes; glumes firm or almost indurate, 3-4 mm. long, lanceolate, involute, acute, scabrous or hirsute; lemma as long as the glumes, not as firm, apically shortly bifid, bearing an awn from between the 2 teeth; awn once-geniculate, twisted in the lower portion, 4-12 mm. long. Loamy usually very sandy soils in prairies and disturbed areas, common in n.-cen. and e. Tex., less common to e. Plains Country, n. Rio Grande Plains and s.e. Tex., Mar-May; Okla. and Ark. s. to Tex. and La.; adv. in Ala. and Fla.

45. ALOPECURUS L. FOXTAIL

Annuals; blades flat; panicles dense, straight, spikelike; zone of abscission just below the glumes; spikelets falling as a unit, one-flowered, strongly laterally compressed; glumes equal, united by the margins basally, keeled dorsally; lemma about as long as glumes, the margins united to each other basally, bearing an awn dorsally below the middle, this once-geniculate, the lower portion twisted; palea absent.

About 50 species in temperate Eurasia, North America and South America.

1. Glumes 6-7 mm. long, not ciliate on the keel except basally . . . 1. *A. myosuroides*.
 1. Glumes 2-2.5 mm. long, ciliate on the keel 2. *A. carolinianus*.

1. *Alopecurus myosuroides* Huds. Tufted annual; culms 2-7 dm. long, 1.5-3 mm. thick, erect or the lower few internodes reclining; ligule a scale 2-4 mm. long; blades 5-30 cm. long, 3-7 mm. broad, flat; spike 5-11 cm. long, 5-10 mm. thick; glumes 6-7 mm. long, the keel merely scabrous, not ciliate except basally; awn of lemma 5-8 mm. long. Moist meadows in e. Tex., occurring only as a waif brought in with hay, May; Euras., adv. and widespread in n.e. U. S.; also Wash. and Ore.

Other European species are to be expected in the state as introductions, notably *A. pratensis* L., the meadow foxtail, rather similar to *A. myosuroides* but perennial and the keels of the glumes ciliate.

2. *Alopecurus carolinianus* Walt. Tufted annual; culm 1-5 dm. long, 1-2 mm. thick, the lower internodes commonly not erect, the remainder erect; ligule a scale 1-3 mm. long; blades 2-15 cm. long, 1.5-5 mm. broad, flat; spikes 2-5 cm. long, 4-6 mm. thick; glumes 2-2.5 mm. long, densely ciliate on the keels; awn of lemma 3-5 mm. long. Moist soil near ponds and streams, wet meadows, e., s.e. and n.-cen. Tex., infrequent and rare w. to Bexar, Burnet, Llano and Wichita cos, Mar-May; B. C. and practically throughout the U. S. except n. N. E.

46. PHLEUM L.

A genus of 15 species in temperate Eurasia, North America and South America; probably all Eurasian in origin.

1. *Phleum pratense* L. ТИМОТНУ. Perennial from very short bulbously thickened rhizomes; aerial culms 5-10 dm. long, 2-3 mm. thick, the lowest internodes often reclining, otherwise erect, leafy; ligule a thin scale 2-4 mm. long; blades 6-26 cm. long, 5-10 mm. broad, tapered to a long point, flat; panicle 5-20 cm. long, 5-8 mm. thick, terete, spike-like; spikelets 1-flowered, strongly laterally compressed; glumes equal, 3-3.5 mm. long, oblong, hyaline but each with a firm keel prolonged into a short spreading awn, the keel ciliate; zone of abscission between the glumes and the lemma; lemma and palea about half as long as the glumes, hyaline, the palea very narrow. Occasional as a waif in the e. half of Tex., not persisting, brought in with hay, summer; widespread in moist temp. parts of N. A., introd. from Euras.

47. PHALARIS L. CANARY GRASS

Soft tufted annuals with broad flat blades and large hyaline scalelike ligules; inflorescences terminal dense capitate ovoid or spikelike panicles; spikelets sessile, 90 to 800 per panicle, strongly laterally compressed (the plane of the glumes perpendicular or at an angle to the axis of the panicle, in transection tangential to the panicle); glumes nearly equal, large, cymbiform, enclosing and hiding the rest of the spikelet, strongly keeled and usually with wings on the upper part of the keels, usually with a strong lateral nerve on each side; zone of abscission just above the glumes; fertile floret solitary (persistently subtended at the base by 2 awns or scales or glandlike structures representing the remains of reduced sterile florets); lemma compressed-ovoid, cartilaginous, nerveless, enclosing and falling with the palea and caryopsis (grain), usually antrorsely strigose.

About 20 species in temperate regions.

- 1. Grain 3.5-4.2 mm. long; fertile florets 4.4-6.8 mm. long; glumes 6.3-9 mm. long, broadly winged, as viewed from the side (when folded) 2 or 3 times as long as broad; panicles usually 1 or 2 times as long as broad (2)
- 1. Grain 1.4-2.3 mm. long; fertile florets 2.1-4.7 mm. long; glumes 3-6.7 mm. long, narrowly winged, as viewed from the side (when folded) 3 or 4 times as long as broad (3)
- 2(1). Sterile florets 2.5-4.5 mm. long, scalelike; grain 3.9-4.2 mm. long 1. *P. canariensis*.
- 2. Sterile florets 0.5-1.2 mm. long, minute, swollen and glandlike at the base of the fertile floret; grain 3.5-3.9 mm. long 2. *P. brachystachys*.
- 3(1). Grain 2-2.3 mm. long; lateral nerves of glumes essentially smooth; panicle ovoid to elongate-ovoid, usually 2 to 4 times as long as broad 3. *P. caroliniana*.
- 3. Grain 1.4-1.6 mm. long; lateral nerves of glumes with remote microscopic teeth or scabrous projections; panicle narrow, cylindrical, usually at least 5 times as long as broad 4. *P. angusta*.

1. *Phalaris canariensis* L. Tufted annual; culms 3-10 dm. long, 2-4 mm. thick, erect, sparingly branched; ligule a hyaline scale 2-5 mm. long; blades 10-25 cm. long, 3-10 mm. broad, flat; panicle 15-20 (-40) mm. long, 15-20 mm. thick; glumes 7-9 mm. long, broadly winged, as viewed from the side 2 or 3 times as long as broad; "sterile florets" merely scales 2.5-4.5 mm. long; fertile floret 4.8-6.8 mm. long; grain 3.9-4.2 mm. long. Loamy garden soil, repeatedly introd. into or a waif in cen. and e. Tex., rare and not persistent, spring-summer; nat. to Medit. region, widely introd. and naturalized in cool-temp. parts of Am.

2. *Phalaris brachystachys* Link. Tufted annual; culms 3-9 dm. long, 2-3 mm. thick, erect, sparingly branched; ligule a hyaline scale 1-4 mm. long; blades 8-25 cm. long, 3-10 mm. broad, flat; panicle 15-30 (-40) mm. long, 8-18 mm. thick; glumes 6.3-8.5 mm. long, broadly winged, as viewed from the side 2 or 3 times as long as broad; "sterile florets" reduced to glandlike nubbins 0.6-1.2 mm. long; fertile floret 4.4-5.5 mm. long;

grain 3.5-3.9 mm. long. Rare in sandy loam along a road near Asherton, Dimmit Co., in the Rio Grande Plains, where deliberately sown or a waif and not persistent, spring; nat. to Medit. region, infrequently introd. at scattered points in N. A.

3. *Phalaris caroliniana* Walt. Tufted annual; culms 23-100 cm. long, 1-4 mm. thick, erect, sparingly branched in the lower part; ligule a hyaline scale 1-5 mm. long; blades 5-12 (-20) cm. long, 2-9 (-13) mm. broad, flat; panicle 1-6 (-9) cm. long, 8-20 mm. thick, ovoid to subcylindric, glumes 4.2-6.7 mm. long, narrowly winged, as viewed from the side 3 or 4 times as long as broad; "sterile florets" subulate, 1.5-2.5 mm. long; fertile floret 3-4.7 mm. long; grain 2-2.3 mm. long. Abundant in loamy usually alluvial soils near creeks, in disturbed soils along roadsides and in fallow fields and pastures throughout Tex., common toward the coast, rare in the Trans-Pecos and w. Plains Country, spring; Va. to Okla. and s. to the Gulf States; also Ore., Calif., s. Nev., Ariz. and N. M., s. to Son., Chih. and Coah.

4. *Phalaris angusta* Trin. Tufted annual; culms 55-150 cm. long, 2-6 mm. thick, erect, sparingly branched in the lower part; ligule a hyaline scale 1-3 mm. long; blades 2-25 cm. long, 3-10 mm. broad, flat; panicle 2.5-17 cm. long, 6-15 mm. broad, cylindrical; glumes 3-5.5 mm. long, narrowly winged, as viewed from the side nearly 4 times as long as broad; "sterile florets" subulate, 0.7-1.5 mm. long; fertile floret 2.1-3.8 mm. long; grain 1.4-1.6 mm. long. Locally abundant in moist loamy soil near ditches, creeks and bayous in s.e. Tex., Mar.-Apr.; Ga. to Tex., w. Ariz., Calif., S. A.; introd. into S. Afr.

48. RHYNCHELYTRUM NEES NATALGRASS

A genus of 37 species in warm parts of the Old World; one species now widely distributed.

1. *Rhynchelytrum repens* (Willd.) C. E. Hubb. Perennial; culms 5-13 dm. long, usually decumbent basally and rooting at the lower nodes, otherwise ascending, the nodes usually villous; panicles ovoid or narrower, 8-15 cm. long, 3-7 cm. broad, rather open, with some long ascending branches near the base (these with capillary-flexuous branchlets and pedicels); pedicel with a zone of abscission just below the glumes and just below the zone of abscission with a few long ascending white hairs; spikelets 2-flowered (the lower floret merely staminate), mostly drooping in the direction away from the prevailing wind, eventually falling entire, slightly laterally compressed, ringent; first glume minute, linear-subulate, long silky-villous; second glume chartaceous, cymbiform, obscurely 3-nerved, 3-4 mm. long, apically acuminate and very slightly notched, recurved outward, short-awned but the awn and nerves obscured by the long dense ascending white or rosy silky-pubescence; lower lemma like the second glume but enclosing a well-developed palea and 3 functional stamens; fertile lemma much shorter than the "sterile" one, glabrous, thin-chartaceous, the margins clasping the palea of the same texture. *R. roseum* (Nees) Stapf & Hubb., *Tricholaena rosea* Nees. Locally abundant along highway and railroad right-of-way, Rio Grande Plains, spring-fall; nat. of Afr., introd. and now widespread in the warmer parts of Am.

A grass with a beautiful feathery, rosy inflorescence used for home decorations but lasting only a short while before the spikelets fall.

49. ANTHAENANTIA BEAUV.

Erect perennials with short creeping rhizomes; blades narrow, firm, flat, the uppermost much-reduced; panicles terminal, narrow, the slender branches ascending or appressed; spikelets obovoid, 2-flowered, the lower flower reduced; first glume absent; second glume and sterile lemma about equal, 5-nerved, the broad internerves infolded, densely villous; sterile lemma with a small palea and sometimes with a staminate flower; fertile lemma cartilaginous, brown, with narrow pale hyaline margins, cymbiform, 3-nerved, subacute.

An American genus of 2 species.

1. Blades erect or spreading, rather blunt or rounded at apex, linear, folded at base; panicle usually purple 1. *A. rufa*.
1. Blades ascending or spreading (on the average shorter and broader than in *A. rufa*), tapering to apex, rounded at base; panicle usually pale 2. *A. villosa*.

1. *Anthraenantia rufa* (Ell.) Schult. Culms slender, 6-12 dm. tall; blades elongate, 3-5 mm. broad, often scabrous; panicle 8-15 cm. long, usually purple; spikelets 3-4 mm. long. Infrequent in savannahs and sandy woodlands, e. and s.e. Tex., summer-fall; Coastal States, N. C. to Tex.

2. *Anthraenantia villosa* (Michx.) Beauv. Differing from *A. rufa* in the broader, mostly shorter, spreading blades and in the usually pale panicles. Rare in sandy woodlands and savannahs, s.e. and e. Tex., summer-fall; Coastal States, N.C. to Tex.

50. TRICHACHNE NEES

Wiry-stemmed perennials from knotty usually pubescent bases; panicles of several racemes, attached at several levels along the axis; spikelets paired, lanceolate, attached in 2 rows on 1 side of the rachis of the raceme, rather remote but usually overlapping, the members of each pair on unequal pedicels; zone of abscission below the glumes; first glume glabrous, minute, noticeable only under a lens; second glume and sterile lemma about as long as the fruit or often longer, the former 3-nerved, the latter 5-nerved, both with abundant long antrorse silky hairs; "fruit" plano-convex, lanceolate, often vaguely prolonged basally into a very short "stipe", apically acuminate.

About 15 species of Australia and warmer parts of America. By some authors, *Trichachne* is submerged in the large genus *Digitaria*.

1. Internerves of the sterile lemma all pubescent; spikelets 2.5-3.8 mm. long; blades 2-6 cm. long 4. *T. Hitchcockii*.
1. Internerves of the sterile lemma adjacent to the midnerve glabrous, the more marginal ones pubescent (2)
- 2(1). Glabrous median stripe of the sterile lemma narrow, less than half the total breadth of the lemma; fruit 3.8-4.2 mm. long 1. *T. nutans*.
2. Glabrous median stripe or portion of the sterile lemma at least half as broad as the sterile lemma; fruit 3-3.5 mm. long (3)
- 3(2). Racemes of panicle few, spreading 2. *T. patens*.
3. Racemes of panicle numerous, ascending or appressed . 3. *T. californica*.

1. *Trichachne nutans* (L.) Baum. SOURGRASS. Tufted perennial from tough hairy knotty or cormlike bases; culms 35-100 cm. long, 1-2 mm. thick, erect, essentially unbranched; ligule a hyaline scale 2-3 mm. long; blades 7-17 cm. long, 3-6 mm. broad, flat or folded; sheaths usually pubescent; panicles 11-20 cm. long, 1-2 cm. broad; racemes few, 4-12 cm. long and erect and appressed; spikelets (not including the apical hairs) 3.9-5.3 mm. long; first glume minute; second glume 3-nerved, with dense antrorse appressed silky white somewhat tawny or buffy-white hairs much-exceeding the apex; sterile lemma 5-nerved, pubescent like the second glume but with a very narrow median stripe (between the midnerve and the nearest laterals) glabrous, less than half as broad as the sterile lemma; fruit 3.8-4.2 mm. long. *Trichachne insularis* (L.) Nees, *Digitaria insularis* (L.) Mez. Among brush on tight loamy well-drained soils in Rio Grande Plains, n. to Bexar and Wilson cos., locally frequent, spring-fall; widespread in warmer parts of the New World n. to Fla., Tex. and Ariz.

In most of tropical America sourgrass has a more robust habit than in our area, with blades as much as 15 mm. broad and panicles to 30 cm. long. The name sourgrass alludes to the unpleasant odor of the bases of the plants when bruised, reminiscent of rotting lemons. The color of the spikelet-pubescence varies from pure-white to tawny.

2. *Trichachne patens* Swall. Tufted perennial from pubescent knotty bases; culms 35-90 cm. long, 1-2 mm. thick, erect, essentially unbranched, the lower nodes slightly geniculate; ligule a hyaline scale 1-4 mm. long; blades 4-12 cm. long, 2-3 mm. broad, flat, sheaths usually pubescent; panicles 10-18 cm. long, (2-) 4-15 cm. broad, very open; racemes few, 4-15 cm. long, laxly flowered, spreading; spikelets (not including hairs) 3.2-4.3 mm. long; first glume minute; second glume 3-nerved, densely covered with silky-white or tawny or purplish hairs that are antrorse at first but when dry widely spreading; sterile lemma 3-nerved (actually 5-nerved, another indistinct pair of nerves

sometimes discernible very near the margin), pubescent like the second glume but with a glabrous median stripe between the midnerve and the nearest laterals, this about half as broad as the lemma; fruit 3-3.5 mm. long. *Digitaria patens* (Swall.) Henr. Among brush and in pastures on tight well-drained loam in Rio Grande Plains, n. to s. part of n.-cen. Tex. and e. Edwards Plateau (Llano Co.), infrequent, spring-fall; endemic.

The color of the spikelet-pubescence is very variable.

3. *Trichachne californica* (Benth.) Chase. ARIZONA COTTONTOP. Tufted perennial from pubescent knotty bases; culms 35-110 cm. long, 1-2 mm. thick, erect, sometimes slightly geniculate at the lower nodes, essentially unbranched; ligule a hyaline scale 1-3 mm. long; blades 5-18 cm. long, 2-5 (-7) mm. broad, usually flat or (when very dry) involute; sheaths sparsely to densely pilose; panicle 5-16 cm. long, 4-16 (-20) mm. thick, usually dense; racemes numerous, 3-7 cm. long, ascending or usually appressed; spikelets (not including hairs) 3-4.2 mm. long; first glume minute; second glume 3-nerved, densely covered with long silky whitish or purplish hairs that before drying are antrorse and much-exceed the spikelet but after drying are widely spreading and fluffy; sterile lemma 3-nerved (actually 5-nerved, another faint pair of nerves discernible along the margins), pubescent like the second glume but with a broad glabrous median stripe between the midnerve and the nearest lateral, this stripe more than half the total breadth of the lemma; fruit 3-3.5 mm. long. *Digitaria californica* (Benth.) Henr. Prairies, brush and rocky slopes in the Plains Country, Trans-Pecos, Edwards Plateau and Rio Grande Plains, frequent, infrequent and locally e. to n.-cen. Tex., spring-fall; Okla. and Colo. to Ariz. and s. to s. Mex.; also s. S. A.

The color of the spikelet-pubescence is very variable. The plants of low, coastal areas in the Rio Grande Plains have usually broader leaves and more densely pilose sheaths, on the average, than the plants of west Texas.

4. *Trichachne Hitchcockii* (Chase) Chase. Tufted perennial from pubescent slightly knotty bases; culms 20-55 cm. long, 0.5-1 mm. thick, erect, slightly geniculate at the lower nodes, sparingly branched; ligule a hyaline scale 1-2 mm. long; blades 2-6 cm. long, 2-3 mm. broad, flat, the margins usually crisped; panicles 5-11 cm. long, 5-10 cm. broad; racemes 1-3 (-8) cm. long, spreading or rarely ascending or erect; spikelets 2.5-3.8 mm. long; first glume 0.3-1 mm. long; second glume 3-nerved, densely silky-pubescent on the internerves with the hairs rather short; sterile lemma 5-nerved, densely silky-pubescent on all the internerves; fruit 2.1-3.5 mm. long. *Digitaria Hitchcockii* (Chase) Stuck. Rocky usually calcareous slopes, Trans-Pecos and w. Edwards Plateau, infrequent to rare, summer-fall; Tex. to Tam. and S. L. P.

51. DIGITARIA FABR. CRABGRASS

Panicles of several long linear spikelike racemes either in one whorl or attached to the short axis at more than one level; spikelets with a single perfect floret [and the remains (sterile lemma) below the perfect floret and above the glumes of a sterile floret], very slightly dorsally compressed, appressed in 2 rows along 1 side of the flattened and/or winged rachis of the raceme, paired, 1 spikelet of each pair on a minute pedicel, the other nearly sessile; zone of abscission at the base of the spikelet; first glume abaxial (away from the rachis), minute or obsolete; second glume appressed to the rachis and to the convex fertile lemma, minute or as large as the spikelet, usually several-nerved and with some pubescence on the internerves; sterile lemma (when the first glume obsolete this appearing as the second glume) abaxial, appressed to the flat back of the palea ("fruit"), usually several-nerved and pubescent on the internerves, as large as the spikelet; lemma convex, thin-cartilaginous but not indurate, white to brown or gray or black, usually shiny and glabrous, usually minutely rugose or punctulate, lance-elliptic, pointed, the edges revolute and enclosing the margin of the palea; palea flat, similar in texture to the lemma and held closely by its margins; the lemma and its enclosures constitute the "fruit" although the true fruit is the caryopsis or grain within.

A genus of several hundred species in warm regions, sometimes made to include the related genera *Trichachne* and *Leptoloma*. The introduced annual crabgrasses, *D. sanguinalis*, and the more abundant native *D. adscendens* and *D. diversiflora* are persistent and pernicious weeds in the loamy soil of plowed fields, lawns and flowerbeds.

1. Glume (i.e., the "second" glume, the first being obsolete) equaling or slightly surpassing the fruit, pilose when mature; stoloniferous or often subrhizomatous perennial of sandy soils of southern Texas7. *D. texana*.
1. Glume (true second glume of *D. sanguinalis*, *D. adscendens* and *D. diversiflora*) slightly or greatly shorter than the fruit, if nearly as long then the plants annual and/or the fruit darkly pigmented (2)
- 2(1). First glume present, i.e., a minute scale present on the flat abaxial side of the spikelet at the base of the sterile lemma (3)
2. First glume absent, i.e., only 2 scales subtending the fruit, namely the "second" (actually first) glume on the convex side toward the rachis and the sterile lemma on the flat side (5)
- 3(2). Sterile lemma of lower spikelet of a pair with 5 equidistant nerves, glabrous or minutely pubescent on 2 of the lateral internerve spaces; first glume of lower spikelet round or truncate, 0.3 mm. long or less; sterile lemma of upper spikelet of a pair densely ciliate-fimbriate on 2 of the lateral internerve spaces, this fringe conspicuous after anthesis at which time it is widely spreading
.....3. *D. diversiflora*.
3. Sterile lemma of lower spikelet of a pair with the internerve spaces next the midnerve noticeably wider than those nearer the sides; sterile lemma of both spikelets of a pair glabrous or variously pubescent in some of the lateral internerve spaces (4)
- 4(3). Spikelet 2.3-3.2 mm. long; second glume 1-1.9 mm. long, thus a third to three fifths as long as spikelet; the 4 lateral nerves of the sterile lemma nearest the midnerve (as seen under a strong lens) scabrous with a row of minute pointed cilia; blades usually densely papillose-pilose like the sheaths1. *D. sanguinalis*.
4. Spikelet 2.6-3.5 mm. long; second glume (1.5-) 1.8-2.3 mm. long, thus half to four fifths as long as the spikelet; the 4 lateral nerves of the sterile lemma nearest the midnerve (as seen under a strong lens) usually perfectly smooth; blades essentially glabrous or sparsely papillose-pilose (especially near the ligule) in contrast to the almost always papillose-pilose sheaths
.....2. *D. adscendens*.
- 5(2). Rachis of raceme broadly triangular in transection, the margin (if any) much narrower than the central rib; plants perennial but flowering the first year
.....6. *D. filiformis*.
5. Rachis of raceme with thin margins or wings as broad as the central rib or a little broader; plants annual (6)
- 6(5). Sheaths pilose; "second" glume a fourth to a sixth as long as the spikelet
.....4. *D. serotina*.
6. Sheaths not pilose or very sparsely so; "second" glume at least two thirds as long as the spikelet5. *D. violascens*.

1. *Digitaria sanguinalis* (L.) Scop. NORTHERN CRABGRASS. Tufted and/or usually stoloniferous annual freely rooting at the nodes; culms 15-90 cm. long, 1-3 mm. thick, usually long-decumbent, ascending only at the ends; ligule a thin scale 1-2 mm. long; blades 2-7 cm. long, 3-10 mm. broad, flat, usually crisped, sparsely or usually densely papillose-pilose; sheaths papillose-pilose; panicle axis 1-15 (-30) mm. long; racemes 2 to 11, 4-12 cm. long, 1-2 mm. thick, often purplish, the wing of the rachis as broad as the central rib; spikelet 2.3-3.2 mm. long; first glume present but minute; second glume 1-1.9 mm. long, narrow, a third to three fifths (usually half) as long as the spikelet; sterile lemma as long as the spikelet, usually with a sparse short antrorse-appressed silky fringe on the margins and the 2 to 4 lateral nerves usually with minute inflexible pointed cilia (as seen under a powerful lens); "fruit" often pale-plumbeous. Disturbed soil along roads, in fields and gardens, frequent in the Plains Country and infrequent to Trans-Pecos, n.-cen. and e. Tex., s. as far as Travis and Gonzales cos., summer-fall; s. Can., N. E. s. to Va., w. and s.w. to Wash., Calif. and Tex.; scattered in U.S.; also Son., Chih. and Dgo.; introd. from n. Eur., now widespread in temp. areas.

2. *Digitaria adscendens* (H.B.K.) Henr. SOUTHERN CRABGRASS. Tufted annual and/or usually stoloniferous, freely rooting at the lower nodes; culms 2-6 dm. long, 1-3 mm. thick; blades 2-10 (-20) cm. long, 3-10 mm. broad, flat, usually crisped, glabrous or occasionally sparsely papillose-pilose; sheaths nearly glabrous to usually papillose-pilose; panicle axis 1-15 (-30) mm. long; racemes 3 to 5 (to 10), 3-10 (-16) cm. long, 1-2 mm. thick, the wing of the rachis as broad as the central rib; spikelets 2.6-3.5 mm. long; first glume of lower spikelet of the pair obtuse or acute, about 0.3 mm. long; second glume (1.5-) 1.8-2.3 mm. long, half to four fifths (usually two thirds) as long as the spikelet; sterile lemma of both spikelets of a pair as long as the spikelet, with inconspicuous antrorse appressed fringes laterally and 5 to 7 smooth nerves, the 2 internerve spaces nearest the midnerve glabrous and noticeably wider than the spaces nearer the margin. *D. marginata* Link, *D. fimbriata* Link, *D. Nealleyi* Henr. (*fide* Swallen). Disturbed loamy soils along roads, in fields and gardens, frequent in n.-cen., e. and s.e. Tex., infrequent w. to the Trans-Pecos and rare in the Rio Grande Plains, summer-fall; warm-temp. areas, perhaps introd. in the New World, now common n. to Va. and the Gulf States, Ark. and Tenn., casual n. to N. E., Mo., Neb. and Ut.; s. in the highlands to cen. and s. Mex.; also S. A. and W. I.

Some few specimens of southern crabgrass recombine the species-characters of leaf pubescence, ciliation of sterile lemma and relative length of second glume that usually distinguish this species from *D. sanguinalis*. These plants may be interpreted as the products of past hybridization.

3. *Digitaria diversiflora* Swall. TROPICAL CRABGRASS. Tufted annual and/or usually stoloniferous, freely rooting at the nodes; culms 3-10 dm. long, 1-3 mm. thick, usually long-decumbent, ascending only at the ends; ligule a thin scale 1-3 mm. long; blades 2-12 (-25) cm. long, 3-6 (-10) mm. broad, flat, usually crisped, glabrous or occasionally sparsely papillose-pilose; sheaths nearly glabrous or papillose-pilose; panicle axis 1-15 (-45) mm. long; racemes 2 to 5 (to rarely 9), 3-10 (-16) cm. long, 1-2 mm. thick, usually stramineous, the wing of the rachis as broad as the central rib; spikelets 2.5-3.1 mm. long; first glume of lower spikelet of the pair round or truncate, 0.3 mm. long or less; second glume 1.8-2.3 mm. long, narrow, half to four fifths (usually two thirds) as long as the spikelet; sterile lemma as long as the spikelet, that of the lower spikelet of the pair with 5 conspicuous strong glabrous or nearly glabrous nerves that are nearly equidistant from each other (the lateral internerve spaces occasionally with some antrorse hairs); sterile lemma of the pedicelled spikelet with coarse ciliate fringes in the lateral internerve spaces, the cilia antrorse-appressed at anthesis, eventually on drying spreading at right angles, comblike; "fruit" usually stramineous. Disturbed usually loose sandy soils along roads, in fields and gardens, and in overgrazed prairies, abundant in Rio Grande Plains, summer-fall; trop. Am. lowlands n. to Cuba, Tex. and Son., probably indigenous.

4. *Digitaria serotina* (Walt.) Michx. DWARF CRABGRASS. Loosely tufted or usually stoloniferous annual freely rooting at the nodes; culms 3-10 dm. long, about 1 mm. thick, long-decumbent, ascending only at the ends; ligule a thin scale 1-2 mm. long; blades 1-3 (-5) (-8?) cm. long, 2-5 (-7) mm. broad, flat, papillose-pilose; sheaths densely pilose; panicle axis 1-5 (-9) mm. long; racemes 3 to 5, 4-7 cm. long, about 1 mm. thick, pale-stramineous, the narrow wings of the rachis as broad as the central rib; spikelets about 1.7 mm. long; first glumes absent; second glume about 0.3 mm. long, a fourth to a sixth as long as the spikelet; sterile lemma as long as spikelet, very finely pubescent on the internerves; "fruit" very pale. Rare and local in sandy soils, e. Tex. (Brazos Co.), fall; Coastal States, Pa. to Tex.; also Cuba.

5. *Digitaria violascens* Link. Tufted annual, rarely shortly stoloniferous at the base; culms 25-70 cm. long, 1-2 mm. thick, basally somewhat genuflexed; ligule a thin scale 1-2 mm. long; blades aggregated toward the base of the plant, 2-6 (-12) cm. long, 3-6 mm. broad, flat, these and the sheaths very sparsely pilose or essentially glabrous; panicle axis 1-9 (-15) mm. long; racemes 2 to 6, 3-5 (-9) cm. long, 1 mm. thick, the wings of the rachis as broad as the central rib; spikelets 1.5-1.7 mm. long; first glume absent; second glume (1-) 1.2-1.5 mm. long, at least two thirds as long as spikelet, very finely pubescent on the internerves; sterile lemma as long as spikelet, very finely pubescent on the internerves; "fruit" purplish-black, very finely punctulate and shiny. *D. floridana* Hitchc. Disturbed openings in pine forest, e. and s.e. Tex., infrequent, summer-fall; warm

parts of the world, nat. to s.e. Asia, in Am. n. to the Gulf States; casual in Ark. and Ky.

6. *Digitaria filiformis* (L.) Koel. Tufted perennial but flowering the first year; culms 1-15 dm. long, 1-3 mm. thick, stramineous, usually erect, less commonly very shortly genuflexed basally, essentially unbranched; ligule a thin scale 1-2 mm. long; blades 10-25 cm. long, 2-6 mm. broad, flat, the lower ones softly pilose as are the sheaths but not so densely as the sheaths and (like the sheaths) commonly turning purplish; panicle axis 2-8 cm. long; racemes (2 to) 4 to 8, (4-) 6-20 (-25) cm. long, about 1.5 mm. thick, the rachis broadly triangular and commonly somewhat arcuate-zigzag; spikelets 1.8-2.8 mm. long; first glume absent; second glume 1.3-2.6 mm. long, about five sixths the length of the spikelet, villosulous on the internerves, some of the white hairs thicker apically than basally or even capitellate; sterile lemma as long as the spikelet, pubescent like the second glume; "fruit" purplish-brown or purplish-black, punctulate and shiny. Incl. var. *villosa* (Walt.) Fern. (this being the name given to the more robust plants with larger panicles and spikelets 2.3-2.8 mm. long), *D. villosa* (Walt.) Pers. Frequent in forest-openings on sandy soil, e. and s.e. Tex., summer-fall; Gulf States and n. to Ia., Mich. and Vt. (behaving mostly as an annual n. of Okla., Ky. and Va.); Cuba; Mex.

7. *Digitaria texana* Hitchc. Long-stoloniferous or long-subrhizomatous perennial (?); culms 5-10 dm. long, 2-3.5 mm. thick, the part that creeps on or is slightly beneath the surface of the sand more slender and ascending toward the end; ligule a thin scale 1-3 mm. long; blades 4-20 cm. long, 2.5-6 mm. broad, flat, pointed, nearly glabrous or the lower ones somewhat pilose; lower sheaths usually densely pilose (eventually glabrate), the upper ones less pilose or even glabrous; panicle axis 6-76 mm. long; racemes 4 to 15 per panicle, 4-15 cm. long, about 1 mm. thick, the rachis very narrow and somewhat curviflexuous; spikelets 2.2-3.4 mm. long; first glume absent or vestigial; second glume 2.2-3.5 mm. long, completely covering the convex side of the fruit and equaling or barely surpassing it in length, pilose on the internerves when quite dry and mature but before maturity the hairs appressed-antrorse and inconspicuous; sterile lemma equaling second glume and similarly pubescent (except the 2 internerves nearest the midnerve glabrous); fruit plumbeous to stramineous. *D. Runyonii* Hitchc. Sandy prairies near the coast, Rio Grande Plains n.e. to s. part of s.e. Tex. (Calhoun Co.), infrequent, fall, winter and early spring; endemic.

The plants from farthest inland (Brooks and Kenedy cos.) have spikelets averaging only 2.2-2.4 mm. long; those from near the coast (*D. Runyonii*) have spikelets averaging larger, but there are no other correlated differentiating characters.

52. LEPTOLOMA CHASE

About 5 species, one in North America, the rest in Australia.

1. *Leptoloma cognatum* (Schult.) Chase. FALL WITCHGRASS. Perennial from pubescent knotty bases, the lower parts of the culms either erect or commonly briefly or lengthily rhizomatous; aerial culms 2-5 dm. long, 1-2 mm. thick, ascending, not or sparingly branched; ligule a scale 1-2 mm. long; blades 2-8 (-16) cm. long, 2-6 mm. broad, mostly flat, nearly glabrous like the upper sheaths (or, in Rusk and Nacogdoches cos. in e. Tex. populations densely pilose on blades and sheaths); panicle when mature 12-20 cm. long, 12-25 cm. broad, the branches widely divaricate but at anthesis much smaller and partially included in the uppermost sheath, after anthesis the much-elongating culm drying and breaking, the mature panicle blowing before the wind as a "tumbleweed"; principal panicle branches numerous, distally broadly triangular and rachislike, terminating in a spikelet and bearing along the length from the abaxial side in two rows 1 to several pedicelled solitary spikelets; pedicels capillary, divaricate; zone of abscission at the base of the spikelet; spikelets 2.3-3.6 (-4.3) mm. long, about 1 mm. broad, plano-convex; first glume minute, nearly obsolete; second glume and sterile lemma equaling fruit, several-nerved, the internerves pubescent, the pubescence antrorse-appressed before maturity but upon drying spreading and fluffy; "fruit" lanceolate, consisting of a glabrous shiny cartilaginous but not indurate convex lemma whose edges clasp the margins of the palea which has the same texture, the fruit pale or in some populations turning brown or blackish. *L. arenicola* Swall., *Digitaria cognata* (Schult.) Pilg., *D. arenicola* (Swall.)

Beetle. Nearly throughout Tex., most abundant in loose sandy prairies on the Coastal Plain and in n.-cen. Tex., frequent elsewhere; N.H. to Minn., s. to Fla. and Tex., w. to Ariz.

In tight soil the rhizomes are short or are not noticeable; they become well-developed in loose sand.

53. STENOTAPHRUM TRIN.

About 7 species in warm regions, possibly all South American in origin.

1. *Stenotaphrum secundatum* (Walt.) O. Ktze. ST. AUGUSTINE GRASS. Perennial, long-creeping and stoloniferous, the stolons 1-10 dm. long; floriferous culms 1-4 dm. long, compressed, about 2 mm. thick on the long axis, erect, unbranched; ligule a fringe 0.2-0.3 mm. long; blades 2-10 cm. long, 4-10 mm. broad, flat or folded, blunt; inflorescence a solitary erect terminal raceme 5-10 cm. long, with a tough fleshy articulated rachis 3-5 mm. broad, the usually paired spikelets in 2 rows, appressed and sunken into 1 side of the rachis, 1 member of each pair sessile, the other (often obsolete or absent) on a short pedicel along the margin of the rachis; spikelets persistent in the articles of the rachis (that abscises tardily near the base of each pair of spikelets), strongly dorsally compressed, 4-5 mm. long, with a single fertile floret, subtended by the remains of a reduced floret (a sterile lemma) and 2 glumes; first glume minute, abaxial; second glume as large as the "fruit" and adaxial, hidden between the fruit and the rachis; sterile lemma as large as the fruit and abaxial; fruit consisting of the slightly cartilaginous broadly lanceolate lemma with revolute margins clasping the palea of the same texture. Widely cult. for lawns in Tex., with slight tendency to escape though commonly not persistent outside of cult.; trop. Am., n. to S.C. and the Gulf States, especially near the coast.

This lawn grass is commonly but mistakenly called "carpet grass," a name best reserved for *Axonopus*.

54. ERIOCHLOA H. B. K. CUPGRASS

Tufted annuals or perennials; inflorescence an elongate panicle of racemes attached in 2 rows along 1 side of a more or less flattened axis (or on 2 sides when the axis is vaguely broadly triangular in transection); racemes with more or less flattened (or in transection broadly triangular) rachises; zone of abscission at the base of the spikelet below the callus; spikelets attached in 2 rows abaxially on the rachis, strongly dorsally compressed, each with one perfect floret, solitary or paired or at the bases of the raceme in racemelets of 3 (in extralimital species the basal racemelets have up to 15 spikelets in 2 rows along the abaxial side of a flattened rachilla, the "raceme" then being a small panicle), commonly the uppermost spikelets solitary even when the lower ones are paired and the pedicelled one slightly larger than the sterile one of the same pair; first glume truncate, about 0.1 mm. long, discolored, closely investing the minute swollen portion of the rachilla below the second glume, the swelling and the glume constituting the "callus"; second glume as large as the spikelet, abaxial, marginally often revolute; sterile lemma toward the rachis, nearly as large as the second glume; fertile lemma abaxial, thin-cartilaginous but not indurate, stramineous, elliptic-oblong, shorter than the second glume, marginally revolute and clasping the palea of the same texture, superficially with microscopic transverse rugae or punctulate and apically mucronate or with an antrorsely scabrous awn.

About 20 species in warm regions. The spikelet measurements given below do not include the "callus".

1. Spikelets all solitary, never paired; racemes few, remote on the panicle axis, scarcely overlapping; leaves distinctly involute 4. *E. sericea*.
1. Spikelets paired or in triplets on at least the lower parts of some racemes; racemes overlapping; leaves flat or eventually loosely involute (2)

- 2(1). Fertile lemma with a mucro 0.05-0.1 (-0.2) mm. long; spikelets abruptly acuminate to a short point; blades usually glabrous 3. *E. gracilis*.
2. Fertile lemma with an awn 0.3-1.5 mm. long; spikelets sharp-pointed or long-acuminate; blades glabrous or pubescent (3)
- 3(2). Plant annual; foliage finely pubescent (as seen under a lens), rarely glabrate; spikelets distinctly acuminate to a very fine point, usually greenish; fertile lemma with an awn 0.3-0.8 (-1) mm. long 2. *E. contracta*.
3. Plant perennial (but flowering the first year); foliage essentially glabrous; spikelets slightly acuminate or usually merely tapered to a point, usually with a purplish tinge; fertile lemma with an awn 0.9-1.5 mm. long . . 1. *E. punctata*.

1. *Eriochloa punctata* (L.) Desv. Tufted weak perennial but flowering the first year; culms 3-10 dm. long, 2-5 mm. thick, commonly geniculate and stoloniform basally, distally ascending, leafy; ligule a fringe about 1 mm. long; blades (3-) 10-27 cm. long, 3-10 mm. broad, mostly flat or folded, essentially glabrous; panicle dense and elongate with numerous broadly overlapping ascending racemes; pedicels merely scabrous, without any longer hairs; spikelets solitary or paired or in threes, 4-6 mm. long, tapered to the slightly or not acuminate apex, purplish when mature; fertile lemma with an awn 0.9-1.5 mm. long. Tight loamy moist soil near ponds or seasonally muddy areas, s.e. Tex. and coastal parts of the Rio Grande Plains, frequent, spring-fall; warmer parts of Am., n. to La. and Tex.

Some plants seem intermediate between this species and *E. contracta*.

2. *Eriochloa contracta* Hitchc. PRAIRIE CUPCRASS. Tufted annual; culms 2-8 dm. long, 1-4 mm. thick, geniculate and infrequently shortly stoloniform basally, mostly ascending, leafy; ligule a fringe 1-2 mm. long; blades 3-20 cm. long, 2-6 mm. broad, mostly flat or folded, or eventually involute, shortly pubescent (like the sheaths); panicle narrow, with overlapping erect racemes; pedicels scabrous and also apically with some long erect cilia a third to half as long as the spikelet; spikelets solitary or paired, (3.1-) 3.7-4 (-5) mm. long, somewhat shaggy-pubescent, acuminate to a long fine point, greenish to stramineous at maturity; fertile lemma with an awn 0.3-0.8 (-1) mm. long. Tight loamy usually seasonally moist soil near swales in prairies and at edges of fields and roadsides and lawns, frequent, s.e. Tex. and Rio Grande Plains n. to n.-cen. Tex., infrequent w. to e. Plains Country, spring-fall; Neb. s. to Tex. and La., w. to Colo. and Ariz.; adv. in Mo. and Va.

Some plants seem intermediate between this species and *E. gracilis*.

3. *Eriochloa gracilis* (Fourn.) Hitchc. Tufted annual; culms 2-8 dm. long, 1-4 mm. thick, often geniculate and rarely shortly stoloniform basally, mostly ascending, leafy; ligule a fringe 1-2 mm. long; blades 3-20 cm. long, 3-13 mm. broad, mostly flat, usually glabrous, less commonly finely pubescent; panicle narrow, with overlapping ascending racemes; pedicels scabrous and also with longer arcuate-erect hairs about half as long as the spikelet; spikelets solitary or paired, 3-4.3 mm. long, somewhat shaggy-pubescent, abruptly acuminate to a very short point (the angle below the point being blunt), greenish to stramineous; fertile lemma with a mucro 0.05-0.1 (-0.2) mm. long. Incl. var. *minor* (Vasey) Hitchc., *E. Lemmonii* var. *gracilis* (Fourn.) Gould. Disturbed areas in seasonally moist gravelly loam in the Trans-Pecos; w. Okla. and Calif. s. to cen. Mex.

4. *Eriochloa sericea* (Scheele) Munro. Tufted perennial; culms 4-8 dm. long, 1-2 mm. thick, erect, leafy; ligule a fringe about 1 mm. long; blades 1-3 dm. long, 1.5-3.5 mm. broad, flat at first but soon involute, mostly erect or ascending, with dense short soft pubescence; panicle very narrow, with few erect remote short racemes rarely overlapping; pedicels scabrous and also with many arcuate-erect soft hairs half to three fourths as long as the spikelets; spikelets always solitary, 3.5-5 mm. long, shaggy-pubescent, acute, whitish; fertile lemma with a mucro 0.05-0.1 mm. long. Well-drained prairies and brushy rocky slopes of tight loamy soil, n.-cen. Tex. and e. Plains Country, s. to Rio Grande Plains and e. Edwards Plateau, infrequent, also in pockets of prairie in e. Tex. (Leon Co.), rare, spring-fall; also Okla.

55. BRACHIARIA GRISEB.

Leaves broad and flat; inflorescence a panicle of spiciform racemes that are subsecund on a flattened twisted axis; racemes with flattened and (in some species) more or less winged rachises; zone of abscission at the base of the spikelet; spikelets solitary (in extralimital species rarely in pairs or racemes even with secondary racemelets basally) in 2 rows on the abaxial side of the rachis, plano-convex (*B. ciliatissima*) or dorsally much-compressed (*B. platyphylla*); first glume smaller than the spikelet but present, turned toward the rachis; second glume as long as the spikelet and with the same shape, abaxial; sterile lemma adaxial, as large as the spikelet, with a membranous palea in the axil, this lower floret either neutral (*B. platyphylla*) or bearing the 3 stamens (*B. ciliatissima*); fertile lemma abaxial, cartilaginous-indurate, marginally revolute and enclosing the palea of the same texture, surficially with irregular microscopic transverse rugae.

A genus of perhaps 50 species in warm regions. The species included here are very dissimilar and are perhaps severally more closely related to species here included in *Panicum* (near *P. fasciculatum*) than they are to each other. Certain species of *Panicum* (*P. reptans*, *P. purpurascens*, *P. obtusum*) have been referred to *Brachiaria* by some authors. The single character of the orientation of the spikelets, with the fertile lemma abaxial as in *Eriochloa*, is the only character separating the genus from *Panicum*, although our two species are remarkable also in having only solitary spikelets.

1. Spikelets pubescent, not much-compressed; lower floret staminate; first glume more than half as long as the spikelet; long-stoloniferous perennial; racemes very short, few-flowered, erect 1. *B. ciliatissima*.
1. Spikelets glabrous, dorsally much-compressed; first glume less than half as long as the spikelet; tufted annual; racemes elongate, several-flowered, mostly not erect ..
..... 2. *B. platyphylla*.

1. *Brachiaria ciliatissima* (Buckl.) Chase. Long-stoloniferous perennial; culms 3-20 dm. long, 1-2 mm. thick, decumbent, branched, freely rooting at the bearded nodes, ascending only shortly at the floriferous ends; ligule a fringe about 0.5 mm. long; blades 2-5 (-9) cm. long, 2-5 mm. broad, flat, pointed, white-margined, marginally pilose; sheaths pilose; panicles 2-6 cm. long, 3-5 mm. broad; racemes 3 to 8, short and few-flowered, ascending or usually erect, with narrow rachises that are triangular in trans-section; spikelets not much-compressed, usually appearing turgid, 3-4 mm. long; first glume three fourths the length of the spikelet, glabrous; second glume with dense soft white spreading pubescence; "sterile" (lower) lemma with such pubescence only marginally and enclosing 3 stamens between it and the "sterile" palea; fruit 2.5-3 mm. long. Sandy prairies, abundant in Rio Grande Plains, s. part of s.e. Tex. and Plains Country, less frequent in parts of e. and n.-cen. Tex., Edwards Plateau and n. Plains Country, spring-fall; s.-cen. Okla. and Tex.; Benton Co., Ark.

This is one of the nondescript ground-cover grasses commonly and mistakenly lumped under the name "mesquite" grass or "buffalo" grass in parts of Texas.

2. *Brachiaria platyphylla* (Griseb.) Nash. Tufted annual; culms 25-90 cm. long, 1-2.5 mm. thick, commonly genuflexed and stoloniferous basally but mostly ascending; ligule a fringe about 0.5 mm. long; blades 5-12 cm. long, 6-12 mm. broad, flat, glabrous; panicles 8-30 cm. long; racemes 3 to 7, long and many-flowered, usually somewhat spreading, with flat rachises about 2 mm. broad; spikelets compressed, appearing flattish, 4-4.5 mm. long; first glume about a third the length of the spikelet; second glume and sterile lemma as long as the spikelet, exceeding the fruit by 1-1.5 mm., glabrous, the portions extending beyond the fruit usually slightly wrinkled to reveal the transverse venation. Usually disturbed loamy soils in fields, gardens, along roads and in ditches, e. and s.e. Tex. and coastal parts of the Rio Grande Plains, infrequent, spring-fall; Ga., Fla., Mo., Ark., La., Okla. and Tex.; Cuba.

56. AXONOPUS BEAUV.

Tufted and usually stoloniferous perennials; blades broad and flat; floriferous culm at anthesis short, after anthesis greatly elongating, filiform; panicle a terminal pair of

ascending divergent linear spikes, with or without another 1 or 2 spikes attached to the axis subterminally; spikes with flattened or even narrowly winged rachises; zone of abscission at the base of the spikelet; spikelets solitary, in 2 rows on the abaxial side of (and appressed to) the rachis, considerably dorsally compressed; first glume absent; "second" (or only) glume abaxial (away from the rachis), as large as the spikelet; sterile lemma appressed to the rachis (sterile palea absent); fertile lemma oblong, abaxial, thin-cartilaginous but not indurate, the margins revolute and clasping the palea of the same texture; fertile floret perfect.

A genus of warm parts of America, with perhaps as many as 75 species. They are of considerable importance in pastures near the coast in east and southeast Texas.

- 1. Spikelets 4.5-6 mm. long; spikes about 2 mm. thick . . . 1. *A. furcatus*.
- 1. Spikelets 1.7-3 mm. long; spikes about 1 mm. thick (2)
- 2(1). Spikelets (2.3-) 2.5-3 mm. long 2. *A. compressus*.
- 2. Spikelets 1.7-2.2 mm. long 3. *A. affinis*.

1. *Axonopus furcatus* (Flügge) Hitchc. Stoloniferous perennial with floriferous tufts at the nodes; culms 4-10 dm. long, compressed, 2-4 mm. wide on the broad axis; ligule a minute firm scale or obsolete; blades 5-15 (-25) cm. long, 5-10 (-13) mm. broad, blunt; spikes 2, digitate, 4-10 cm. long, about 2 mm. thick; spikelets 4.5-6 mm. long, glabrous, apically pointed. Moist sand, e. and s.e. Tex., infrequent, summer-fall; Coastal States, Va. to Tex.; also Ark.

2. *Axonopus compressus* (Sw.) Beauv. Tufted perennial; culms 20-75 cm. long, compressed, about 2 mm. broad on the long axis, often rather long-stoloniferous basally, the tufted floriferous culms erect and unbranched; ligule a scale about 0.5 mm. long; blades 8-25 cm. long (shorter on stolons), 5-7 (-10) mm. broad; spikes 2 to 4, 4-10 cm. long, 1 mm. thick; spikelets (2.3-) 2.5-3 mm. long, minutely pubescent basally, apically pointed, the point prolonged beyond the blunt end of the fruit. Moist sand, s.e. Tex., rare (near Anahuac, Chambers Co.), mostly in the fall; widespread in warmer parts of Am., n. to Fla., La. and Tex.

3. *Axonopus affinis* Chase. CARPET GRASS. Tufted perennial; culms 20-75 cm. long, compressed, about 2 mm. broad on the long axis, often rather long-stoloniferous basally, forming carpets but the tufted floriferous culms erect and unbranched; ligule a scale about 0.3 mm. long; blades 6-17 (-28) cm. long, shorter on the stolons, 3-6 (-9) mm. broad, flat, blunt; sheaths keeled; spikes 2 to 4, 2-10 cm. long, about 1 mm. broad; spikelets 1.7-2.2 mm. long, very minutely pubescent around the edges, apically rather blunt, the "second" glume not much if any prolonged beyond the fruit. Moist sand, openings in forests, roadsides, etc., e. and s.e. Tex., very frequent, spring-fall (in Calhoun, Jackson and Aransas cos. even as late as Dec. and as early as Feb.); widespread in warmer parts of Am. n. to N.C. and Gulf States, Ark. and Okla.

57. PASPALUM L. PASPALUM

Ligule a scale; inflorescence a panicle of 1 to several racemes on the common axis; raceme with a more or less flattened rachis; the numerous spikelets borne in pairs or singly in 2 rows on the abaxial side of the rachis, the pedicels of the pairs short and unequal in length; zone of abscission at the base of the spikelet at the end of the pedicel; spikelets each with a single perfect floret subtended by 2 or 3 scales, when 3 then the lowest one being a minute abaxial first glume; next highest one the adaxial second glume as large or nearly as large as the spikelet; the abaxial sterile lemma representing the sole remains of a neutral lower floret; fertile lemma adaxial, chartaceous-indurate, convex, the margins revolute, clasping the fertile palea of similar texture, the fertile lemma and palea and their enclosures and appendages constituting the "fruit."

A genus of about 250 species in warm regions. Most Paspalums are of great economic importance as forage plants.

- 1. Racemes 20 to 50 per panicle, eventually deciduous from the panicle axis; attached and floating aquatics; spikelets solitary, 1.2-1.7 mm. long, pubescent
- 22. *P. fluitans*.

1. Racemes fewer, persistent (2)
- 2(1). "Second" (only) glume and sterile lemma abruptly pointed beyond the blunt fruit (3)
2. Second (only) glume and sterile lemma not abruptly pointed beyond the fruit (5)
- 3(2). Spikelets solitary (that is, not paired) and glabrous; fruit with microscopic cilia apically20. *P. acuminatum*.
3. Spikelets paired and silky-fringed (4)
- 4(3). Racemes (8 to) 12 to 22 per panicle; spikelets 2-3 mm. long 11. *P. Urvillei*.
4. Racemes 3 to 6 (to 11) per panicle; spikelets 2.8-4.1 mm. long 12. *P. dilatatum*.
- 5(2). Spikelets 3.6-5 mm. long (6)
5. Spikelets less than 3.6 mm. long (9)
- 6(5). Spikelets solitary (7)
6. Spikelets paired; fruit brown (8)
- 7(6). Nonrhizomatous (but culms long-decumbent); spikelets stramineous, pointed; plants of moist saline to brackish sands at edge of lagoons, bays and river mouths 19. *P. vaginatum*.
7. Sod-formers with masses of thick short branching rhizomes; spikelets greenish-stramineous, usually blunt; plants of sandy openings in forests or upland roadsides 23. *P. notatum*.
- 8(6). Spikelet pairs remote, usually not overlapping; first glume present on at least some of the spikelets; rachis of raceme 0.5-0.8 mm. broad 5. *P. bifidum*.
8. Spikelet pairs approximate, overlapping; first glume absent; rachis 1-1.5 mm. broad 6. *P. floridanum*.
- 9(5). All the spikelets solitary, never paired (10)
9. Some and usually nearly all the spikelets paired (17)
- 10(9). Spikelets 1.4-2.3 mm. long (11)
10. Spikelets 2.4-3.6 mm. long (13)
- 11(10). Panicle axis 30-80 mm. long; rachis 1.8-3 mm. broad, broadly winged 21. *P. dissectum*.
11. Panicle axis very short, to 2 mm. long; rachis 0.7-0.8 mm. broad, triangular in cross section (12)
- 12(11). Spikelets 1.9-2.3 mm. long, glabrous; raceme 2.5-7 cm. long 25. *P. minus*.
12. Spikelets 1.4-1.8 mm. long, pubescent; racemes 4-15 cm. long 26. *P. conjugatum*.
- 13(10). Panicle axis 3-10 (-19) cm. long; racemes 2 to 9 per panicle 13. *P. laeve*.
13. Panicle axis obsolete or only to 2.5 cm. long; racemes 1 to 3 per panicle (14)
- 14(13). Plants sod-forming or densely tufted from short branched rhizomes; rachis about 1 mm. broad; racemes nearly always 2, arched so that the spikelets are on the concave side of the arc (15)
14. Plants spreading, the culms long-decumbent and rooting at the nodes; racemes either spreading and straight or else reflex-arched so that the spikelets are on the convex side of the arc (16)
- 15(14). Sod-forming perennial from a mass of short thick branching rhizomes; blades mostly aggregated at ground level; spikelets broadly ovate to broadly obovate 23. *P. notatum*.
15. Densely tufted perennial shortly and slenderly subrhizomatous basally; culms leafy in the lower half 24. *P. alnum*.

- 16(14). Spikelets 2.5-3.2 mm. long; second glume minutely pubescent; first glume usually present 18. *P. distichum*.
16. Spikelets 3.1-4.5 mm. long; second glume nearly glabrous; first glume usually absent 19. *P. vaginatum*.
- 17(9). Fruits (fertile lemmas) brown or brownish-olive at maturity (18)
17. Fruits (fertile lemmas) whitish or stramineous at maturity (21)
- 18(17). Panicle axis 12-25 cm. long; racemes 7 to 25 per panicle; spikelets conspicuously pubescent; fruits pale-brown 10. *P. virgatum*.
18. Panicle axis to 13 cm. long; racemes 1 to 15 per panicle; spikelets essentially glabrous or minutely pubescent; fruits quite brown (19)
- 19(18). Perennial with long to very short rhizomes; rachis of raceme 0.5-1 mm. broad, broadly triangular in transection 7. *P. plicatulum*.
19. Annuals without rhizomes; rachis of raceme 1-2.5 mm. broad, with margins more or less winglike (20)
- 20(19). Rachis 2-2.5 mm. broad, remarkably winged; spikelets 2-2.3 mm. long 8. *P. Boscianum*.
20. Rachis 1-2 mm. broad, the winglike margins relatively narrow and interrupted by the zigzag central spikelet-bearing rib; spikelets 2.2-3 mm. long 9. *P. convexum*.
- 21(17). Rachis 0.4-1 mm. broad, triangular to broadly triangular in transection; first glume usually present (except in *P. setaceum*); axillary panicles often present in the uppermost sheaths in addition to the exerted terminal panicles (22)
21. Rachis 1.3-2.5 mm. broad, broadly triangular in transection or usually with narrow to broad winglike margins; first glume usually absent; axillary panicles absent (25)
- 22(21). Blades involute and the margins coalescent toward the tips 1. *P. monostachyum*.
22. Blades flat, the margins separate (23)
- 23(22). Spikelets 2.9-3.4 mm. long; racemes solitary, very rarely 2 per panicle 2. *P. unispicatum*.
23. Spikelets 1.5-2.8 mm. long; racemes often not solitary (24)
- 24(23). First glume usually present on at least one spikelet of every pair; spikelets with large sordid-brownish splotches all over 3. *P. Langei*.
24. First glume very rarely present; spikelets smooth or with merely small scattered brown points, mostly whitish or stramineous 4. *P. setaceum*.
- 25(21). Spikelets orbicular or suborbicular, glabrous 14. *P. praecox*.
25. Spikelets longer than broad (26)
- 26(25). Spikelets thickly turgidly plano-convex, usually pubescent; rachis rarely with purplish coloration; racemes only 1 to 6 per panicle . 17. *P. pubiflorum*.
26. Spikelets flatly compressed plano-convex; rachis usually with a distinct purplish color; racemes usually more numerous, 3 to 15 per panicle (27)
- 27(26). Spikelets (2.1-) 2.3-2.7 (-2.9) mm. long, glabrous 15. *P. lividum*.
27. Spikelets (2.2-) 2.5-2.9 (-3.2) mm. long, pubescent .. 16. *P. Hartwegianum*.

1. *Paspalum monostachyum* Vasey. Perennial from scaly creeping rhizomes 2-5 mm. thick; aerial culms 4-10 dm. long, 2-3 mm. thick, erect; ligule a scale about 2 mm. long (base of blade next to it with a fringe of long cilia); blades 15-60 cm. long, 1-2 mm. thick, strongly involute (the upper part with the two edges coalescent), tough and wiry; panicles terminal (rarely a short axillary one present from the same sheath as the primary terminal one); panicle axis (when the racemes not solitary) 10-35 (-95) mm. long, tough; racemes 1 or 2 (to 4), 8-30 cm. long; rachis about 0.8 mm. broad, triangular in transection; spikelets paired, 2.7-3.3 mm. long, usually obovate, plano-convex, apically blunt, stramineous, glabrous, on minutely pubescent pedicels; first glume usually present, small, triangular. Sandy prairies, s.e. Tex. and coastal parts of Rio Grande Plains, frequent, summer-fall; Fla., La. and Tex.

2. *Paspalum unispicatum* (Scribn. & Merr.) Nash. Perennial from short scaly rhizomes 2-4 mm. thick; aerial culms 2-8 dm. long, 1-2.5 mm. thick, erect; ligule a scale 1-3 mm. long (immediately juxtaposed portion of blade hirsute); blades 10-25 cm. long, 8-15 mm. broad, mostly flat or folded, sparsely to densely papillose-hirsute; panicles terminal and axillary; panicle axis (when (rarely) the racemes are not solitary) 1-2 cm. long; racemes solitary, very rarely 2 per culm, 6-20 cm. long; rachis about 1 mm. broad, triangular in transection; spikelets paired, 2.9-3.4 mm. long, obovate, plano-convex or somewhat concavo-convex, apically acute, stramineous, glabrous; first glume usually present, small, triangular. Sandy or loamy prairies, Rio Grande Plains (rare, Kleberg Co.), perhaps no longer a member of our flora, not collected since 1906, summer; Venez., Parag., Arg.; Cuba; e. Mex.

3. *Paspalum Langei* (Fourn.) Nash. Tufted perennial; culms 3-10 dm. long, about 1 mm. thick, erect, unbranched; ligule a sordid scale about 1 mm. long; blades 9-40 cm. long, 6-15 mm. broad, flat, pointed, marginally often crisped, nearly glabrous or (like the sheaths) with a few papillose cilia near the ligule, or minutely appressed-pubescent; panicles terminal and often in the same sheath a nearly hidden axillary one; panicle axis (when racemes not solitary) 3-8 (-12) cm. long; racemes 1 to 4 (or 5), 3-11 cm. long; rachis 0.4-0.6 mm. broad, triangular in transection; spikelets paired, rarely by abortion a few solitary in the same raceme, 2.1-2.6 (-2.8) mm. long, usually narrowly obovate, plano-convex, apically blunt, dark-stramineous with sordid-brown glandular splotches; first glume about a fourth as long as the spikelet, always present on at least one (usually both) spikelets of each pair, pubescent at least marginally and apically; second glume with minute spreading pubescence; sterile lemma usually pubescent like the second glume. Loamy soils, often in shaded areas, woods in stream bottoms, s.e. Tex., Rio Grande Plains and s. parts of e. Tex., frequent, spring-fall; widespread in trop. Am. n. to Fla., La. and Tex.

4. *Paspalum setaceum* Michx. Perennial from tufted knotty and shortly subrhizomatous branched bases; flowering culms 20-65 (-100) cm. long, 1-2.5 mm. thick, erect, unbranched; ligule a scale 0.2-0.3 mm. long (base of blade next to it usually pilose); blades 5-35 cm. long, 2-20 mm. broad, varying from very sparsely papillose-pilose along the margins to densely softly pubescent all over both surfaces, mostly flat or loosely folded; sheaths varying in pubescence like the blades; panicles axillary as well as terminal, the axillary ones often short and hidden in the sheaths; panicle axis (when racemes more than one) 10-65 mm. long; racemes 1 to 3 (or 4), 4-10 (-17) cm. long, often with long hairs in the axils, often weak and arcuate-nodding; rachis 0.5-1 mm. broad, triangular in transection; spikelets paired, (1.5-) 1.8-2.1 (-2.7) mm. long, ovate to obovate or usually suborbicular, turgidly plano-convex to plano-hemispheric, blunt apically, white to stramineous; first glume very rarely developed, when present narrowly triangular; second glume and sterile lemma glabrous to usually minutely pubescent all over. *P. ciliatifolium* Michx., *P. debile* Michx., *P. ciliatifolium* var. *Muhlenbergii* (Nash) Fern., *P. pubescens* Muhl., an illegit. name, *P. stramineum* Nash (*P. ciliatifolium* var. *stramineum* (Nash) Fern.), *P. rigidifolium* Nash, *P. separatum* Shinnars. Usually in sandy soil throughout the state except rare in Edwards Plateau and Trans-Pecos, most abundant in e. and s.e. Tex. and coastal parts of Rio Grande Plains, spring-fall; e. U.S. w. to Wisc., Neb., Kan., Okla. and Tex.; also Colo., N.M., Ariz., Son., Chih. and e. Mex.; C. A., W. I.

A common plant [var. *Muhlenbergii* (Nash) D. Banks] in east Texas combines some or all of the characters of robust habit, highly pubescent foliage, long racemes with little or no axillary hair and large, glabrous, orbicular spikelets. Other plants completely connect this variant with the average *P. setaceum* through recombination of characters. Nearly all of our plants are the var. *stramineum* (Nash) D. Banks.

5. *Paspalum bifidum* (Bert.) Nash. Perennial from rhizomes 3-4 mm. thick with pubescent scales; aerial culms 5-12 dm. long, 2-3 mm. thick, erect, unbranched; ligule a thin brownish scale 1-5 mm. long; blades 1-5 dm. long, 3-14 mm. broad, flat or folded, densely pilose at least near the ligule and often on both surfaces; sheaths pilose; panicle axis 12-20 cm. long; racemes 2 to 6, 4-16 cm. long, ascending or somewhat spreading; rachis 0.5-0.8 mm. broad, triangular in transection, often markedly zigzag; spikelets paired or by abortion a few solitary in the same raceme (the pairs remote from each other and not much if at all overlapping), 3.6-4.2 mm. long, ovate to obovate, brownish, turgidly plano-convex, glabrous; first glume present as a minute triangle at the base of

the sterile lemma; second glume and sterile lemma firm-membranous; fruit brownish-green or olivaceous. Incl. var. *projectum* Fern. In moist acid sand near bogs and open woods, infrequent or rare in e. Tex., Sept.-Oct.; Coastal States, from Va. to Tex. and inland to Ark. and Okla.

6. *Paspalum floridanum* Michx. Robust perennial from short rhizomes 3-6 mm. thick with pubescent scales; aerial culms (5-) 8-15 (-20) dm. long, 2-5 mm. thick, erect, unbranched; ligule a brownish scale 1-2 mm. long; blades 1-5 dm. long, 4-13 mm. broad, firm, flat or folded, glabrous to pilose; sheaths keeled, glabrous to pilose; panicle axis (when racemes not solitary) 4-13 (-20) cm. long; racemes (1 or) 2 to 4 (to 6), 4-15 cm. long, ascending or somewhat spreading; rachis 1-1.5 mm. broad, usually strongly zigzag, the central rib to which the pedicels are attached even more markedly zigzag, the very narrow margins thus interrupted; spikelets paired or by abortion some solitary on the same raceme, 3.6-5 mm. long, ovate to obovate, usually broadly so, brownish, turgidly plano-convex, glabrous; first glume always absent or present as a mere minute line at the base of the sterile lemma; second glume and sterile lemma firm-membranous, sometimes the latter slightly wrinkled; fruit pale-brownish. Incl. var. *glabratum* Engelm. Permanently or seasonally moist clay or sandy loam, e., s.e. and n.-cen. Tex. and extreme n.e. Rio Grande Plains, frequent, summer-fall; N.J. to Ill., Mo. and Kan., s. to the Gulf States.

7. *Paspalum plicatum* Michx. BROWNSEED PASPALUM. Tufted perennial with very short to rather elongate rhizomes basally; culms 3-8 dm. long, 1-2 mm. thick, unbranched; erect or occasionally basally decumbent and rooting at the nodes; ligule a thin brownish scale 2-3 mm. long; blades 1-4 dm. long, 2-4 (-6) mm. broad, flat or usually folded, or on drying loosely involute, usually pilose near the ligule; sheaths loosely keeled; panicle axis 5-13 cm. long, slender; racemes (2 or) 3 to 5 (to 8), 2-5 (-8) cm. long, arcuate, commonly spreading; rachis 0.5-1 mm. broad, triangular in transsection, olivaceous; spikelets paired or by abortion a few solitary in the same raceme, (2-) 2.3-2.9 (-3.1) mm. long, obovate, olive-brown, plano-convex; first glume always absent; second glume glabrous or microscopically pubescent; sterile lemma glabrous, often with several transverse wrinkles; fruit brown at maturity. *P. texanum* Swall. Sandy loam prairies and open woods, common in s.e. and e. Tex. and coastal part of Rio Grande Plains, infrequent w. to n.-cen. Tex. and n. Rio Grande Plains, spring-fall; widespread in warmer parts of Am., n. to Ga. and the Gulf States.

The elongation of the rhizomes is more pronounced in some populations (*P. texanum*) of moist, sandy soils in southeast Texas.

8. *Paspalum Boscianum* Flügge. BULL PASPALUM. Tufted annual; culms 3-10 dm. long, 2-7 mm. thick, ascending, often prostrate basally, rooting and genuflexed at the nodes, purple; ligule a brown scale 2-4 mm. long; blades 1-4 dm. long, 5-13 mm. broad, flat or folded, pilose near the ligule; lowermost sheaths inconspicuously pilose; axis of panicle 5-10 cm. long; racemes (2 to) 4 to 11 (to 15), 2-9 cm. long, ascending, arcuate, pilose in the axils; rachis 2-2.5 mm. broad, olivaceous, the pedicels attached in a narrow central rib, the marginal winglike portions mostly broader than the rib; spikelets paired or by abortion a few in the same raceme solitary, 2-2.3 mm. long, plano-convex, brownish, obovate-orbicular, glabrous; first glume always absent; second glume and sterile lemma thin; fruit brown and shining at maturity. Reported to occur in e. Tex., summer-fall; Coastal States, Va. to Tex. and inland to Tenn. and Ark.; W. I.

9. *Paspalum convexum* H.&B. Tufted annual; culms 10-75 cm. long, 1-2.5 mm. thick, mostly ascending, often the lower nodes geniculate; ligule a thin brownish scale about 2 mm. long; blades 5-23 cm. long, 3-11 mm. broad, flat, pilose at least on part of the upper surface; panicle axis (when racemes not solitary) 2-8 cm. long; racemes 1 to 4, 1-7 cm. long, spreading, pilose in the axils; rachis 1-2 mm. broad, the pedicel-bearing central rib zigzag from side to side, marginal winglike portions thus interrupted; spikelets paired, 2.2-3 mm. long, plano-convex, obovate-suborbicular, olive-brownish; first glume always absent; second glume and sterile lemma membranous, the former minutely pubescent; fruit brown at maturity. Disturbed sandy soil near roads, e. Tex., rare (Jasper Co.), summer-fall; widespread in Am. tropics n. to n. Mex.; introd. and probably not persistent in Tex.

10. *Paspalum virgatum* L. Robust tufted perennial; culms 1-2 m. long, 2-8 mm. thick, erect, unbranched; ligule a scale 0.5-2.5 mm. long; blades 30-75 cm. long, 10-25 mm.

broad, firm, flat, marginally serrulate, pilose near the ligule; sheaths pilose at the summit; axis of panicle 12-25 cm. long; racemes 7 to 25, 3-15 cm. long, ascending; rachis 1-1.5 mm. broad, purplish-olive or olive-purple, the central rib (to which the pedicels are attached) narrow, the winglike margins slightly broader than the rib, commonly with some few scattered cilia; spikelets paired, 2.5-3.2 mm. long, brownish or purplish-brown, elliptic to narrowly obovate, much-compressed, plano-convex; first glume always absent; second glume softly spreading pubescent, the hairs longer near the margin; sterile lemma often nearly glabrous; fruit pale-brownish. Moist clay loam, disturbed places, s. Rio Grande Plains, rare (Cameron Co.); widespread in trop. Am. n. to Tex. and Cuba.

11. *Paspalum Urvillei* Steud. VASEY GRASS. Tufted perennial, often shortly subrhizomatous basally; culms 7-20 dm. long, 2.5-8 mm. thick, mostly strictly erect; ligule a scale 3-6 mm. long (base of blade pilose); blades 1-4 dm. long, 4-13 mm. broad, flat, essentially glabrous except near the ligule; lowermost sheaths densely pilose; panicle axis 8-25 cm. long; racemes (8 to) 12 to 22, 2-13 cm. long, pilose at the axils; rachis about 1 mm. broad, greenish or purplish, flattened, the pedicels attached at the central rib, the marginal portions about as broad as the rib; spikelets paired, (2-) 2.2-2.7 (-3) mm. long, broadly obovate, greenish-stramineous, much-flattened, plano-convex, extended in the broad triangular point beyond the fruit; first glume always absent; second glume softly silky-pubescent, this pubescence much longer near the margins than in the center; sterile lemma nearly glabrous at the center; fruit elliptic-oblong, slightly obovate. Loamy disturbed usually very moist soil, e., s.e. and n.-cen. Tex., rare w. to Edwards Plateau, spring-fall; nat. of S. A., now distributed in N. A., n. to N.C., the Gulf States and Ark.; Calif.

12. *Paspalum dilatatum* Poir. DALLIS GRASS. Tufted perennial; shortly subrhizomatous basally; culms 3-15 dm. long, 2-6 mm. thick, erect or somewhat sprawling and slightly genuflexed and rarely rooting at the lower 1 or 2 nodes; ligule a scale 2-5 mm. long (base of blade pilose); blades 7-36 cm. long, 4-12 mm. broad, flat, essentially glabrous except near the ligule; lowermost sheaths pilose; panicle axis (3-) 5-10 (-15) cm. long; racemes 3 to 6 (to 11), 4-12 cm. long, pilose at the axils; rachis 0.8-1.7 mm. broad, greenish or purplish-olive, flattened, the pedicels attached at the narrow central rib, the marginal portions winglike and at least as broad as the rib; spikelets paired, (2.8-) 3.2-3.5 (-4.1) mm. long, basally obovate, greenish-stramineous, very flattened, compressed plano-convex, extended in a broad triangular point beyond the fruit; first glume always absent; second glume softly pubescent, shortly so in the middle but near the margins with a long silky fringe; sterile lemma softly pubescent; fruit nearly orbicular. Loamy disturbed soils, abundant in e., s.e. and n.-cen. Tex., infrequent in Rio Grande Plains, Edwards Plateau and Trans-Pecos, spring-fall; nat. of S. A., now rather widely distributed in warm-temp. areas n. to N.J., Tenn., Ark., Okla. and Ore.

A persistent weed in lawns, almost impossible to eradicate once it has become established.

13. *Paspalum laeve* Michx. Tufted perennial, very shortly subrhizomatous basally; culms 3-9 dm. long, about 2 mm. thick, erect, unbranched; ligule a brown scale 1-2 mm. long; blades 6-40 cm. long, 3-10 mm. broad, flat or folded, glabrous or pilose; sheaths somewhat keeled, glabrous or pilose; panicle axis 3-10 (-19) cm. long; racemes (2 to) 3 to 6 (to 9), 3-11 cm. long, spreading, pilose in the axils; rachis about 1 mm. broad, dark-olive-green, with a zigzag central rib, the pedicels attached on this rib where it is nearest the margin, the narrow winglike margins interrupted; spikelets solitary, 2.4-3.1 mm. long, very broadly obovate to orbicular, pale or stramineous-olive, plano-convex, blunt; first glume always absent; second glume and sterile lemma firm-membranous, glabrous. *P. longipilum* Nash, *P. circulare* Nash. Sandy loam, prairies and open forests, e. and s.e. Tex. and extreme n.e. Rio Grande Plains (Nueces Co.), infrequent, summer-fall; Coastal States, Mass. to Tex. and inland to O., Ind., Ill., Mo., Kan. and Okla.

14. *Paspalum praecox* Walt. Tufted perennial, very shortly rhizomatous basally, culms 5-15 dm. long, 1-3 mm. thick, erect, unbranched; ligule a brown scale 1-3 mm. long; blades 1-3 (-4) dm. long, 3-10 mm. broad, flat or usually folded, glabrous to pilose; sheaths glabrous to pilose, keeled; panicle axis 5-17 cm. long; racemes (2 to) 4 to 6 (to 9), 2-7 (-9) cm. long, arcuate, ascending or spreading, shortly bearded and sometimes also pilose at the axils; rachis 1.3-2 mm. broad, purplish-olive, with a broad central rib to which the pedicels are attached, the marginal winglike portions firm and narrower

than the central rib; spikelets paired or a few by abortion solitary on the same raceme, 2.2-3.2 mm. long, orbicular to suborbicular, yellowish-green, occasionally with a purplish-tinge, highly compressed plano-convex; first glume always absent; second glume and sterile lemma membranous, glabrous. *P. lentiferum* Lam. Sandy loam, open pine flats, s.e. Tex., infrequent, summer-fall; Coastal States, Va. to Tex.

15. *Paspalum lividum* Trin. LONGTOM. Tufted perennial; culms 50-175 cm. long, compressed, 2-4 mm. thick on the long axis, often basally decumbent and freely rooting for up to 1 m., then ascending at the floriferous ends; ligule a scale 1-3 mm. long; blades 10-23 cm. long, 3-5 mm. broad, flat or folded; panicle axis 3-12 cm. long, curviflexuous; racemes 3 to 8, 15-50 mm. long, ascending and curved, floriferous to the base, the lower racemes with a few hairs in the axils; rachises 1.5-2.5 mm. broad, thin, purplish-olive to olive-purple, rather elongate, spreading, the rather elongate spreading pedicels attached along a very narrow central rib, the lateral portions of the rachis foliaceous and winglike and usually sparsely papillose-pilose marginally; spikelets paired or rarely a few also solitary in the same raceme, (2.1-) 2.3-2.7 (-2.9) mm. long, obovate, bluntly pointed, with nearly parallel plane surfaces or at least very compressed plano-convex, yellowish-green or occasionally with a purplish cast; first glume always absent; second glume and sterile lemma essentially glabrous. Moist tight clay loam in ditches, tanks, resacas and shallow lakes, s.e. Tex. and coastal parts of Rio Grande Plains, frequent, spring-fall; widespread in warmer parts of Am., n. to Ala., La. and Tex.

16. *Paspalum Hartwegianum* Fourn. Tufted stoloniferous perennial; floriferous culms 5-15 dm. long, slightly compressed, 2-5 mm. thick on the long axis; ligule a scale 1-3 mm. long; blades 10-35 cm. long, 2-6 mm. broad, flat or folded; sheaths keeled; panicle axis 5-15 cm. long, mostly straight and slender; racemes (3 or) 4 to 8, 2-9 cm. long, ascending or somewhat spreading, often slightly curved, floriferous to the base, the lower ones usually with a few long hairs in the axils; rachises 1.5-2 mm. broad, thin, olive or purplish-olive, the rather elongate spreading pedicels attached along a very narrow central rib, the lateral portions of the rachis foliaceous and winglike; spikelets paired, rarely also a few in the same raceme solitary, (2.2-) 2.5-2.9 (-3.2) mm. long, obovate, slightly pointed, with nearly parallel plane surfaces or at least very compressed plano-convex, yellowish-green; first glume always absent; second glume and sterile lemma shortly and uniformly pubescent. Moist tight soil, Rio Grande Plains, frequent, spring-fall; much of Mex. n.w. to Son.; Tex.

17. *Paspalum pubiflorum* Fourn. Loosely tufted perennial; culms 3-15 dm. long, compressed, 2-3 mm. thick on the long axis, decumbent and freely rooting in the basal third to half the length but usually mostly ascending; ligule a scale 1-3 mm. long; blades 6-30 cm. long, 5-13 mm. broad, mostly flat, marginally crisped and basally papillose-pilose; lower sheaths usually papillose-pilose; panicle axis 8-62 mm. long; racemes 2 to 4 (to 6), 2-10 cm. long, ascending or spreading, floriferous to the base or infrequently with a naked basal portion 1-3 mm. long and a few long hairs in the axil; rachises 1.5-2 mm. broad, broadly triangular, olive-green; spikelets attached even along the margins, paired or rarely in the same raceme a few of them solitary, (2.3-) 2.7-2.9 (-3.2) mm. long, obovate, turgidly plano-convex, greenish to stramineous or with a purplish cast, blunt to very slightly pointed; first glume small, triangular, usually absent or much-reduced; second glume and sterile lemma microscopically pubescent to rarely glabrate. Incl. var. *glabrum* Scribn. Moist garden loam and moist usually calcareous soil at edges of streams and lakes, throughout the state (but rare in Plains Country), spring-fall; lowlands of s.e. U.S. n. to N.C., O., Ind., Ill., Mo. and Kan.; much of Mex.; Cuba.

18. *Paspalum distichum* L. KNOTGRASS. Long-decumbent perennial; culms 5-15 dm. long, compressed, 2-3 mm. thick on the long axis, extensively creeping, freely rooting, somewhat branched, ascending at the simple floriferous ends; ligule a scale 0.5-1 mm. long; blades 3-12 cm. long, 2-6 mm. broad, membranous and usually flat or folded, or the tip on drying loosely involute, basally broader than the summit of the sheath; sheaths slightly keeled at summit, the corner with a few soft hairs and often the lower sheaths (when emergent) visibly pubescent ("var. *indutum*") but these usually lost in specimens; racemes usually 2, rarely 1 or 3, 15-70 mm. long, erect or somewhat spreading, often arcuate, floriferous essentially to the base; rachises broadly triangular in transection, 1-1.5 (-2) mm. broad; spikelets attached nearly at the margin by the short pedicels, solitary, elliptic, (2.5-) 2.7-3 (-3.2) mm. long, greenish to stramineous, blunt to somewhat

pointed; first glume usually present, minute, triangular; second glume microscopically pubescent; sterile lemma glabrous or rarely with a few microscopic hairs near midrib. Incl. var. *indutum* Shinn. Margins of fresh ponds, streams and lakes, frequent in e., s.e. and n.-cen. Tex., Edwards Plateau and Trans-Pecos, infrequent in Rio Grande Plains and Plains Country, summer-fall; widespread in the warmer parts of the world, in Am. n. to N.J., Tenn., Ark., Okla., Ut., Ida. and Wash.

Some coastal specimens seem intermediate between *P. distichum* and *P. vaginatum*; some specimens from central Texas seem to combine characters of *P. distichum* and *P. pubiflorum*.

19. *Paspalum vaginatum* Sw. Long-decumbent perennial; culms 5-25 dm. long, compressed, 3-4 mm. thick on the long axis, extensively creeping and freely rooting, branched, ascending only at the simple floriferous ends; ligule a scale about 1 mm. long; blades 2.5-15 cm. long, 3-8 mm. broad, firm and stiffly straight, basally narrower than the summit of the sheath and folded, tapering to a long-involute tip (occasionally near semi-brackish water the blades persistently flat); sheaths keeled, the corners ciliate; panicle axis 1-10 (-15) mm. long; racemes 1 or 2 (or 3), 2-8 cm. long, divaricate; rachises often naked for the basal 2-5 mm., 1-2 mm. broad, broadly triangular or occasionally very narrowly winged; spikelets attached nearly at the margin by the broad short pedicels, solitary, ovate-elliptical, 3.1-4.2 (-4.5) mm. long, glabrous, stramineous, pointed; first glume very rarely present; sterile lemma thin and often transversely wrinkled; fruit pointed, nearly as long as spikelet, apically glabrous. Moist saline to brackish sands at edges of lagoons, bays and river-mouths, rarely in sub-brackish ponds near the coast, s.e. Tex. and Rio Grande Plains, frequent, summer-fall-early winter; widespread in warm coastal areas of the world, in Am., n. to N.C. and the Gulf States.

20. *Paspalum acuminatum* Raddi. Long-decumbent aquatic or subaquatic perennial; culms 3-10 dm. long, 1-3.5 mm. thick, soft, freely rooting and rather freely branching, ascending and emergent only at the end; ligule a membranous scale 1-3 mm. long; blades 3-20 cm. long, 2-12 mm. broad, flat, thin; panicle axis 1-3 cm. long; racemes 2 or 3 (to 5?), 3-7 cm. long, ascending, usually somewhat arcuate; rachis 3-3.5 mm. broad, with the spikelets borne in a very narrow central rib, the remainder of the rachis forming foliaceous wings; spikelets solitary, elliptic, 3.3-3.5 mm. long, glabrous, greenish, apically abruptly pointed beyond the fruit; first glume absent; fruit blunt, apically with some minute cilia. In fresh water ponds, Rio Grande Plains, rare (Cameron and Brooks cos.), spring-fall; lowlands, widespread but scattered in trop. Am., n. to s. La. and s. Tex.

21. *Paspalum dissectum* (L.) L. Long-decumbent mat-forming perennial; culms 20-75 cm. long, compressed, 1.5-2 mm. thick on the long axis, freely rooting in the mud, rather freely branched; ligule a membranous scale 1-2 mm. long; blades 2-9 (-12) cm. long, 2-5 mm. broad, thin, flat or folded; panicle axis 3-8 cm. long, slender and grooved, 0.2-0.4 mm. thick; racemes 2 to 4, 1-5 cm. long, ascending and slightly arcuate; rachis 1.8-3 mm. broad, with the spikelets borne on a very narrow central rib, the remainder of the rachis forming foliaceous wings; spikelets solitary, broadly elliptic, 1.7-2 mm. long, 1-1.2 mm. broad, essentially glabrous, greenish to stramineous, apically blunt; first glume absent; fruit blunt. Forming mats in moist sand at the margins of seeps, bogs and lakes, e. Tex., infrequent, summer-fall; lowlands of s. U.S., n. to N.J. and Ill.; Cuba.

22. *Paspalum fluitans* (Ell.) Kunth. Long-decumbent or floating aquatic grasses said to be annual; culms 3-10 dm. long, 2-5 mm. thick, soft (with much gas-holding tissue), mostly submerged, only the floriferous ends emergent; ligule a membranous scale 2-4 mm. long; aerial blades 10-25 cm. long, 9-20 mm. broad, very thin and flat; sheaths pubescent, their corners triangular-auricled; panicle axis 6-16 cm. long, 0.5-1 mm. thick; racemes (20 to) 30 to 50, 25-75 mm. long, ascending or usually arcuate-spreading, at maturity deciduous from the axis; rachis 1-1.7 mm. broad, the spikelets borne on a very narrow central rib, the remainder of the rachis forming thin foliaceous wings; spikelets solitary, 1.2-1.7 mm. long, only about 0.7-0.9 mm. broad, pubescent, pale-stramineous, often with a discolored or stained spot at the base of the sterile lemma and apically acute; first glume absent. *P. repens* Berg. Forming colonies in fresh water, s.e. Tex., infrequent, summer-fall; widespread in trop. Am., n. to N.C., Ill., Ind., Mo. and Neb.

23. *Paspalum notatum* Flüggé. BAHIA GRASS. Sod-forming perennial from a mass of thick short branching rhizomes; aerial culms numerous, 2-5 dm. long, compressed, 1.5-3 mm. thick on the long axis, erect; ligule a fragile scale 0.2-0.3 mm. long (the base of the

blade next to the ligule pilose); blades aggregated in tufts at ground level, 7-20 cm. long, 3-6 mm. broad, mostly flat or folded, rather stiffly straight; panicle axis 1-2 mm. long or rarely 5-10 mm.; racemes 2, emerging at the same level or rarely a third raceme present a short distance below, 3-12 cm. long; rachis about 1 mm. broad, triangular in transection, the marginal portions narrower than the central spikelet-bearing rib; spikelets solitary, (2.5-) 2.8-3.5 (-4) mm. long, broadly ovate to broadly obovate, greenish-stramineous, very compressed, plano-convex; first glume always absent; second glume and sterile lemma glabrous, shiny. Sandy loam, openings in forest, usually on roadsides, e. Tex., late spring-fall; warmer parts of Am., indigenous n. to Cuba and Mex.; introd. and persistent in the Gulf States.

A more robust plant, var. *Saurae* Parodi, has been introduced but it neither spreads nor persists.

24. *Paspalum alnum* Chase. COMB'S PASPALUM. Densely tufted perennial, shortly and slenderly subrhizomatous basally at the margins of the tuft; culms 20-35 cm. long, slightly compressed, 1-2 mm. thick, erect; ligule a scale about 1 mm. long; blades 8-28 cm. long, 3-5 mm. broad, mostly flat, straightish, papillose-pilose near the ligule and on the margin basally; panicle axis 1-5 mm. long, rarely to 25 mm.; racemes 2, emerging at nearly the same level, less commonly a third one present below, 5-9 cm. long; rachis about 1 mm. broad, triangular in transection, the marginal portions narrower than the central spikelet-bearing rib; spikelets solitary, 3-3.3 (-3.5) mm. long, ovate, 1.8-2 mm. broad, stramineous, very much-compressed, plano-convex; first glume always absent; second glume and sterile lemma glabrous. Rare in e. Tex. (Jefferson Co.), summer-fall; Braz., Parag. and Arg.; introd. and persistent in s.e. Tex.

25. *Paspalum minus* Fourm. Sod-forming perennial from a mass of slender short branching rhizomes aerial culms 20-35 cm. long, compressed, 1.5-2 mm. thick on the long axis, erect; ligule a fragile scale 0.2-0.3 mm. long (base of blade near the ligule pilose, ligulelike); blades aggregated at ground level, 5-13 cm. long, 3-7 mm. broad, flat, mostly erect; panicle axis 0-2 mm. long; racemes 2, emerging at nearly the same level (very rarely a third present below), 25-70 mm. long; rachis about 0.8 mm. broad, triangular in transection, the marginal portions very narrow; spikelets solitary, 1.9-2.3 mm. long, ovate to obovate, stramineous, very compressed, plano-convex; first glume always absent; second glume and sterile lemma glabrous. Loamy soil in coastal prairies, s.e. Tex., rare (Chambers and Jefferson cos.) where probably introd., summer-fall; widespread in trop. Am. grasslands, n. to Mex. and W. I.

26. *Paspalum conjugatum* Berg. Loosely tufted perennial with long leafy stolons 3-20 dm. long, bearded at the nodes; flowering culms 2-5 dm. long, 1-1.5 mm. thick, erect; ligule a scale 0.3-1 mm. long (base of blade hirsute and pilose next to it); blades 5-22 cm. long, 5-15 mm. broad, flat or folded; panicle axis 1 mm. long, rarely 15-30 mm.; racemes 2, emerging at nearly the same level, very rarely with a third one below, 4-15 cm. long, densely short-pubescent in the axils; rachis 0.7-0.8 mm. broad, triangular in transection, the thin marginal portions very narrow; spikelets solitary, 1.4-1.8 mm. long, very broadly ovate, strongly compressed concavo-convex, stramineous, acute or abruptly acuminate; first glume always absent; second glume glabrous except for a marginal fringe of long papillose-cilia; sterile lemma glabrous. Moist loam in disturbed areas near the Rio Grande, s. Rio Grande Plains, infrequent or rare (Cameron Co.), summer-fall; widespread in warmer parts of the world, in Am. n. to Fla. and Tex.

An unpalatable "sour" grass.

58. PANICUM L. PANIC GRASSES

Widely diverse in habit; spikelets in panicles or less commonly in racemes (rarely in spikelike panicles and then sometimes with a bristlelike sterile branch subtending some spikelets); pedicels usually present; each spikelet falling as a unit, 2-flowered, the lower floret staminate or completely reduced, the upper perfect; first glume much shorter than the spikelet, several-nerved, membranous; second glume as long as the spikelet or nearly as long; lower "sterile" lemma several-nerved, membranous, usually as long as the spikelet or essentially so; sterile palea usually obsolete but occasionally (as in *P. hians*) very strongly developed and cupped and/or hooded; fertile lemma usually somewhat indurate, strongly convex, the margins revolute and clasping the palea of the same

texture, usually smooth and shining like white cartilage, rarely transversely rugose.

A large genus (perhaps 500 species) of warm parts of the world, made particularly difficult in North America because of the occurrence of cleistogamy and occasional wide outcrossing among the "Dichantheleiums" or dichotomous panic grasses (see key below). The taxonomy of *Dichantheleium* has consisted mainly of arbitrary pigeonholing on highly technical and equally highly superficial "key" characters of a mass of populations varying and intergrading chaotically in nearly every character. The admirable work of A. S. Hitchcock and Agnes Chase in reducing hundreds of names to synonymy has been a great step forward, but it was not carried quite far enough.

1. Axis of panicle branchlets extending beyond the base of the uppermost spikelet as a point or bristle 1-6 mm. long (occasionally such bristles are seen in *P. rigidulum* but it has an open panicle); panicle slender, often spikelike (2)
 1. Axis of panicle branchlets not so extended or if so panicle not spikelike (4)
- 2(1). Blades 4-7 mm. broad, about 10 times as long as broad 68. *P. firmulum*.
2. Blades 2-4 mm. broad, often 25 to 50 times as long as broad (3)
- 3(2). Spikelet 2.4-3(-3.2) mm. long 66. *P. ramisetum*.
3. Spikelet (2.6-) 3-4 mm. long 67. *P. Reverchonii*.
- 4(1). Basal leaves usually distinctly different from those of the culm, forming a winter rosette (not very marked in species 1 through 3 or in No. 21); plants perennial, in spring producing simple culms with mostly narrowly lanceolate blades and terminal panicles with numerous spikelets (in most species these not producing viable seeds); later culms often much-reduced and much-branched, producing an autumnal phase usually quite different from the vernal phase and with reduced axillary panicles (*Dichantheleium*) (5)
4. Basal leaves similar to though usually smaller than those of the stem leaves; winter rosette absent; plants annual or perennial; spikelets usually nearly all fertile (30)
- 5(4). Vernal blades elongate, not more than 5 mm. broad, 20 to 50 times as long as broad; autumnal phase branching from the base only (6)
5. Vernal blades either not so elongate or if so then more than 5 mm. broad or the autumnal phase not branching from the base (7)
- 6(5). Spikelets 3.2-4.2 mm. long 1. *P. depauperatum*.
6. Spikelets 2.2-3.2 mm. long 2. *P. linearifolium*.
- 7(5). Plants branching from the base, finally forming rosettes or cushions, the foliage soft and lax 3. *P. laxiflorum*.
7. Plants branching from the culm nodes or rarely remaining simple (8)
- 8(7). Blades long, stiff; autumnal phase bushy-branched above (9)
8. Blades not long and stiff except in some species; not bushy-branched (11)
- 9(8). Spikelets subsessile and more or less secund along the panicle branches 5. *P. neuranthum*.
9. Spikelets not as above (10)
- 10(9). Vernal blades 4-6 cm. long; autumnal blades involute, sharp-pointed, usually arcuate 6. *P. aciculare*.
10. Vernal blades (5-) 7-15 cm. long; autumnal blades flat or mostly involute, not remarkably sharp-pointed 4. *P. angustifolium*.
- 11(8). Plants not forming a distinct winter rosette; spikelets attenuate at base, 3.5-4.3 mm. long (12)
11. Plants forming a distinct winter rosette; spikelets not usually markedly attenuate at base, 0.9-4.7 mm. long (13)
- 12(11). Blades mostly 5-9 mm. broad and mostly 6 to 10 times as long as broad; plants of sandy soil in south Texas 20. *P. nodatum*.
12. Blades mostly 3-6 mm. broad and mostly much more than 10 times as long as broad; plants of Edwards Plateau and other limestone uplands 21. *P. pedicellatum*.

- 13(11). Spikelets blunt and strongly nerved; blades rarely as much as 15 mm. broad (sometimes 20 mm. broad in *P. Ravenelii*) (14)
13. Spikelets rarely both blunt and strongly nerved (17)
- 14(13). Spikelets 1.5-2.4 mm. long; culms erect, wiry with few short stiff divergent blades 13. *P. portoricense*.
14. Spikelets 2.6-4.3 mm. long; culms spreading to erect, not wiry, usually with well-developed ascending blades (15)
- 15(14). Spikelets 2.6-3 mm. long 18. *P. malacophyllum*.
15. Spikelets (2.9-) 3-4.3 mm. long (16)
- 16(15). Blades of vernal culms 10-20 mm. broad, densely velvety hirsute beneath; spikelets 3.7-4.3 mm. long 22. *P. Ravenelii*.
16. Blades of vernal culms 5-12 mm. broad, pubescent to glabrous beneath; spikelets 2.9-4 mm. long 19. *P. oligosanthos*.
- 17(13). Ligule (or at least a ligulelike tuft at the extreme base of the blade) of conspicuous hairs usually (2-) 3-5 mm. long (18)
17. Ligule less than 2 mm. long to obsolete (22)
- 18(17). Spikelets 0.9-1.3 mm. long; "ligule" 2-3 mm. long 8. *P. leucothrix*.
18. Spikelets 1.3-2.9 mm. long; "ligule" (2-) 3-5 mm. long (19)
- 19(18). Sheaths glabrous or sparingly pubescent; spikelets 1.3-1.7 mm. long 9. *P. Lindheimeri*.
19. Sheaths pubescent; spikelets 1.6-2.9 mm. long (20)
- 20(19). Spikelets 1.6-2.1 mm. long; pubescence various but rarely copiously pilose 10. *P. lanuginosum*.
20. Spikelets 1.8-2.9 mm. long; sheaths pilose (21)
- 21(20). Spikelet 1.8-2.8 mm. long; tuft of hairs at base of blade (2-) 4-5 mm. long; sheaths copiously and usually retrorsely pilose 11. *P. villosissimum*.
21. Spikelet 2.7-2.9 mm. long; tuft of hairs at base of blade 2-3 mm. long; sheaths ascending-pilose 12. *P. ovale*.
- 22(17). Spikelets nearly spherical at maturity; blades glabrous, firm, cordate; ligule obsolete (23)
22. Spikelets usually obovoid or ellipsoid; ligule usually developed (obsolete in *P. commutatum* and allies) (24)
- 23(22). Panicle nearly as broad as long 16. *P. sphaerocarpon*.
23. Panicle at least twice as long as broad 17. *P. polyanthes*.
- 24(22). Spikelets 3.6-4.7 mm. long 23. *P. latifolium*.
24. Spikelets 1.2-3.2 mm. long (25)
- 25(24). Spikelets 2.3-3.2 mm. long (26)
25. Spikelets 1.2-2.2 mm. long (28)
- 26(25). Ligule obsolete; blades only 5-10 (-15) cm. long, 8-25 mm. broad, glabrous, at base cordate and ciliate; spikelets slenderly ellipsoid, 2.4-3.1 mm. long, never turgid 25. *P. commutatum*.
26. Ligule a muticous scale or a short fringe; blades 10-23 cm. long, 9-30 mm. broad, glabrous or scabrous, at base only slightly if at all cordate; spikelet turgidly ellipsoid to obovoid or ovoid, 2.3-3.2 mm. long (27)
- 27(26). Spikelets 2.7-3.2 mm. long 26. *P. clandestinum*.
27. Spikelets 2.3-2.6 mm. long 24. *P. scoparium*.
- 28(25). Culms delicate, usually less than 30 (rarely to 40) cm. tall; blades filmy, usually only 1-3 cm. long and 1-3 mm. broad, often reflexed 14. *P. ensifolium*.
28. Culms delicate or usually not so delicate, (15-) 20-100 cm. tall; blades firmer (membranous, or firmer), 3-12 cm. long, 3-15 mm. broad, reflexed or ascending (29)

- 29(28). Blades soft, never cartilage-margined; panicle 5-12 cm. long; spikelets 1.4-2.2 mm. long 7. *P. dichotomum*.
29. Blades rather firm and stiff, tending to become cartilaginous at the margin; panicle 3-6 cm. long; spikelets 1.3-1.8 mm. long 15. *P. tenue*.
- 30(4). Plants annual (Doubtful cases should be keyed under both alternatives) (31)
30. Plants perennial (45)
- 31(30). Inflorescence consisting of several more or less secund spikelike racemes; fertile lemma transversely rugose (32)
31. Inflorescence a more or less diffuse panicle (35)
- 32(31). Spikelets 5-6 mm. long 63. *P. texanum*.
32. Spikelets 1.9-3.8 mm. long (33)
- 33(32). Spikelets 3.5-3.8 mm. long 64. *P. arizonicum*.
33. Spikelets 3 mm. long or less (34)
- 34(33). Spikelets strongly reticulate-veined (i.e., longitudinal nerves connected by random transverse connections) 65. *P. fasciculatum*.
34. Spikelets never reticulate-nerved 30. *P. reptans*.
- 35(31). Spikelets microscopically tuberculate (36)
35. Spikelets not tuberculate (37)
- 36(35). Spikelets 1.8-2.6 mm. long, glabrous 35. *P. verrucosum*.
36. Spikelets 3.2-3.6 mm. long, pubescent 34. *P. brachyanthum*.
- 37(35). First glume about a fourth as long as the spikelet 62. *P. dichotomiflorum*.
37. First glume usually proportionately longer (38)
- 38(37). Spikelets about 1.3 mm. long 48. *P. trichoides*.
38. Spikelets 1.7-5 mm. long (39)
- 39(38). Spikelets 4.5-5 mm. long 55. *P. miliaceum*.
39. Spikelets 1.7-4.2 mm. long (40)
- 40(39). Panicles about half the length of the entire plant (41)
40. Panicles a third the total length of plant or less (43)
- 41(40). Panicles narrow, usually less than half as broad as long 60. *P. flexile*.
41. Panicles as broad as long or nearly so (42)
- 42(41). Fertile lemma with a prominent lunate scar or discolored area at base 58. *P. Hillmanii*.
42. Fertile lemma not scarred or discolored at base 59. *P. capillare*.
- 43(40). Spikelets 1.7-2.2 mm. long 61. *P. philadelphicum*.
43. Spikelets 2.7-4.2 mm. long (44)
- 44(43). First glume half to two thirds the length of the spikelet; spikelets 2.7-3.3 mm. long 56. *P. hirticaule*.
44. First glume more than three fourths the length of the spikelet; spikelets 3.8-4.2 mm. long 57. *P. pampinosum*.
- 45(30). Spikelets short-pedicelled along one side of the rachises, forming spikelike racemes; fertile lemma transversely rugose (except in *P. hemitomom*) (46)
45. Spikelets in open or sometimes contracted or congested panicles (somewhat 1-sided in *P. anceps* and *P. rigidulum*) (51)
- 46(45). First glume nearly equaling the sterile lemma (47)
46. First glume much shorter than the sterile lemma (48)
- 47(46). Racemes spreading; fertile lemma not more than one third the total length of the spikelet 31. *P. gymnocarpon*.
47. Racemes appressed; fertile lemma nearly as long as spikelet 33. *P. obtusum*.

- 48(46). Fertile lemma not transversely rugose 32. *P. hemitomon*.
 48. Fertile lemma transversely rugose (49)
- 49(48). Nodes bearded 29. *P. purpurascens*.
 49. Nodes not bearded (50)
- 50(49). Spikelets 2.2-2.4 mm. long 27. *P. geminatum*.
 50. Spikelets 2.5-3 mm. long 28. *P. paludivagum*.
- 51(45). Fertile lemma transversely rugose (52)
 51. Fertile lemma not transversely rugose (53)
- 52(51). Blades (10-) 17-35 mm. broad; nodes usually densely hirsute; rare in extreme south Texas 47. *P. maximum*.
 52. Blades usually 3-17 mm. broad; nodes not bearded; uplands and mountains in west Texas 46. *P. bulbosum*.
- 53(51). Sterile palea enlarged and indurate at maturity, expanding the spikelet; blades scarcely broader than their sheaths; spikelets about 2.3 mm. long, borne toward the ends of the few slender branches 36. *P. hians*.
 53. Sterile palea usually absent or (if present) minute (54)
- 54(53). Plants with conspicuous creeping scaly rhizomes (55)
 54. Plants without creeping scaly rhizomes (59)
- 55(54). Spikelets short-pedicelled, more or less secund along the nearly simple panicle branches 37. *P. anceps*.
 55. Spikelets long-pedicelled, not secund, arranged in an open or contracted panicle (56)
- 56(55). Spikelets 2.2-2.5 mm. long 45. *P. repens*.
 56. Spikelets 2.8-8 mm. long (57)
- 57(56). Panicle compact, strongly contracted, elongate and nodding; plants of coastal sands 42. *P. amarulum*.
 57. Panicle diffuse or only slightly contracted (58)
- 58(57). Spikelets 2.8-5 mm. long 44. *P. virgatum*.
 58. Spikelet usually 6-8 mm. long 43. *P. Havardii*.
- 59(54). Panicles narrow and few-flowered; culms erect and wiry; blades drying involute 41. *P. tenerum*.
 59. Panicles open or contracted, many-flowered (60)
- 60(59). Spikelets 5-6 mm. long, the fertile lemma only 1.6-1.8 mm. long 54. *P. capillarioides*.
 60. Spikelets 1.8-3.7 mm. long (61)
- 61(60). Spikelets short-pedicelled along the nearly simple panicle branches; plants usually of low moist ground (62)
 61. Spikelets either long-pedicelled in open panicles or if very short-pedicelled then the panicle open and its branches branching and plants not confined to low moist ground (63)
- 62(61). Ligule fimbriate-ciliate, 2-3 mm. long 40. *P. longifolium*.
 62. Ligule membranous, about 1 mm. long or less 39. *P. rigidulum*.
- 63(61). Culm (at least the lower part) knotty, the nodes as much as twice as thick as the middle of the internodes 38. *P. antidotale*.
 63. Culm not so knotty (64)
- 64(63). Blades (larger ones) 20-35 mm. broad 49. *P. hirsutum*.
 64. Blades 2-12 mm. broad (65)
- 65(64). Blades hirsute on both surfaces (glabrescent in some specimens) 50. *P. Ghiesbreghtii*.
 65. Blades glabrous or essentially so (at least above) (66)
- 66(65). Culms 70-100 cm. tall, at least the lower nodes with a ring of erect hairs; panicle often nearly half the height of the plant ... 53. *P. pilcomayense*.
 66. Culms 15-80 cm. tall, the lower nodes nearly glabrous; panicle 6-25 cm. long (67)

- 67(66). Spikelets 3-3.7 mm. long 51. *P. Hallii*.
 67. Spikelets 2-3 mm. long 52. *P. filipes*.

1. *Panicum depauperatum* Muhl. Perennial; elongate *vernal phase* differing slightly from the compact autumnal phase; bases firm crowns; vernal phase with culms several to many in a tuft, slender but rather stiff, erect or nearly so; sheaths glabrous or papillose-pilose; ligule less than 1 mm. long; blades 6-15 cm. long, 2-5 mm. broad, often involute in drying, 20 or more times as long as broad; panicle exserted but usually not much exceeding the leaves, 4-8 cm. long, few-flowered; spikelets 3.2-3.8 (-4.2) mm. long, elliptic, pointed, glabrous or sparsely pubescent; second glume and sterile lemma extending beyond the fruit to form a beak, the sterile lemma 7- to 9-nerved; *autumnal phase* similar, the reduced panicles partly concealed in the basal leaves. Rare on gravelly slopes in pine-oak woodlands, e. Tex., very rare w. to n.-cen. Tex., spring-fall; Que. and N.S. to Minn., s. to Ga. and Tex.

2. *Panicum linearifolium* Scribn. Perennial; *vernal phase* in dense tufts; culms slender, erect, 20-45 cm. tall, often pilose; sheaths papillose-pilose; ligule a fringe 0.6-1.5 mm. long; blades erect, usually nearly as long as the panicles, 2-4 mm. broad, 20 or more times as long as broad; panicle long-exserted, 5-10 cm. long, the flexuous branches ascending; spikelets 2.2-3.2 mm. long, oblong-elliptic, obtuse, sparsely pilose; glume and sterile lemma not extending beyond the fruit, the sterile lemma 7- to 9-nerved; *autumnal phase* similar, the reduced panicles hidden among the basal leaves. *P. perlongum* Nash. Frequent in dry sterile gravel or sandy slopes, e. Tex. and isolated in the Llano region, spring(-fall); Que. and Me. to Man. and N.D., s. to Ga., Tex. and Colo.

A form known as "*P. Werneri* Scribn.," probably not specifically distinct, with blades 15 cm. long or shorter, nodes usually sparingly pilose, sheaths glabrous, spikelets nearly glabrous, has been reported to occur at Dallas. *P. linearifolium* is probably merely the small-spikeletted extreme of a continuously intergrading series of forms, all of which should probably be referred to *P. depauperatum*.

3. *Panicum laxiflorum* Lam. Perennial, tufts loose or compact; *vernal culms* (1) 2-4 dm. tall, erect or geniculate below, branching from the base; nodes bearded with reflexed hairs; sheaths retrorsely pilose; foliage soft, lax, aggregated toward the base, the basal leaves not in distinct rosettes in autumn; ligule nearly obsolete; blades 5-15 (-20) cm. long, 7-12 mm. broad, glabrous or sparsely ciliate, or pilose on 1 or both surfaces; panicle long-exserted, 8-12 cm. long, lax, few-flowered, the lower branches often reflexed; spikelets 1.7-2.3 mm. long, obovate, obtuse, turgid, 5- to 7-nerved; *autumnal phase* branching near the base, forming a close flat tuft; blades scarcely reduced or shorter, often much-exceeding the much-reduced secondary panicles, often in dense tufts. *P. xalapense* H.B.K. and var. *strictirameum* Hitchc. & Chase. Frequent in sandy woodlands, e., s.e. and n.-cen. Tex., spring-fall; Md. to Ill. and Mo., s. to Gulf States; Mex., Guat., Hisp.

A very depressed, depauperate form from a few boggy areas in east Texas has been referred to "*P. ciliatum* Ell." but does not appear to be specifically distinct in any critical way. A form known as *P. strigosum* Muhl. with glabrous spikelets 1.3-1.7 mm. long has been reported to occur in east Texas. It is very closely related to *P. laxiflorum* and probably not specifically distinguishable; we have seen no Texas material.

4. *Panicum angustifolium* Ell. Perennial; densely tufted *vernal culms* ascending or spreading 3-5 dm. tall, the lowermost or all the internodes gray crisp-villous or often all internodes nearly glabrous; nodes sometimes bearded, sometimes not; sheaths villous or glabrous, or the lower villous and the upper glabrous; ligules not more than 1 mm. long; blades stiff, ascending, (5-) 7-15 cm. long, 3-8 mm. broad, long-acuminate, glabrous or villous on both surfaces, with usually fairly conspicuous principal nerves, often ciliate at base; panicle long-exserted, 4-10 cm. long, loosely flowered, the branches widely spreading at anthesis, the lower branches often reflexed or ascending; spikelets 2-3 mm. long, elliptic-obovate, papillose-pubescent, attenuate at base, rather strongly 7-nerved; first glume narrow and sheathing at base; *autumnal phase* ascending, repeatedly branching, often somewhat top-heavy and reclining, or spreading or decumbent or mat-like; blades much reduced, very numerous, flat or involute, appressed, falcate or straight, rather thin and papery. *P. consanguineum* Kunth, *P. ovinum* Scribn. & Sm., *P. arenicoloides* Ashe, *P. chrysopsidifolium* Nash. Sandy woodlands, e. and s.e. Tex., s. to Nueces Co., spring-fall; s.e. U.S., W.I., Guat., Nic. and n. S.A.

This is a fairly variable species, as species of *Panicum* go, but the variation is too chaotic to permit recognition of more than one species. The more glabrous phase, *P. ovinum*, grades completely into the rest, although the extremes may be recognized on ultra-technical characters. There is complete intergradation also to *P. portoricense* through the plant known as "*P. aciculare*."

5. *Panicum neuranthum* Griseb. Perennial; rather like the glabrous phase of *P. angustifolium* but the short-pedicelled spikelets more or less secund along the panicle-branches. Reported to occur in Tex., apparently on the basis of a misdetermined specimen of the glabrous phase of *P. angustifolium*, from which it is doubtfully distinct, spring-fall; savannahs and open ground, s. Fla.; Miss.; Br. Hond.; Cuba.

6. *Panicum aciculare* Poir. Perennial, densely tufted; *vernal culms* ascending from a spreading base, 2-5 dm. tall, appressed-pubescent below; lower sheaths villous; ligules not more than 1 mm. long; blades spreading or ascending, stiff, narrowed to an involute point, glabrous or the lower sparsely pilose, the middle-culm blades 4-6 cm. long and 2-5 mm. broad; panicle 3-7 cm. long, the flexuous branches spreading at maturity; spikelets 1.8-2.2 mm. long, obovate, pubescent, attenuate at base, rather strongly 7-nerved; first glume narrow and sheathing at base; *autumnal phase* bushy-branched; culms 1 (-3) dm. long, spreading, forming dense cushions; blades involute, sharp-pointed, usually arcuate, mostly 1-3 cm. long. Scattered in e. and s.e. Tex. on sandy soil, spring-fall; N.J., Va. to n. Fla., Ark., Okla. and Tex.; W.I.; n. S.A.

This is closely related to both the *P. angustifolium* complex and to the *P. portoricense*-*P. lancearium* complex, probably representing a selection of intermediate specimens of hybrid origin and is of negligible taxonomic value.

7. *Panicum dichotomum* L. Perennial; *vernal phase* (Apr.-Aug.) culms tufted, erect or ascending from a knotted or loose crown, 3-5 (-10) dm. tall, glabrous but the nodes very often with a grayish retrorse beard about 1 (-2) mm. long and often the lower nodes geniculate; sheaths essentially glabrous; ligules minute; blades usually spreading, the upper often reflexed, 3-12 cm. long, 4-15 mm. broad, glabrous or sparsely papillose-ciliate at base, green (often bright, rarely olivaceous) and thin, quite flat; panicle usually elongate-ovoid, usually many-spikeletted, 5-12 cm. long, with the slightly spreading very slender and often flexuous branches usually copiously branched; spikelets 1.4-2.2 mm. long, elliptic, glabrous or pubescent, 5- to 7-nerved; second glume usually shorter than fertile lemma; *autumnal phase* (June-Dec.) much-reduced, much-branched at some nodes, the lower part usually ascending (or reclining from the heavy weight of the top) and bladeless like a slender tree-trunk, the upper part copiously bushy-branched with numerous small blades 2-4 cm. long and 1-3 mm. broad (thin, green, flat or often involute). *P. nitidum* Lam., *P. barbulatum* Michx., *P. microcarpon* Muhl., *P. lucidum* Ashe, *P. roanokense* Ashe, *P. yadkinense* Ashe. Frequent in moist sandy woodlands, e. and s.e. Tex., rare w. to n.-cen. Tex., spring-fall; s.e. Can., e. U.S., Bah. I., Cuba.

A slightly variable species represented with us mostly by the trivial forms known as "*P. barbulatum*" and "*P. microcarpon*." In some parts of the range it is apparently often contaminated genetically by the "*P. Lindheimeri*" form of the *P. spretum* complex. Apparently the more glabrous forms of *P. dichotomum* pass (through large-leaved plants known as *P. cryptanthum*) to the *P. scoparium* alliance.

8. *Panicum leucothrix* Nash. Perennial; *vernal phase* light olive-green to dark-green; culms 1-5 (-7) dm. tall, ascending (often decumbent at base and somewhat geniculate), weak, slender, glabrous or appressed papillose-pilose, the nodes pubescent or glabrous; sheaths papillose-pilose to puberulent or glabrous; ligule minute but blade at base with a ligulelike tuft of hairs 2-3 mm. long; blades 3-8 mm. broad, about 2-5 cm. long, glabrous or sparsely villous above, puberulent or glabrous beneath, or even velvety-puberulent beneath; panicle 3-8 cm. long, rather densely flowered; spikelets 0.9-1.3 mm. long, pubescent, elliptic; *autumnal phase*: stems reclining or decumbent-spreading, occasionally the culms at first sending out from lower and middle nodes long branches similar to primary culms, later producing more or less fascicled branches, or usually the culms with crowded branchlets, the whole somewhat bushy-branched; blades flat or subinvolute. *P. Wrightianum* Scribn., *P. longiligulatum* Nash. Infrequent in sandy woodlands, often in boggy or moist low places, e. and s.e. Tex., spring-fall; Coastal States, Mass. to Tex.; also Tenn.; W.I., C.A., Col.

Closely related to the *P. spretum*-*P. Lindheimeri* complex, and grading into the smaller-spikeletted forms of *P. Lindheimeri*.

9. *Panicum Lindheimeri* Nash. *Vernal culms* 3-9 dm. long, tufted, ascending or spreading; lower internodes often pubescent; sheaths glabrous or pubescent; ligule minute but blade at base with a ligulelike tuft of hairs 2-5 mm. long; blades firm, ascending to reflexed, 4-8 mm. broad, sparingly ciliate around the base, otherwise glabrous; panicle 4-8 (-12) cm. long, usually nearly as broad, the branches ascending or appressed or usually spreading; spikelets 1.3-1.7 mm. long, elliptic to obovate, pubescent (rarely nearly glabrous), 5- to 7-nerved; *autumnal phase* mostly reclining or stiffly spreading, the early branches elongate, the subsequent branches in short fascicles or in tufts of short appressed branches; blades involute at least at the tip, greatly reduced and often appressed or ascending, often ciliate basally. *P. lanuginosum* var. *Lindheimeri* (Nash) Fern. Widespread often in calcareous soils in e. half of Texas, w. over the Edwards Plateau and even to Brewster Co. in the Trans-Pecos, spring-fall; N.S., Que., e. U.S., N.M., Calif., Coah.

P. Lindheimeri freely grades into the phases of the *P. lanuginosum* complex which have small spikelets and sparse pubescence. Closely related and reportedly occurring in the moist coastal areas of the state is *P. spretum* Schult. with large, narrow panicles; we have seen no Texas material of this species.

10. *Panicum lanuginosum* Ell. Perennial; *vernal phase* (usually grayish) olive-green or bluish-green, velvety-villous to densely spreading-villous throughout or the upper parts of the culm or the various parts of the leaves glabrate; culms usually in large clumps, 2-7 dm. tall, spreading, often with a glabrous ring below the nodes, the nodes themselves usually with a retrorse gray beard; sheaths like the midstems in pubescence; ligule a short fringe but blade at base with a ligulelike tuft of hair 3-5 mm. long; blades thickish, sometimes stiff, often somewhat incurved or spoon-shaped (when fresh), from nearly glabrous to densely velvety or densely villous, 4-10 cm. long, 5-12 mm. broad, sometimes with a very thin firm margin; panicle (4-) 6-12 cm. long, the axis and also often the branches pubescent; spikelets 1.6-2.1 mm. long, pubescent, 5- to 9-nerved; *autumnal culms* widely spreading to matted-decumbent or ascending or rarely erect, freely branching from the middle nodes, the branches repeatedly branching and much-exceeding the internodes, the ultimate branchlets forming flabellate fascicles; blades much-reduced, 2-3 cm. long, usually much-exceeding the panicles. *P. Thurowii* Scribn. & Sm. Frequent in sandy woodlands and prairies, e. half of state, spring-fall; N.S. and Que. to Mont., s. to Gulf States, N.M., Ariz. and Calif. (rare w. of the 100th meridian).

This species in its typical form looks like a small edition of *P. scoparium*. *P. lanuginosum* grades into the *P. spretum*-*P. Lindheimeri* alliance through such forms as have been called *P. huachucae* Ashe [incl. var. *fasciculatum* (Torr.) F. T. Hubb. and *P. tennesseense* Ashe]. One form, "*P. auburne* Ashe," recombines the small spikelets of *P. Lindheimeri* and the pubescence of *P. lanuginosum*. *P. lanuginosum* passes into the shaggier *P. villosissimum* through forms called "*P. praecocius* Hitchc. & Chase." There seems to be little merit in recognizing all these "species," which are arbitrary selections of specimens showing various recombinations of characters. See remark under *P. villosissimum*.

11. *Panicum villosissimum* Nash. Perennial; *vernal phase* light olive-green; culms 25-45 cm. tall, erect or ascending, pilose with spreading hairs 3 mm. long; sheaths pilose; ligule a minute fringe but blade at base with a ligulelike tuft of hairs (2-) 4-5 mm. long; blades rather firm, 6-10 cm. long, 5-10 mm. broad, pilose on both surfaces or occasionally nearly glabrous above; panicle 4-8 cm. long, the branches stiffly ascending or spreading; spikelets 1.8-2.8 mm. long, pilose, 5- to 9-nerved; *autumnal culms* stiffly spreading, finally prostrate, often sparingly branched from the middle and lower nodes, the leaves of the fascicled branches appressed to give the cluster or mat a "combed-out" appearance. *P. pseudopubescens* Nash. Infrequent or locally abundant in sandy woodlands, e., s.e. and n.-cen. Tex., spring-fall; Mass. to Wisc. and Kan., s. to Fla. and Tex.; Mex., Guat.

The merits of recognizing this as distinct from the *P. lanuginosum* complex will have to be the subject of investigation. Only the arbitrary-spikelet-size character can be used to separate *P. villosissimum* from some of the shaggier forms of *P. lanuginosum*.

12. *Panicum ovale* Ell. Perennial; *vernal culms* 2-5 dm. tall, erect or ascending, rather stout, long-pilose below with ascending or appressed hairs, often nearly glabrous above, the nodes bearded; sheaths ascending-pilose; ligule a minute fringe, the blade at base with a ligulelike tuft 2-3 mm. long and rather sparse; blades 5-10 mm. broad, the upper surface nearly glabrous except for long hairs near the base and margins, the lower surface appressed-pubescent; panicle 5-9 cm. long; spikelets 2.7-2.9 mm. long, 5- to 9-nerved, pubescent; *autumnal phase* spreading-decumbent, the stiff culms rather loosely branching from the middle and upper nodes, the leaves and panicles greatly reduced. Reported to occur in Waller Co., s.e. Tex., where it supposedly was collected once in 1906; we have not seen any Tex. collections that fit the description; N.C. to Fla.; Ind.; Ill.; Tex. (?)

13. *Panicum portoricense* Hamilt. Perennial, olive-green; *vernal culms* 15-50 cm. long, wiry, slender minutely grayish crisp-puberulent to nearly glabrous, often somewhat geniculate at the lower nodes; sheaths glabrous or crisp-puberulent; ligule a very minute ciliate fringe or obsolete; blades firm, 2-6 cm. long, 3-7 mm. broad, glabrous to puberulent; panicle 2-4 (-6) cm. long, the branches spreading, with few spikelets; spikelets (1.5-) 1.7-2.4 mm. long, puberulent or rarely nearly glabrous, asymmetrically pyriform, strongly 7- to 9-nerved, markedly turgid; *autumnal culms* spreading, branching from all but the uppermost node, the reduced blades involute-pointed. *P. lancearium* Trin., *P. pauciciliatum* Ashe. Rare in e. and s.e. Tex. (locally common in Aransas Co.) in sandy woodlands, spring-fall; Coastal States, Va. to Tex.; Br. Hond.; Gr. Ant.

This species grades into the widespread *P. angustifolium* through the plant known as *P. "aciculare."*

14. *Panicum ensifolium* Ell. Perennial, glabrous throughout; *vernal culms* 2-4 dm. tall, erect or reclining; ligule a very minute fringe or obsolete; blades distant, often reflexed, 1-3 cm. long, 1.5-3 mm. broad, puberulent beneath (at least toward the tip); panicle 15-40 mm. long; spikelets 1.2-1.7 mm. long, glabrous or puberulent, 5- to 7-nerved; *autumnal culms* spreading or reclining, sparingly branching from the middle nodes, the branches mostly simple. Rare in moist sand, e. Tex. (Nacogdoches and Newton cos.), spring-fall; Coastal States, N.J. to Tex.

"*P. curtifolium* Nash," reported to occur in e. Tex., is basically *P. ensifolium* as to genetic constitution, but contaminated by something like the *P. spretum*-*P. Lindheimeri* complex.

15. *Panicum tenue* Muhl. Perennial; *vernal phase* green to olive-green; culms 15-55 cm. tall, tufted, often slightly geniculate at the lower nodes, ascending or erect, sometimes sparsely appressed-pubescent below, the leaves rather crowded near the base, sheaths puberulent between the nerves or sparsely appressed-pilose or nearly glabrous; ligule a very minute dense fringe; blades rather firm and stiff, tending to becoming minutely cartilaginous at the margin, the lower ones 3-5 (-7) cm. long and 3-6 mm. broad, rather much-reduced upward along the stem and distant, glabrous on both sides or puberulent beneath; panicle 3-6 cm. long; spikelets 1.3-1.8 mm. long, puberulent, 5- to 7-nerved; *autumnal culms* erect, leaning or spreading, usually much-branched, the branches bushy or fascicled. *P. albomarginatum* Nash, *P. trifolium* Nash. Infrequently or locally abundant in sandy soil, e. and s.e. Tex., spring-fall; s.e. U.S. and along the coast n. to N.J.; Cuba; Guat.

This is fairly closely related to *P. sphaerocarpon*.

16. *Panicum sphaerocarpon* Ell. Perennial, except for spikelets completely glabrous (except when genetically contaminated); *vernal phase* light-green; culms few in a tuft, 2-8 dm. long, radiate-spreading, sometimes nearly erect, the nodes appressed-pubescent; ligule absent (except a minute scale in contaminated genotypes); blades 7-14 mm. broad, thick, cartilaginous-margined, at base cordate and ciliate; panicle 5-10 cm. long, about as broad as long, the branches often viscid; spikelets 1.3-2 mm. long, obovoid-spherical when fully mature, ellipsoid when young, 5- to 7-nerved, puberulent to essentially glabrous; *autumnal phase* prostrate-spreading, remaining simple or sparingly branched late in the season from the lower and middle nodes, the short branches mostly simple, the thick white-margined blades of the winter rosette conspicuous. Frequent, sandy or gravelly soil, e., s.e. and n.-cen. Tex. and Rio Grande Plains (coastal part), isolated in dunes in Winkler and Ward cos., spring-fall; Vt. to Kan., s. to n. Fla. and Tex.; Mex. to Venez.

Miscellaneous genetically contaminated plants with minute ligules have been designated as var. *inflatum* (Scribn. & Sm.) Hitchc. & Chase.

17. *Panicum polyanthes* Schult. Perennial, completely glabrous (except spikelets); *vernal culms* erect, 3-9 dm. tall, the nodes glabrous or nearly so; ligules absent or a minute fringe in genetically contaminated plants; blades 12-33 cm. long, 15-25 mm. broad, firm, cartilage-margined, at base cordate and ciliate, the upper scarcely reduced; panicle 8-25 cm. long, a fourth to half as wide as long, densely flowered, the branches mostly viscid; spikelets 1.3-1.8 mm. long, minutely puberulent, obovoid-spherical at maturity, broadly ellipsoid when young, 5- to 7-nerved; *autumnal phase* remaining erect, producing simple branches from the lower and middle nodes, the thick white-margined blades of the winter rosette conspicuous. Infrequent in sandy woodlands, e. Tex., spring-fall; s.e. U.S. n. to Conn., Pa., Ill., Mo. and Okla.

18. *Panicum malacophyllum* Nash. Perennial; *vernal phase* velvety or minutely velvety-pilose throughout; culms slender, 25-70 cm. long, erect or ascending, rarely spreading, the nodes retrorsely bearded; sheaths with retrorse hairs; ligule a fringe 1-1.5 mm. long (actually the true ligule minute, the fringe attached at the very base of the blade); blades 7-10 cm. long, 5-12 mm. broad; panicle 3-7 cm. long; spikelets 2.6-3 mm. long, papillose-pilose, strongly 7- to 9-nerved; *autumnal phase* spreading, forming bushy top-heavy clumps with reduced blades. Infrequent in sandy woodlands, n.-cen. Tex., spring-fall; Tenn., Mo., Kan., Ark., Okla. and Tex.

This neatly combines characters of the *P. oligosanthos*-*P. lanuginosum* complex, indicating its probable origin.

19. *Panicum oligosanthos* Schult. Perennial; *vernal culms* 2-6 dm. tall, glabrous or variously pubescent; sheaths often papillose-pubescent; ligules less than 1 mm. long; blades 5-15 cm. long, 5-12 mm. broad, rather firm, variously pubescent, usually ascending, at base often short-ciliate, at apex usually sharply acute; panicle 4-12 cm. long; spikelets pedicelled, 2.9-4 mm. long, usually turgid-obovoid, pubescent to nearly glabrous, usually quite blunt, strongly 7- to 9-nerved, at base somewhat attenuate; sterile lemma often with a dark spot at the base; *autumnal phase* much-branched most of the length, especially in the upper part. *P. Helleri* Nash, *P. Scribnerianum* Nash. Practically all over Tex., spring-fall; most of the U.S.; Coah.

An attempt has been made to recognize several taxa in this rather variable one but the intergrading series is so complete from one sort to another that nothing is thereby gained. The "true" *P. oligosanthos*, with rather stiff blades which have some harsh pubescence beneath, is confined to the sandy soils of east Texas (in our range), whereas the "*Helleri*" and "*Scribnerianum*" segregates are more generally distributed and weedy, but every conceivable intermediate type can be found. There is also intergradation through such forms as "*P. malacon* Nash" and *P. malacophyllum* to the *P. lanuginosum* complex; and through *P. Ravenelii* to the *P. scoparium* complex.

20. *Panicum nodatum* Hitchc. & Chase. Perennial; *vernal culms* ascending or spreading, hard and wiry, 25-35 (-65) cm. tall, finely papillose, crisp-puberulent; blades firm, ascending, 3-5 (-9) cm. long, 5-9 mm. broad, puberulent on both surfaces, rather abruptly narrowed at apex; panicle 4-5 cm. long, few-flowered; spikelets 3.5-4.3 mm. long, slightly pyriform, rather long-attenuate basally, 7- to 9-nerved, pubescent; *autumnal culms* widely geniculate-decumbent, branching from all but the uppermost node, the branches somewhat divaricate, the nodes of the main culm swollen, no distinct winter rosette formed. Sandy prairies, Rio Grande Plains and the s. extremes of e. and s.e. Tex., grading into forms of *P. oligosanthos* on a broad scale, the basal attenuation of the spikelets being the sole technical character permitting determination in many instances, spring-fall; endemic.

21. *Panicum pedicellatum* Vasey. Perennial; *vernal culms* erect or ascending, 2-5 dm. tall, usually ascending-hirsute, at least below; blades 5-9 cm. long, 3-6 mm. broad, mostly linear, often narrowed toward base, glabrous or sometimes minutely hispid; panicle 3-6 (-10) cm. long; spikelets about 3.5-3.7 mm. long, pubescent, narrowly obovoid, attenuate and often discolored at base, 7- to 9-nerved; first glume about half as long as the spikelet, acute, the second glume slightly shorter than the fertile lemma; *autumnal culms* erect or leaning, freely branching from all but the uppermost nodes, the branches spreading, no distinct winter rosette formed. Frequent in limestone uplands, Edwards Plateau and nearby limestone areas, spring-fall; Tex., Coah.

Closely related to *P. transiens* Swall., and both are related to the *P. oligosanthos* alliance.

22. *Panicum Ravenelii* Scribn. & Merr. Perennial; *vernal culms* fairly stout and erect, 3-7 dm. tall, densely papillose-hirsute with ascending hairs, the nodes short-bearded;

sheaths hirsute like the culms; ligule a fringe or tuft 3-4 mm. long, on the larger leaves grading into additional tuft at blade base; blades thick and firm, 8-15 cm. long, 1-2 cm. broad, glabrous above, densely velvety-hirsute beneath; panicle 7-12 cm. long; spikelets 3.7-4.3 mm. long, sparsely papillose-pubescent, strongly 7- to 9-nerved; *autumnal phase* more or less spreading, branching from the middle and upper nodes, the short branches crowded at the summit. Sandy woodlands, e. and s.e. Tex., spring-fall; Del. to Mo., s. to Fla. and Tex.

This species combines the spikelet characters of *P. latifolium*, the pubescence of some other species, such as *P. scoparium* or typical *P. oligoanthes*, and the "ligule" of *P. lanuginosum*. The blades are not as cordate as those of *P. latifolium*. Reports of the occurrence in Texas of *P. Leibergii* (Vasey) Scribn. are based on specimens referable to *P. Ravenelii*.

23. *Panicum latifolium* L. Perennial; *vernal culms* from a knotted crown, suberect, 4-7 dm. long, glabrous to downy-villous, the nodes retrorsely bearded; sheaths glabrous to downy-villous; ligule a fringe about 0.5 mm. long; blades spreading, 7-12 cm. long, 15-30 mm. broad, sparsely ciliate at the cordate base, glabrous to velvety; panicle 6-12 cm. long; spikelets 3.6-4.7 mm. long, about half as broad, ellipsoidal, pubescent, 7- to 9-nerved; *autumnal phase* more or less spreading, branching from the middle nodes, finally top-heavy and reclining, the upper leaves of the branches crowded and spreading, not much reduced. *P. Boscii* Poir. var. *molle* (Vasey) Hitchc. & Chase. Infrequent in sandy woodlands, e. and s.e. Tex., spring-fall; e. U.S.

Doubtfully distinct from *P. macrocarpon* Le Conte (*P. "latifolium"* of older manuals) (with usually nonbearded nodes and spikelets averaging smaller, and occurring s.w. to Ark.). *P. latifolium* is closely related to the *P. oligoanthes*-*P. Ravenelii* alliance, having the large spikelets precisely like those of *P. Ravenelii* but the herbage more like that of *P. commutatum* (or *P. clandestinum*).

24. *Panicum scoparium* Lam. Perennial; *vernal phase* grayish-olive-green, velvety-pubescent throughout except on a viscid ring below the nodes and at the summit of the sheath; culms 8-15 dm. long, stout, usually 2-3 (-4) mm. thick, erect or ascending, usually geniculate basally, sometimes scabrous below the nodes, sometimes puberulent; sheaths glabrous or hispid, often mottled or white-spotted, commonly swollen basally and contracted upward; ligule a fringe 0.5-1.3 (-1.4) mm. long (more than 1 mm. long only in the best-developed leaves); blades rather thick, 12-25 cm. long, 9-18 mm. broad, often stiffish, ascending or spreading, glabrous or scabrous, sometimes more or less pubescent beneath; panicle 8-20 cm. long, the axis and branches with viscid blotches or these absent; spikelets 2.3-2.6 mm. long, ovate to obovate, turgid, papillose-pubescent to obscurely puberulent to glabrous, pointed (not sharply), 7- to 9-nerved; *autumnal phase* erect, leaning or spreading, freely branching from the middle and upper nodes, forming flabellate fascicles. *P. scabriusculum* Ell. Sandy woodlands, usually in moist or even boggy areas, e. and s.e. Tex., spring-fall; Mass. to Fla. w. through Ky. to Mo., Okla. and Tex.; Cuba.

Apparently grading through glabrous forms known as "*P. cryptanthum* Ashe" to *P. dichotomum*.

25. *Panicum commutatum* Schult. Perennial; *vernal culms* erect or decumbent often from somewhat knotty bases, 25-75 cm. long, sometimes purplish-tinged; nodes never bearded; sheaths glabrous or nearly so; ligule a minute scale or usually essentially absent; blades 5-10 (-15) cm. long, (6-) 8-25 mm. broad, glabrous on both surfaces but often slightly cordate and marginally ciliate near base; panicle 5-12 cm. long, loosely flowered, not much or often incompletely exerted from the upper sheath; spikelets 2.4-3.1 mm. long, 7- to 9-nerved, pubescent, ellipsoid, not very turgid; *autumnal culms* erect or leaning, often widely spreading, not much-branched, the winter rosette leaves often with a minute cartilaginous margin. *P. Joorii* Vasey, *P. Ashei* Pearson. E. U.S. w. to Mo., Okla. and Tex.; Mex.

Some populations seem to show some introgressive influence of the *P. oligoanthes* complex. This species is rather like a version of *P. clandestinum* (or *P. latifolium*), contaminated by *P. dichotomum* genes.

26. *Panicum clandestinum* L. Perennial; *vernal culms* in large dense clumps, sometimes with strong rhizomes, 5-10 cm. long; culms 7-15 dm. tall, scabrous to papillose-hispid at least below the nodes; sheaths strongly papillose-hispid to nearly glabrous; ligule a

muticous scale, very short; blades spreading or finally reflexed, 10-23 cm. long, 12-30 mm. broad, scabrous on both surfaces (at least toward the end), usually ciliate and slightly cordate at base, sharply acute; panicle 8-15 cm. long; spikelets 2.7-3.2 mm. long, pubescent, 7- to 9-nerved; *autumnal culms* erect or leaning, the branches leafy, the swollen bristly sheaths overlapping and wholly or partly enclosing the panicles, usually rather sparingly branched. Rare in extreme n.e. Tex. (Bowie Co.), reported also from Dallas Co. in last century, spring-fall; N.S., Que. and Me. to Kan., s. to Gulf States.

27. *Panicum geminatum* Forsk. Perennial, glabrous; culms terete, tufted, 25-80 cm. long, rarely decumbent basally and rooting at the nodes, usually slightly geniculate basally and essentially erect; blades 1-2 dm. long, 3-6 mm. broad, flat or toward the apex involute; panicle 12-30 cm. long, extremely narrow; appressed spikelike racemes (3 to) 8 to 18, lower racemes 25-30 mm. long, upper gradually shorter; raceme rachis ending in a short naked point; spikelets 2.2-2.4 mm. long, 5-nerved, subsessile, abruptly pointed, glabrous, the first glume truncate; fertile lemma and palea transversely rugose. *Paspalidium geminatum* (Forsk.) Stapf. Moist ground or shallow water, e. half of Tex., frequent nearest the coast, summer-fall; Fla., La., Tex., Okla. and warmer regions of the world.

28. *Panicum paludivagum* Hitchc. & Chase. Perennial, glabrous, resembling *P. geminatum* but the culms at base elongate, creeping, rooting, rather succulent, as much as 2 mm. long, the lower part often submerged, loosely branching; blades 15-40 cm. long, scabrous on the upper surface; spikelets 2.5-3 mm. long, faintly 3-nerved; fertile lemma obscurely to obsoletely transversely rugose. *Paspalidium paludivagum* (Hitchc. & Chase) Parodi. Scattered in wet places, s. Tex. (Cameron, Hidalgo and San Patricio cos.), summer-fall; Fla., Tex; Mex.; Guat.

This is not adequately separable from *P. geminatum*, being scarcely more than a form of that species.

29. *Panicum purpurascens* Raddi. Robust stoloniferous perennial; culms decumbent and rooting at the base, 2-5 m. long, the nodes densely villous; sheaths villous or the upper glabrous, densely pubescent on the collar; blades 1-3 dm. long, 10-15 mm. broad, flat, glabrous; panicle 12-20 cm. long, the rather distant subracemose densely flowered branches ascending or spreading; spikelets subsessile, 3 mm. long, elliptic, 5-nerved, glabrous; fertile lemma and palea minutely transversely rugose. *Brachiaria purpurascens* (Raddi) Henr. Abundant along canals and resacas in the Rio Grande delta, Brownsville region, late summer-fall; Tex., Fla. and Ala.; throughout trop. Am. at low alt.; commonly cult. in trop. Am. as a forage grass, being cut for green feed; probably introd. into Braz. at an early date from Afr., where it was perhaps indigenous.

30. *Panicum reptans* L. Branching annual; culms ascending 1-3 dm. above the creeping base (rooting at the lower nodes); ligules less than 1 mm. long; blades 15-60 mm. long, 4-12 mm. broad, flat, cordate basally, usually glabrous, ciliate on the undulate margin near base; panicles of ascending spikelike racemes along an angled axis, 2-6 cm. long; the 3 to 12 ascending or spreading racemes 2-3 cm. long, aggregated, the rachis usually pilose with long weak hairs; spikelets secund along the raceme, about 2 mm. long, glabrous, abruptly pointed, strongly 5-nerved, on pubescent or pilose pedicels about 1 mm. long; first glume very short, truncate or rounded. Infrequent, s.e., e. and n.-cen. Tex. and Rio Grande Plains, usually in flowerbeds or other disturbed ground, summer-fall; Fla. to Tex.; trop. regions of the world, probably introd. in Tex. at an early date.

31. *Panicum gymnocarpon* Ell. Perennial, rooting at the lower nodes; culms basally prostrate, terminally ascending, 3-7 mm. thick; blades 14-25 mm. broad, basally with pronounced corners, marginally finely serrate; ligule a thin scale 1 mm. long; inflorescence paniculoid, 12-40 cm. long, 7-25 cm. broad, of 14 to 35 loosely ascending remote or remotely whorled branches ("racemes" of some descriptions) with each secondly bearing a number of closely set appressed nearly sessile spikelets or (toward the base) usually compound with short appressed secondary branchlets (each bearing several appressed sessile spikelets); spikelets 5.5-7 mm. long, narrow; first glume nearly as long as the sterile lemma, the second glume strongly 3- to 5-nerved and surpassing the sterile lemma, both of them acuminate and glabrous; fertile lemma 2 mm. long, smooth, shiny. Local in wet sand along streams, e. and s.e. Tex. (w. to Anderson and Colorado cos.), fall; Coastal States, S.C. to Tex. and inland to Ark.

32. *Panicum hemitomon* Schult. MAIDENCANE. Aquatic or subaquatic perennial from extensively creeping rhizomes, often producing numerous sterile shoots with overlapping sometimes densely hirsute sheaths; culms 5-15 dm. tall, usually hard; sheaths of fertile culms usually glabrous; blades 10-25 cm. long, 7-15 mm. broad, usually scabrous on the upper surface and smooth beneath; panicles elongate, very narrow, 15-30 cm. long, the branches erect, the lower branches distant, the upper ones approximate, 2-10 cm. long; spikelets subsessile, 2.4-2.7 mm. long, lanceolate, acute, 3- to 5-nerved, glabrous; first glume about half the length of the spikelet; fertile lemma less indurate than usual in *Panicum*; apex of fertile palea scarcely enclosed by the margin of the fertile lemma. Frequent (rarely flowering) on margin of lakes, ponds and stream, e. and s.e. Tex., spring (usually May); Coastal States, N.J. to Tex.; also Tenn.; Braz.

33. *Panicum obtusum* H.B.K. VINE-MESQUITE. Perennial forming large colonies from extensive stolons; culms in tufts from a knotty base at intervals along the stolon, wiry, compressed, 2-8 dm. tall; ligules about 1 mm. long; blades mostly elongate, 2-7 mm. broad, glabrous or nearly so; panicles narrow, 3-12 cm. long, about 1 cm. broad, the few appressed branches densely flowered, the short pedicels secund; spikelets 3-3.8 mm. long, obovoid, brownish, blunt, scabrous; first glume nearly as long as the spikelet; fertile lemma smooth and shiny. Frequent, forming large colonies near water or in sporadic overflow areas, w. half of Tex., e. to n.-cen. Tex. and the Coastal Bend area, spring-fall; Mo. to Colo., s. to Ark. and cen. Mex.

34. *Panicum brachyanthum* Steud. Glabrous branching annual; culms slender, weak, decumbent at base, 3-10 dm. long; ligules minute; blades 5-15 cm. long, 2-3 mm. broad; panicle 5-15 dm. long, diffuse, the few branches divaricate and capillary, spikelet-bearing toward the ends; spikelets mostly in twos, 3.2-3.6 mm. long, fusiform, acute, obscurely nerved, roughened with small warts each of which is furnished with a short stiff hair; first glume minute; fertile lemma minutely papillose, the margin inrolled only in the lower part. Frequent in sandy woodlands, e. and s.e. Tex. (s. to Aransas Co.), late summer-fall; Ark., La., Tex. and Okla.

35. *Panicum verrucosum* Muhl. Glabrous branching annual, bright green, at first erect (or erect when growing up through thick vegetation), later widely spreading when not crowded; culms slender, weak, 2-15 dm. long, decumbent at base, usually with prop-roots; ligules minute; blades thin, flat, lax, 5-20 cm. long, 4-10 mm. broad; panicles 5-30 cm. long, about as wide, diffuse, with divaricate capillary branches that are spikelet-bearing toward the ends; small panicles often produced at the lower nodes; spikelets mostly in twos, 1.8-2.1 (-2.6) mm. long, elliptic-obovate, subacute, roughened with small warts, the nerves obscure or obsolete; first glume minute; fertile lemma minutely papillose, the margin inrolled only in the lower part. Sandy woodlands, e., s.e. and n.-cen. Tex., frequent, late summer-fall; Mass. to Fla., w. to Mich., Ky., Ark. and Tex.

36. *Panicum hians* Ell. Tufted perennial; culms compressed, 2-6 dm. tall, mostly erect, sometimes more or less decumbent or prostrate with erect branches; ligules minute; blades 5-15 cm. long, 1-5 mm. broad, flat or folded, pilose on the upper surface near base; panicles 5-20 cm. long, usually loose and open, the primary branches few, slender, distant, spreading or drooping, the branchlets borne on the upper half or toward the ends only; spikelets in more or less secund clusters, short-pedicelled, 2.2-2.4 mm. long, 5-nerved, glabrous; palea of the sterile floret becoming enlarged and indurate, expanding the spikelet to twice as thick as wide at maturity; fertile lemma minutely papillose-roughened, relatively thin for this genus. Usually in low places, damp soil, e., s.e. and n.-cen. Tex. and Rio Grande Plains, rare w. to Llano region, spring-fall; Coastal States, Va. to Tex.; also Mo., Ark., Okla. and N.M.; Mex.

Some of the denser-spikeletted forms bear a strong superficial resemblance to *Sphenopholis obtusata*.

37. *Panicum anceps* Michx. Perennial from branching scaly rhizomes 2-4 mm. thick; culms 3-10 dm. long, erect, compressed; sheaths keeled, glabrous to pilose or densely to sparsely villous (especially at summit); ligule a scale 0.2-0.6 mm. long, firm; blades elongate, 4-12 mm. broad, pilose near base or often pubescent on both surfaces; panicles 15-40 cm. long, the branches ascending or spreading, slender, remote, bearing short mostly appressed rather densely flowered branchlets; spikelets slightly oblique to the pedicels, 2.4-3.8 mm. long, short-pedicelled, lanceolate, pointed, glabrous, often gaping; sterile lemma 5- to 7-nerved; glumes and sterile lemma mostly keeled; fertile lemma

smooth and shiny and with a very minute tuft of thickish hairs at apex. *P. rhizomatum* Hitchc. & Chase. Abundant in sandy well-drained usually forested uplands, e. and s.e. Tex., infrequent w. to n.-cen. Tex., late summer-fall; s.e. U.S., w. to Kan., Okla. and Tex.

38. *Panicum antidotale* Retz. Perennial from short knotty subrhizomatous base; culms 5-20 (-30) dm. long, mostly erect, sparingly branched, robust, glabrous, compressed, mostly exposed (the sheaths shorter than and often diverging from the internodes), the swollen nodes as much as twice as thick as the middle of the internodes; sheaths nearly glabrous or the lowest ones minutely pubescent; ligule 0.3-0.8 mm. long, a fimbriate scale; blades elongate, flat, 5-12 mm. broad; panicle 15-30 dm. long, the many-flowered branches ascending; spikelets 2.5-3 mm. long, strongly nerved, pointed, the first glume a third to two thirds as long as the spikelet; sterile lemma 7-nerved; fertile lemma smooth and shining, acute. Local in roadsides and other disturbed areas, Rio Grande Plains, spring-fall; nat. of India, introd. and naturalized in Tex. and Ariz., perhaps elsewhere.

39. *Panicum rigidulum* Nees. Tufted perennial in dense clumps from a short multi-noded crown, with numerous short-leaved innovations at base; culms 5-10 dm. tall, erect, compressed; sheaths keeled; ligules membranous, about 1 mm. long or less; blades erect, folded basally, flat distally, 2-5 dm. long, 5-12 mm. broad, glabrous or sparsely pilose on the upper side at the folded base; panicles terminal and axillary, 1-3 dm. long, a fifth to nearly as broad as long, the long branches erect or spreading, naked at base, the appressed to spreading densely flowered branchlets mostly borne on the underside of the branches, the pedicels glabrous or bearing near the summit 1 or several hairs; spikelets 1.8-2.8 mm. long, short-pedicelled, lanceolate, pointed, glabrous; sterile lemma 5- to 7-nerved; glumes and sterile lemma mostly keeled; fertile lemma and palea smooth and shiny, the fertile lemma sessile or rarely with a very minute stipe and with a minute tuft of thickish hairs at apex. *P. agrostoides* Spreng. and var. *ramosius* (Mohr) Fern., *P. condensum* Nash, *P. stipitatum* Nash. Abundant in moist or poorly drained areas, e. and s.e. Tex., infrequent w. to n.-cen. Tex., late summer-fall; most of e. U.S.; W.I.; Coah.

40. *Panicum longifolium* Torr. Perennial; culms erect, 35-80 cm. tall, in dense tufts, compressed, usually surrounded by basal leaves nearly half as long; sheaths usually villous near summit; ligule membranous, fimbriate-ciliate, 2-3 mm. long; blades elongate, 2-5 mm. or more broad, pilose on the upper surface near the base; lateral panicles few or none, the terminal ones 10-25 cm. long, the branches slender and ascending; spikelets 2.4-2.7 mm. long, short-pedicelled (the pedicel often with a delicate hair near the tip), lanceolate, pointed, glabrous; sterile lemma 5- to 7-nerved; glumes and sterile lemma mostly keeled; fertile lemma smooth and shiny, with a minute tuft of thickish hairs at apex. Reported to occur in e. Tex.; Mass. to Fla. and Tex., to Ind. and Tenn.

Extremely similar to *P. rigidulum*; the merits of recognizing the 2 as separate species should be carefully re-evaluated.

41. *Panicum tenerum* Beyr. Perennial from knotty crowns; culms several, sub-compressed, wiry, erect, 4-9 dm. tall; lower sheaths pubescent toward the summit, with spreading hairs; ligule minute; blades 4-15 cm. long, 2-4 mm. broad, erect, firm, sub-involute, pilose on upper surfaces toward the base; panicle 3-8 cm. long, very slender, terminal and axillary; spikelets short-pedicelled (the pedicel usually with a few long hairs), 2.2-2.8 mm. long, pointed, glabrous; fertile lemma and palea smooth and shiny. Rare in wet places in s.e. Tex., rarer still in e. Tex., summer-fall; Coastal States, N.C. to Tex.; W.I.

42. *Panicum amarulum* Hitchc. & Chase. BEACH PANIC. Perennial from extensive decumbent subrhizomatous to rhizomatous bases, forming clumps as much as 3 m. across; ascending aerial portions of the numerous culms to 1 m. long and 1 cm. thick, glaucous, glabrous throughout; ligule a fringe about 2 mm. long or at the extreme base of the fringe a firm minute scale; blades linear, firm, 2-5 dm. long, 5-12 mm. broad, involute near the tip, pilose on the upper surface near the base; panicle large, rather compact, 3-10 cm. broad, slightly nodding, densely flowered; spikelets 4.3-5.5 mm. long, acuminate-pointed, glabrous; sterile lemma strongly 5- to 9-nerved; lower floret staminate; fertile lemma and palea smooth and shiny. All along the Gulf beaches in loose dune sand, fall; beaches, N.I. to Mex.; W.I.

Very doubtfully distinct from *P. amarum* Ell., which occurs on beaches from Connecticut to Georgia, and has been reported to occur in Texas. *P. amarum* supposedly

differs in more definitely rhizomatous habit, with culms rising singly at intervals, panicle a fourth to a third the entire height of the plant and not more than 3 cm. broad and spikelets 5-6.5 mm. long. *P. amarulum* intergrades with *P. virgatum* inland.

43. *Panicum Havardii* Vasey. Perennial from extensively creeping scaly rhizomes to 1 cm. thick; culms robust, about 1 m. tall, rising solitary and erect at intervals from the rhizomes, stout, glaucous, pale green, glabrous; sheaths glabrous; ligule membranous, ciliate; blades firm, 5-10 mm. broad, tapering into long setaceous-involute tips; panicle to 4 dm. long, diffuse; spikelets usually 6-8 mm. long, turgid, usually gaping, strongly 5- to 9-nerved, glabrous, pointed; lower floret usually staminate; fertile lemma and palea smooth and shiny. Sandhills, usually in deep loose blowing sand, w. half of Tex., especially abundant in the sandy South Plains, late summer-fall; Tex., N.M. and Chih.

Perhaps no more than a dune ecotype of *P. virgatum*.

44. *Panicum virgatum* L. SWITCHGRASS. Perennial from strong branching scaly horizontal rhizomes; culms stout, robust, in large bunches, green or glaucous, tough, 1-2 (-3) m. tall; sheaths glabrous; ligule membranous, ciliate; blades 1-6 dm. long, 3-15 mm. broad, flat, glabrous or sometimes pilose above near base, rarely pilose all over; panicle 15-50 cm. long, open and diffuse; spikelets turgid, often gaping, glabrous, (2.8-) 3.5-5 mm. long, acuminate-pointed; first glume clasping, two thirds to three fourths as long as the spikelet, acuminate or cuspidate; sterile lemma 5- to 9-nerved; lower floret usually staminate; fertile lemma narrowly ovate, smooth and shiny, the margins inrolled only in the lower part. In moist or seasonally moist open places nearly throughout the state but infrequent or rare in the Trans-Pecos, late summer-fall; N.S. and Ont. to N.D. and Wyo., s. to Gulf States; Cuba; reported in Jal. and Gro. but perhaps based on mis-determinations; reports of its occurrence in Coah. and Chih. are based on specimens of *P. bulbosum*.

45. *Panicum repens* L. Perennial with strong horizontal often extensively creeping rhizomes which are clothed basally with bladeless sheaths; culms stout, rigid, 3-8 dm. long, erect; sheaths more or less pilose; ligule membranous, ciliate; blades flat or folded, linear, mostly firm, 2-5 mm. broad, sparsely pilose to glabrous; panicle open, 7-12 cm. long, the somewhat distant branches stiffly ascending; spikelets turgid, usually gaping, strongly 5- to 9-nerved, glabrous, pointed, 2.2-2.5 mm. long, ovate; first glume about a fifth as long as the spikelets, loose, truncate; lower floret usually staminate; fertile lemma smooth and shining. Rare in beach sand, Chambers and Galveston cos., probably not persistent, summer; Fla. to Tex.; trop. and subtrop. coasts of the world, possibly adv. in Am.

46. *Panicum bulbosum* H.B.K. Perennial from knotty subrhizomatous bases, the knots roundish and as much as 1-2 cm. thick in some populations; culms robust and knotty, (5-) 8-20 dm. tall, the bases sometimes shortly decumbent but the culms mostly erect, slightly compressed; sheaths glabrous to pilose toward the summit; ligule membranous, ciliate; blades 2-6 dm. long, 3-17 mm. broad, scabrous or glabrous above, glabrous beneath, flat; panicle 2-5 cm. long, diffuse or open; spikelets 2.8-4.2 mm. long, ellipsoid, faintly nerved, glabrous; first glume about half the total length of the spikelet or a little less, usually rather blunt; fertile lemma transversely rugose. Incl. var. *minus* Vasey, *P. plenum* Hitchc. & Chase. Frequent in higher parts of Trans-Pecos Tex., mostly more than 4,500 ft. elev., late summer-fall; Tex., N.M. and Ariz., s.e. to Oax.

47. *Panicum maximum* Jacq. GUINEA GRASS. Robust perennial (often lasting only one season in our range because not frost-hardy), light-green, from short stout rhizomes; culms mostly erect, usually 1-2 m. tall, the nodes usually densely hirsute; sheaths papillose-hirsute to glabrous, usually densely pubescent on the collar; ligule 4-6 mm. long, membranous, ciliate; blades flat, 30-75 cm. long, to 35 mm. broad, glabrous, very scabrous on the margins, sometimes hirsute on the upper surface near base; panicles many-flowered, 2-5 dm. long and about a third as broad, the long rather stiff branches ascending, naked at base, the lower in whorls, the axils pilose, the short branchlets appressed and bearing more or less clustered short-pedicelled spikelets; spikelets 3-3.3 mm. long, ellipsoid, faintly nerved, glabrous; first glume about a third the length of the spikelet; fertile lemma transversely rugose. Repeatedly introd. and as a waif in s. Tex. but not hardy; s. Fla.; trop. regions of the world, probably originally from Afr.

This is one of the most highly esteemed forage grasses in the world, hence the repeated attempts to establish it in southern Texas, but the winters are too severe.

48. *Panicum trichoides* Sw. Annual; culms widely creeping and spreading, freely branching; sheaths mostly longer than the internodes, pilose; blades 4-7 cm. long, 8-15 mm. broad, thin, ovate-lanceolate, asymmetrical, ciliate at base; panicle 8-15 cm. long, very diffuse, the branches capillary, ascending to spreading, the branchlets even thinner, spreading, few-flowered; spikelets about 1.3 mm. long, acute, sparsely pubescent. Exceedingly rare and probably not persistent, Brownsville region of s. Tex.; Mex.; W.I., s. to Peru and Braz.; s.e. Asia and Phil.

49. *Panicum hirsutum* Sw. Perennial; culms tufted, robust, erect, to 15 dm. tall and 1 cm. thick, simple or branched at base only; nodes appressed-pubescent; sheaths papillose-hirsute, the hairs stiff, spreading, fragile, causing mechanical irritation to the skin when handled; ligule membranous, ciliate; blades flat, to 6 dm. long, 20-35 mm. broad, glabrous; panicle 20-35 cm. long, at first condensed, finally open, the branches ascending; spikelets pointed, 7- to 9-nerved, glabrous, 2-2.2 mm. long; fertile lemma smooth and shiny. Rare in thickets, Rio Grande delta (Brownsville region) in extreme s. Tex., June-Dec.; Tex. and trop. Am.

50. *Panicum Ghiesbreghtii* Fourn. Perennial; culms tufted, stiff, erect, rather robust, ascending-hirsute, 6-8 dm. tall, the nodes densely hirsute; sheaths mostly hirsute; ligule membranous, ciliate; blades to 6 dm. long and 12 mm. broad, flat, papillose-hirsute to glabrescent; panicles 2-3 dm. long, usually less than half as broad as long, the branches ascending, naked at base, the branchlets more or less appressed; spikelets pointed, 7- to 9-nerved, glabrous, 3 mm. long, 1 mm. broad; fertile lemma smooth and shiny. Infrequent in low moist ground and dense thickets, s. Tex. (Calhoun, Cameron and Hidalgo cos.), late summer-fall, rarely spring; Tex. and trop. Am.

51. *Panicum Hallii* Vasey. Perennial, erect, 15-60 cm. tall, somewhat glaucous; leaves usually crowded toward the base; sheaths sparsely papillose-hispid to glabrous; blades ascending, flat, curling with age, 4-15 cm. long, 2-6 mm. broad, sparsely ciliate toward the base, otherwise glabrous or nearly so; panicle 6-20 cm. long, the few branches stiffly ascending; spikelets 3-3.7 mm. long, 7- to 9-nerved, glabrous; fertile lemma smooth and shining. Frequent in rocky open dry uplands, w. two thirds of the state, intergrading on a broad scale with *P. filipes* and probably not specifically distinct from it, (spring-) summer-fall; Okla., Colo. and Ariz., s. to n. Mex.

52. *Panicum filipes* Scribn. Perennial, tufted; culms 3-8 dm. tall, erect or ascending, stiff; sheaths rarely pubescent; ligule membranous, ciliate; blades laxly ascending or spreading, 10-25 cm. long, 3-8 mm. broad, flat, glaucous, glabrous or sometimes sparsely hirsute beneath; panicles 7-25 cm. long, usually equaled or exceeded by the upper blades, the distal branches spreading; spikelets about 3 mm. long, pointed, 7- to 9-nerved, glabrous; fertile lemma smooth and shiny. Common in Rio Grande Plains and Coastal Bend region, frequent elsewhere in cen. Tex., becoming infrequent inland to w. Tex.; La., Tex., Coah., N.L., Tam. and S.L.P.

Supposedly distinguished from *P. Hallii* by the longer blades, looser panicle and smaller spikelets, but actually intergrading with that species on a broad scale. Closely related also to what we call *P. pilcomayense*.

53. *Panicum pilcomayense* Hack. Perennial; culms stiff, robust, few together, 7-10 dm. tall, at least the lower nodes with a ring of erect hairs; sheaths mostly hirsute; ligule membranous, ciliate; blades flat, elongate, 4-8 mm. broad, essentially glabrous; panicle very diffuse, nearly half the height of the plant, the branches to 3 dm. long, in fascicles of 2 to 4 or solitary, scabrous, naked below, loosely branched toward the ends, at least the lower axils pilose; spikelets pointed, 2.2-3 mm. long, 7- to 9-nerved, glabrous, on appressed pedicels; fertile lemma smooth and shiny. Local in s.e. Tex. and s. in coastal areas to Rio Grande delta, rare inland to Brazos Co., spring-fall; Tex.; Parag.

Apparently introduced, though perhaps bicentric in distribution. We are including here a few plants which have been referred to *P. Bergii* Arech. Some of the plants have a great resemblance to *P. filipes*.

54. *Panicum capillarioides* Vasey. Perennial from a knotty base; culms stiff, erect or ascending, 30-55 cm. tall, appressed-pubescent or glabrate, the nodes densely ascending-pubescent; sheaths mostly hirsute; ligule membranous, ciliate; blades rather stiff, 1-3 dm. long, 2-10 mm. broad, flat, harshly papillose-pubescent; panicle diffuse, few-flowered, 1-2 dm. long, the capillary branches stiffly spreading at maturity; spikelets pointed, 7- to

9-nerved, 5-6 mm. long, lanceolate, long-acuminate, glabrous; fertile lemma 1.6-1.8 mm. long. Frequent usually in sandy soil, Rio Grande Plains, spring-fall; Tex.; Tam.

This species is readily distinguished from all others by the peculiar elongated second glume and sterile lemma.

55. *Panicum miliaceum* L. BROOMCORN MILLET, HOG MILLET, PROSO. Branching annual; culms stout, erect or decumbent basally, 2-10 dm. long; ligule 1-3 mm. long; blades more or less pilose on both surfaces or glabrate, to 3 dm. long and 2 cm. broad, rounded at base; panicles usually more or less included at base, 1-3 dm. long, usually nodding, rather compactly diffuse, the numerous branches ascending, very scabrous, spikelet-bearing toward the ends; spikelets 4.5-5 mm. long, ovate, acuminate, strongly 9- to 11-nerved, pointed, glabrous; first glume large and clasping; fertile lemma smooth and shining, stramineous to reddish-brown. Occasional in disturbed places, Plains Country and n.-cen. Tex. and probably elsewhere as an escape, summer-fall; waste places, introd. or escaped from cult., n.e. U.S. and occasionally in other parts of the U.S.; temp. part of the Old World.

Cultivated in the cooler parts of the United States to a limited extent for forage and occasionally for feed for hogs.

56. *Panicum hirticaule* J. Presl. Annual; culms simple or nearly so, usually 15-70 cm. tall, papillose-hispid to nearly glabrous; ligule 1-3 mm. long; blades 5-15 cm. long, 4-13 mm. broad, often cordate basally, sparsely hispid to nearly glabrous, ciliate toward base; panicles 5-15 cm. long, scarcely a third the entire height of the plant, diffuse; spikelets 2.7-3.3 mm. long, lanceolate-fusiform, acuminate, usually reddish-brown, pointed, 7- to 9-nerved; first glume half to three fourths the length of the spikelet, clasping; fertile lemma 2 mm. long, smooth and shining, usually olive-brown at maturity. Infrequent in the Trans-Pecos, usually in seasonally moist alluvial flats and fans, summer-fall; Tex. to Calif. s. to Arg.

57. *Panicum pampinosum* Hitchc. & Chase. Annual much like *P. hirticaule* but freely branching and nearly glabrous throughout; blades longer; spikelets more turgid, about 4 mm. long; first glume more than three fourths the length of the spikelets; second glume and sterile lemma equal in length; fertile lemma 2.2 mm. long. Allegedly occurring in w. Tex., summer-fall; Tex. to Ariz.; Mex.

58. *Panicum Hillmanii* Chase. Resembling *P. capillare* (below) especially the larger-fruited forms, differing in having no short flowering branches at the base, stouter culms, firmer foliage, stiffer panicle branches with the lateral spikelets on shorter more appressed pedicels, well-developed sterile palea and especially in the larger darker fertile lemma (to 2 mm. long) with a prominent lunate scar at its base. Local in the Trans-Pecos and Plains Country, intergrading on a broad scale with *P. capillare*; plants showing combination of characteristics of the 2 "species" being common, summer-fall; Kan. to Tex.; Calif. Probably a mere form of *P. capillare*.

59. *Panicum capillare* L. WITCHGRASS. Annual, freely branched from the base; culms usually somewhat spreading from the base, 2-8 dm. long, papillose-hispid to rarely nearly glabrous; sheaths hispid; ligule 1-3 mm. long; blades 10-25 cm. long, 5-15 mm. broad, hispid on both surfaces; panicles many-flowered, diffuse, often making up half the total length of the plant, included at base until maturity, the branches finally divaricately spreading, the whole panicle breaking away and rolling before the wind; spikelets 2-3.3 mm. long, pointed or attenuate at the tip, 7- to 9-nerved, glabrous; first glume large, clasping; fertile lemma and palea smooth and shining, usually olive-brown at maturity. Incl. var. *occidentale* Rydb. Frequent in the Trans-Pecos and Plains Country, infrequent e. to n.-cen. Tex., often in disturbed ground, summer-fall; most of N. A.

60. *Panicum flexile* (Gatt.) Scribn. Branching tufted annual, erect, much-branched from the base, 2-7 dm. tall, somewhat hispid or papillose-hispid below and on the sheaths, the nodes pubescent; ligule 1-3 mm. long; blades erect but not stiff, glabrous or sparsely hispid, to 3 dm. long, 2-6 mm. broad; panicles oblong, narrow, 1-2 dm. long, about a third as wide as long, diffuse; spikelets 3.1-3.5 mm. long, pointed, 7- to 9-nerved, glabrous; first glume large, clasping; fertile lemma and palea smooth and shining, usually olive-brown at maturity. Exceedingly rare, in extreme n.e. Tex. (Clarksville, Red River Co. where collected once in the 19th century), fall (?); sandy mostly damp soil, meadows and open woods, e. Can. and N.Y. to N.D., s. to Fla. and Tex.; introd. in Ut.

61. *Panicum philadelphicum* Trin. Branching tufted annual, light-yellowish-green; culms slender, usually erect, 15-50 cm. tall, papillose-hispid to glabrous, more or less zigzag at base; sheaths papillose-hispid to nearly glabrous; ligule a fringed scale about 1 mm. long; blades usually erect, 5-15 cm. long, 2-6 mm. broad, rather sparsely hirsute; panicles 1-2 dm. long, diffuse, the branches solitary, rather stiffly ascending, the axillary pulvini hispid; spikelets 1.7-2.2 mm. long, pointed, 7- to 9-nerved, glabrous; fertile lemma and palea smooth and shining. Rare in sandy gravelly soil, e. and n.-cen. Tex., Oct.; Conn. to Minn., s. to Ga., Ala. and Tex.

62. *Panicum dichotomiflorum* Michx. FALL PANIC. Somewhat succulent branching annual; culms ascending or spreading from a geniculate base, 5-10 dm. tall or in robust specimens to 2 m. long; ligule a dense ring of white hairs 1-2 mm. long; blades flat, scaberulous and sometimes sparsely pilose on the upper surface, 1-5 dm. long, 3-20 mm. broad, the white midrib usually prominent; panicles many-flowered, terminal and axillary, mostly included in the upper sheath at the base, 1-4 dm. long or more, the main branches rather stiff, ascending, the branchlets short and appressed along the main branches; spikelets short-pedicelled, narrowly oblong-ovate, 2-3 mm. long, acute, 7-nerved, glabrous; first glume only about a fourth as long as the spikelet; fertile lemma smooth and shining. Moist ground along streams and in disturbed soil, e. half of Tex., more common in low areas near the coast such as rice fields, rare in e. part of Plains Country, late summer-fall; N.S. and Me. to Minn., s. to Fla. and Tex., occasionally introd. farther w.; W.I.

63. *Panicum texanum* Buckl. TEXAS MILLET. Annual, robust, much-branched; culms erect or ascending or decumbent and rooting at the lower nodes, 5-15 dm. or even to 3 m. long, softly pubescent at least below the nodes and below the panicles; sheaths softly pubescent, often papillose; ligule 1 mm. long or shorter; blades flat, 8-20 cm. long, 7-15 mm. broad, softly pubescent; panicle 8-20 cm. long, of ascending spikelike racemes along an angled axis, the racemes short, appressed and loosely flowered, the axis and rachises pubescent, with long hairs intermixed; spikelets 5-6 mm. long, fusiform, sessile, abruptly pointed, strongly 5- to 7-nerved, pilose, often obscurely reticulate. Frequent in disturbed usually sandy ground, e. two thirds of the state, summer-fall; Tex., Okla., Miss., Fla., Tam., N.L. and Chih.

64. *Panicum arizonicum* Scribn. & Merr. Annual, branching; culms erect or often decumbent at base, 2-6 dm. tall; sheaths glabrous to papillose-hispid; ligule a fringe about 1 mm. long; blades 5-15 cm. long, 6-12 mm. broad, glabrous or papillose-hispid beneath, ciliate near base; panicle of ascending spikelike racemes along an angled axis, 7-20 cm. long, the racemes rather loosely flowered, finely pubescent and papillose-hirsute; spikelets 3.5-3.8 mm. long, obovate-elliptic, densely hirsute to glabrous, sessile, abruptly pointed; sterile lemma strongly 5-nerved; fertile lemma and palea very minutely transversely rugose. Locally abundant in disturbed soil, Trans-Pecos deserts, (June-) Sept.-Oct.; Tex., N.M., Ariz., Calif., s.e. to Oax.

65. *Panicum fasciculatum* Sw. BROWNTOP PANIC GRASS. Much-branched annual; culms erect or spreading from a decumbent base (much-rooting at the nodes), 3-10 dm. tall, sometimes pubescent below the panicle or hispid below the appressed-pubescent nodes, the more robust freely branched from the lower nodes; sheaths glabrous to papillose-hispid; blades 4-30 cm. long, 6-20 mm. broad, glabrous, flat; ligule not more than 1 mm. long; panicle of ascending spikelike racemes along an angled axis, 5-15 cm. long, the racemes 5-10 cm. long; spikelets yellow or bronze-brown, 2.1-3 mm. long, obovate, turgid, glabrous, sessile, abruptly pointed, strongly 5-nerved and transversely wrinkled; fertile lemma and palea transversely rugose. Incl. var. *reticulatum* (Torr.) Beal. Frequent in disturbed ground, nearly throughout (rare in the Trans-Pecos and higher parts of the Plains Country), summer-fall; warmer parts of Am, n. to Fla. and Tex.

66. *Panicum ramisetum* Scribn. Perennial from knotty subrhizomatous bases; culms tufted, erect or ascending, 25-60 cm. tall; blades 5-12 cm. long, 2-4 mm. broad; panicle 5-20 cm. long, very slender and spikelike, the branches short, appressed, the ultimate branchlets bearing 1 to several spikelets, produced beyond the uppermost spikelet as a bristle 1-6 mm. long, bristles not exceeding the spikelets; spikelets about 2.4-3 (-3.2) mm. long, obovate, much-swollen on the face, glabrous, strongly nerved; first glume about half as long as the spikelet; fertile lemma transversely rugose, apiculate. *Setaria ramiseta* (Scribn.) Pilg. Frequent in caliche-sand loam and dry uplands in Rio Grande Plains, infrequent n. to Stonewall, Callahan and Ector cos., spring-fall; Tex., Coah., N.L. and Tam.

Intergrades with *P. Reverchonii* and to a lesser extent with *P. firmulum*.

67. *Panicum Reverchonii* Vasey. Perennial from knotty subrhizomatous bases; culms tufted, stiffly erect, 3-7 dm. tall; blades erect, stiff, 5-20 cm. long, 2-3 mm. broad; panicle 5-20 cm. long, very slender and spikelike, the branches short, appressed, the ultimate branchlets bearing 1 to several spikelets, produced beyond the uppermost spikelet as a bristle 1-6 mm. long; bristles equaling or exceeding the spikelet; spikelet 1 to 4 to a branchlet, (2.6-) 3-4 mm. long, elliptic, much-swollen on the face, glabrous, strongly nerved; first glume about half as long as the spikelet; fertile lemma transversely rugose, acute. *Setaria Reverchonii* (Vasey) Pilg. Frequent in the Edwards Plateau, less frequent in the limey areas of the Plains Country and Rio Grande Plains, rare to n.-cen. Tex., spring-fall; Tex., Okla. (Harmon Co.) and presumably also Coah.

Intergrading toward the south with *P. ramisetum*.

68. *Panicum firmulum* Hitchc. & Chase. Perennial from knotty rhizomatous bases forming stools; culms tufted, ascending or decumbent at base, 3-4 dm. tall, rather loosely tufted from creeping knotty rhizomes to 5 cm. long; blades ascending or spreading, firm, 4-10 cm. long, 4-7 mm. broad; panicles very slender, spikelike, the branches short, appressed, the ultimate branchlets bearing 1 to several spikelets, produced beyond the uppermost spikelet as a bristle 1 to 2 times as long as the spikelet; spikelet 2.8-3.5 (-3.7) mm. long, obovate, much-swollen on the face, glabrous, strongly nerved; first glume half as long as the spikelet; fertile lemma transversely rugose, apiculate. *Setaria firmula* (Hitchc. & Chase) Pilg. Open sandy ground, Rio Grande Plains, spring-fall; endemic.

Intergrading with *P. ramisetum*, but the relatively short, broad blades, and large spikelets mark *P. firmulum* rather well.

59. SACCIOLEPIS NASH

A genus of about 30 species in warm regions.

1. *Sacciolepis striata* (L.) Nash. Perennial; culms extensively creeping, the lower internodes 2-4 mm. thick; sheaths usually shortly papillose-pilose; ligule obsolete; blades with conspicuous nervature; panicles terminal, not much-exserted, spiciform, 6-15 (-25) cm. long, about 1 cm. thick, with numerous appressed branches, the minute ultimate pedicels abscising just below the glumes; spikelets not much-compressed, 2-flowered, the lower floret staminiferous, the upper perfect; rachilla abscising just below the fertile lemma; first glume minute, triangular, 3- to 5-nerved; second glume lanceolate, gibbous basally, 4-5 mm. long, strongly several-nerved; lower lemma as long as the second glume, with obscure nerves and a well-developed palea and 3 stamens; fertile lemma about half as long as the spikelet, very thin-cartilaginous, oblong, blunt, the margins revolute, enclosing the palea of the same texture. In moist sands near streams, marshes and bogs, infrequent to rare in e. and s.e. Tex., late summer-fall; Coastal States, N.J. to Tex.; Okla. and Tenn.

60. OPLISMENUS BEAUV.

A genus of about a dozen species of warm regions.

1. *Oplismenus hirtellus* (L.) Beauv. Perennial; culms creeping and rooting at the nodes, about 1 mm. thick; ligule a fringed scale; blades 2-7 cm. long, 5-15 mm. broad; panicles 2-12 cm. long, slender, of a few short remote spiciform racemes (racemes often falling from the axis as a unit); racemes 3-20 mm. long, divergent-ascending, with (1 or) 2 to 10 nodes, from the adaxial side of which in 2 rows are attached the pairs of spikelets; the minute pedicels abscising just below the first glume; spikelets not compressed, 2-flowered, the lower floret empty, the upper perfect; rachilla abscising just below the fertile lemma; glumes only a little more than half as long as the spikelet, several-nerved, hispidulous, awned; awn of the first glume longer than that of the second; sterile lemma as long as the spikelet, several-nerved, hispidulous, mucronate or short-awned; fertile lemma lanceolate, thin-cartilaginous, acute, the lateral margin revolute, enclosing the lanceolate acute palea of the same texture. Scattered in e. and s.e. Tex. and Rio Grande Plains, in shady usually moist loam near streams, summer-fall; warmer parts of Am., n. to N.C., Ark. and the Gulf States.

Our plants are nearly all of the subsp. *setarius* (Lam.) Mez [*O. setarius* (Lam.) R. & S.], marked by the very short leaves, panicles and racemes. A very few of our specimens (from Cameron Co.) have slightly longer leaves (4-6 cm.), panicles (6-12 cm.) and racemes (8-17 mm.), and thus tend toward the subsp. *hirtellus*.

61. ECHINOCHLOA BEAUV.

Culms rarely erect, often rooting at the nodes; leaves membranous, flat; ligule absent in most species; inflorescence an elongate terminal panicle of numerous ascending spike-like branchlets that are secundly flowered on the abaxial side; spikelets paired in the upper nodes of the spikelike branchlets and in several-flowered secondary panicles in the lower part, not at all compressed, 2-flowered (the lower floret usually completely reduced, rarely stamiferous), turgidly plano-convex; first glume about half as long as the spikelet, acute; second glume and sterile lemma membranous, equal, about as long as the spikelet, usually stiffly hispidulous along the several nerves, acute; glume usually coarsely mucronate or awned (if awned, the awn of the second glume much longer than that of the first); sterile lemma enclosing a thin palea and rarely 3 stamens and often awned; fertile lemma broadly elliptical, cartilaginous-indurate, acuminate, the lateral margins revolute, clasping the lateral margins of the similarly textured palea but not its acute free tip.

A genus of perhaps 25 species of warm regions. They are excluded from *Panicum* on the bases of the form of the inflorescence, the usually very coarsely pubescent spikelets and the coarsely mucronate or awned glumes. Probably they represent merely a part of the very diverse genus *Panicum*, and should be placed therein. These plants are commonly found in muddy places and provide good forage locally.

1. Ligule a row of stiff yellowish hairs; body of sterile lemma 4-5 mm. long 5. *E. polystachya*.
1. Ligule obsolete or absent; body of sterile lemma 2.5-4 mm. long (2)
- 2(1). "Spikes" of inflorescence 3-20 (-40) mm. long, ascending, often diverging from the axis at angles of 20-45°, only shortly if at all overlapping; blades 3-6 mm. broad 1. *E. colonum*.
2. "Spikes" of inflorescence 10-100 mm. long, ascending or slightly diverging, often overlapping a considerable portion of their lengths; blades mostly broader than 5 mm. (3)
- 3(2). Inflorescence thick, if slender then erect; sterile lemmas unawned or with awns to 10 mm. long 2. *E. crusgalli*.
3. Inflorescence slender, nodding, dense; sterile lemmas with awns 4-43 mm. long (4)
- 4(3). Sheaths usually papillose-pilose or papillose-hispid; spinulose cilia of the nerves of the second glume and sterile lemma conspicuously papillose 4. *E. Walteri*.
4. Sheaths glabrous; spinulose cilia of the nerves of the second glume and sterile lemma not conspicuously papillose 3. *E. cruspavonis*.

1. *Echinochloa colonum* (L.) Link. JUNGLE-RICE. Diffuse annual; culms 1-2 (-3) mm. thick basally; ligule obsolete; "spikes" 3-20 (-40) mm. long, ascending, appressed or often diverging from the axis at angles of 20-45°, remote on the axis, only shortly if at all overlapping; second glume and sterile lemma simply strongly acuminate, not awned, hispid along the nerves (use lens), about 3 mm. long. *Panicum colonum* L. Nearly throughout the state (infrequent in Plains Country) in moist loamy often disturbed soil, summer-fall; nat. to the Old World trop., now widespread in warm regions of the world.

2. *Echinochloa crusgalli* (L.) Beauv. BARNYARD GRASS. Erect or diffuse annual; culms 2.5-10 mm. thick basally; sheaths smooth; ligule obsolete; panicle erect or slightly nodding; "spikes" 1-10 cm. long, ascending, lengthily overlapping, often with stiff bristlelike hairs; second glume and sterile lemma mucronate or awned, the nerves hispid or spinose-hirsute, 2.5-4 mm. long. *Panicum crusgalli* L. Nearly throughout the state in moist often disturbed loamy soil, summer-fall; widespread in temp. and trop. areas of the world.

Variable species; we have two fairly well-marked but intergrading varieties:

Var. *crusgalli*, commonest in the e. and cen. parts of Tex., with long, somewhat spreading, papillose cilia at the summits of the internodes and bases of the branches in the inflorescence, and short, very thick, papillose cilia along the lateral nerves of the second glume and sterile lemma, and somewhat spreading "spikes", and sterile lemmas with awns 0-10 mm. long; synonyms include *E. crusgalli* subsp. *muricata* (Michx.) Shinnery, var. *muricata* (Michx.) Shinnery and var. *microstachya* (Wieg.) Shinnery, and perhaps var. *mitis* (Pursh) Peterm.

Var. *zelayensis* (H.B.K.) Hitchc., commonest in the w. and s. parts of the state, with non-papillate ascending cilia in the inflorescence or these absent, and short, thinner, not-so-markedly papillose cilia along the nerves of the second glume and sterile lemma, usually strictly ascending "spikes", and sterile lemma rarely short-awned; synonyms include *E. crusgalli* subsp. *zelayensis* (H.B.K.) Shinnery and var. *macera* (Wieg.) Shinnery.

Japanese millet is planted in places and occasionally escapes; it is usually called *E. crusgalli* var. *frumentacea* (Link) W. Wight but is no doubt merely a cultivar of var. *crusgalli*.

One specimen from near Brownsville, Cameron Co., Rio Grande Valley, has stamiferous lower florets and therefore corresponds to *E. paludigena* Wieg., which is otherwise identical to, and is to be referred to, *E. crusgalli* var. *crusgalli*.

3. *Echinochloa crusgalli* (H.B.K.) Schult. Diffuse annual, the lower parts of the culms long-trailing in water and mud and rooting at the nodes, the lower internodes 4-12 mm. thick; sheaths smooth; ligule obsolete; panicles long, slender, conspicuously nodding; "spikes" ascending or appressed, 1-4 cm. long, lengthily overlapping, often with stiff bristlelike hairs; second glume and sterile lemma with bodies 3-4 mm. long and awns, the awn of the lemma 4-29 mm. long, the nerves with spinulose cilia but these not conspicuously papillose. *Panicum crusgalli* (H.B.K.) Nees, *E. crusgalli* var. *crusgalli* (H.B.K.) Nees. Marshy margins of streams and lakes, infrequent in s.e. Tex. and n. parts of Rio Grande Plains, rare in the Trans-Pecos, summer-fall; trop. areas of Afr. and Am., n. to Ala., La. and Tex.; also rare in Va.

4. *Echinochloa Walteri* (Pursh) Heller. Mostly erect annual; culms 4-17 mm. thick basally; sheaths papillose-pilose or papillose-hispid at least part of the length or rarely wholly glabrous; ligule obsolete; panicles elongate, nodding; "spikes" 2-10 cm. long, ascending or spreading, lengthily overlapping, often with stiff bristlelike hairs; second glume and sterile lemma with bodies 3-4 mm. long and awns, the awns of the lemma 10-43 mm. long, the nerves (especially the lateral) with conspicuously papillose-spinulose cilia. *Panicum Walteri* Pursh. Margins of streams, extreme n. edge of Rio Grande Plains, s. parts of n.-cen. Tex. and e. Tex., infrequent, summer; Wisc., Va., S.C., Ark., La., Tex. and Coah.

5. *Echinochloa polystachya* (H.B.K.) Hitchc. Long-creeping perennial, some of the lower internodes 3-6 mm. thick; nodes villous; sheaths smooth; ligule a row of stiff yellowish hairs (use lens); panicles slender and usually nodding; "spikes" 2-5 mm. long, strictly ascending and appressed, the lower ones only slightly overlapping, often with stiff bristlelike hairs; second glume and sterile lemma with bodies 4-5 mm. long and awns, the awn of the lemma 4-18 mm. long, the nerves (especially the lateral ones) with spinulose cilia but these not conspicuously pilose. *Panicum polystachyum* H.B.K. Infrequent in moist clay loam, coastal parts of Rio Grande Plains and s. part of s.e. Tex., Mar.-Nov.; warm-temp. and trop. parts of Am. n. to Cuba and Tex.

62. SETARIA BEAUV.

Panicles with many nodes and short branches, each branch system exhibiting numerous reduced sterile branchlets which are seen as bristles subtending the spikelets; spikelets essentially sessile, each falling as a unit, 2-flowered, the lower floret staminate or completely reduced, the upper perfect; first glume much shorter than the spikelet, several-nerved, membranous; second glume nearly as long as the spikelet, several-nerved, membranous; lower ("sterile") lemma several-nerved, membranous, usually not quite as long as the fertile lemma; sterile palea nearly obsolete to well-developed and as long

as the sterile lemma; fertile lemma indurate, strongly convex, the margins revolute and clasping the palea of the same texture, smooth or usually faintly to strongly transversely rugose.

A genus of about 140 species in the warmer parts of the world; closely related to certain species of *Panicum* and probably best treated as a subgenus of that genus.

1. Bristles 4 to 12 below each spikelet; panicles spiciform, not tapering nor interrupted; lower floret usually staminate (2)
1. Bristles 1 to 3 below each spikelet; panicles tapering or if spiciform then usually interrupted in the lower part (except in *S. magna*, *S. viridis* and *S. corrugata*); lower floret rarely staminate (except in *S. magna*) (3)
- 2(1). Plants perennial, from hard knotty subrhizomatous bases; spikelets mostly 1.2-1.6 mm. broad, elliptic 11. *S. geniculata*.
2. Plants annual, from bases that are not hard knotty or subrhizomatous; spikelets mostly 1.5-1.9 mm. broad, turgid 12. *S. glauca*.
- 3(1). Bristles retrorsely scabrous 10. *S. adhaerens*.
3. Bristles antrorsely scabrous only (4)
- 4(3). Fertile lemma smooth and shiny; lower floret often staminate 8. *S. magna*.
4. Fertile lemma finely to coarsely transversely rugose; lower floret rarely staminate (5)
- 5(4). Panicle densely flowered, spiciform, minutely interrupted in the lower part where the axis can be seen with difficulty (6)
5. Panicle more open, the axis readily visible for most of the length (7)
- 6(5). Sterile palea about three fourths the length of its lemma 7. *S. corrugata*.
6. Sterile palea about a third the length of its lemma 9. *S. viridis*.
- 7(5). Annual; sterile palea only about a third as long as the fertile palea; spikelets 1.5-2.2 mm. long 6. *S. Grisebachii*.
7. Perennials; sterile palea at least two fifths as long as the fertile one; spikelets 1.9-3.4 mm. long (8)
- 8(7). Spikelets 2.9-3.4 mm. long 5. *S. villosissima*.
8. Spikelets 1.9-2.6 mm. long (9)
- 9(8). Panicles 2-6 cm. long, about 5 mm. thick; spikelets 1.9-2.1 mm. long; culms usually moderately bushy-branched 2. *S. texana*.
9. Panicles 6-30 cm. long, 10-70 mm. thick; spikelets 2-2.6 mm. long; culms usually simple above the base (10)
- 10(9). Sterile palea essentially as long as the fertile palea which is slightly convex; spikelets extremely turgid basally 1. *S. macrostachya*.
10. Sterile palea two fifths to three fourths as long as the fertile palea which is nearly flat; spikelets simply turgid basally (11)
- 11(10). Blades 2-5 mm. broad; panicles usually cylindric, 6-15 cm. long; culms mostly tightly tufted and erect 3. *S. leucopila*
11. Blades 5-18 mm. broad; panicles usually strongly tapered, (7-) 11-25 cm. long; culms mostly loosely tufted and basally reclining ... 4. *S. Scheelei*.

1. *Setaria macrostachya* H.B.K. Tufted perennial; culms 2-10 dm. long, with a few branches in the lower part, mostly simple, often geniculate at the lower 1 or 2 nodes (the lowest internodes thus often decumbent and 2-4 mm. thick), mostly ascending or erect; sheaths mostly glabrous or the uppermost margin usually pilose; blades 7-15 mm. broad, glabrous or very sparsely pilose near the base; panicles 1-3 dm. long, 1-2 cm. thick, nearly cylindric (some of the longer ascending bristles 9-20 mm. long, flexuous); spikelets 2-2.3 mm. long; second glume two thirds to three fourths as long as the fertile lemma whose tip is thus considerably exposed; sterile palea as long as the convex fertile palea; fertile lemma extremely turgid basally. Rio Grande Plains and extreme s. part of s.e. Tex., infrequent, summer-fall; Cto. and Qro. n. to Tex. and n.w. to s. Ariz.

This species, *S. texana* and *S. leucopila* are closely related and have been known collectively by the vernacular name "plains bristlegrass."

2. *Setaria texana* W. H. P. Emery. Tufted perennial; culms 1-7 dm. long, moderately bushy-branched, erect or ascending, the lowest internodes 0.9-1.5 mm. thick; sheaths glabrous except very shortly pilose on the upper part of the margin; blades 2-5 mm. wide, glabrous; panicles 2-6 cm. long, about 5 mm. thick, nearly cylindrical (some of the longer ascending bristles 3-7 mm. long, flexuous); spikelets 1.9-2.1 mm. long, second glume about three fourths as long as the fertile lemma whose tip is thus considerably exposed; sterile palea rudimentary or to half as long as the slightly convex fertile palea. Brush-covered plains and low foothills in Rio Grande Plains, rarely w. to s.w. parts of Edwards Plateau and the extreme e. Trans-Pecos, summer-fall; also N. L. and Tam.

3. *Setaria leucopila* (Scribn. & Merr.) K. Schum. Tufted perennial; culms 2-10 dm. long, mostly simple or rarely branched, occasionally geniculate at the lowest nodes (the lowest internodes usually erect and 1-2.5 mm. thick), mostly erect; sheaths mostly glabrous but short-pilose usually on the upper part of the margin; blades 2-5 mm. broad, rarely pubescent, marginally straight (not plicatulate or very rarely so in a few spots); panicles 6-15 cm. long, about 1 cm. thick, nearly cylindrical (some of the longer of the ascending bristles 5-12 mm. long, flexuous); spikelets 2.1-2.5 mm. long; second glume not quite as long as the fertile lemma whose tip is thus exposed; sterile palea lanceolate, a half to three fourths the length of the nearly flat fertile palea. Dry plains and upland slopes, Rio Grande Plains, Trans-Pecos and Plains Country, abundant in some areas, especially along stream-beds, summer-fall; Colo. and Ariz. s. to S.L.P., Gto. and Zac.

4. *Setaria Scheelei* (Steud.) Hitchc. Loosely tufted perennial; culms (3-) 6-12 dm. long, nearly simple, usually geniculate at a few of the lowest nodes but not rooting (the lowest internodes usually decumbent, purplish-olive, 1.5-3.5 mm. thick), distally ascending; sheaths glabrous or usually densely to sparsely pilose at least apically and near the upper margins; blades 5-18 mm. broad, tapering only slightly to the base, long-tapering to the apex, usually minutely plicatulate marginally in spots; panicles (7-) 11-25 cm. long, 1-7 cm. thick, usually rather open basally, mostly long-tapered (some of the longer spreading bristles near the base 8-18 mm. long, flexuous); spikelets 2.2-2.6 mm. long; second glume not quite as long as the fertile lemma whose tip is thus exposed; sterile palea lanceolate, about two fifths to three fifths as long as the flat fertile palea. Abundant in n.-cen. Tex., Rio Grande Plains and Edwards Plateau, less abundant to rare in s. part of e. and s.e. Tex., the Trans-Pecos and s. Plains Country, found chiefly in shaded stream-canyons, spring-fall; Tex. s. to Coah., N. L., Tam. and S.L.P.

5. *Setaria villosissima* (Scribn. & Merr.) K. Schum. Loosely-tufted perennial; culms 5-10 dm. long, simple, slightly geniculate at a few of the lowest nodes but not rooting (the lowest internodes 2.5-3 mm. thick, purplish-glaucous and decumbent), distally ascending; blades 6-14 mm. broad, tapering very gently to the base and apex, only very slightly and sparsely transversely plicatulate marginally, usually sparsely to densely short-pilose above and below; panicles 7-22 cm. long, 13-35 mm. thick, rather open basally, mostly long-tapered (some of the longer spreading bristles near the base 13-23 mm. long, flexuous); spikelets 2.9-3.4 mm. long; second glume not quite as long as the fertile lemma whose tip is thus exposed; sterile palea lanceolate, long-attenuate, acute, half to two thirds as long as the flat fertile palea. Rare (very locally common) in soils derived from igneous rocks, Edwards Plateau and Trans-Pecos, summer-fall; Tex., Coah., Ariz. and Son.

6. *Setaria Grisebachii* Fourn. Loosely tufted annual; culms 15-100 cm. long, mostly simple, the lower internodes very short and 1-2 mm. thick, sometimes geniculate and rarely rooting at the lowest node, distally ascending; sheaths sparsely short-pilose in the upper part and along the upper margins; blades 5-13 mm. broad, sparsely short-pilose on both surfaces; panicles 3-18 cm. long, 4-15 mm. thick, nearly cylindrical (some of the longer ascending bristles 5-15 mm. long); spikelets 1.5-2.2 mm. long; second glume about four fifths as long as the fertile lemma whose tip is thus exposed; sterile palea about a third the length of the fertile palea. Infrequent in mts. of the Trans-Pecos, rare e. to w. part of Edwards Plateau, summer-fall; highlands of Mex., s. to Oax. and n. to Ariz., N.M. and Tex.

7. *Setaria corrugata* (Ell.) Schult. Tufted annual; culms 3-10 dm. long, branched only at the base which is decumbent and rooting at the lowest nodes; sheaths usually

wholly glabrous; blades 4-9 mm. broad; panicles very dense (axis usually wholly hidden), cylindric, often slightly curviflexuous, 3-10 cm. long, 10-15 mm. thick; spikelets 2.1-2.7 mm. long; sterile palea about three fourths the length of the sterile lemma; fertile lemma coarsely transversely rugose, each ruga about 0.2 mm. broad. Rare along streams, s.e. Tex. (Harris Co.), summer; Coastal States, N.C. to Tex.; Cuba; Hisp.

8. *Setaria magna* Griseb. Robust annual; culms 1-4 m. tall, 5-20 mm. thick basally, prop-rooting from the lower nodes but erect and simple; panicles 25-60 cm. long, 2-3 cm. thick, dense (the axis mostly hidden); spikelets very numerous, about 2 mm. long; fertile lemma smooth, shiny. Infrequent in moist ditches, bayous, etc., s.e. Tex., summer-fall; Coastal States, N.J. to Tex.; W. I., Yuc., C. R.

9. *Setaria viridis* (L.) Beauv. Tufted annual; culms 1-10 dm. long, mostly ascending, slightly geniculate and sparsely branched at the lower nodes; blades 4-8 (-14) mm. broad; panicles 2-8 cm. long, 6-10 mm. thick, cylindric, often curviflexuous, densely flowered (axis nearly wholly hidden); spikelets 2.2-2.8 mm. long; sterile palea about a third as long as the sterile lemma; fertile lemma finely and faintly transversely rugose (each ruga 0.03-0.1 mm. broad) or nearly smooth. Disturbed areas, frequent in Trans-Pecos and n.-cen. Tex. and the Plains Country, rare elsewhere, summer; temp. regions of the world, rare in warmer areas.

The related foxtail millet, *S. italica* (L.) Beauv., is occasionally planted in Texas but does not persist; it has 2 features of *S. magna*, namely the smooth fertile lemma and abscission of the rachilla above the node of the sterile floret; the spikelets are about 3 mm. long, the sterile palea is about half as long as the sterile lemma.

10. *Setaria adhaerens* (Forsk.) Chiov. Tufted annual; culms 15-60 cm. long, usually decumbent basally (the lower nodes occasionally rooting and geniculate), sparsely to moderately branched, distally ascending; sheaths glabrous with narrow hyaline margins toward the summit; blades 5-11 mm. broad, shortly and sparsely papillose-pilose on both surfaces; panicles 2-6 (-8) cm. long, cylindric, the axis retrorsely scabrous-hispid on the angles but mostly hidden in the dense mass of flowers, the bristles short and retrorsely scabrous; spikelets 1.5-2 mm. long. Rare in disturbed areas, Rio Grande Plains, Edwards Plateau and Trans-Pecos, spring-summer; trop. areas of the world, in Am. n. to the Gulf States and n. Mex.

Our plants have for a long time passed under the name of the closely related species *S. verticillata* (L.) Beauv. which shares with *S. adhaerens* the character of retrorsely scabrous bristles. In *S. verticillata* the upper sheath margins are pilose and not hyaline, the blades not papillose-pilose on both surfaces, and the spikelets 2-2.2 mm. long. It is known in cool-temperate areas of North America, and may yet be found in Texas; it is most likely to occur in the Plains Country or Trans-Pecos.

11. *Setaria geniculata* (Lam.) Beauv. Perennial from hard knotty subrhizomatous bases; aerial culms 2-10 dm. long, geniculate at the lower nodes, mostly erect; blades 3-8 mm. broad, mostly rather strictly erect; panicles 1-8 cm. long, cylindric, about 15 mm. thick, dense, a 1-cm. transection including 13 to 25 spikelets; spikelets subtended by numerous stiff bristles, mostly 2.5-3 mm. long, 1.2-1.6 mm. broad, elliptic to elliptic-ovate; lower (sterile) floret usually staminiferous with a well-developed palea. Throughout the state, most common in disturbed moist areas, spring-fall; in warmer parts of Am. n. to Calif., Ariz., N.M., Kan., Ia., W.Va. and Mass.

12. *Setaria glauca* (L.) Beauv. YELLOW FOXTAIL. Loosely-tufted annual; culms 2-10 dm. long, often geniculate and decumbent basally, ascending distally; blades 4-10 mm. broad, ascending; panicles 1-8 cm. long, cylindric, about 1 cm. thick, fairly dense, a 1-cm. transection near the middle including 11 to 20 spikelets; each spikelet subtended by numerous bristles, mostly 2.5-3.2 mm. long, 1.4-2.1 mm. broad, rotundly ovate, turgid; lower (sterile) floret usually staminiferous with a well-developed palea. *S. lutescens* (Weig.) F.T. Hubb. Nearly throughout, absent from Rio Grande Plains and Plains Country, rare in the Trans-Pecos, summer-fall; nearly throughout the temp. and trop. areas of the world, introd. from Eur.

63. CENCHRUS L.

Sheaths compressed-keeled (internodes slightly compressed in the same plane); inflorescence a terminal spiciform determinate panicle (terminal or middle flowers maturing

first), the angled axis prolonged beyond the uppermost node as a bristle or terminating as a reduced bur, bearing in about 5 ranks the sessile few-flowered usually bristly glomerules (burs), each with a zone of abscission at the base and consisting of a more or less basally fused and cuplike or urceolate mass of aceriform bristles surrounding as an "involucre" a fascicle of 1 to 4 nearly sessile spikelets; spikelets persistent in the bur, not compressed but turgid, 2-flowered, the lower flower usually staminate, the upper perfect; the rachilla remaining intact; first glume minute, membranous, 1- to 3-nerved; second glume 3- to 7-nerved, membranous, nearly as long as the remainder of the spikelet; first (lower) lemma membranous, 3- to 7-nerved, as long as the spikelet; fertile lemma convex dorsally, slightly indurate or simply chartaceous, acuminate apically, marginally revolute, enclosing a plane palea. *Pennisetum* Rich.

About 160 species in warmer parts of the world. Individuals of this genus are exceedingly abundant, perhaps the most abundant grasses in Texas, especially so in disturbed, sandy, non-forested areas and at elevations below 4,000 feet. Several species have been introduced, including Pearl Millet and Napier Grass. Some authors segregate the genus into two genera on trivial technical grounds. The spiny burs cause pain and sometimes infection when they penetrate the skin, and they are noxious to animals when mixed with hay.

1. Bristles united only into a shallow cup, the body of which is much shorter than the spikelets (2)
 1. Longer bristles united into a somewhat urceolate structure (bur), the body of which nearly equals the spikelets (5)
 - 2(1). Longer bristles 3-5 cm. long 1. *C. longisetus*.
 2. Longer bristles much shorter (3)
 - 3(2). Longer bristles rigid, none of them plumose 4. *C. myosuroides*.
 3. Longer bristles flexible (4)
 - 4(3). Bristles all scabrous 2. *C. nervosus*.
 4. Inner bristles plumose 3. *C. ciliaris*.
 - 5(1). Lateral spinous bristles confined to the lower part of the bur; a 1-cm. transection near the middle of the panicle including 4 to 7 burs 5. *C. echinatus*.
 5. Lateral spinous bristles not confined to the lower part, a minority of them spreading from the upper part of the bur; a 1-cm. transection of the panicle including only 2 to 4 burs (6)
 - 6(5). Lateral bristles 50 to 75 per bur, the bases of the larger ones about 0.4-1 mm. broad; spikelets 5.8-7.6 mm. long 6. *C. longispinus*.
 6. Lateral bristles 8 to 40 (to 50) per bur, the bases of the larger ones 0.7-1.5 mm. broad; spikelets 3.4-5.8 mm. long 7. *C. incertus*.

1. *Cenchrus longisetus* M. C. Johnst. FEATHERTOP. Perennial from subrhizomatous matted bases; nodes not swollen; blades 3-5 mm. broad, mostly folded; panicles 6-11 cm. long, several cm. thick, softly fuzzy and pale-buffy- or tawny-white, the longer bristles of the burs 3-5 cm. long. *Pennisetum villosum* R. Br. Cult. in various areas and infrequently escaped, summer-fall; nat. of Afr., widely introd.

2. *Cenchrus nervosus* (Nees) O. Ktze. Perennial from knotty bases; nodes swollen; blades 8-12 mm. broad, mostly flat; panicles 1-2 dm. long, about 14 mm. thick, not soft, the scabrous bristles usually purple distally and about 1 cm. long. *Pennisetum nervosum* (Nees) Trin. Escaped in extreme s. part of Rio Grande Plains near Brownsville, summer-fall; S.A.; elsewhere introd.

3. *Cenchrus ciliaris* L. BUFFELGRASS. Tufted perennial from hard knotty bases; culms 25-60 (-100) cm. long, often spreading and geniculate basally, distally ascending; panicle 2-10 (-12) cm. long, 1-2 cm. thick, dense, a 1-cm. transection near the middle containing 7 to 14 burs; internodes of axis about 1 mm. long; burs 2-3.5 mm. thick basally, the bristles numerous (about 50 per bur), united only in the short cup which does not equal the spikelets, greatly unequal, the outer ones shorter than the inner, ascending, usually purplish, some of the inner ones elongate, flexible, appearing double and plumose.

Pennisetum ciliare (L.) Link. Frequent along roadsides and edges of fields, Rio Grande Plains, spring-fall; nat. of India, now widely introd. as a forage grass in the warmer, drier parts of the world.

4. *Cenchrus myosuroides* H.B.K. Perennial from hard knotty subrhizomatous bases; culms 6-20 dm. long, erect; panicle (6-) 10-23 cm. long, 6-12 mm. thick, interrupted at the very base, otherwise rather dense, a 1-cm. transection near the middle containing 7 to 10 burs; internodes of axis about 1-1.5 mm. long; burs about 3 mm. thick basally, the bristles numerous (about 35 to 60 per bur), united only basally in the short cup which does not equal the spikelets, greatly unequal (outer ones shortest), spreading (outer) or ascending (inner ones), the inner ones stiff, none plumose. In ditches and near creeks or springs, infrequent in Rio Grande Plains, rare in the Trans-Pecos, summer-fall; Col., Ecu., Bol., Chile, Parag., Arg. and extreme s. Braz.; also W.I. n. to Fla. Keys; Mex.; Tex.

5. *Cenchrus echinatus* L. CADILLO. Loose annual; culms 15-85 cm long, widely spreading and geniculate, distally ascending; panicle 2-10 cm. long, 10-17 mm. thick, relatively lax, a 1-cm. transection near the middle containing 4 to 7 burs; internodes of axis 1.5-3 mm. long; burs about 4-6 mm. thick basally, the longer bristles united into an urceolate shortly-pubescent body which equals the spikelets and which is ringed below the middle by a zone of about 50 relatively short spreading stiff spinous bristles; none of the bristles plumose but some of them shortly pubescent. Infrequent weed in disturbed areas in Rio Grande Plains, rare in s.e. Tex., spring-fall; Coastal States, N.C. to Tex.; also Ariz., Calif., Mex., and C.A.; W.I.; n. coasts of S.A., and scattered in w. and s. temp. parts of S.A.; H.I.; introd. in Pac. Is., Austral.; Isr.

6. *Cenchrus longispinus* (Hack.) Fern. Loosely tufted annual; culms 1-9 dm. long, usually decumbent basally and at the lower nodes rooting and slightly geniculate, ascending above; panicle 4-10 cm. long, 1-2 cm. thick, relatively lax, a 1-cm. transection near the middle including 2 to 4 burs; internodes of axis 2-5 mm. long; burs about 4-6 mm. thick basally (not including the bristles), the longer bristles united into an urceolate pubescent body equaling the spikelets, with spinous bristles emerging at various levels from this body (not confined to below the middle although more numerous there), the bases of these slightly flattened and 0.4-1 mm. broad, the bristles stiff, usually purplish and numbering about 50 to 75 per bur, some of the longer ones near the base retrorsely pubescent. Disturbed areas of sandy soils, frequent in Plains Country, infrequent to rare e. to e. Tex. and s. to Trans-Pecos and Rio Grande Plains, spring-fall; mostly midwest. U.S. and the Plains States, less abundant w. to Calif. and e. to e. seaboard, rare in n.w. and s.e. U.S.

7. *Cenchrus incertus* M. A. Curtis. GRASSBUR, COAST SANDBUR. Perennial or often behaving as annual; culms 5-80 cm. long, usually decumbent basally and at the lower nodes rooting and slightly geniculate, ascending distally; panicle 15-50 (-90) mm. long, 8-18 mm. thick, relatively lax, a 1-cm. transection near the middle including 3 or 4 burs; internodes of axis 2-5 mm. long; burs about 2.5-5 mm. thick basally (not including the bristles), the longer bristles united into an urceolate very shortly pubescent body equaling the spikelets, with spinous bristles emerging at various levels from this body (not confined to below the middle, although more numerous there), the bases of these being slightly flattened and 0.7-1.5 mm. broad, the bristles stiff, spinous, usually purplish and numbering 8 to 40 (to 50) per bur. *C. pauciflorus* Benth., *C. parviceps* Shinnery. Sandy or tighter soils, especially in disturbed areas, throughout the state but most abundant in n.-cen. and s.e. Tex. and Rio Grande Plains, spring-fall; Coastal States, Va. to Tex. and inland to Ark. and Okla.; N.M., Ariz., Calif.; nearly throughout Mex., C.A. and W.I.; also warm-temp. and subtrop. parts of S.A.; Phil.; S.Afr.

64. IMPERATA Cyr.

A genus of about 10 species in warm parts of the world.

1. *Imperata brevifolia* Vasey. SATINTAIL. Perennial with short hard scaly rhizomes; culms erect, 10-15 dm. tall, leafy at least in lower part; leaves elongate; panicle terminal, narrow, silky, 15-30 cm. long; spikelets all alike, somewhat dorsally compressed, awnless, in pairs, about 3 mm. long, unequally pedicellate on a slender continuous rachis, sur-

rounded by long silky hairs 3 times as long as the spikelet; glumes about equal, membranous; sterile lemma, fertile lemma and palea thin and hyaline. Rare in mts., s. part of Brewster and Hudspeth cos. in the Trans-Pecos, summer-fall; Tex., N.M., Ariz., Ut., Nev. and Calif.; probably Chih.

Another grass with technical spikelet details similar to this species with a flaring or fanlike panicle is *Miscanthus sinensis* Anderss., called "Eulalia," a native of eastern Asia infrequently cultivated in east Texas and elsewhere in eastern United States.

65. ERIANTHUS MICHX.¹¹

PLUMEGRASS

Perennials, 1-3 m. tall, forming robust clumps; leaves elongate: ligules narrow, usually hippocrepiform; panicle 1-9 dm. long, terminal, often pyramidal to clavate or even slender; spikelets in pairs, one of each pair sessile, one pedicelled, both perfect, usually 4-6 mm. long (not including awn), typically membranous to coriaceous, usually dorsally villous with long hairs; sterile lemma hyaline, shorter, with usually 1 median nerve; fertile lemma narrow, ovate-lanceolate, hyaline, with usually a prominent straight or twisted exerted awn 4-20 mm. long; palea (if present) hyaline.

A genus of 28 species of southeast Asia to southeast Europe, Madagascar, and the warmer parts of America.

1. Culm appressed-hairy below the panicle (2)

1. Culm glabrous below the panicle (3)

2(1). Awn straight or slightly flexuous4. *E. giganteus*.

2. Awn loosely twisted3. *E. alopecuroides*.

3(1). Hairs subtending the spikelet few and short or absent; panicle nearly completely glabrous; awn straight1. *E. strictus*.

3. Hairs subtending the spikelet as long as or longer than the spikelet; panicle very hairy; awn 2 cm. long, coiled2. *E. contortus*.

1. *Erianthus strictus* Baldw. NARROW PLUMEGRASS. Perennial; culms 1-2 m. tall, relatively slender, glabrous; nodes sometimes hirsute with stiff erect deciduous hairs; internode below the panicle glabrous; foliage glabrous; lower sheaths narrow and crowded; blades mostly 4-12 mm. broad; panicle 2-4 dm. (rarely 8 dm.) long, strict (about 1-2 cm. thick), the branches closely appressed; spikelets brown, about 8-11 mm. long (not including awn), scabrous, nearly naked to sparsely short-hairy at base; awn straight, 15-20 mm. long; rachis joint and pedicel scabrous. Rare in moist sandy places, e. and s.e. Tex., fall; Va. to Fla. and Tex., n. to Tenn. and Mo.

2. *Erianthus contortus* Baldw. BENT-AWN PLUMEGRASS. Perennial; culms 1-2 m. tall, glabrous or sometimes sparsely appressed-pilose below the panicle; nodes glabrous or pubescent with erect deciduous hairs; internodes below the panicle glabrous; sheaths sparsely pilose at summit or glabrous; blades 10-15 mm. broad, scabrous; panicle 15-30 cm. long, narrow, the branches ascending but not closely appressed; spikelets 6-8 mm. (excluding awn) long, brownish, the basal hairs nearly or about as long as the spikelet; awn about 2 cm. long, spirally coiled at base; rachis joint and pedicel villous. Rare in moist sandy places, e. and s.e. Tex., fall; Md. to Fla. and Tex., n. to Tenn. and Okla.

3. *Erianthus alopecuroides* (L.) Ell. SILVER PLUMEGRASS. Perennial; culms robust, 15-30 dm. tall, appressed-villous below the panicle and usually on the nodes; sheaths pilose at the summit; blades 12-20 mm. wide, scabrous, pilose on upper surface toward base; panicle 2-3 dm. long, silvery to tawny or purplish; spikelets 5-6 mm. long, pale, sparsely villous, shorter than the copious basal hairs; awn 10-15 mm. long, flat, loosely twisted; rachis joint and pedicel long-villous. *E. divaricatus* Hitchc. Infrequent in sandy woodlands, usually near water in e. and s.e. Tex., fall; N.J. to Ill., s. Mo. and Okla., s. to Gulf States.

¹¹ Adapted from the treatment by Sunil Kumar Mukherjee in *Lloydia* 21:157-188. 1959 ("1958").

4. *Erianthus giganteus* (Walt.) Muhl. SUGARCANE PLUMEGRASS. Perennial; culms 1-3 m. tall, appressed-villous below the panicle, the nodes appressed-hispid, the hairs deciduous; sheaths and blades from nearly glabrous to shaggy appressed-villous; blades 4-15 mm. broad; panicle 10-15 (-40) cm. long, oblong or ovoid, tawny to purplish; spikelets 5-6 (-7) mm. long, sparsely long-villous on the upper part, shorter than the copious basal hairs; awn 10-25 mm. long, terete, straight or rarely slightly flexuous; rachis joint and pedicel long-pilose. *E. saccharoides* Michx., *E. Tracyi* Nash, *E. laxis* Nash, *E. compactus* Nash. Infrequent in sandy soil, usually near moisture, e. and s.e. Tex., fall; N.Y. to Tex., n. to Ky.; Cuba; probably elsewhere in trop. Am.

Mukherjee breaks this down into as many as 4 "species," mainly on the basis of panicle shape. The variability in all these characters does not support his treatment.

66. SCHIZACHYRIUM NEES¹² LITTLE BLUESTEM

Cespitose or rhizomatous perennials with rounded or compressed and keeled sheaths and flat or folded infrequently terete blades; flowering culms usually much-branched, each branch or branchlet terminating in a single pedunculate raceme; spikelets numerous on the raceme, appressed to the axis or divergent at maturity, in pairs, one spikelet of each pair sessile; perfect and fertile, the other pedicellate, smaller and often rudimentary or absent; sessile spikelet falling attached to the rachis joint and associated pedicel; rachis joint oblique and hollow at summit; spikelets somewhat dorsiventrally compressed; glumes 2, flat or slightly concavo-convex, coriaceous, narrow, the second sometimes slightly keeled; pits absent; lemma of sterile floret shorter than the glumes, hyaline; lemma of fertile floret hyaline, narrow, entire or bifid, bearing a bent and twisted awn from the apex or from between the lobes; palea hyaline, small or absent. *Andropogon* Sect. *Schizachyrium* (Nees) Trin.

A relatively large genus, well-represented in grasslands of the warmer regions of the world. It is segregated from *Andropogon* mainly on the basis of the single raceme per inflorescence.

1. First glume of sessile spikelet minutely papillose, slightly pubescent 2. *S. Feense*.
1. First glume of sessile spikelet glabrous (2)
- 2(1). Internode of rachis relatively slender, hairy throughout its length or nearly so .. 4. *S. scoparium*.
2. Internode of rachis relatively thick, glabrous or ciliate only at apex (3)
- 3(2). Sessile spikelet about 4 mm. long; blades about 1 mm. broad 1. *S. tenerum*.
3. Sessile spikelet 8-9 mm. long; blades 1-4 mm. broad .. 3. *S. cirratum*.

1. *Schizachyrium tenerum* Nees. Perennial; culms slender, tufted, sometimes reclining or decumbent, 6-10 dm. long, the upper half rather sparingly branching; blades scarcely 1 mm. wide, flat or loosely involute, often sparingly long-pilose on upper surface near base; raceme finally long-exserted, slender, subterete, glabrous, 2-6 cm. long; rachis joint ciliate only at apex; sessile spikelet about 4 mm. long, its glume glabrous, the awn 7-10 mm. long. *Andropogon tener* (Nees) Kunth. Rare in woodlands, e. Tex., summer-fall; Gulf States, Ga. and Okla.

2. *Schizachyrium Feense* (Fourn.) A. Camus. Perennial; culms tufted, 6-12 dm. tall, erect, reddish, the upper half sparingly branching; foliage often glaucous, the blades scabrous, 2-4 mm. wide; raceme 6-10 cm. long, the base often included in the somewhat dilated sheath, the rachis joints, pedicels and first glume of sessile spikelet at least minutely pubescent; sessile spikelet 5-9 mm. long, the awn 10-15 mm. long; pedicellate spikelets much-reduced, short-awned. *Andropogon hirtiflorus* (Nees) Kunth. var. *Feensis* (Fourn.) Hack. Rare in Trans-Pecos mts., summer-fall; Tex., N.M., Ariz., s.e. to Oax.

¹² Frank W. Gould kindly supplied helpful suggestions on the treatment of genera 66, 67, 68 and 69.

3. *Schizachyrium cirratum* (Hack.) Woot. & Standl. TEXAS BEARDGRASS. Perennial; plants pale, glaucous to purplish; culms slender, tufted, 3-7 dm. tall, erect, the upper half sparingly branched; blades flat, 1-4 mm. wide, usually scabrous; raceme exserted, 3-6 cm. long; rachis joint ciliate only at the apex; sessile spikelet glabrous, 8-9 mm. long, the awn 5-10 mm. long; pedicellate spikelet scarcely reduced, awnless, the pedicel stiffly ciliate on one side near summit. *Andropogon cirratus* Hack. Infrequent in Trans-Pecos mts., summer-fall; Tex., N.M., Ariz., Chih., Son. and Calif.

4. *Schizachyrium scoparium* (Michx.) Nash. LITTLE BLUESTEM. Rather variable perennial, usually tufted and sometimes with short rhizomes; culms erect, (2-) 3-10 (-15) dm. tall; sheaths sometimes laterally compressed and keeled; blades numerous, either crowded at base or well-distributed, usually 3-6 mm. broad; branching often copious; rachis joints and usually pedicels hairy throughout their full length, slender; first glume of sessile spikelet glabrous. *Andropogon scoparius* Michx. Growing essentially all over the state, though rare in extreme w., summer-fall; represented with us by several completely intergrading varieties as follows from west to east:

Var. *neomexicanum* (Nash) Gould. Glabrous, usually glaucous; at maturity the pedicels are only slightly if at all spreading and the rachis very slightly if at all zigzag; rachis and pedicels copiously villous. *Andropogon scoparius* var. *neomexicanus* (Nash) Hitchc. Frequent in Plains Country, infrequent in Trans-Pecos mts.; Tex. to Ariz. and s. to Coah., N.L. and S.L.P.

Var. *frequens* (F. T. Hubb.) Gould. LITTLE BLUESTEM. Glabrous and often glaucous (green and glaucous plants are often mixed in the same populations); pedicellate spikelet 1.5-5 mm. long (excluding awn), consisting of a single empty glume. *Andropogon scoparius* var. *frequens* F. T. Hubb. Very abundant in a north-south zone through cen. Tex., intergrading in the plains with var. *neomexicanum* and in e. Tex. with var. *virile*; widespread in cen. U.S.

Var. *virile* (Shinners) Gould. Usually somewhat pubescent; the pedicellate spikelets 4.5-7 mm. long (excluding awns), many or most pedicellate spikelets in each inflorescence with 2 glumes and commonly lemma and stamens. E. Tex., in sandy woodlands, w. on sandy soils to n.-cen. Tex. These populations actually represent broad-scale intergradation between var. *frequens* and var. *divergens*. Ark., Okla., Tex.

Var. *divergens* (Hack.) Gould. Robust plants with villous sheaths; pedicellate spikelet well-developed and its glume often with a short awn. Common in s.e. Tex. and s. part of e. Tex.; Tex., La., Ark. and Miss.

Var. *littoralis* (Nash) Gould. SEACOAST BLUESTEM. Rhizomes often developed; lower sheaths often strongly laterally compressed and keeled, often bluish-glaucous; rachis joints and pedicels copiously long-villous. *Andropogon scoparius* var. *littoralis* (Nash) Hitchc. Frequent in coastal sands especially on the barrier islands all along the coast in extreme s. Tex., inland as far as Jim Hogg Co., very late summer and fall; along Atl. and Gulf coasts s. to Ver.

67. ANDROPOGON L. BLUESTEM

Cespitose branching perennials with usually stiffly erect culms, rounded or flattened and keeled sheaths and flat or folded blades; inflorescence various, the flowering culm much-branched above and terminating in numerous branchlets bearing 2 to several pedunculate flower clusters or the flowering culm little-branched and terminating in a stiffly erect panicle of 2 (rarely 1) to few spicate branches; rachis joints slender, mostly pubescent, the rachis articulated at base; spikelets in pairs, one of each pair sessile, fertile and awned, the other pedicelled, smaller and often rudimentary or absent; sessile spikelets falling attached to the rachis joint and associated pedicel; spikelets somewhat dorsiventrally compressed; glumes 2, flat or slightly concavo-convex, coriaceous, narrow, the second sometimes slightly keeled; sterile lemma shorter than the glumes, hyaline; fertile lemma hyaline, narrow, entire or bifid, that of the sessile spikelet bearing a bent and twisted awn from the apex or from between the lobes; palea hyaline, small or absent.

This genus is sometimes enlarged to include the very closely related genera *Bothriochloa*, *Dichanthium*, and *Schizachyrium*. In the present strict sense it is a genus of some few dozens of species of the temperate and subtropical areas of the Old World and New World.

1. Pedicellate spikelet staminate, similar to the sessile spikelet but awnless (2)
1. Pedicellate spikelet much-reduced or obsolete and represented by the pedicel only; racemes silky-villous (3)
- 2(1). Rhizomes short or absent; rachis joint and sterile pedicel ciliate, the joints short-hispid at base; awn of sessile spikelet 10-20 mm. long 1. *A. Gerardi*.
2. Rhizomes well-developed; rachis joint and sterile pedicel densely long-villous; awn of sessile spikelet rarely more than 5 mm. long, often obsolete 2. *A. Hallii*.
- 3(1). Inflorescence very decompound, the profuse pairs of racemes aggregated in an elongate or corymbose mass; spathes (i.e., partially sheathing uppermost leaves) rarely more than 2 mm. broad; pedicellate spikelet obsolete (see also forms of *A. virginicus*) 6. *A. glomeratus*.
3. Inflorescence not conspicuously decompound nor dense (except in forms of *A. virginicus*) (4)
- 4(3). Peduncle not more than 1 cm. long, the dilated spathes exceeding the 2 (rarely 3 or 4) racemes (5)
4. Peduncles 2 cm. long or longer (6)
- 5(4). Upper sheaths inflated-spathelike, aggregate, the late inflorescence a flabellate tuft 4. *A. Elliottii*.
5. Upper sheaths not inflated and aggregate 5. *A. virginicus*.
- 6(4). Upper sheaths inflated, overlapping, conspicuous ... 4. *A. Elliottii*.
6. Upper sheaths not inflated, overlapping nor conspicuous 3. *A. ternarius*.

1. *Andropogon Gerardi* Vitman. BIG BLUESTEM. Perennial; plants often glaucous; culms robust, often in large tufts, sometimes with short rhizomes, 1-2 m. tall, usually sparingly branching toward the summit; lower sheaths and blades sometimes villous, occasionally densely so; blades flat, elongate, mostly 5-10 mm. broad, the margins very scabrous; racemes on the long-exserted terminal peduncle mostly 3 to 6, fewer on the branches, 5-10 cm. long, usually purplish, sometimes yellowish; rachis straight, the joints and pedicels stiffly ciliate on one or both margins, the joints hispid at base; sessile spikelet 7-10 mm. long, the first glume slightly sulcate, usually scabrous, the awn geniculate and tightly twisted below, 1-2 cm. long; pedicellate spikelet not reduced or but slightly so, awnless, staminate. *A. provincialis* Lam. not Retz., *A. furcatus* Muhl. Locally abundant nearly throughout the state, usually in low meadows and prairies but rare in extreme w., late summer-fall; Que. and Me. to Sask. and Mont., s. to Gulf States and cen. Mex.

An important forage grass in the prairie states of the Mississippi Valley, and a constituent of prairie hay, but less important in Texas.

2. *Andropogon Hallii* Hack. SAND BLUESTEM. Perennial, resembling *A. Gerardi* but with creeping rhizomes; racemes conspicuously villous, the hairs grayish to pale-golden; awn of sessile spikelet rarely more than 5 mm. long, often obsolete. Local in areas of deep loose quartz sand in the w. half of Tex., late summer-fall; N.D. and Mont. s. to Chih. and Ariz.

A form with yellow villous racemes and awns 5-10 mm. long has been segregated as *A. chrysocomus* Nash. *A. Hallii* intergrades completely with *A. Gerardi* in zones of intermediate soil-texture, and its recognition as a separate "species" is of dubious merit.

3. *Andropogon ternarius* Michx. SPLITBEARD BLUESTEM. Perennial; culms tufted, erect, 8-12 dm. tall, the upper half to two-thirds branching, the branches usually long, slender and erect; leaves often purplish-glaucous, glabrous or the lower loosely villous, the blades 2-4 mm. wide; inflorescence elongate, loose, of few to many pairs of silvery to creamy or grayish feathery racemes, usually on long-exserted peduncles from slender inconspicuous spathes, some of the lateral peduncles often short, from dilated spathes, rarely most of them so; racemes 3-6 cm. long, with mostly less than 12 joints, the rachis not flexuous, the joints shorter than the spikelets, copiously long-villous; sessile spikelets 5-7 mm. long, glabrous and nerveless between the keels, the awn twisted below, 15-20 mm. long;

stamens 3; pedicel long-villous, the spikelet obsolete or nearly so. Frequently in sandy usually wooded areas, e. half of state, late summer-fall; Del. to Ky. s. to Gulf States.

Variable in the density and length of pubescence on the rachis and pedicels, the less hairy specimens verging toward the Floridian *A. arctatus* Chapm.

4. *Andropogon Elliottii* Chapm. Perennial; culms tufted, erect, 3-8 dm. tall, at first nearly simple, later branching toward the summit; lower sheaths keeled, rather narrow, commonly loosely pilose, those near the summit inflated and spathe-like, crowded, the very short internodes densely bearded; blades flat, 3-4 mm. wide; primary inflorescence of few to several racemes, mostly in pairs, rarely threes or fours, on filiform often strongly flexuous peduncles, long-exserted from inconspicuous spathes, these on slender branchlets borne in the axils of the broad spathe-like sheaths of the main culm; secondary inflorescence of numerous pairs of racemes on short peduncles subtended by broad spathes, these on short bearded often fasciated branchlets borne in the axils of the spathe-like sheaths of the main culm and short primary branches, the whole forming a series of flabellate tufts with conspicuous purplish to copper-brown spathes 5-10 mm. wide, much-exceeding the feathery racemes; racemes flexuous, 3-4 (-5) cm. long, the slender rachis joints and pedicels long-villous; sessile spikelets 4-5 mm. long, those of the late enclosed racemes cleistogamous, the awn loosely twisted, 10-15 mm. long; pedicellate spikelets obsolete or nearly so. *A. gracilior* (Hack.) Nash. Rare in sandy wooded areas, e. and s.e. Tex., late summer-fall; Gulf States n. to Mo., Ill., Ind., O. and N.J.; also Br. Hond.

Intergrading to *A. virginicus*. The flattened ferruginous upper sheaths are conspicuous in winter. The characteristic plant is very striking, but occasional individuals occur with less aggregate upper sheaths, and others with scarcely dilated sheaths, aggregate or scarcely aggregate. This form, which has been distinguished as *A. Elliottii* var. *gracilior* Hack., appears to merge into *A. subtenuis* Nash, of Mississippi eastward.

5. *Andropogon virginicus* L. BROOMSEDEGE. Perennial; culms erect, 5-10 dm. tall, usually in rather small tufts, the upper two-thirds mostly freely branching; lower sheaths compressed, keeled, equitant; sheaths glabrous to villous; ligule strongly ciliate; blades flat or folded, 2-5 mm. wide, pilose on the upper surface toward base; inflorescence elongate, narrow or thick, simple to much-branched, the 2 to numerous racemes 2-3 cm. long, partly included and shorter than the inflated tawny to bronze spathes; rachis very slender, flexuous, long-villous; sessile spikelet about 3 mm. long, the delicate straight awn 1-2 cm. long; pedicel long-villous, its spikelet obsolete or nearly so. Frequent in sandy woodlands or less frequent in calcareous soil, e. half of state w. to n.-cen. Tex., rare w. to Edwards Plateau and s. to Rio Grande Plains, late summer-fall; nearly all of e. U.S.; Calif., Mex., C.A., W.I.

Grading through the moist-ground forms with dense inflorescences, known as var. *hirsutior* (Hack.) Hitchc., into *A. glomeratus*.

6. *Andropogon glomeratus* (Walt.) B.S.P. BUSHY BEARDGRASS. Perennial; culms erect, 5-15 dm. tall, compressed, with broad keeled overlapping lower sheaths, the flat tufts often forming dense usually glaucous clumps, the culms from freely to bushy-branching toward the summit; sheaths occasionally villous; blades elongate, 3-8 mm. wide; inflorescence dense, feathery, from flabellate to oblong, the paired racemes 1-3 cm. long, about equaling the slightly dilated spathes, the enclosed peduncle and ultimate branchlets long-villous, the peduncle at least 5 mm. long or often longer; rachis very slender, flexuous, long-villous; sessile spikelets 3-4 mm. long, the awn straight, 10-15 mm. long; sterile spikelet reduced to a subulate glume or wanting, the slender pedicel long-villous. *A. virginicus* var. *abbreviatus* (Hack.) Fern. & Griseb. Frequent in moist areas, e. half of Tex., rare westw., late summer-fall; s.e. U.S. n. to N.E., Ky., Okla.; also N.M., Ariz., Nev., Calif., Mex., W.I. and C.A.

Grading into *A. virginicus* and probably correctly considered no more than a variety of it.

68. BOTHRIOCHLOA O. KTZE.¹³

BEARDGRASS

Cespitose perennials with erect or decumbent-spreading culms, rounded sheaths and flat blades; inflorescence a terminal panicle, the spikelets on few to several spicate primary

¹³ Adapted from the work of Frank W. Gould in Madroño 14: 18-29. 1957.

branches, these moderately rebranched in New World species with large panicles; pedicels and upper rachis joints with a central groove or membranous area, this most strikingly developed in New World species; rachis articulated at base; spikelets in pairs, one of each pair sessile, fertile and awned, more or less triangular in outline, the first glume dorsally flattened, the second glume with a medial keel; sterile lemma shorter than the glumes, hyaline; fertile lemma hyaline, narrow, entire or bifid, bearing a bent or twisted awn from the apex or from between the lobes (awns absent or nearly so in *B. exaristata*); palea small, hyaline or absent; the other spikelet of the pair pedicellate, staminate or neuter, usually well-developed but tending to be more reduced in New World species, not awned; sessile spikelets falling attached to the rachis joint and associated pedicel. *Amphilophis* Nash; *Andropogon* Subg. *Amphilophis* Trin.

A genus of about 40 species distributed through the warmer regions of all continents, weakly segregated from *Andropogon* and even more weakly from *Dichanthium*.

1. All or some sessile spikelets pitless (that is, the first glumes of at least some of the sessile spikelets without any small circular, median glandular depression) (2)
1. First glumes of *all* sessile spikelets pitted, i.e., each with one small circular (or nearly circular) glandular depression near the median line and usually just distal from the middle (9)
- 2(1). Pedicelled spikelets about as large and broad as the sessile ones (3)
2. Pedicelled spikelets much narrower and usually shorter than the sessile ones (5)
- 3(2). Sessile spikelets more than 5 mm. long 7. *B. Wrightii*.
3. Sessile spikelets less than 5 mm. long (4)
- 4(3). Panicle axis shorter than the branches; sessile spikelets never pitted 9. *B. Ischaemum*.
4. Panicle axis longer than the branches; sessile spikelets without pits or only some of them pitted 11. *B. intermedia*.
- 5(2). Sessile spikelets less than 4.5 mm. long (not including awn); awn of lemma less than 19 mm. long; spikelets never pitted (6)
5. Sessile spikelets 4.5-7.3 mm. long; awns 20-33 mm. long; spikelets pitless or panicle with both pitless and pitted spikelets on same individual (7)
- 6(5). Awns absent or not more than 6 mm. long 1. *B. exaristata*.
6. Awns present, 8-18 mm. long 2. *B. saccharoides*.
- 7(5). Panicle axis less than 5 cm. long; panicle-branches 2 to 8; rachis joints and pedicels densely white-villous; culms slender, not more than 1 m. tall and usually much shorter; leaf blades rarely more than 4 mm. broad 6. *B. Springfieldii*.
7. Panicle axis typically 5-15 cm. or more long; panicle branches typically numerous; rachis joint and pedicels villous but not densely so; culms typically stout, often more than 1 m. tall; leaf blades (at least some) often 5-8 mm. broad (8)
- 8(7). Panicles of the larger culms 14-25 cm. long; culms very stout, stiffly erect, 12-25 dm. tall, bluish-glaucous below the nodes; culm nodes bearded with spreading hairs 3-6 mm. long. 5. *B. alta*.
8. Panicles mostly 7-13 cm. long; culms curving-erect, tending to become decumbent and much-branched below in age, mostly 7-11 dm. tall, not bluish-glaucous below the nodes or not conspicuously so; culm nodes bearded with appressed hairs less than 3 mm. long 8. *B. barbinodis*.
- 9(1). Pedicelled spikelets about as large and broad as the sessile ones (10)
9. Pedicelled spikelets much narrower and usually shorter than the sessile ones (12)
- 10(9). Sessile spikelets more than 5 mm. long 7. *B. Wrightii*.
10. Sessile spikelets less than 5 mm. long (11)
- 11(10). Panicle axis shorter than the lower branches 10. *B. pertusa*.
11. Panicle axis longer than the lower branches 11. *B. intermedia*.
- 12(9). Panicle axis less than 5 cm. long; primary panicle branches mostly 2 to 7, rarely more than 8; culm nodes glabrous or minutely pubescent (13)
12. Panicle axis typically 5-15 cm. long or longer; panicle branches numerous (14)

- 13(12). Upper culm nodes glabrous; primary panicle branches never rebranched; first glume of sessile spikelet 5.5-7 mm. long, glabrous dorsally, with a relatively large and deep glandular pit; leaves mostly in dense basal tufts, the culm leaves reduced; blades rarely more than 2 mm. broad 3. *B. edwardsiana*.
13. Upper culm nodes glabrous or puberulent; lower 1 or 2 panicle branches frequently rebranched; first glume of sessile spikelet 4.5-5.7 mm. long, usually sparsely hispid dorsally at base; glume pit relatively small and shallow; culm leaves well-developed; blades 2-5 mm. broad 4. *B. hybrida*.
- 14(12). Panicles of the larger culms 14-25 cm. long; culms very stout, stiffly erect, 12-25 dm. tall, bluish-glaucous below the nodes; culm nodes bearded with spreading hairs 3-6 mm. long; panicle axis and branches often remaining "kinked" from compression in the sheath 5. *B. alta*.
14. Panicles mostly 7-13 cm. long; culms curving-erect, tending to become decumbent and much-branched below in age, mostly 7-11 dm. tall, not or scarcely bluish-glaucous below the nodes; culm nodes bearded with appressed hairs less than 3 mm. long; panicle axis and branches not "kinked" 8. *B. barbinodis* var. *perforata*.

1. *Bothriochloa exaristata* (Nash) Henr. Perennial, resembling *B. saccharoides*; panicle slender; spikelets slightly smaller, awnless or nearly so. *Andropogon exaristatus* (Nash) Hitchc. Rare in low open ground, s.e. Tex., summer-fall; also La.

2. *Bothriochloa saccharoides* (Sw.) Rydb. SILVER BEARDGRASS, SILVER BLUESTEM. Perennial; culms tufted, (2-) 4-13 dm. tall, erect or ascending, often branching below, the nodes from appressed-hispid to glabrous; foliage commonly glaucous, glabrous or nearly so, the blades 3-6 mm. wide; panicle long-exserted or those of the branches short-exserted, silvery white, silky, dense, oblong, 6-22 cm. long; racemes 2-4 cm. long, the common axis mostly at least twice as long but readily breaking; rachis joints and pedicels long-villous; spikelets never pitted, about 4 mm. long, the delicate awn twisted below, geniculate, 10-17 mm. long; pedicellate spikelet reduced. *Andropogon saccharoides* Sw. A species widespread in the Americas, represented with us by 2 varieties as follows:

Var. *Torreyana* (Steud.) Gould. Panicles relatively small, 6-10 (-13) cm. long; spikelets broad, blunt and usually glabrous; plants usually glaucous, with leaves predominantly in a basal tuft. *Andropogon saccharoides* var. *Torreyanus* (Steud.) Hack. Frequent in dryish open places essentially throughout the state, spring-fall; Ala., Mo. and Colo. to Mex.

Var. *longipaniculata* (Gould) Gould. Plants large and coarse; culms stout, the nodes glabrous or short-bearded; panicle large, dense, on vigorous plants 13-22 cm. long; panicle branches stiffly erect-appressed, the lower branches freely rebranched; spikelets narrow, shiny-green, narrowly pointed, 3.5-4.5 mm. long, awn 11-17 mm. long. *Andropogon saccharoides* var. *longipaniculatus* Gould. Frequent locally in open places, e., s.e. and n.-cen. Tex. and Rio Grande Plains, spring-fall; also N.L.

3. *Bothriochloa edwardsiana* (Gould) Parodi. Culms mostly 3-7 dm. tall, densely tufted, slender, stiffly erect, geniculate-spreading only at margins of large clumps, unbranched above or with lateral panicles sparingly produced after development of terminal panicle; upper culm nodes glabrous or glabrate, the lower glabrous to densely short-hairy, the hairs not more than 1 mm. long; leaves mostly in a basal tuft, with a waxy bloom; blades filiform, mostly 1-2 (rarely -3.5) mm. broad, those of the basal tuft 10-25 cm. long, ciliate on the margins below the middle with hairs 4-7 mm. long; panicle of 3 to 6 simple racemes, these mostly 6-10 cm. long; panicle axis not more than 18 mm. long, with 1 to 3 nodes; sessile spikelet perfect, fertile, 5-8 mm. long (excluding awn); first glume relatively narrow, gradually tapering to an acute or slightly bifid apex, glabrous and shiny dorsally, always with a deep cylindrical glandular pit 2-2.5 mm. from the apex; lemma reduced, membranous, with a geniculate awn 20-28 mm. long; rachis node at base of sessile spikelet with a dense tuft of hairs 1-2 mm. long; pedicellate spikelet sterile, awnless, glabrous or scabrous, slender, about 3 mm. long; pedicel averaging 4.7-5 mm. long, with a deep medial groove and densely long-ciliate margins,

the hairs near apex longer than those below. *Andropogon edwardsianus* Gould. Rare in Edwards Plateau (Edwards Co.) in dry calcareous soil, late summer-fall; Tex.; Arg. and Urug.

4. *Bothriochloa hybrida* (Gould) Gould. Perennial, with strictly erect culms in small to medium-sized tufts; culms 3-8 dm. tall, moderately branched and leafy above the base; culm nodes glabrous or minutely puberulent; sheaths green or glaucous, glabrous; blades mostly 2-4 (-5) mm. broad, usually sparsely ciliate with long hairs near the base, often with a few hairs on the surfaces; panicles hairy but not densely so, 6-11 cm. long, usually with 3 to 8 primary branches on an axis 6-35 (-45) mm. long, the lower branches often simply rebranched; rachis joints and pedicels about equal, with a broad membranous often dark central groove and thickened hairy margins, the hairs mostly 5-7 mm. long near the apex; sessile spikelet 4.5-6.5 mm. long, with an awn 18-25 mm. long; first glume of sessile spikelet shiny, yellowish-green, with usually 5 greenish nerves on upper half, with a moderately deep glandular pit above the middle and usually with a few stiff hairs on the lower third or half of the back; pedicelled spikelets highly reduced, sterile, mostly 2.2-3.6 mm. long and shorter than the supporting pedicel. *Andropogon hybridus* Gould. Frequent in open calcareous areas, Rio Grande Plains, Edwards Plateau and s.e. Tex., spring-fall; Tex. and Coah.

Bothriochloa hybrida is intermediate between *B. edwardsiana* and *B. barbinodis*, but is probably an allotetraploid arising from hybridization between *B. edwardsiana* and *B. saccharoides* var. *Torreyana* and subsequent doubling of chromosome number. Rare plants have been found which appear to be hybrids of *B. hybrida* and *B. saccharoides* var. *longipaniculata*.

5. *Bothriochloa alta* (Hitchc.) Henr. Robust tufted perennial; culms stiffly erect, 12-25 dm. tall, green and glabrous but a zone just below each node is markedly blue-glaucous; nodes bearded with spreading hairs 3-6 mm. long; sheaths glabrous; ligule membranous, 3-4 mm. long; blades glabrous or scabrous, with a few long hairs on the upper surface near the base, 2-3 dm. long, 5-10 mm. broad; panicle long-exserted, oblong, dense, 1-2 dm. long, the branches numerous, appressed, the axis 5-15 cm. or more long; panicle axis and branches often remaining "kinked" from compression in the sheath; racemes 2-3 cm. long, clustered on the upper parts of the branches, the hairs at the top 5-8 mm. long; sessile spikelets about 5-6 mm. long, many or all of them pitted; awn of fertile lemma about 2 cm. long. *Andropogon altus* Hitchc. Infrequent in high dry grassy plains in the Trans-Pecos (Davis Mts. area, Jeff Davis, Brewster and Presidio cos.), summer; Tex., N.M., s. to Jal., S.L.P. and Qro.; Bol., Arg. and Urug.

6. *Bothriochloa Springfieldii* (Gould) Parodi. Tufted perennial with culms 3-8 dm. tall; culm nodes densely bearded with spreading hairs, these usually 3-7 mm. long; blades 2-3 (-5) mm. broad, glabrous or sparsely papillose-hispid on the adaxial surface and with tufts of hair on each side of the ligule; panicle densely white-villous, with 2 to 8 racemose branches, these infrequently rebranched; rachis joints and pedicels about equal, with thickened densely villous margins and a broad thin-membranous central area; hairs of the inflorescence 5-10 mm. long; sessile spikelets mostly 5.5-7.3 (-8.5) mm. long; first glume acute and minutely bifid at apex, hairy on the lower third or half the dorsal surface, occasionally with a faint glandular pit or depression above the middle; awn of the lemma 20-26 mm. long; pedicelled spikelet sterile, narrow, averaging 4-5 mm. long, 1-2 mm. longer than the pedicel. *Andropogon Springfieldii* Gould. Local in grassy or desert plains and in mts. in the Trans-Pecos and higher parts of the Plains Country, spring-fall; Tex., N.M., Ariz.; Arg.

7. *Bothriochloa Wrightii* (Hack.) Henr. Perennial, somewhat glaucous; culms tufted, 5-10 dm. tall, simple, the nodes usually hispid; blades flat, 3-5 mm. wide, tapering to a fine point; racemes 3 to 7, suberect, mostly 3-6 cm. long, green or tawny, not conspicuously woolly, the hairs of rachis joints and pedicels much shorter than the spikelets; peduncle usually long-exserted; sessile spikelet about 6 mm. long, short-pilose at base, the first glume several-nerved toward the summit, stiffly short-ciliate on the keels above, with or without a pit; awn twisted below, geniculate, 10-15 mm. long; pedicellate spikelet about as large as the sessile one, awnless. *Andropogon Wrightii* Hack. Reported to occur in s. N.M. and to be expected in westernmost Tex. although no specimens have been seen from Tex.; N.M., Chih.

8. *Bothriochloa barbinodis* (Lag.) Herter. Perennial; culms densely tufted, usually 7-11 dm. tall, spreading to ascending, often branching or even geniculate and decumbent below, the nodes bearded with short usually appressed hairs less than 3 mm. long; sheaths sparsely hairy in the throat, foliage otherwise glabrous or nearly so; blades 2-7 mm. wide, scabrous; panicles from rather long-exserted to included at base, those of the branches often partly included in dilated sheaths, silvery to creamy-white, silky, sub-flabellate, mostly 7-13 cm. long; racemes several to many or sometimes few on the branches, 2-7 cm. long, the common axis 5-15 cm. long or longer; rachis joints and pedicels copiously long-villous, the hairs on the average longer than in *B. saccharoides*; spikelets 4.5-7.3 mm. long; awn twisted below, geniculate, 20-25 mm. long; pedicellate spikelet reduced. *Andropogon barbinodis* Lag. Widespread in w. half of Tex., spring-fall; s.w. U.S., Mex., Arg., Urug.; represented with us by two forms or "varieties", as follows:

Var. *barbinodis*. Most sessile spikelets not pitted. Locally abundant in w. Tex., spring-fall; Tex., Colo., Ut., Calif. s. to s. Mex.; Arg., and Urug.

Var. *perforata* (Fourn.) Gould. Most of the sessile spikelets pitted. *Andropogon barbinodis* var. *perforatus* (Fourn.) Gould. Locally abundant in w. half of Tex., e. to Brown and Aransas cos., spring-fall; Tex., Ariz., Chih., Coah., Dgo., Hgo., Mex., S.L.P., Ver., Zac.; Arg., Urug.

9. *Bothriochloa Ischaemum* (L.) Keng var. *songarica* (Fisch. & Mey.) Celarier & Harlan. Perennial; culms ascending, 7-10 dm. tall; nodes variously pubescent; panicle-axis shorter than the branches; racemes nodding, few to several, on slender peduncles aggregate or somewhat distant on a slender axis 3-5 cm. long, the sterile (pedicellate) spikelets as large and broad as the fertile (sessile) ones, the rachis and pedicels silky-ciliate; sessile spikelets never pitted; awns slender, twisted and bent, about 15 mm. long. *Andropogon Ischaemum* L. var. *songaricus* Fisch. & Mey. Widespread along roadsides, where sown by highway department, spring-fall; introd. from the steppes of n. Asia; reportedly a promising pasture grass in s. Tex. but not persisting except in cult. or along roadsides.

10. *Bothriochloa pertusa* (L.) A. Camus. Perennial; culms ascending, branching; panicle axis shorter than the lower branches; racemes few to several, sparsely villous; first glumes of sessile spikelets always pitted; awn of sessile spikelet geniculate, 10-15 mm. long; pedicellate spikelet about as large and broad as the sessile ones. *Andropogon pertusus* (L.) Willd. Rare in disturbed areas, especially road-shoulders where sown, summer-fall; nat. of Old World, introd. as an experimental forage grass at various localities.

11. *Bothriochloa intermedia* (R. Br.) A. Camus. Similar to *B. Ischaemum* var. *songarica* but with a panicle axis longer than the lower panicle-branches and at least some of the sessile spikelets with pitted first glumes. *Andropogon intermedius* R. Br. In disturbed ground near roads where sown, summer; very widespread in trop. and subtrop. areas of the Old World, introd. as an experimental forage-grass in Tex. but apparently not persistent except along roadways.

Natural introgression of this species and *B. Ischaemum* has been reported in West Pakistan. Plants called *Bothriochloa caucasica* (Trin.) C. E. Hubb. [*Andropogon caucasicus* Trin. and *A. intermedius* var. *caucasicus* (Trin.) Hack.] are referred here; they differ somewhat from typical *B. intermedia* in a slightly more branched panicle.

69. DICHANTHIUM WILLEM.¹⁴

Low to moderately tall perennials, mostly caespitose but some with extensive creeping stolons; inflorescence and spikelets as in *Bothriochloa* but pedicels and rachis joints flat or rounded without a groove or membranous central area and lower pair of spikelets of the inflorescence branches usually both sterile and awnless.

A small genus of Asiatic, Australian and African species, exceedingly closely related to *Bothriochloa* and differing mainly in the rounded rather than grooved pedicel and rachis joints. Three species have been introduced in Texas and at other locations in the

¹⁴ Adapted in part from the work of Robert P. Celarier and Jack R. Harlan in Okla. A. & M. Coll. Expt. Sta. Tech. Bull. T-58. 1955.

South and Southwest and persist as casual weeds in some areas where they have been seeded.

1. Rachis joints and pedicels with long white hairs; lower glume densely covered and with an arc of extremely long hairs at the tip 1. *D. sericeum*.
1. Rachis joint hairs short; glume without arc of long hairs (2)
- 2(1). Stem nodes with conspicuous collar of long hairs; ligule well-developed
 2. *D. annulatum*.
2. Stem nodes glabrous or with a band of short velvety hairs; ligule absent or very small 3. *D. aristatum*.

1. *Dichanthium sericeum* (R.Br.) A. Camus. Perennial; culms slender, leafy, 5-8 dm. tall, branching; nodes bearded; racemes 2 to 7, aggregate, 3-5 cm. long, nodding from a very slender peduncle, conspicuously silky; rachis joints and pedicels with long white hairs; sessile and pedicellate spikelets about equal, the first glume strongly several-nerved; pits absent; awn of sessile spikelet twisted, geniculate, 2-3 cm. long. *Andropogon sericeus* R. Br. Apparently established at a few points in s. Tex. where sown, summer-fall; Austral. and Pac. I., now widely introd.

2. *Dichanthium annulatum* Stapf. Perennial; culms erect to decumbent or procumbent, some strains creeping by stolons; nodes with a conspicuous ring of long white hairs; leaves broad, usually light-green, glabrous to sparsely papillose-pubescent on upper or lower or both surfaces; ligule conspicuous, well-developed; peduncle usually glabrous; primary panicle axis very short, the racemes usually short; rachis joints and pedicels with very few hairs and these short; glumes of sessile spikelets broad, truncate at tip, often obovate, densely covered with long papillose hairs; pits absent; awn of lemma much longer and more conspicuous than in *Bothriochloa Ischaemum*. Widespread in drier warmer parts of Old World and introd. at scattered points in e. half of Tex. as an experimental forage grass.

D. annulatum is reported to hybridize naturally with *Bothriochloa intermedia* in the Old World.

3. *Dichanthium aristatum* (Poir.) C. E. Hubb. Perennial; culms finally ascending from a decumbent often creeping base, freely rooting at the lower nodes; nodes usually glabrous or with a narrow velvety band of hairs but never bearded; leaves green to pink or purple, glabrous or with varying papillose-pubescent; ligule absent or very small; peduncle glabrous below the panicle; racemes solitary to several (to numerous), approximate and subdigitately arranged; rachis joints and pedicels sparsely hairy on one margin with short hairs; pedicellate spikelets as large and broad as the fertile sessile ones; first glume of the sessile spikelet either glabrous or with scattered long white papillose-hairs; pits absent; awns long, similar to those of *D. annulatum* and usually but not always with the lowermost sessile spikelets awnless. *Andropogon caricosus* L., *A. aristatus* Poir., *A. nodosus* (Willem.) Nash. Apparently established at a few scattered points in s. Tex. where sown as an experimental forage introd., summer-fall; s.e. Asia, Polyn., Afr., Madag., now widely introd. for experimental purposes.

70. SORGHUM MOENCH

Robust annuals or perennials; spikelets in terminal panicles of several to numerous racemes, tardily disarticulating just below each sessile spikelet; spikelets in pairs, one sessile and fertile, the other pedicellate and sterile (but well-developed), usually staminate; spikelets somewhat dorsiventrally compressed, with 2 flattish-indurated glumes; sterile and fertile lemmas and palea hyaline, the fertile lemmas awned.

A large genus centered in the Near East; at least 2 species are cultivated and escaped in Texas.

1. Plants perennial from creeping rhizomes 1. *S. halepense*.
1. Plants annual 2. *S. bicolor*.

1. *Sorghum halepense* (L.) Pers. JOHNSON GRASS. Perennial; culms 5-15 dm. tall, from extensively creeping scaly rhizomes; blades mostly less than 2 cm. wide; panicle open,

15-50 cm. long; sessile spikelet 4.5-5.5 mm. long, ovate, appressed-silky, the readily deciduous awn 10-15 mm. long, geniculate, twisted below; pedicellate spikelet 5-7 mm. long, lanceolate. Open ground, fields and waste places, Mass. to Ia. and Kan., s. to Fla. and Tex., w. to s. Calif.; nat. of the Medit. region but in the trop. and warmer regions of both hemispheres.

Cultivated for forage, but because of the difficulty of eradication it becomes a troublesome weed.

2. *Sorghum bicolor* (L.) Moench. SORGHUM. Annual; differing from *S. halepense* in being annual and more robust. *Holcus Sorghum* L., *Sorghum vulgare* Pers., *Panicum frumentaceum* Salisb. This species has been cultivated in warmer regions since prehistoric times for the seed, which has been used for food, for its sweet juice, and for forage. In the U.S. it is cult. under the general name of "sorghum."

There are many varieties or races of cultivated sorghums, all of which have the same chromosome number (10) and which fall naturally into distinct groups, the chief of which (in the United States) are sorgo, kafir, durra, milo, feterita, shallu, kaoliang, and broomcorn. Sorgo includes the varieties known collectively as sweet or saccharine sorghums, in which the juice in the stems is abundant and very sweet. In this country sorgo is cultivated chiefly in the region from Kansas and Texas to North Carolina for forage and for the juice which is made into syrup. The differences between most of the varieties are so indistinct and so unstable because of intercrossing as to make it very difficult to assign descriptive limits. The application of botanical names is uncertain, and it seems best, therefore, not to assign to them definite varietal or specific Latin names.

71. SORGHASTRUM NASH

Tufted perennials, rather robust, with or without rhizomes; blades flat, often somewhat bluish-green; panicles terminal, long-exserted, with few to many raceme-branches; the racemes 1- to few-spikeletted; spikelets all alike, perfect, fertile, sessile on the rachis (which disarticulates at the base of each spikelet) and each subtended by a hairy stalk about as long as itself and representing the vestigial pedicel of a spikelet which has been completely reduced; spikelets dorsiventrally flattened, with 2 narrowly elliptical coriaceous or indurate glumes; sterile lemma, fertile lemma (which is awned) and palea all reduced and hyaline.

About 12 species in warm America and tropical Africa.

1. Awns usually 15 mm. long or shorter; panicle rather dense and with many branches, golden brown or golden 1. *S. avenaceum*.
1. Awns 25-35 mm. long; panicles loose and not golden .. 2. *S. Elliottii*.

1. *Sorghastrum avenaceum* (Michx.) Nash. INDIAN GRASS. Perennial; culms 10-25 dm. tall from short scaly rhizomes; blades elongate, flat, mostly 5-10 mm. wide, tapering to a narrow base, scabrous; panicle narrow, yellowish, rather dense, 15-30 cm. long, contracted and darker at maturity; summit of branchlets, rachis joints and pedicels grayish-hirsute; spikelets 6-8 mm. long, lanceolate, hirsute, the awn 10-15 mm. long. *S. "nutans"* of many auth. Frequent in n.-cen. Tex., Edwards Plateau and Plains Country, infrequent in e., s.e. and Trans-Pecos Tex., late summer-fall; Que. and Me. to Man. and N.D., s. to Gulf States and cen. Mex.

One of our most beautiful fall-flowering grasses, and one of the most desirable for forage purposes; a high-yielding genotype known as Tejas Indian grass has been selected for planting in field trials in north-central Texas.

2. *Sorghastrum Elliottii* (Mohr) Nash. Perennial; culms 10-15 m. long, more slender and weaker than in *S. avenaceum*; rhizomes absent; the base comparatively delicate, smooth or nearly so; blades on the average narrower; panicle loose, 15-30 cm. long, nodding, the filiform branchlets and pedicels flexuous but not recurved, with a few long hairs at the tip; spikelets 6-7 mm. long, chestnut-brown at maturity, with a short blunt bearded callus; first glume hirsute or glabrescent on the back; awn 25-35 mm. long. Locally abundant in sandy woodlands, e. and s.e. Tex., summer-fall; Md. to Tenn., s. to Gulf States.

Reports of the occurrence of *S. secundum* (Ell.) Nash in Texas are based on mis-determined specimens of *S. Elliottii*.

72. HETEROPOGON PERS.

Tufted annuals or perennials with flat blades; spikelets in dense solitary terminal racemes, in pairs, one of each pair sessile or nearly so, the other pedicellate; raceme in lower part remaining intact, in upper part disarticulating at the base of each hairy internode (just above each node); in the lower part of the raceme both spikelets of each pair staminate or neuter, in the upper part the sessile spikelets perfect, the pedicellate ones staminate; perfect spikelets with equal coriaceous concavo-convex glumes, the first glume brown-hirsute, infolding the second; lemma thin and hyaline, the fertile one narrow, extending into a strong bent and twisted brown awn; palea absent; pedicellate staminate spikelets flat, conspicuous, awnless; glumes membranous, the first green, faintly many-nerved, asymmetric, one submarginal keel rather broadly winged, the other wingless, the margins inflexed, the second glume narrower, symmetric; lemmas hyaline; palea absent.

A genus of half a dozen species of the warmer parts of the globe, probably originally restricted to the Old World; adventive in America since the time of Columbus.

1. Plants perennial, less than 1 m. tall; first glume of staminate spikelet usually papillose-hispid 1. *H. contortus*.
1. Plants annual, usually more than 1 m. tall; first glume of staminate spikelet with a row of glands along the back, glabrous 2. *H. melanocarpus*.

1. *Heteropogon contortus* (L.) R. & S. TANGLEHEAD. Perennial, tufted; culms 2-8 dm. tall, branched above, the branches erect; sheaths smooth, compressed-keeled; blades flat or folded, 3-7 mm. wide; raceme 4-7 cm. long, 1-sided; sessile spikelets about 7 mm. long, slender, nearly hidden by the imbricate pedicellate spikelets; awns 5-12 cm. long, bent and flexuous, commonly tangled; pedicellate spikelet about 1 cm. long; first glume papillose-hispid toward the tip and margins, sometimes nearly glabrous. Local in sandy prairies of extreme s. Tex. and in Trans-Pecos mts., summer-fall; warm regions n. to Ariz. and Tex.

2. *Heteropogon melanocarpus* (Ell.) Benth. SWEET TANGLEHEAD. Annual, 1-2 m. tall, freely branching; sheaths smooth, the upper part of the keel (especially of the upper sheaths) with a row of concave glands; blades 5-10 mm. wide; raceme 3-6 cm. long, looser than in *H. contortus*; sessile spikelets 9-10 mm. long, relatively thick, the awns 10-15 cm. long; pedicellate spikelet 15-25 mm. long, the first glume with a line of punctate glands along the middle. Very rare and probably not persistent in s.e. Tex., summer-fall; scattered and local, Ga., Gulf States and Ariz.; trop. regions of the world.

The plant when fresh emits an odor like that of citronella oil.

73. TRACHYPOGON NEES CRINKLE-AWN

A genus of about 10 species of warmer parts of America, Africa and Madagascar.

1. *Trachypogon secundus* (Presl) Scribn. Tufted perennial 6-12 dm. tall, the nodes appressed-hirsute; sheaths with erect auricles 2-5 mm. long; blades flat to subinvolute, 3-8 mm. broad; raceme spikelike, solitary, terminal, dense, 10-18 cm. long, the rachis glabrous, remaining intact; spikelets in pairs, 6-8 mm. long, one spikelet of each pair nearly sessile, staminate, awnless, the other pedicellate, perfect, the pedicel disarticulating near its base and constituting a sharp-barbed callus below the detached spikelet; first glume firm-membranous, rounded dorsally, several-nerved, obtuse; second glume firm, obscurely nerved; fertile lemma narrow, extending into a stout twisted and bent or flexuous awn 4-6 cm. long, short-plumose below and nearly glabrous toward the tip; palea obsolete. Infrequent in sandy prairies and woodlands, s. and s.e. Tex., summer-fall; warmer parts of Am., n. to Tex., s. Ariz. and s.w. N.M.

74. ELYONURUS WILLD.

BALSAMSCALE

Rather robust tufted perennials, often with rhizomes; blades flat or usually at least partially involute; racemes spike-like, terminal, solitary, 5-15 cm. long, somewhat flattened but roughly oval in transection, the rachis thick but not noticeably sculptured, tardily disarticulating at the base of each internode and woolly, the joints not much thicker at the summit than at the middle; spikelets in pairs, one of each pair sessile, perfect, fertile, appressed to the concave side of the rachis joint, the other pedicellate (the pedicel appressed), staminate but otherwise similar to the sessile one, neither awned; first glume firm, somewhat coriaceous, dorsally flattened, the margins inflexed around the second glume, a line of balsam-scented glands on the marginal nerves, the apex entire and acute or acuminate, or bifid with aristate teeth; second glume similar to the first; sterile and fertile lemmas thin and hyaline; palea obsolete.

A genus of about 20 species in warmer regions, only weakly distinguished from *Manisuris*. The name is sometimes spelled "Elionurus."

1. Rhizomes absent; culms hirsute below the nodes; racemes conspicuously woolly
 1. *E. barbiculmis*.
1. Rhizomes present; culms glabrous; racemes slightly pubescent; first glume glabrous or nearly so dorsally 2. *E. tripsacoides*.

1. *Elyonurus barbiculmis* Hack. Perennial; culms tufted, erect, simple or sparingly branching, 4-6 dm. tall, pubescent below the nodes; blades involute, striate, about 1 mm. thick as rolled, the upper surface usually long-pilose; raceme mostly 5-10 cm. long, pale; rachis joints, pedicels and spikelets densely woolly; spikelets 6-8 mm. long; first glume acuminate. Local in the Trans-Pecos, summer-fall; Tex., N.M. and Ariz., s. to Dgo.

2. *Elyonurus tripsacoides* Willd. Perennial; culms 6-12 dm. tall, glabrous, rather freely branching and with short rhizomes; blades flat or involute, 2-4 mm. wide, slightly pilose on the upper surface near the base; raceme 7-15 cm. long; rachis joints ciliate, the pedicels pilose; spikelets 6-8 mm. long; first glume ciliate toward the acuminate 2-toothed apex, usually glabrous on the back. Locally abundant on the Coastal Plain in woodlands and prairies, usually in sandy soil, summer-fall; warmer parts of Am. n. to Gulf States and Ga.

75. MANISURIS L.

JOINT-TAIL

Rather similar to *Elyonurus* but the racemes nearly cylindrical, their rachises glabrous or nearly so and quite thick, the base of each internode on one side sculptured with a niche into which the spikelets fit closely; pedicellate spikelets much more reduced than in *Elyonurus*, often rudimentary.

A small genus of the warmer parts of the world.

1. Racemes flattened, tardily disarticulating; first glume of sessile spikelet smooth
 1. *M. altissima*.
1. Racemes nearly cylindrical, readily disarticulating at maturity; first glume of sessile spikelet marked with pits or wrinkles (2)
- 2(1). Sheaths not compressed-keeled; first glume more or less pitted 2. *M. cylindrica*.
2. Sheaths compressed-keeled; first glume with prominent transverse wrinkles 3. *M. rugosa*.

1. *Manisuris altissima* (Poir.) Hitchc. Perennial; culms ascending from a long creeping base, compressed and 2-edged, 4-8 dm. long, freely branching toward the ends; blades flat, 3-8 mm. wide; flowering branches often short and fascicled; racemes 3-5 cm. or sometimes 1 dm. long, compressed; pedicel free or partly adnate to the rachis joint; sessile spikelet 5-7 mm. long, the keels of the first glume very narrowly winged toward the apex; pedicellate spikelet 5-6 mm. long, acute. Rare in coastal s. Tex., where repeatedly introd., spring-fall; warmer parts of the world, introd. in Am.

2. *Manisuris cylindrica* (Michx.) O. Ktze. Perennial; culms tufted, with short rhizomes, erect, rather slender, 3-10 dm. tall, simple or curved; sessile spikelet 4-5 mm. long, the first glume pitted along the nerves. Infrequent in open areas, e., s.e. and n.-cen. Tex., usually in sandy soil, spring-fall; Coastal States, N.C. to Tex.; also Okla., Ark., Mo.

3. *Manisuris rugosa* (Nutt.) O. Ktze. Perennial; culms mostly rather stout, 7-12 dm. tall, freely branching; sheaths compressed-keeled; blades commonly folded, 3-8 mm. wide; flowering branches often numerous; racemes 4-8 cm. long, partly included in brownish sheaths; rachis joint and pedicel contracted in the middle; sessile spikelet 3.5-5 mm. long, the first glume strongly and irregularly transversely ridged, the keels narrowly winged toward the summit. Infrequent in open woodlands on low often moist sandy loam, e. and s.e. Tex., summer-fall; Coastal States, Va. to Tex.; Ark.

76. TRIPSACUM L.

A small American genus of which we have one species.

1. *Tripsacum dactyloides* (L.) L. EASTERN GAMAGRASS. Very robust perennial, usually 15-30 dm. tall, often with rhizomes, glabrous throughout; blades elongate, 1-2 cm. broad, flat; inflorescence 15-25 cm. long, terminal, subdigitate group of a few androgynous spikelike racemes, each with a few lower solitary pistillate fertile spikelets at the base and many paired staminate spikelets above; pistillate spikelets 7-10 mm. long, occasionally subtended by a rudimentary pedicel, arranged on opposite sides at each joint of the thick hard articulate lower part of the rachis, sunken in niches of the sculptured rachis, consisting of one perfect floret and a sterile lemma; first glume coriaceous, nearly infolding the spikelet, fitting into and closing the hollow of the rachis; second glume similar to the first but smaller, infolding the remainder of the spikelet; sterile and fertile lemmas and palea very thin and hyaline; staminate spikelets 7-11 mm. long, paired and 2-flowered; glumes firm, acute; lemma and palea hyaline. Incl. var. *occidentale* Cutler & Anders. Frequent in scattered parts of the state, more common in the e. half, very rare in the Plains Country, summer-fall; W.I.; e. U.S., Coah., N.L., Tam., S.L.P.

77. ZEA L. MAIZE. (INDIAN) CORN

An American monotype, not known and incapable of survival outside of cultivation, very rarely waifed at the edges of cornfields.

1. *Zea Mays* L. Robust annual with broad flat leaves; pistillate spikelets somewhat like those of *Tripsacum* or usually with much-reduced glumes, borne in several rows on a much-thickened cylindrical rachis ("cob") terminal on short axillary branches, the whole inflorescence covered with usually modified leaves (shucks) and the entire "ear" marked at the end by the termini of the enormously elongated styles ("silk"); staminate spikelets much like those of *Tripsacum*, borne in pairs on a branched panicle of spikelike racemes at the top of the plant. Widely introd., probably originally from cen. and s. Mex. (s. Pue.). The name "maize" is often used in Texas for races of *Sorghum bicolor*, but should be restricted to *Zea*, to which the name "corn" is almost universally applied.

78. SCLEROPOGON PHIL.

An American monotypic genus.

1. *Scleropogon brevifolius* Phil. BURRO GRASS. Perennial forming extensive colonies; stolons numerous, long, slender, conspicuous; culms numerous from the tight tufts, 1-2 dm. long, erect, unbranched; leaves crowded near the base; blades 15-70 mm. long, 1.5-2.5 mm. broad, folded usually, strict or the fine tip arcuate-divergent; staminate panicles on separate culms from the pistillate (usually in different tufts), 4-6 cm. long, 10-15 mm. broad, loosely spikelike, few-flowered, stramineous; staminate spikelets about 2 cm. long, 10- to 14-flowered, slightly laterally compressed, the rachilla not abscising; glumes shorter than the lowest lemma; lemmas keeled; pistillate panicles with axes 1-3 cm. long, few-flowered, stramineous or purplish; spikelets erect, appressed, 8-12 cm. long (including awns), few-flowered, only the lowest floret fertile, the rest reduced, the

rachilla with one zone of abscission above the glumes; each lemma with 3 very long fine awns, the lower part with a pubescent basal callus. Abundant on desert alluvial flats and fans in the Trans-Pecos and w. Edwards Plateau, rare in Plains Country, May-Oct.; Colo. to Nev. and s.e. to Pue.; also Arg. and Chile.

79. ERAGROSTIS BEAUV. LOVEGRASS

Variable in habit and foliage; panicles usually much-branched (the branches in some species very short and closely appressed); spikelets usually somewhat laterally compressed, several-flowered; glumes shorter than the lowest lemma, 1-nerved; lemmas 3-nerved (lateral nerves sometimes obscure); rachilla either remaining intact (lemmas then deciduous) or abscising above the glumes and either at the upper part or lower part of each lemma-node or breaking irregularly between the florets under mechanical pressure during tumbling of the panicle.

A genus of about 300 species widely distributed in warm regions. Some lovegrasses are difficult to determine, the characters useful in distinguishing them being subtle, quantitative ones which tend to grade from one species to another. This probably is evidence of past hybridization and genetic contamination of many species.

- 1. Mat-forming annuals creeping by stolons (2)
- 1. Not mat-forming (3)
- 2(1). Flowers unisexual, staminate ones on some plants, pistillate on others; lemmas about 3 mm. long, persistent on the rachilla 1. *E. reptans*.
- 2. Flowers perfect; lemmas 1.5-2 mm. long, falling individually from the rachilla to expose the minute paleas which persist on the rachilla 2. *E. hypnoides*.
- 3(1). Panicles spikelike and 3-10 mm. thick (4)
- 3. Panicles more open, thicker than 10 mm. (5)
- 4(3). Delicate annual 15-35 cm. tall; panicle 3-12 cm. long 29. *E. ciliaris*.
- 4. Coarse perennial bunchgrass; panicle 15-35 cm. long .. 14. *E. spicata*.
- 5(3). Keels of paleas long-ciliate 30. *E. amabilis*.
- 5. Keels of paleas not long-ciliate (6)
- 6(5). Spikelets (the lateral ones, not those terminal on the panicle branches) sessile, their pedicels averaging less than 1 mm. long (cf. also *E. Barrelieri* and *E. refracta*) (7)
- 6. Spikelets (the lateral ones) with pedicels averaging more than 1 mm. long, often much more (13)
- 7(6). Lemmas about 1 mm. long (8)
- 7. Lemmas 1.5-5.5 mm. long (9)
- 8(7). Annual; spikelet 2-3 mm. long; panicle 5-50 cm. long, only 1-4 cm. broad, with numerous long main branches and these in turn further branched, all the branches strictly ascending 28. *E. glomerata*.
- 8. Perennial; spikelets 3-12 mm. long; panicle open, 8-15 cm. long, 3-7 cm. broad, with few ascending branches 31. *E. Lehmanniana*.
- 9(7). Lemmas 1.5-2 mm. long 25. *E. curtipedicellata*.
- 9. Lemmas 2-5.5 mm. long (10)
- 10(9). Annuals; lemmas with a few glands on the keel near the tip 4. *E. cilianensis*.
- 10. Perennials; lemmas not glandular (11)
- 11(10). Spikelets remote and appressed on very stiff straight branches 26. *E. sessilispica*.
- 11. Spikelets not appressed or if so not remote from each other (12)

- 12(11). Panicles open with numerous ascending weak branches; spikelets 7- to 11-flowered, plumbeous20. *E. curvula*.
12. Panicles with few erect or spreading branches, the terminal axis and each branch toward the tip interrupted-spike-like, with glomerules of spikelets; spikelets 10- to 50-flowered, stramineous or often with a buffy or rufous tinge27. *E. oxylepis*.
- 13(6). Pedicels of individual spikelets 1-3 cm. long, averaging about 15-20 mm. long, rather stiff and straight21. *E. Elliottii*.
13. Pedicels of individual spikelets 1-18 cm. long, averaging usually less than 10 mm. long, stiffish to weak and flexible (14)
- 14(13). Each pedicel with a yellowish glandular (sticky) band completely around it or on one side of it near the middle (15)
14. Most pedicels lacking glandular bands (glandular depressions occasionally present) (16)
- 15(14). Perennial; panicle usually broader than 6 cm.; pedicels 3-10 mm. long 7. *E. Swallenii*.
15. Annuals; panicle 1-6 cm. broad; pedicels 0.5-4 mm. long (15a)
- 15a(15). Lemma keel glandular 5. *E. poaeoides*.
- 15a. Lemma keel never glandular 6. *E. Barrelieri*.
- 16(14). Annuals (see also *E. lugens* which sometimes simulates annual habit) (17)
16. Perennials (24)
- 17(16). Spikelets with 2 to 4 lemmas13. *E. capillaris*.
17. Spikelets with (3 to) 5 to 40 lemmas, averaging at least 5 per spikelet on any plant (18)
- 18(17). Lemmas about 1 mm. long 3. *E. pilosa*.
18. Lemmas 1.5-2.5 mm. long (19)
- 19(18). Lower lemmas 2-2.5 mm. long (20)
19. Lower lemmas 1.5-2 mm. long (21)
- 20(19). Culms mostly diffuse and spreading, sparingly branched and geniculate at base, often with a ring of yellow glands shortly below the nodes; sheaths often with rows of minute glandular depressions on the keel and near the nerves 8. *E. neomexicana*.
20. Culms erect or ascending; nodes and sheaths not glandular12. *E. mexicana*.
- 21(19). Pedicels appressed, flexuous, 1-5 mm. long, averaging less than 4 (or 5) mm. long 9. *E. pectinacea*.
21. Pedicels not appressed, 3-10 mm. long, averaging longer than 4 mm. (22)
- 22(21). Culms often with a ring of yellow glands shortly below the nodes; sheaths often with rows of minute glandular depressions on the keel and near the nerves 8. *E. neomexicana*.
22. Culms and sheaths never glandular (23)
- 23(22). Culms mostly spreading; blades 2-5 mm. broad; spikelets 8- to 15-flowered 10. *E. arida*.
23. Culms ascending; blades 2-4 mm. broad; spikelets 6- to 14-flowered11. *E. tephrosanthos*.
- 24(16). Lemmas not falling individually but the spikelet rachilla eventually breaking from external mechanical forces; panicles with numerous long stiff antrorsely scabrous branches which in turn bear secondary branches mostly deflexed secundly from their lower side (25)
24. Lemmas eventually falling individually from the spikelet axis; panicles usually not so formed except in *E. Silveana* (27)

- 25(24). Culms not knotty at base; lateral spikelets appressed to the secondary branchlets 22. *E. refracta*.
25. Culms from hard knotty bases; lateral spikelets not appressed (26)
- 26(25). Lateral spikelets on pedicels 3-5 mm. long 23. *E. spectabilis*.
26. Lateral spikelets on pedicels 1-3 mm. long 24. *E. Silveana*.
- 27(24). Panicles with numerous long stiff somewhat viscid antrorsely scabrous main branches which in turn bear some short stiff branches usually secundly reflexed below the lower side of the main branches 24. *E. Silveana*.
27. Secondary branches of panicle usually not uniformly stiffly secundly deflexed from the main branches (28)
- 28(27). Spikelets (1- to) 3- to 26-flowered; lower lemmas 2.4-3.8 mm. long, with prominent lateral nerves; panicles often weak and nodding 19. *E. trichodes*.
28. Spikelets (1- to) 2- to 12-flowered; lower lemmas 1.3-3 mm. long, with weak obscure lateral nerves when mature (29)
- 29(28). Spikelets 2-4 mm. long, markedly tapered to apex, (1- to) 2- to 4-flowered, the lemmas 1.7-2.2 mm. long; sheaths much longer than their internodes, shortly ascending-pilose in the upper part and long erect-pilose at the apex dorsally (or rarely nearly glabrous); eastern half of Texas 15. *E. hirsuta*.
29. Spikelets 3-10 mm. long, the lemmas 1.3-3 mm. long; sheaths about as long as to longer than their internodes, either glabrous or pilose at the summit (30)
- 30(29). Lemmas 1.3-2 mm. long, variously colored but usually slightly dull-purplish, with a golden tinge only in genetically contaminated plants; lower axils of panicle pilose 16. *E. lugens*.
30. Lemmas 1.8-3 mm. long, golden-green to bronzy or golden-stramineous to golden-plumbeous; lower axils of panicle glabrous or nearly so (31)
- 31(30). Panicles 5-13 cm. broad; pedicels 3-9 mm. long; Trans-Pecos Texas and Edwards Plateau 17. *E. erosa*.
31. Panicles 3-5 cm. broad; pedicels 2-5 mm. long; extreme south Texas, where very rare 18. *E. Palmeri*.

1. *Eragrostis reptans* (Michx.) Nees. Mat-forming annual, extensively creeping by stolons, rooting at the numerous nodes; sheaths about 5 mm. long; blades 1-4 cm. long; panicles 1-3 cm. long, about as thick, of several glomerules of spikelets, often subcapitate, of 2 sexes, the staminate panicles on some plants, the pistillate on others; spikelets laterally compressed, curvilinear, 4-17 mm. long, 6- to 32-flowered, the rachilla remaining intact; lemmas often pubescent, about 3 mm. long, not falling individually from the rachilla. *Neeragrostis reptans* (Michx.) Nicora. Locally abundant in swales and lake- and river-beds, usually in tight clay-loam soil, n.-cen., e. and s.e. Tex. and Rio Grande Plains, spring-fall; cen. U.S. from S.D. e. to Ill. and Ky. and s. to Coah. and Tam.; also Fla.

2. *Eragrostis hypnoides* (Lam.) B.S.P. Annual, creeping over small areas by short stolons; culms very slender and short; sheaths and blades very short as in *E. reptans*; panicles often subcapitate or occasionally elongate to interrupted-spike-like or even more open, diffusely oblong, with short branches; pedicels 1-3 mm. long, capillary, somewhat flexuous; spikelets approximate or even glomerulate, linear, 2-20 mm. long, 4- to 44-flowered, the flowers all perfect, the rachilla remaining intact; lemmas lance-ovate, 1.5-2 mm. long, falling individually (starting at the bottom of the spikelet) to liberate the grains and to leave the minute paleas persistent on the rachilla. Locally abundant in swales, barrow ditches, streambars and banks, e. and s.e. Tex., rare in coastal parts of Rio Grande Plains (Cameron Co.), spring-fall; widespread from s. Can. nearly throughout the U.S. to Mex. and W.I.; Arg.

3. *Eragrostis pilosa* (L.) Beauv. INDIA LOVEGRASS. Loosely tufted annual; culms 1-5 dm. long, very slender, pronouncedly geniculate and sparingly or not branched near the base; sheaths much shorter than the internodes, mostly glabrous except at the corners; blades short, 1-3 mm. broad, often flat; panicles mostly pyramidal, long-exserted, very

diffuse, 5-20 cm. long, with a few widely spreading capillary branches which in turn bear the capillary pedicellary branchlets that are mostly deflexed and 3-8 mm. long; spikelets linear, 3-6 mm. long, about 1 mm. broad, 3- to 10-flowered; lemmas about 1 mm. long, gray with dark purple tip, falling individually from the slightly zigzag intact rachilla. Rare weeds, n.-cen. and e. Tex., summer; nat. of s. Eur., now scattered in warmer parts of the New World.

4. *Eragrostis cilianensis* (All.) E. Mosher. STINKGRASS. Loosely tufted annual, odoriferous when fresh; culms 5-50 cm. long, mostly decumbent and geniculate basally, ascending distally, rarely branched, with an obscure yellow glandular (often broken) ring shortly below each node; sheaths mostly shorter than their internodes and often pilose on the corners, with microscopic glands along the keel and near the base also along the nerves; blades 3-7 mm. broad, mostly flat, often papillose-pilose along the margins basally; panicles 3-20 cm. long, 1-7 cm. broad, narrowly oblong or ovoid, rather dense (spikelets touching), with a number of short ascending branches (glabrous in the axils) bearing in turn the glomerules of spikelets on individual pedicels 0.5-1 mm. long, the branches and pedicels often gland-dotted; spikelets 8- to 40-flowered, 5-15 mm. long, slightly tapering; lemmas 2-2.8 mm. long, membranous, suborbicular, with conspicuous lateral veins and rounded apex, falling individually from the intact rachilla, the keel scabrous and with a few glands toward the apex. *E. megastachya* (Koel.) Link. Frequent weed in the Trans-Pecos and Plains Country, infrequent e. to n.-cen. Tex. and Rio Grande Plains, rare in s.e. Tex., spring-fall; nearly throughout the warmer parts of the world, introd. from the Old World.

5. *Eragrostis poaeoides* Beauv. Resembling *E. Barrelieri* but the lemmas with a few glands as in *E. cilianensis* (use strong lens). *E. minor* Host. Reported to occur in Tex.; if present then vary rare; a Euras. weed sparingly adv. in temp. N. A.

6. *Eragrostis Barrelieri* Daveau. Tufted annual; culms 7-50 cm. long, mostly erect, somewhat geniculate basally, nearly simple, usually with a yellowish glandular band shortly below each node; sheaths mostly shorter than their internodes, not glandular, pilose at the summit; blades short, 2-5 mm. broad, flat or (upon drying) involute; panicle 2-15 cm. long, 1-6 cm. broad, open, with a few stiff slightly ascending branches in the lower part, these bearing the pedicels that are 0.5-4 mm. long and each often with a yellow glandular band around it or on one side near the middle; spikelets 4-18 mm. long, 6- to 30-flowered, linear, ascending-divaricate; lemmas 1.8-2.4 mm. long, blunt (emarginate usually), often darkly pigmented, falling individually from the intact rachilla, the keel scabrous but never glandular. Abundant especially along roads and other disturbed areas, Plains Country, Trans-Pecos and Rio Grande Plains, infrequent e. to n.-cen. Tex., spring-fall; Kan. to Calif. and s. into Mex., introd. from s. Eur.

7. *Eragrostis Swallenii* Hitchc. SWALLEN'S LOVEGRASS. Tufted perennial; culms 2-6 dm. long, often diffuse and spreading, rarely erect, often with an incomplete yellow glandular annulus shortly below each node; leaves mostly crowded toward the base; sheaths nearly glabrous or with a few hairs at the corners; blades mostly quickly becoming involute, diverging at an angle from the sheaths, arcuate, firm; panicle 1-2 dm. long, almost as broad, with a few remote rather stiffly spreading branches (glabrous in the axils) bearing some slightly spreading stiff secondary branches that in turn bear the flexuous pedicels (each of which is 3-10 mm. long and bears near the middle a minute annular gland); spikelets mostly linear, 5-23 mm. long, 6- to 38-flowered, mostly stramineous; lemmas ovate, subacute, 1.8-2.3 mm. long, falling individually from the intact rachilla. Frequent in sandy prairies, coastal parts of Rio Grande Plains (Brooks, Kenedy and Kleberg cos.), summer-fall; endemic.

8. *Eragrostis neomexicana* Vasey. Loosely tufted annual; culms 25-100 cm. long, mostly diffuse and spreading, sparingly branched and geniculate in the lower part, often with a ring of yellow glands shortly below the nodes; sheaths sparingly papillose-pilose or glabrous and often with rows of minute glandular depressions on the keel and near the nerves; blades 2-10 mm. broad, mostly flat; panicle 9-40 cm. long, ascending or more often inclined or at least nodding, with numerous ascending branches that in turn bear the secondary branches which in turn bear the pedicellary ones that are flexuous, mostly appressed (rarely slightly spreading) and 3-10 mm. long; spikelets mostly appressed or nearly so, slightly tapered, plumbeous, 4-10 mm. long, mostly 6- to 16-flowered; lemma

ovate, blunt, plumbeous, the lower ones 1.6-2.5 mm. long, falling individually from the intact rachilla, the lower ones falling first. Frequent on roadsides and mt. slopes in the Trans-Pecos, summer-fall; Colo. to Ariz. and Calif. s. to cen. Mex. (adv. in cen. U.S.).

This species, in Texas, intergrades completely with *E. pectinacea* which has generally lesser stature, narrower leaves and spikelets, and shorter pedicels and panicle branches. In *E. pectinacea*, glandular sheaths are rare, whereas they are common in *E. neomexicana*. *E. neomexicana* also passes freely into *E. mexicana*, which is distinguished mostly by the more divaricate pedicels and lesser stature.

9. *Eragrostis pectinacea* (Michx.) Nees. Loosely tufted diffuse annual; culms numerous, 15-60 cm. long, ascending or usually spreading and geniculate in the lower part where also sparingly branched; sheaths usually folded, softly keeled, pilose at the corners; blades 2-5 mm. broad, mostly flat; panicles ascending or often nodding or even altogether inclined, obovoid, usually open and diffuse when mature, 5-40 cm. long, with numerous ascending branches bearing along the distal two-thirds of their length the appressed flexuous pedicellary branchlets (1-5 mm. long) or in larger specimens the lower main branches with ascending secondary branchlets that in turn bear the appressed pedicellary branchlets; spikelets mostly appressed or nearly so, slightly tapered, plumbeous, 3-10 mm. long; lemmas 1.5-2 mm. long, blunt, all plumbeous, eventually falling from the intact rachilla (the lowest lemma falling first). *E. diffusa* Buckl., *E. perplexa* L. H. Harvey. Frequent in a variety of habitats, most abundant in disturbed loamy soil near roads, fields and streams, in all regions of the state, spring-fall; essentially throughout the U.S. and s. into Mex.

This species tends to be more robust in the western and southern parts of the state (*E. diffusa*) and intergrades in the Trans-Pecos with *E. neomexicana* (which has longer pedicels) and elsewhere with *E. arida* (which has longer, divaricate pedicels).

10. *Eragrostis arida* Hitchc. Loosely-tufted annual; culms 2-4 dm. long, mostly spreading, rarely branched and often slightly geniculate in the lower part; sheaths not glandular, pilose on the corners; blades 2-5 mm. broad, mostly flat; panicle 1-2 dm. long, mostly ovoid, open, rather diffuse, with numerous spreading branches bearing numerous spreading branchlets that bear the stiffly spreading capillary pedicels (3-7 mm. long); spikelets usually somewhat tapered, stramineous, 5-10 mm. long, 8- to 15-flowered; lemmas ovate, obtuse, the lower ones 1.5-2 mm. long, falling individually from the intact rachilla, the lower ones first. Infrequent in Trans-Pecos, Plains Country and w. part of Edwards Plateau, summer; Tex. to Calif., s. to Son., Dgo. and Nay.

This species passes into *E. pectinacea*. It is not too definitely separable from *E. tephrosanthos* of southern Texas.

11. *Eragrostis tephrosanthos* Schult. Tufted annual; culms 5-60 cm. long, ascending, sparingly branched and markedly geniculate in the lower part; sheaths not glandular, pilose at the corners; blades 2-4 mm. broad, mostly flat; panicle 1-2 dm. long, mostly ovoid, open, rather diffuse, with numerous spreading branches bearing spreading branchlets that bear the slightly spreading pedicels (3-7 mm. long); spikelets slightly tapered, stramineous to dark-plumbeous, 3-10 mm. long, 6- to 14-flowered; lemmas ovate, obtuse, the lower ones 1.5-2 mm. long, falling individually from the intact rachilla, the lower ones first. Infrequent in Rio Grande Plains and rare in s. part of n.-cen. Tex., summer-fall; Gulf States s. through trop. Am.

This is not too well separated from *E. arida* from farther inland.

12. *Eragrostis mexicana* (Hornem.) Link. Weakly tufted annual; culms 15-75 cm. long, erect or ascending, slender; sheaths not glandular, pilose at the corners; blades 3-6 mm. broad, flat; panicle 5-30 cm. long, ovoid, open and diffuse, with numerous spreading branches bearing spreading branchlets that bear the spreading pedicels (4-15 mm. long); spikelets markedly tapering, mostly purplish-green to stramineous-green, 4-9 mm. long, about 2 mm. broad, 6- to 10-flowered; lemmas ovate, obtuse, the lower ones 2-2.5 mm. long, falling individually from the intact rachilla, the lowest first. Infrequent to rare in the Trans-Pecos, summer-fall; Tex. to Calif. and s. to C. A.; Venez.; Braz.

13. *Eragrostis capillaris* (L.) Nees. LACEGRASS. Loosely tufted annual; culms 2-5 dm. long, numerous, ascending, moderately branched from nodes crowded in the lower fourth of the plant; sheaths keeled, mostly short and spreading from the contained branches (exposing the conspicuously discolored nodes), usually pilose along the

margins and at the corners; blades strictly ascending into and around the panicle, elongate, 1-3 mm. broad, mostly flat; panicle about two thirds or more as long as the plant (the lower part usually included in the upper sheath), obovoid, with numerous approximate somewhat ascending capillary-flexuous branches which in turn bear the capillary-flexuous pedicels (4-12 mm. long); spikelets 2- to 4-flowered; lemmas 1-1.5 mm. long, eventually falling individually. Rare weed, n.-cen. Tex. (Tarrant Co.), summer; e. U.S. w. to Wisc., Ia., Kan., Okla. and Tex.

14. *Eragrostis spicata* Vasey. Coarse bunchgrass; tufts as much as 6 dm. thick basally; culms terete, 5-10 dm. long, 2-3 mm. thick, stiffly erect; ligule a short fringed scale; blades 3-7 mm. broad basally but involute most of the length, ascending; panicles dense, narrow, spikelike, terete, 15-35 cm. long, 4-5 mm. thick, stiffly erect, the lower part usually included in the upper sheath, actually with numerous extremely short few-flowered branchlets tightly appressed to the main axis; spikelets laterally compressed, glabrous, with 2 or 3 perfect flowers and another terminal one in which the genitalia abort; rachilla eventually abscising above the glumes and between the florets (this abscission beginning in the uppermost spikelets of the panicle and gradually proceeding to lower and lower levels); lemmas 1.3-1.7 mm. thick, membranous except for the veins, perfectly glabrous. Infrequent or locally abundant, Rio Grande Plains, spring-fall; Tex.; Tam.; Baja Calif.; Parag.; Arg.

15. *Eragrostis hirsuta* (Michx.) Nees. Tightly tufted perennial; culms 4-10 dm. long, erect, unbranched; sheaths much longer than their internodes, shortly ascending-pilose in the upper part and long erect-pilose at the apex dorsally, or rarely nearly glabrous; blades elongate-arcuate, the upper ones nearly surpassing the panicle, folded or eventually involute, 5-10 mm. broad when flattened; panicle 2-6 dm. long, 8-30 cm. broad, open and diffuse, of numerous usually slightly to markedly ascending branches bearing several secondary branches (these often deflexed) which in turn bear the long capillary spreading pedicels (8-18 mm. long); spikelets 2-4 mm. long, markedly tapered, (1- or) 2- to 4-flowered; lemmas 1.7-2.2 mm. long, ovate, blunt, with obscure lateral nerves, falling individually from the intact rachilla. Frequent in open sandy woods, e. and s.e. Tex., s.w. to San Patricio Co., summer-fall; Coastal States, Me. to Tex. and inland to Tenn., Ark. and Okla.; Br. Hond.

Some Texas specimens in which the sheaths are relatively short and crowded basally have been called *E. trichocolea* Hack. & Arech.; these are apparently plants showing intergradation to *E. lugens*.

16. *Eragrostis lugens* Nees. Tightly tufted perennial (occasionally simulating the annual habit); culms 12-80 cm. long, erect or ascending or spreading, occasionally geniculate, unbranched; leaves often crowded toward the lower part; sheaths about as long as their internodes, either glabrous or pilose near the apex; blades short or elongate, flat or usually folded or involute; panicle 1-3 dm. long, nearly as broad, erect, open, diffuse, with numerous spreading or somewhat ascending branches (the lower axils pilose), bearing spreading branchlets that in turn bear deflexed pedicels 4-13 mm. long; spikelets 3-8 mm. long, linear to strongly tapering, mostly 3- to 9-flowered, variously colored but usually slightly purplish; lemmas 1.3-2 mm. long, ovate, with only an extremely narrow distal hyaline margin or none at all, with very obscure lateral nerves, ovate, blunt, falling individually from the intact rachilla. *E. intermedia* Hitchc. Frequent nearly throughout the state (absent in Plains Country), most abundant in Rio Grande Plains, spring-fall; Fla., Mo. to La. and w. to Ariz., s. to C. A. and S. A.

This is an exceedingly variable species, grading in east Texas into *E. hirsuta* (specimens have been called *E. trichocolea*), and on a much broader scale intergrading in the Edwards Plateau, Rio Grande Plains and Trans-Pecos Texas, and Mexico into *E. erosa*, as represented by the frequent strong perennial plant with long-sheathed leaves not crowded below, larger stature, large panicle with nearly glabrous axils and ascending branches, several-flowered spikelets, longer, hyaline-tipped, golden-stramineous lemmas. These intermediate plants are usually called *E. intermedia* Hitchc. Arbitrarily those plants with lemmas more than 2 mm. long are placed in *E. erosa*, although the combination of characters is completely scrambled in certain Trans-Pecos populations.

17. *Eragrostis erosa* Scribn. Strongly tufted perennial; culms 5-9 dm. long, erect, unbranched; sheaths nearly glabrous or usually pilose at the summit; blades mostly

ascending, usually closely-involute; panicles 15-40 cm. long, 5-13 cm. broad, erect, open, diffuse, with numerous mostly ascending branches (these glabrous in the axils) with each bearing several secondary branches diverging at a low angle and in turn bearing the pedicels (also diverging at a low angle and 3-9 mm. long), capillary and flexuous; spikelets 3- to 12-flowered, 3-10 mm. long, mostly linear or slightly tapering, often appressed to the branchlets or nearly so; lemmas ovate, subacute, with broad hyaline distal margins, golden-stramineous or golden-plumbeous, 2-3 mm. long, with obscure lateral nerves, falling individually from the intact rachis, the lower first. Infrequent in mts. of the Trans-Pecos and rare e. to s.w. part of Edwards Plateau, summer-fall; w. Tex., N.M., Chih. and Coah. Intergrading with *E. lugens* (see remarks under that species).

18. *Eragrostis Palmeri* Wats. Closely tufted perennial; culms slender, erect and unbranched, 6-10 dm. long; sheaths minutely pilose toward the summit, glabrate, longer than the internodes; blades ascending, eventually mostly closely involute; panicles 10-35 cm. long, only 3-5 cm. thick, rather open, with numerous sharply ascending branches (these glabrous or nearly so in the axils), each in turn bearing several secondary branchlets each with a few capillary flexuous pedicels (2-5 mm. long) either divaricate or nearly appressed; spikelets 3- to 6- (to 8-) flowered, slightly tapered, mostly golden-green or bronze-stramineous; lemmas 1.8-2.9 mm. long, with obscure lateral nerves when mature, with narrow hyaline margins, narrowly ovate, subacute, falling individually from the intact rachilla. Rare, Rio Grande Plains (near Harlingen, Cameron Co.), fall; Tex., Coah., N. L. and Tam.

19. *Eragrostis trichodes* (Nutt.) Wood. Tufted perennial; culms 5-13 dm. long, erect or ascending, unbranched; sheaths pilose at the corners and in some populations (especially in e. Tex.) on the upper part as in *E. hirsuta*; blades elongate-arcuate, often quickly involute; panicles 25-70 cm. long, 6-25 cm. broad, often weak and nodding, open, diffuse, with numerous spreading-ascending branches (glabrous in the axils) each bearing several diverging usually weak flexuous secondary branchlets that in turn bear the capillary pedicels (3-10 mm. long); spikelets 5-20 mm. long, linear or oblong, (1- to) 3- to 26-flowered, usually bronzy or purplish, occasionally stramineous; lemmas narrowly ovate, acute, the lowest ones 2.4-3.8 mm. long, with prominent lateral nerves, falling individually from the intact rachilla, the lowest ones first. Incl. var. *pilifera* (Scheele) Fern., *E. pilifera* Scheele. Infrequent in open woods and brush, usually in somewhat sandy soil, e. and n.-cen. Tex., Plains Country, n. parts of Rio Grande Plains and rare in parts of Edwards Plateau, summer-fall; Ill. to Colo. and s. to Tex.

20. *Eragrostis curvula* (Schrad.) Nees. WEEPING LOVEGRASS. Tufted perennial; culms 6-12 dm. long, erect, simple; sheaths keeled and densely to sparsely hispidulous basally (use lens); blades ascending, involute, attenuate to a fine point, arcuate-spreading; panicles 15-40 cm. long, 5-10 cm. broad, open, with numerous ascending branches (the lower ones pilose in the axils), bearing numerous ascending secondary branchlets that bear the sessile spikelets; spikelets appressed, 8-10 mm. long, 7- to 11-flowered, plumbeous; lemmas about 2.5 mm. long, falling individually. Infrequent in Plains Country, summer; nat. of S. Afr., introd. and now spontaneous in s. parts of U.S.

21. *Eragrostis Elliottii* Wats. Tufted perennial (not knotty basally); culms 4-8 dm. long, erect; ligule a minute lacerate-fringed scale; sheaths long, shortly pilose at the corners, otherwise glabrous; blades rolled up marginally, stiffly ascending to a very slender tip; panicles erect, 25-50 cm. long, nearly as broad as long, very diffuse, with numerous long stiff antrorsely scabrous capillary branches that in turn bear long straight mostly deflexed capillary pedicellary branchlets 1-3 cm. long (these bearing spikelets only at the end, not along the length); part of the panicle often included in the uppermost sheath; spikelets strongly laterally compressed, remote, linear, 5-12 mm. long, mostly 8- to 15-flowered, about 1.5 mm. broad; lemmas ovate, about 1.5 mm. long, not falling away individually but the rachilla of the spikelet eventually breaking up by mechanical action. Rare in wet sandy open woods, extreme s.e. Tex. near the coast, summer-fall; Coastal States, from N.C. to Tex.; W. I.; Mex.; Br. Hond.

22. *Eragrostis refracta* (Muhl.) Scribn. Tufted perennial (not knotty basally); culms 4-8 dm. long, erect; ligule a minute fringed scale; sheaths short; blades elongate, mostly rather stiffly ascending to a fine point, glabrous or often densely pilose above; panicles

erect, 25-50 cm. long, nearly as broad as long, diffuse, with numerous long stiff antrorsely scabrous capillary branches that in turn bear elongate straight capillary mostly deflexed secondary branchlets, part of the panicle often included in the uppermost sheath; pedicels short, appressed, 1-3 mm. long; spikelets strongly laterally compressed, linear, 5-15 mm. long, about 2 mm. broad, the lateral ones nearly sessile on and appressed to the secondary branchlets, not quite or barely overlapping; lemmas ovate, acute, 1.7-2.2 mm. long, not falling individually but the rachilla of the spikelets eventually breaking from external mechanical forces. Infrequent in open sandy woods and along roadsides, e. and s.e. Tex., summer-fall; Coastal States, Del. to Tex.

23. *Eragrostis spectabilis* (Pursh) Steud. Loosely tufted perennial from hard knotty bases; culms 2-6 dm. long, erect; ligule a dense silky fringe; sheaths long, mostly densely pilose, rarely nearly glabrous; blades rolled up marginally or flat, mostly rather stiffly straight, ascending or slightly spreading; panicles erect, 15-40 cm. long, nearly as broad, diffuse, with numerous long stiff antrorsely scabrous branches that are pilose in the axils and in turn bear rather long stiff branches usually secundly reflexed from the lower side of the main branches, part of the panicle often included in the uppermost sheaths when submature and later breaking away and tumbling before the wind; spikelets strongly laterally compressed, numerous but not overlapping, the lateral ones on stiff pedicels 3-5 mm. long, usually reflexed slightly, linear, 3-10 mm. long, 1.5-2 mm. broad, 4- to 12-flowered; lemmas ovate, 1.4-2.1 mm. long, not falling away individually from the rachilla to liberate the grains; rachilla breaking irregularly under mechanical pressure during tumbling. Infrequent in open woods and prairies mostly in loose sandy soil, Plains Country, n.-cen. and e. Tex., in s. part of range grading into *E. Silveana*, summer-fall; e. U.S. w. to Minn., Neb., Colo. and n. Ariz.

24. *Eragrostis Silveana* Swall. Loosely tufted perennial from hard knotty bases; culms 2-6 dm. long, erect; ligule a dense silky fringe; sheaths long, glabrous to densely softly hirsute; blades rolled up from the margins or flat, mostly rather stiffly straight, ascending or spreading; panicles erect, 15-40 cm. long, about two thirds as broad, diffuse, with numerous long stiff somewhat viscid antrorsely scabrous branches that are often shortly pilose in the axils and in turn bear some short stiff branches usually secundly reflexed below the lower side of the main branches, part of the panicle usually included in the uppermost sheath when submature and later elongating and breaking away and tumbling before the wind; spikelets laterally compressed, numerous but not overlapping, the lateral ones on short capillary flexuous pedicels 1-3 mm. long, either appressed or usually reflexed slightly, linear, 2-6 mm. long, about 1 mm. broad, 4- to 12-flowered; lemmas ovate, 1.1-1.6 mm. long, often falling individually from the rachilla to liberate the grains and/or in many specimens the rachilla tending to break irregularly between the florets when the panicle is mature and tumbling. Frequent in loamy soil, s.e. Tex. and coastal parts of Rio Grande Plains, summer-fall; Tex. to Tam. and N. L.

Intergrading with *E. spectabilis* of the interior and rarely with *E. curtipedicellata*.

25. *Eragrostis curtipedicellata* Buckl. GUMMY LOVEGRASS. Tufted perennial from hard knotty bases; culms 7-60 cm. long, erect or ascending; ligule a dense silky fringe; sheaths silky at the corner and in some specimens villous all over; blades mostly involute (at least when dry), stiffly ascending; panicles erect, 3-25 cm. long, nearly as broad, with numerous long stiff somewhat viscid antrorsely scabrous branches that are eventually widely spreading and in turn bear some short stiff branches usually secundly spreading from the lower side of the main branch, at first the lower part of the panicle partly included in uppermost sheath, eventually all or nearly all exerted, breaking away and tumbling before the wind; spikelets mostly close enough to overlap, the lateral ones nearly sessile and appressed along the branches (but absent in the immediate vicinity of the axils), linear, 6- to 20-flowered; rachilla breaking irregularly between the florets under mechanical pressure, not regularly abscising, the grains usually liberated by the spreading of the lemma and palea; lemmas elongate-ovate, 1.5-2 mm. long. Prairies and open woods on sandy loam in all regions of the state but abundant only in the lower Plains Country and Rio Grande Plains, spring-fall; s.e. Colo. and Kan. s. to Coah. and N. L.

Apparently some populations show some gradation toward *E. spectabilis* and/or *E. Silveana*.

26. *Eragrostis sessilispica* Buckl. Densely tufted perennial from hard knotty bases; culms 2-7 dm. long, at first erect, gradually arching over; ligule a dense fringe; sheaths silky at the corners; blades mostly involute (at least when dry); panicles arched, 1-5 dm. long, with remote long rigidly divaricate few-flowered branches pilose in the lower axils, at length the whole breaking away and tumbling before the wind; spikelets terminal on (also sessile and appressed in axils of) and sessile and remote and appressed along the branches, linear, 6- to 12-flowered, 6-15 mm. long; rachilla abscising tardily if at all (in some specimens remaining intact) just above each node so that each internode-fragment adheres to the floret just above it; lemmas lanceolate, acute, 3-3.5 mm. long, drying chartaceous; palea nearly as long as the lemma, also chartaceous. Frequent in prairies on sandy loam, Plains Country and Rio Grande Plains, less frequent e. to s. parts of s.e. and n.-cen. Tex. and n. part of Edwards Plateau, spring-fall; Kan. to Tam. and w. to N.M. and Chih.

27. *Eragrostis oxylepis* (Torr.) Torr. RED LOVEGRASS. Loosely tufted perennial; culms 1-7 dm. long, often diffuse or decumbent below, geniculate, terminally ascending; ligule a short fringed scale; sheaths pilose at the corners; blades mostly 2-5 mm. broad, at first flat, later involute, rather firm and stiff, spreading or erect; panicles mostly well-exserted, erect or often weak and nodding, 3-37 cm. long, with few (or no) erect or spreading branches, the terminal axis and each branch toward the tip interrupted-spike-like with glomerules of nearly sessile spikelets (rarely a few spikelets scattered singly on the branches); spikelets generally glabrous, 10- to 50-flowered, 5-25 mm. long; lemmas 2.3-5.5 mm. long, those about a third the distance from the end of the spikelet longest, lanceolate, acuminate to acute, not falling individually from the rachilla; rachilla eventually abscising at the lower part of each node. Incl. var. *Beyrichii* (J. G. Sm.) Shinnery, *E. Beyrichii* J. G. Sm. Frequent in prairies and openings in woods and brush on sandy soils throughout Tex. (except the Trans-Pecos), somewhat weedy, spring-fall; s. Calif.; Colo. to Tenn. and s. to N.M. and the Gulf States of the U.S. and Mex.

28. *Eragrostis glomerata* (Walt.) L. H. Dewey. Annual; culms 2-10 dm. long, erect, sparingly branched and geniculate in the lower third; panicles erect or slightly nodding, 5-50 cm. long, only 1-4 cm. broad, with numerous long main branches and these in turn further branched, all the branches strictly ascending; spikelets nearly sessile, 2-3 mm. long, 6- to 8-flowered; lemmas about 1 mm. long; palea glabrous or merely scabrous on the keels; rachilla eventually abscising above the glumes and between the florets. Rare in roadside ditches, e. Tex., summer-fall; widespread in warmer parts of the New World n. to S.C. and the Gulf States; also waifed n. to Mo.

29. *Eragrostis ciliaris* (L.) R. Br. Tufted annual; culms few, slender, 15-35 cm. long; panicles interrupted-spike-like, 3-12 cm. long, 3-10 mm. thick, erect; spikelets sessile, 2-4 mm. long, 6- to 12-flowered; lemmas about 1 mm. long; keels of palea long-ciliate; rachilla eventually abscising above the glumes and between the florets. Rare, waifed in gardens and along roads, e. Tex., fall; widespread in the warmer parts of the world, in the New World n. to S.C. and the Gulf States.

30. *Eragrostis amabilis* (L.) Nees. Tufted annual; culms few; slender, 15-45 cm. long; panicles 4-15 cm. long, 15-180 mm. broad, diffuse, oblong, with numerous slender spreading branches in turn bearing branched capillary flexuous branchlets; ultimate pedicels 2-6 mm. long; spikelets 1-2 mm. long, about as broad, 4- to 8-flowered; lemmas about 1 mm. long; keels of palea long-ciliate; rachilla eventually abscising above the glumes and between the florets. Rare waifs near the coast and in gardens, not persistent, spring-fall; nat. of Old World, widely adv. in warmer parts of the New World, n. to the Gulf States.

31. *Eragrostis Lehmanniana* Nees. Tufted perennial; culms strongly geniculate basally and frequently rooting at the lower nodes, sparingly branched, distally ascending; sheaths much shorter than the internodes, pilose at the corners; blades only 2-5 cm. long, mostly loosely involute; panicles open, obovoid, 8-15 cm. long, 3-7 cm. broad, with few ascending branches (glabrous in the axils) bearing few short ascending branchlets that bear pedicels only 0.5-1 mm. long; spikelets linear, 3-12 mm. long, about 1 mm. broad, 6- to 12-flowered; rachilla at maturity abscising at the lower part of each node and eventually even below the small pointed glumes; lemmas about 1 mm. long, dark-plumbeous, blunt, falling individually from the node usually at about the same time the rachilla breaks;

paleas slightly surpassing the lemmas. Rare near highways, Trans-Pecos and Rio Grande Plains, summer; nat. of Afr., introd. and spontaneous in Ariz., Okla. and Tex.

80. REDFIELDIA VASEY

A monotypic genus in the United States.

1. *Redfieldia flexuosa* (Thurb.) Vasey. BLOWOUT GRASS. Perennial from elongate slender rhizomes; aerial culms solitary and simple, 5-10 dm. long, ascending; ligule a short fringed scale; blades firm, loosely involute; panicle terminal, erect, narrowly conical, not much-surpassing the leaves, very diffuse, 20-45 cm. long, the ultimate branchlets elongate, capillary, divaricate and flexuous; spikelets 2- or 3- (rarely to 4-) flowered, 5-6 mm. long, all the florets perfect; glumes lanceolate, about half as long as the spikelet; rachilla abscising above the glumes and at the upper part of each node (the glabrous segment of the rachilla thus extending below each detached floret); lemmas lanceolate, with a densely silky-pilose callus and 3 glabrous nerves, the lateral nerves attaining the distal margin very near the apex and often minutely excurrent therefrom; palea nearly as long as lemma. Rare in loose sandy soils, Plains Country (Lipscomb Co.), late summer; N.D., s. to Tex. and w. Ut. and Ariz.

The species is of great economic importance as a sand-binder in the states north and west of Texas.

81. TRIDENS R. & S. TRIDENS

Tufted or rarely shortly rhizomatous perennials; culms erect (or in one species scandent); ligule a white fringe or short fringed scale; blades mostly flat, elongate; panicles terminal, diffuse or spikelike; spikelets not much laterally compressed, several-flowered, all the florets perfect or the pistil of the uppermost usually abortive; rachilla abscising just below the lemma nodes; lemmas broad, mostly apically obtuse, emarginate and/or very shallowly cleft, 3-nerved (the midnerve and/or the laterals in some species minutely excurrent), usually pubescent on the lower half to two-thirds of the nerves (glabrous in *T. albescens*); paleas either glabrous or short silky-hairy on the nerves and dorsally.

A North American genus of about a dozen species, in some works enlarged to include the related genus *Erioneuron*.

1. Glumes as long as the spikelets or nearly so7. *T. strictus*.
1. Glumes about equaling the lowest lemma (2)
- 2(1). Lemmas essentially glabrous (hair, if present, only at the basal callus of the lemma); panicles spikelike, 8-23 cm. long9. *T. albescens*.
2. Lemmas pubescent, at least at the base of the lateral nerves (3)
- 3(2). Lemmas about 2 mm. long; culms near the base of the plant only about 1 mm. thick8. *T. eragrostoides*.
3. Lemmas longer; culms thicker (4)
- 4(3). Lateral nerves of most lemmas stopping well short of the distal margin, never excurrent; palea silky-pubescent on the keels and often very short-pubescent elsewhere (5)
4. Lateral nerves reaching the distal margins and mostly very shortly excurrent; paleas essentially glabrous (6)
- 5(4). Panicle-branches long, spreading (see also *T. muticus* f. *effusus*)6. *T. Buckleyanus*.
5. Panicle-branches short, strictly erect and appressed (except in f. *effusus*)5. *T. muticus*.
- 6(4). Panicle thickly spikelike, 5-10 cm. long; lemmas nearly as broad as long4. *T. congestus*.
6. Panicle more diffuse and larger (7)

- 7(6). Plants 1-6 dm. tall at anthesis; blades mostly 1-3 mm. broad
3. *T. texanus*.
7. Plants 6-16 dm. tall at anthesis; blades mostly more than 3 mm. broad (8)
- 8(7). Subterminal spikelets on pedicels about 1 mm. long, erect and appressed to the
 stiffly ascending panicle branches, nearly as broad as long
2. *T. ambiguus*.
8. Subterminal spikelets (most of them) on pedicels more than 1 mm. long, mostly
 drooping from the usually spreading panicle branches, longer than broad
1. *T. flavus*.

1. *Tridens flavus* (L.) Hitchc. PURPLETOP. Tufted and with very short rhizomes developed in sandy soil; culms 6-16 dm. long, erect; basal sheaths keeled; panicle large and diffuse, often appearing purplish, the branches usually spreading and terminally drooping, most pedicels more than 2 mm. long; spikelets mostly diverging or drooping from the branches; lemmas 4-5 mm. long, the 3 nerves usually minutely excurrent and pubescent in the lower two-thirds the length. Abundant in sandy loam soils, open forests, prairies and roadsides, e., s.e. and n.-cen. Tex. and n. Plains Country, abundant, late summer-fall; e. U.S. w. to Neb., Kan., Okla. and Tex.

In east and north-central Texas some of the populations show stiffer panicle-branches which at the base have larger, hairier buttresses, and the spikelets are on longer, more noticeably divergent pedicels. These are var. *Chapmanii* (Small) Shinnery [*T. Chapmanii* (Small) Chase].

2. *Tridens ambiguus* (Ell.) Schult. Tufted; culms 6-10 dm. long, erect; basal sheaths keeled; panicle broadly to narrowly obovoid, 8-15 cm. long, the branches stiffly ascending; most pedicels (of lateral spikelets) about 1 mm. long; spikelets erect, appressed to the branches; lemmas 3-4 mm. long, the 3 nerves usually minutely excurrent and pubescent in the lower two-thirds the length, or the lateral nerves scarcely excurrent in many specimens. Infrequent to rare, wet pinelands, extreme e. Tex., late summer-fall; Coastal States, S.C. to Tex.

3. *Tridens texanus* (Wats.) Nash. Tufts 1-6 dm. tall at anthesis; sheaths of lowest leaves inconspicuously keeled; panicle 5-15 cm. long, often appearing purplish, few-flowered, the branches spreading and flexuous; pedicels of subterminal spikelets 1-5 mm. long; lemmas 4-4.5 mm. long, the 3 nerves usually minutely excurrent and pubescent in the lower half of the length. Brush, Rio Grande Plains and Edwards Plateau, abundant, late spring-fall; Tex. to S.L.P. and Coah.

4. *Tridens congestus* (L. H. Dewey) Nash. Tufts very robust basally (very short rhizomes sometimes present); culms 30-65 cm. tall, often geniculate, stout; sheaths apically round-keeled; blades usually flat, 2-4 mm. broad, with involute tips (the rest involute on drying); panicle long-exserted, thickly spikelike, 5-10 cm. long, 15-25 mm. thick, often pinkish; lemmas 3-4 mm. long, nearly as broad as long, the 2 lateral nerves and midnerve reaching the distal margin and in some lemmas minutely excurrent and pubescent on the lower third of their length. Infrequent in low-lying prairies of black clay loam, s.e. and n.-cen. Tex., spring-fall; endemic.

5. *Tridens muticus* (Torr.) Nash. SLIM TRIDENS. Densely tufted; culms 15-80 cm. long, erect, slender; sheaths pubescent to glabrous, not keeled, often somewhat glaucous; blades mostly involute, 1-3 mm. broad when flat; panicles interrupted-spikelike, 7-25 cm. long, 3-10 mm. thick, very slightly pinkish, usually with some short appressed branches near the base; lemmas about 5 mm. long, 3-nerved, the lateral nerves seeming to end well within the distal margin, all 3 nerves hairy on the lower two-thirds the length; palea silky-pubescent on the keels and the lower part of the internerves. Incl. var. *elongatus* (Buckl.) Shinnery, *T. elongatus* (Buckl.) Nash. Abundant on dry exposed flats and hills in the Trans-Pecos, Plains Country, Edwards Plateau, Rio Grande Plains, infrequent e. to n.-cen. and s.e. Tex.; Ark. and Tex., w. to s.e. Calif., n. to Nev., Ut. and Colo.; n. Mex.

On the Edwards Plateau and in north-central Texas occur populations in which the lower appressed branches on the panicle are more elongate, the glumes somewhat more pointed, the lateral nerves of the second glume somewhat more conspicuous and the panicles longer on the average; these are the var. *elongatus*. In a local area 20-21 miles

south of Marathon, Brewster Co., in the Trans-Pecos, occur populations in which the panicle-branches are widely spreading; these are the f. *effusus* M. C. Johnst.

6. *Tridens Buckleyanus* (L. H. Dewey) Nash. Culms 4-8 dm. long, erect; sheaths not keeled; blades 1-3 mm. broad, flat or usually dried-involute; panicle 1-2 dm. long, the branches few, remote, the upper ones erect and appressed, the lower ones 5-10 cm. long and spreading, few-flowered, some of them again branched; lemmas 4-5 mm. long, 3-nerved, the lateral nerves appearing to end well within the distal margin, all 3 nerves pubescent on the lower two-thirds the length; palea silky-pubescent on the lower half of the 2 keels. Rare on shaded banks, s.e. margin of Edwards Plateau (Bexar, Comal, Travis and Hays cos.), late summer-fall; endemic.

7. *Tridens strictus* (Nutt.) Nash. Culms 8-17 dm. long, erect; sheaths not keeled; blades 3-8 mm. broad; panicle spike-like, 1-3 dm. long, 9-15 mm. thick, with a few short appressed branches near the base; glumes as long as to longer than the rest of the spikelet, viscid, acuminate to a fine point, conspicuous in the panicle; lemmas about 3 mm. long, the lateral nerves reaching the distal margin and in some specimens excurrent, all 3 nerves hairy in the distal two-thirds the length. Infrequent in open forests on sandy soil, e., s.e. and n.-cen. Tex., summer-fall; s.e. U.S. n. to N.C., Tenn., Ill. and Mo., w. to Kan., Okla. and Tex.

8. *Tridens eragrostoides* (Vasey & Scribn.) Nash. Culms densely tufted but very slender and usually scandent in bushes, 1-10 dm. long; lower sheaths keeled; blades 1-4 mm. broad, usually flat; panicle 5-30 cm. long, diffuse, few-branched and usually few-flowered, the branches capillary, flexuous; spikelets darkly-pigmented, often pendulous or nearly so on their pedicels; lemmas about 2 mm. long, 3-nerved, the lateral nerves reaching the margin but rarely microscopically excurrent, all 3 nerves shortly pubescent on the lower half. Frequent in brush, Rio Grande Plains and infrequent in s.e. Tex. and s. part of n.-cen. Tex., s. Edwards Plateau and the extreme e. Trans-Pecos, spring-fall; Ariz., Fla., Cuba, Tex., Tam., N.L. and Coah.

9. *Tridens albescens* (Vasey) Woot. & Standl. WHITE TRIDENS. Tufts robust; culms 3-10 dm. long, erect; basal sheaths not or obscurely keeled; panicle spike-like, 8-25 cm. long, 5-13 mm. broad, very pale in color; lemmas about 3 mm. long, 3-nerved, the nerves ending well within the distal margin and glabrous (hair, if present, confined to the basal callus of the lemma). Abundant in roadside ditches, streamsides, overflows, draws and low-lying prairies throughout, summer-fall; Okla. and Colo., s. to Tam., N.L. and Coah.

82. BLEPHARIDACHNE HACK.

A genus of two species in western North America.

1. *Blepharidachne Bigelovii* (Wats.) Hack. Densely tufted perennial; culms bushy-branched, arcuate-ascending, 6-18 cm. long; ligule a minute white fringe; leaves crowded; blades 8-20 mm. long, closely involute, arcuate, rigid, aculeate-mucronate, superficially densely canescent with microscopic whitish subpaleiform hairs; panicles narrowly oblong, 2-3 cm. long, the lower partly included in the uppermost sheaths; spikelets 5 to 10 per panicle, 5-7 mm. long, scarcely laterally compressed, uniformly 4-flowered, the lower 2 lemmas and paleas empty, the third floret perfect, the fourth a vestigial rudiment; rachilla with zone of abscission just above the glumes but not at the other nodes; glumes cymbiform, nearly as long as the spikelet, membranous, with scabrous midveins; lemmas 3-nerved (each nerve excurrent as a short awn) and cleft about half the length along the side of the midvein, densely pubescent especially along the lateral nerves and the central lobe. On interbedded yellow marl and limestone desert flats and low hills in the Trans-Pecos, restricted but locally abundant, spring-summer; also Coah.

83. ERIONEURON NASH

Densely tufted low perennials, rarely stoloniferous; culms numerous, erect, unbranched; leaves mostly crowded at the base, the sheaths and blades folded and keeled (or the latter involute); blades short, falcate and with white-cartilaginous margins; panicles

short, compact, stramineous; pedicels very short; spikelets 4- to 12-flowered, laterally compressed, nearly all the flowers fertile; rachilla abscising above the glumes and at each node; lemmas keeled, 3-nerved, the midnerve hairy basally and excurrent as a long or short awn, the lateral nerves with long hairs on the lower part and shorter hairs above; paleas with long hairs on the lower part of the adaxial surface and near the lateral margins and ciliate on the 2 nerves.

A very small American genus, formerly included in *Tridens*.

1. Panicles included in and surpassed by a fascicle of leaves at the top of a naked culm; stolons abundant 1. *E. pulchellum*.
1. Panicles long-exserted; stolons rare (2)
- 2(1). Lemmas entire or merely minutely retuse; flowering culms scapose 3. *E. pilosum*.
2. Lemmas shallowly 3-lobed, the central lobe subulate and awned; flowering culms with a few leaves 2. *E. grandiflorum*.

1. *Erioneuron pulchellum* (H.B.K.) Tateoka. FLUFFGRASS. Strongly stoloniferous mat-formers, the tuft forming as floriferous fascicles at the ends of ascending stolons while gradually bending to the ground permitting rooting; leaves crowded, 1-5 cm. long, about 1 mm. broad, the blades folded or usually involute; panicle included in the fascicle of leaves; lemmas 3-lobed about half the total length. *Tridens pulchellus* (H.B.K.) Hitchc. Desert flats and hills, abundant in the Trans-Pecos and less frequent in w. Edwards Plateau, summer-fall; Tex. to Nev. and Calif., s.e. to Mexico City.

2. *Erioneuron grandiflorum* (Vasey) Tateoka. Culms 1-6 dm. long; most leaves crowded basally but a few scattered on the long flowering culm, 2-12 cm. long, 2-3 mm. broad, folded, with conspicuous cartilaginous margins; panicles elongate, usually conspicuously longer than broad, often 2 to 3 times as long; lemmas 3-lobed about a fourth the total length. *Tridens grandiflorus* (Vasey) Woot. & Standl., *T. Nealleyi* (Vasey) Woot. & Standl., *Erioneuron Nealleyi* (Vasey) Tateoka. Some plants (i.e., *E. Nealleyi*) seem intermediate between this species and *E. pilosum*. Infrequent in the Trans-Pecos, summer-fall; Ariz. to N.M., s. to Dgo. and Coah.

3. *Erioneuron pilosum* (Buckl.) Nash. Culms 1-3 dm. long; nearly all leaves basal, very short ones rare on the scapelike flowering culm, the lower ones 2-10 cm. long and about 2 mm. broad; lemmas merely acute at the apex or only microscopically notched on each side of the very short awn, not lobed. *Tridens pilosus* (Buckl.) Hitchc. Very abundant in the Trans-Pecos and Edwards Plateau, less so in Rio Grande Plains and n.-cen. Tex., rare in s. part of s.e. Tex., spring-fall; Kan. to Nev. s. to S.L.P.

84. MUNROA TORR.

FALSE BUFFALO GRASS

A small genus of dry regions of North America and South America.

1. *Munroa squarrosa* (Nutt.) Torr. Annual, forming mats as much as 1 m. across by means of stolons, the lower internodes long and horizontal with leafy flowering clusters at the more or less remote node; sheaths short and often purplish- or whitish-discolored; blades pale green, flat, stiff, pungent, only 1-3 cm. long, 1-3 mm. broad; fascicles of spikelets borne among the leaves, about 7 mm. long; spikelets in twos or threes along a short rachis, the lower 1 or 2 larger, 3- or 4-flowered, the group (reduced spike) enclosed in the broad sheaths of short leaves, usually about 3 in a fascicle, forming a cluster or head at the ends of the short branches; rachilla disarticulating above the glumes and between the florets; glumes of the lower 1 or 2 spikelets equal, 1-nerved, narrow, acute, a little shorter than the lemmas, those of the upper spikelet unequal, the first much shorter or obsolete; lemmas 3-nerved, with a tuft of hairs on the margin about the middle, those of the lower spikelet coriaceous, acuminate, the points spreading, the midnerve extended into a mucro, those of the upper spikelet membranous; palea narrow, enclosing the elliptic dorsally compressed grain. Infrequent in sandy and gravelly plains in the Trans-Pecos and Plains Country, summer-fall; N.D. and Mont. s. to Tex., Chih. and Ariz.

The leafy flowering tufts readily separate from the main part of the mat and are blown about, facilitating dissemination.

85. **TRIPLASIS BEAUV.**

A genus of two species mainly in eastern North America.

1. *Triplasis purpurea* (Walt.) Chapm. **PURPLE SANDGRASS.** Tufted annual; culms 4-10 dm. long, 0.6-2 mm. thick, numerous, spreading, multinoded and geniculate basally, terminally ascending, essentially simple; ligule a short white-fringed scale; sheaths shorter than the internodes (the lower ones often swollen and containing cleistogenes); blades mostly flat; aerial panicles partly or mostly included, flabellate, few-branched, the branches capillary, curviflexuous or straight; spikelets 7-11 mm. long, 3- or 4-flowered, usually purple; flowers perfect (or the pistil of the uppermost one abortive); rachilla abscising at the nodes; lemmas 3-nerved, deeply 3-parted (the middle lobe consisting merely of the excurrent awnlike midnerve), short, silky-pubescent on all 3 nerves; palea long silky-pubescent from the distal margin and the distal third of the length. Open areas of loose sand, Plains Country, n.-cen., e. and s.e. Tex., and Rio Grande Plains, late summer-fall; c. Can. and e. U.S. w. to Minn., Neb. and Colo.

86. **CALAMOVILFA HACK.**

A North American genus of about 4 species.

1. *Calamovilfa gigantea* (Nutt.) Scribn. & Merr. **BIG SANDREED.** Rhizomatous perennial; aerial culms erect, 9-22 dm. long, 4-12 mm. thick, leafy; ligule a ciliate fringe 1-2 mm. long; blades firm to subcoriaceous, 2-6 dm. long, 5-12 mm. broad toward the base where flat, tapering to an involute point; panicle 3-6 dm. long, diffuse, pyramidal, the branches spreading and naked toward the base; spikelets 1-flowered, somewhat laterally compressed, appressed to the branches; glumes firm, persistent, keeled, acute, the first 5-7 mm. long, the second 7-9 mm. long; zone of abscission between the second glume and the lemma; lemma about as long as second glume, glabrous but with a callus bearing a beard of white soft hairs 4-5 mm. long; palea about as long as lemma. Loose sand hills and active dunes, Plains Country and n.e. Trans-Pecos (Ward, Winkler and Crane cos.), abundant, summer-fall; Kan. to Ut., Tex. and Ariz.

87. **SPOROBOLUS R. BR. DROPSEED**

Perennials (except in 1 species); inflorescences paniculate, either open and diffuse or spiciform; spikelets 1-flowered, slightly laterally compressed, with membranous to scarious parts; peduncles with zone of abscission just below the glumes in *S. Tharpii*, *S. airoides* and *S. Wrightii*; rachilla with zone of abscission just above the glume node and below the lemma nodes in most species; palea often splitting at maturity; grain usually falling readily, often reddish, with a coat (ovary wall) that imbibes water, becoming loose and easily detached from the remainder of the grain.

A genus of about 150 species of the warmer regions of the world. Sand dropseed (*Sporobolus cryptandrus*) vies with *Cenchrus incertus* for the title of most abundant Texas grass species. By virtue of sheer abundance it has a small amount of economic value as a forage grass, though it is stemmy, fibrous and unpalatable in the extreme.

1. Mature panicles more than 9 cm. broad (2)

1. Mature panicles less than 9 cm. broad (7)

2(1). Lemma more than 4 mm. long 18. *S. Silveanus*.

2. Lemma less than 4 mm. long (3)

3(2). Sheaths sharply keeled 11. *S. Buckleyi*.

3. Sheaths not sharply keeled (4)

4(3). Spikelets so closely spaced in panicle that they mostly are in contact with adjacent spikelets (5)

4. Spikelets more remotely disposed so that they rarely touch each other (6)

- 5(4). First glume 0.5-1 mm. long; second glume 0.8-1.8 mm. long; lemma 1.2-2.1 mm. long 2. *S. Wrightii*.
5. First glume 1-2 mm. long; second glume 2-2.9 mm. long; lemma 2.3-3.5 mm. long 3. *S. Tharpaii*.
- 6(4). Ligule less than 1 mm. long; pedicellary branchlets 5-20 mm. long 1. *S. texanus*.
6. Ligule commonly 2-5 mm. long; pedicellary branchlets 0.5-2 mm. long 4. *S. airoides*.
- 7(1). Collar of sheath (dorsal summit where it joins the blade) abundantly furnished with soft white hairs (8)
7. Collars of sheath glabrous (but the corners commonly pilose) (15)
- 8(7). Panicles 3-9 cm. long; lemma about 2 mm. long .. 8. *S. Nealleyi*.
8. Panicles longer than 12 cm. or if shorter the lemma longer than 3 mm. (9)
- 9(8). Mature panicles 5-15 cm. broad (10)
9. Mature panicles less than 5 cm. broad (11)
- 10(9). Lemma 4.5-6.1 mm. long 18. *S. Silveanus*.
10. Lemma 1.9-2.3 mm. long 9. *S. flexuosus*.
- 11(9). First glume more than 1.7 mm. long 20. *S. asper*.
11. First glume less than 1.5 mm. long (12)
- 12(11). At least part of mature panicle exerted from the sheath and less than 27 mm. broad (13)
12. Mature panicles either all enclosed in sheath or else exerted and more than 27 mm. broad (14)
- 13(12). Exserted portion of mature panicle 8-25 mm. thick 5. *S. giganteus*.
13. Exserted portion of mature panicle 4-7 mm. thick 6. *S. contractus*.
- 14(12). Main panicle branches spreading, nearly straight; spikelets on very short pedicels; mature panicles 5 to 8 times as long as broad 7. *S. cryptandrus*.
14. Main panicle branches divaricate or deflexed and arcuately reflexed; pedicels about 1 mm. long; panicles about 3 times as long as broad 9. *S. flexuosus*.
- 15(7). Mature panicles at least 5 cm. broad (16)
15. Mature panicles less than 5 cm. broad (18)
- 16(15). Lemma more than 4 mm. long; sheaths not keeled . 18. *S. Silveanus*.
16. Lemma less than 4 mm. long; sheaths keeled (17)
- 17(16). Keels of sheaths sharp; panicle branches not whorled; panicle 7-17 cm. broad 11. *S. Buckleyi*.
17. Keels of sheaths rounded; main panicle branches whorled; panicle 5-8 cm. broad .. 12. *S. pyramidatus*.
- 18(15). Mature panicles less than 5 cm. long (19)
18. Mature panicles more than 5 cm. long (21)
- 19(18). Panicles open, not at all spikelike; desert annual .. 10. *S. patens*.
19. Panicles dense or somewhat spikelike (20)
- 20(19). Panicles dense, 6-10 mm. broad, exerted, terminal; rhizomatous coastal perennial 14. *S. virginicus*.
20. Panicle somewhat spikelike, 2-3 mm. broad, often partly or entirely hidden in sheath, mostly axillary; tufted annual 21. *S. vaginaeflorus*.
- 21(18). Panicle very open and diffuse; first glume less than 1 mm. long 12. *S. pyramidatus*.
21. Panicle narrow or dense, or if slightly open then the first glume more than 1 mm. long (22)

- 22(21). First glume 0.4-0.9 mm. long (23)
 22. First glume at least 1.2 mm. long (24)
 23(22). Panicle only 5-10 mm. thick, 20 to 40 times as long; second glume 0.8-1.3 mm. long15. *S. indicus*.
 23. Panicle 12-20 mm. thick, 6 to 10 times as long; second glume 1.2-2.1 mm. long ...
13. *S. domingensis*.
 24(22). Second glume slightly shorter than lemma; panicle 4-12 (-18) mm. thick, commonly at least partly included in the uppermost sheath
20. *S. asper*.
 24. Second glume about equaling or usually slightly surpassing lemma, or if shorter then the panicle 15-30 mm. thick and exerted (25)
 25(24). Blades closely involute nearly their entire length, only 1-2 mm. broad when unrolled17. *S. junceus*.
 25. Blades flat or merely folded at least in the basal third of their length, mostly broader than 2 mm. (26)
 26(25). Panicle 6-16 mm. thick, spikelike; grain prolate, minute
16. *S. purpurascens*.
 26. Panicle 15-30 mm. broad, more open; grain globose ...19. *S. heterolepis*.

1. *Sporobolus texanus* Vasey. Tufted perennial from short very firm rhizomes 1.5-2 mm. thick, or these often apparently absent; aerial culms numerous, 3-7 dm. long, 1-2 mm. thick, leafy; ligule a very dense line of cilia about 0.5 mm. long; blades 1-12 (-20) cm. long, 2-4 mm. broad near the base, flat or drying involute, pointed; summit of sheath glabrous but the corners and margins often sparsely long-pilose; panicle 15-30 cm. long, 1-2 dm. broad, vaguely obovoid, open and diffuse, the branches not whorled but bearing numerous somewhat flexuous capillary ultimate branchlets 5-20 mm. long, each terminating in a single spikelet; first glume 0.7-1.5 mm. long; second glume 2.1-2.8 mm. long; lemma 2.3-2.9 mm. long; palea about equaling lemma. Seasonally moist and often subsaline low areas, Plains Country and Trans-Pecos, infrequent or rare, summer-fall; w. Kan. to Tex. and w. to Ariz.

2. *Sporobolus Wrightii* Scribn. SACATON. Tufted perennial; culms numerous, 9-25 dm. long, 2-9 mm. thick, unbranched, erect; ligule a fringe of cilia 2-10 mm. long; blades 2-7 dm. long, 3-10 mm. broad, flat or eventually drying involute; summit of sheath glabrous; panicles 2-6 dm. long, 12-26 cm. broad, open, more or less pyramidal when mature, the branches not whorled, spreading or slightly ascending, with short densely flowered secondary branchlets bearing subsecundly on the underside the pedicellary tertiary branchlets mostly less than 0.5 mm. long, the spikelets touching; first glume 0.5-1 mm. long; second glume 0.8-1.8 mm. long; lemma 1.2-2.1 mm. long; palea about as long as lemma. *S. airoides* var. *Wrightii* (Scribn.) Gould. Hard-packed clay loam, often subsaline, mostly near the Rio Grande or near the coast, Rio Grande Plains, s.w. Edwards Plateau and Tran-Pecos, rare except near the coast in extreme s. Tex., spring-summer; Tex. to s. Calif., s. to n. Mex.

3. *Sporobolus Tharp* Hitchc. COASTAL SACATON. Tufted perennial; culms numerous, 6-17 dm. tall, 2-5 mm. thick, unbranched, erect or the lowermost internodes shortly rhizomatous; ligule a fringe of cilia 4-10 mm. long; blades 2-6 dm. long, 3-6 mm. broad but closely involute and arcuate most of the length; summit of sheath glabrous; panicles 20-45 cm. long, vaguely ellipsoidal, open, the main branches not whorled nor much-spreading but diverging only at angles of 10° to 60° from the main axis and again much-branched, the secondary branches 1-4 cm. long, the tertiary pedicellary branchlets very shortly subsecund on the lower (abaxial) sides, the spikelets close so that they commonly touch each other; first glume 1-2 mm. long; second glume 2-2.9 mm. long; lemma 2.3-3.5 mm. long; palea about equaling lemma. Sand and calcareous shell debris (hash) near the coast, s.e. Tex. and Rio Grande Plains (Aransas, Calhoun, Cameron, Kenedy and Nueces cos.), infrequent, summer-fall; endemic (probably continuing south into Tam.)

4. *Sporobolus airoides* (Torr.) Torr. ALKALI SACATON. Tufted perennial; culms numerous, 5-15 dm. long, 1-2 mm. thick, unbranched, erect or the lowermost internodes occasionally shortly subrhizomatous; ligule a fringe of cilia 2-5 mm. long; blades 15-45 cm. long, 2-6 mm. broad, flat or soon closely involute and distally arcuate; the sheaths

marginally and at the summit dorsally essentially glabrous or rarely on the corners with very few hairs 2-4 mm. long; panicles 20-45 cm. long, 15-25 cm. broad, open and diffuse, subpyramidal, the long branches not widely spreading and not whorled, the pedicellary branchlets subsecund on the lower side of the branches, mostly 0.5-2 mm. long, the spikelets few and borne remotely so that they often do not touch each other; first glume 0.4-1.8 (-2) mm. long; second glume 1-2.2 (-2.8) mm. long; lemma 1.3-2.5 (-2.8) mm. long; palea about equaling lemma. Open ground, prairies or sandflats or occasionally alkali or subsaline playas or gravelly and rocky slopes, Plains Country and Trans-Pecos, often very abundant, rare e. to w. Edwards Plateau, spring-fall; w. U.S. e. to S.D., Neb., Kan., Okla. and Tex.

Very variable, probably hybridizing with and intergrading with *S. Wrightii*. Plants of the El Paso area often have spikelets with the larger measurements approaching the maxima given above.

5. *Sporobolus giganteus* Nash. GIANT DROPSEED. Tufted perennial; culms 7-20 dm. long, 2-7 mm. thick, unbranched, erect; ligule a dense ciliate fringe 1-1.5 mm. long; blades 1-7 dm. long, 3-13 mm. broad, flat or drying involute; corners and dorsal summit of sheaths with abundant soft white hairs 2-6 mm. long; panicle 20-65 cm. long, 8-25 mm. broad, spikelike or with some of the longer branches less strictly appressed than in *S. contractus*, the lower portion included in the uppermost sheath; first glume 1-2 mm. long; second glume 2.6-3.2 mm. long; lemma 2.5-3.1 mm. long; palea about equaling lemma. Loose sandy soil in blowing dune areas, common in the Plains Country s. to Ward, Winkler and Crane cos., infrequent in the w. Trans-Pecos, summer-fall; Colo. and w. Okla. s.w. to Ariz. and s. to n. Chih.

6. *Sporobolus contractus* Hitchc. SPIKE DROPSEED. Tufted perennial; culms 35-115 cm. long, 1.5-3 mm. thick, unbranched, erect; ligule a dense ciliate fringe 0.5-1 mm. long; blades 4-35 cm. long, 3-8 mm. broad, flat or drying mostly involute; corners and dorsal summit of sheath with abundant soft white hairs 2-4 mm. long; panicle 15-50 cm. long, 4-7 mm. thick, dense and spikelike even in the upper portion where not included in the uppermost sheath; first glume 1-2 mm. long; second glume (1.8-) 2-2.7 mm. long; lemma (2.2-) 2.4-3.2 mm. long; palea usually slightly shorter than the lemma. Loose, gravelly and sandy soils, less commonly on rocky hillsides in the Trans-Pecos, late summer-Sept.; Colo. to Nev. and s. to Tex., Chih. and Son.; waived in Ark.

7. *Sporobolus cryptandrus* (Torr.) Gray. SAND DROPSEED. Tufted perennial; culms 3-11 dm. long, 1-3 mm. thick, unbranched, erect; ligule a dense ciliate fringe 0.5-1 mm. long; blades 3-35 cm. long, 2-6 mm. broad, flat or on drying mostly involute; corners and dorsal summit of sheath with abundant soft white hairs 2-4 mm. long, the summit of the sheath often obscurely round-keeled dorsally; panicle 15-40 cm. long, when not included 3-15 cm. broad, open or often partly or entirely included in the uppermost sheath and then linear and spikelike; branches of panicle not verticelled, spreading, the spikelets densely subsecund on the lower (abaxial) sides of the branchlets; first glume 0.5-1.1 (-1.5) mm. long; second glume 1.2-2.1 (-2.7) mm. long; lemma 1.3-2.3 (-2.7) mm. long; palea about as long as lemma. Weedy; abundant in all parts of the state in sandy soil and less abundant in tighter finer disturbed soils, spring-summer-fall; s. Can. and almost all the U.S. except extreme s.e. states (Fla., Ga., Ala., Miss); n. Mex.

Perhaps this species is the most abundant of all our grasses, vying for this position with *Cenchrus incertus*. Because of this abundance, and not because of its food quality, sand dropseed is an important forage grass.

8. *Sporobolus Nealleyi* Vasey. Tufted perennial; culms 15-40 cm. long, 0.5-1 mm. thick, unbranched, erect except the shortly subrhizomatous lower internodes; ligule a very dense ciliate fringe about 0.5 mm. long; blades 2-7 cm. long, 1-1.5 mm. broad when flat and straight but soon closely involute and arcuate, widely spreading from the stem; sheaths at the dorsal summit with a dense zone of short soft white hairs, longer at the corners; panicle 3-9 cm. long, 10-35 mm. broad, open, the basal part occasionally enclosed by the uppermost sheath; first glume 0.5-1.2 mm. long; second glume 1.5-2.2 mm. long; lemma 1.8-2 mm. long; palea about equaling lemma. Sandy, gypsiferous and/or alkaline soil, and blowing gypsum sands in the Trans-Pecos (Crane, Ward, Culberson and Hudspeth cos.), locally abundant, spring-late summer-fall; locally in Nev., Ariz., N.M., Tex. and Coah.

9. *Sporobolus flexuosus* (Thurb.) Rydb. MESA DROPSEED. Tufted perennial; culms 3-10 dm. long, 1-2 mm. thick, erect, unbranched; ligule a ciliate fringe 0.3-0.5 mm. long; blades 5-23 cm. long, 2.4 mm. broad at the base where flat but usually soon involute; sheaths obscurely round-keeled apically, the corners with some soft white hairs but the dorsal summit or collar glabrous or only very sparsely furnished with hairs 1-1.5 mm. long; panicles 12-30 cm. long, 4-9 cm. broad, basally sometimes partially included in the uppermost sheath, open, the branches not whorled, divaricate or even somewhat deflexed and then arcuately reflexed distally, the floriferous branchlets subsecund on the lower side of the branches, mostly widely divergent from the branches, the spikelets borne on tertiary pedicellary branchlets about 1 mm. long which are subsecund along the proximal side of the secondary branchlets; first glume 1-1.3 mm. long; second glume 1.9-2.5 mm. long; lemma 1.9-2.3 mm. long; palea about equaling lemma. Loose usually blowing sand in dune areas in the Trans-Pecos, locally frequent, Sept.-Nov., rarely also in spring; w. Tex. to s. Ut., Nev., s. Calif. and n. Mex.

10. *Sporobolus patens* Swall. Tufted annual; culms 10-25 cm. long, 0.5-1 mm. thick, erect, unbranched; ligule a ciliate fringe about 0.4 mm. long; blades aggregated toward the base of the plant, 5-35 mm. long, 1-2 mm. broad, flat or folded, basally the midrib forming an obscure keel; sheaths obscurely keeled at top and at the corners shortly pilose; panicle 25-50 mm. long, 3-4 cm. broad, subpyramidal, open, the branches in whorls, spreading, flexuous, naked basally, in turn bearing the widely divergent pedicellary branchlets; first glume about 0.3 mm. long; second glume 1.7-1.9 mm. long; lemma 1.8-2 mm. long; palea a little shorter than the lemma. Sandy, gravelly deserts near El Paso in the Trans-Pecos, rare, Sept.; also s. Ariz.

Resembles a small annual version of *S. flexuosus* but the panicle-branches are verticillate as in *S. pyramidatus*.

11. *Sporobolus Buckleyi* Vasey. Tufted perennial; culms 3-10 dm. long, 0.7-2 mm. thick, erect, unbranched; ligule a ciliate-fringed scale 0.2-0.4 mm. long; blades rather few, the basal ones very short, the cauline ones 12-30 cm. long, mostly flat or sharply folded, 3-12 mm. broad about a third the length from the base, gently tapered to the base and to the usually involute point; sheaths very sharply and remarkably folded and keeled, at their margins and corners shortly and inconspicuously pubescent; panicle 11-34 cm. long, 7-17 cm. broad, vaguely pyramidal, very open and diffuse, the numerous branches spreading, not whorled; first glume 0.6-1 mm. long; second glume 0.9-1.3 mm. long; lemma 1.2-1.7 mm. long; palea almost equaling lemma. Deep shade of brush on well-drained calcareous loam, extreme s. Rio Grande Plains (Cameron Co.), Sept.-Nov.; Tex. to n. Ver. and s.e. S.L.P.

12. *Sporobolus pyramidatus* (Lam.) Hitchc. Tufted perennial (flowering first year and often behaving as an annual); culms 1-7 dm. long, 1-2 mm. thick, reclining or usually ascending; ligule a ciliate-fringed scale about 0.5 mm. long; blades aggregated toward the base of the plant, 3-20 cm. long, usually flat for most of the length, somewhat keeled basally, 2-4 mm. broad, the point often loosely involute; corners of sheaths sparsely pilose and upper part of sheaths dorsally keeled; panicle (2-) 3-10 (-20) cm. long, when young loosely ellipsoidal, when mature elegantly pyramidal, diffuse, 15-55 (-80) mm. broad, the branches in definite verticels and widely spreading, naked basally; first glume 0.3-1 mm. long; second glume 1.2-1.9 mm. long; lemma 1.2-2 mm. long; palea about equaling lemma. *S. pulvinatus* Swall. Clay or packed loam, often alkaline or subsaline soil in open disturbed areas, abundant in s.e. Tex. and Rio Grande Plains near the coast, scattered or rare inland to the s. Trans-Pecos, Plains Country and n.-cen. Tex., all year but usually summer-fall; widespread in the warmer parts of Am., n. to Ariz., Colo. and Kan.; also Fla.

13. *Sporobolus domingensis* (Trin.) Kunth. Tufted perennial; culms 2-10 dm. tall, 1-3 mm. thick, erect, leafy; ligule a ciliate-fringed scale 0.5-1 mm. long; blades 5-25 cm. long, usually flat basally or round-keeled, 3-8 mm. broad, tapering to an involute point; corners of sheaths sparsely pilose and upper part of sheath keeled; panicle 8-20 cm. long, 12-20 mm. broad, dense, narrowly ellipsoidal; first glume 0.6-0.9 mm. long; second glume 1.2-2.1 mm. long; lemma 1.5-2 mm. long; palea about equaling lemma. Packed shell or debris (hash) near coast, waived at least once in Nueces Co. (causeway e. to Aransas Pass), probably not persistent in our flora, spring-summer-fall; limey coasts, s. Fla.; W.I.

14. *Sporobolus virginicus* (L.) Kunth. COASTAL DROPSEED. Perennial from scaly creeping stramineous rhizomes 1-3 mm. thick; aerial culms mostly ascending or the lowermost internodes stoloniform, 7-40 cm. long, 1-3 mm. thick, leafy; ligule a ciliate scale 0.2-0.4 mm. long; blades 3-20 cm. long, usually flat at the very base or rounded-keeled and 2.5-4 mm. broad, tapering to an involute point; corners of sheaths sparsely pilose and upper part of sheath dorsally keeled; panicle 25-80 mm. long, 6-10 mm. broad, dense, spikelike or usually narrowly ellipsoidal or oblong-ellipsoidal; first glume 1.3-2.8 mm. long; second glume 1.8-3 mm. long; lemma 2.1-3 mm. long; palea about as long as lemma. Packed loamy somewhat saline soil all along the Tex. coast, common, summer-fall; warmer Atl. and Carib. coasts, s. to Braz. and n. to Va.

15. *Sporobolus indicus* (L.) R. Br. SMUTGRASS. Tufted perennial; culms 3-11 dm. long, 1-3 mm. thick, erect, unbranched; ligule obsolete or only a scale 0.1 mm. long; blades aggregated at the base of the plant, 15-25 (-50) cm. long, at the base usually flat or sharply folded, 3-5 mm. broad, tapering to a long involute arcuate tip; upper part of the sheaths usually dorsally keeled; panicles 1-4 dm. long, 5-10 mm. thick, dense, spikelike, often somewhat interrupted in the lower part; first glume 0.4-0.9 mm. long; second glume 0.8-1.3 mm. long; lemma 1.4-2 mm. long; palea 1.2-1.8 mm. long; pericarp mucilaginous, the grain often sticking persistently instead of falling readily as in many dropseeds. In some works erroneously called *S. Poiretii*. Mud and moist loam, low prairies and swales, e. and s.e. Tex., s.w. to Bexar, DeWitt, Goliad and Aransas cos., frequent, late spring-Nov.; widely distributed in the warmer parts of the world, nat. to the Old World; in Am. occurring n. to Va., Tenn., Ark. and Okla.

16. *Sporobolus purpurascens* (Sw.) Hamilt. Tufted perennial; culms 25-90 cm. long, 1-2 mm. thick, erect, unbranched; ligule an erose scale about 0.2 mm. long; blades aggregated at the base of the plant, mostly straight and often sparsely pilose, 3-15 (-22) cm. long, at least the basal part flat and 2-5 mm. broad, usually tapering to an involute tip; panicles 7-30 cm. long, 6-16 mm. broad, often like a much-interrupted spike, the numerous short branches in dense whorls, appressed, floriferous nearly to the base; first glume 1.6-2.5 mm. long; second glume 3.2-4.5 mm. long; lemma 3-4 mm. long, usually rufescent-purple; palea 3.2-4 mm. long. Prairies and brush on loose sandy soil, Rio Grande Plains n. to s. Bexar Co., infrequent, summer-fall; Tex. to Mex.; W.I.; Braz.

17. *Sporobolus junceus* (Michx.) Kunth. Tufted perennial; culms 5-10 dm. long, 1-2 mm. thick, erect, unbranched; ligule a minute fringed scale 0.1-0.2 mm. long; blades aggregated toward the base of the plant, 1-3 dm. long, 1-2 mm. broad when flat but soon involute and irregularly arcuate; panicles 9-25 cm. long, 9-40 mm. broad, interrupted, occasionally somewhat spikelike but usually rather open, the branches in whorls, spreading, naked in the lower half; first glume 1.2-3 mm. long; second glume 3-3.8 mm. long; lemma 2.8-3.7 mm. long, usually rufescent-purple; palea 2.8-3.5 mm. long. Loose sandy soil, open forests and forest openings, e. and s.e. Tex., s.w. to Atascosa and San Patricio cos., infrequent; Coastal States, Va. to Tex.

In the southwest extremity of its distribution this approaches *S. purpurascens* in the form of the panicle.

18. *Sporobolus Silveanus* Swall. Tufted perennial from slightly swollen bases; culms 50-115 cm. long, 1-2 mm. thick, erect, unbranched; ligule a dense line of minute cilia or a minute lacerate-ciliate scale about 0.1 mm. long; blades aggregated toward the base of the plant, 15-50 cm. long, 1-2 mm. broad, flat or soon involute; sheaths at the summit dorsally with some soft hairs 1-2 mm. long; panicles 15-50 cm. long, 5-15 cm. broad, open, the branches stiffly ascending, not whorled, naked at base; pedicels 3-12 mm. long, the spikelets remote; first glume 3-4.5 mm. long; second glume 4.5-6 mm. long; lemma 4.5-6.1 mm. long, dark-purple; palea about as long as lemma, often a little longer, also purple. Sandy soils, meadows and openings in forests, e. Tex., rare, fall; also w. La.

19. *Sporobolus heterolepis* (Gray) Gray. PRAIRIE DROPSEED. Tufted perennial; culms 30-75 cm. long, 1-2 mm. thick, erect, unbranched; ligule a lacerate scale about 0.2 mm. long; blades aggregated toward the base of the plant, 8-36 cm. long, 1-2 mm. broad, usually folded basally and involute-arcuate distally; sheaths essentially glabrous except occasionally at the corners; panicles 5-20 cm. long, 15-30 mm. broad, fairly open but the whorled basally naked branches ascending; pedicels 1-3 mm. long; first glume 1.9-3 (rarely to 4) mm. long; second glume 3.5-4.5 (rarely to 6) mm. long; lemma 3-5 (rarely

to 6) mm. long; palea about equaling lemma; caryopsis nearly globose. Sandy soil, e. Tex., rare, Sept.-Oct.; Que. to Sas k.s. to N.E., O., Ind., Ill., Ark. and Tex.

20. *Sporobolus asper* (Michx.) Kunth. TALL DROPSEED. Tufted perennial (but sometimes flowering the first year), often with shortly subrhizomatous lowermost internodes or these elongated into creeping rhizomes in loose sandy soils; ligule a minute ciliate-fringed scale 0.1-0.2 mm. long or nearly obsolete; culms 4-12 dm. long, 1-4 mm. thick, leafy, erect or ascending and slightly geniculate at the lower nodes; blades of the lower half of the plant 15-40 cm. long, 1-3.5 mm. broad at base, quickly and very closely involute into a filiform arcuate distal portion, glabrous or pilose near the ligule or more extensively; sheaths glabrous or on the corners and occasionally at the summit dorsally somewhat pilose; panicles 5-24 cm. long, 4-12 (-18) mm. thick, spike-like but often interrupted, terminal, rarely axillary, often some or all included in the sheath; first glume (1.7-) 2-3.2 (-4.5) mm. long; second glume (2-) 3-4 (-5) mm. long; lemma (3-) 4-5 (-6) mm. long, glabrous or minutely pubescent; palea usually a little shorter than the lemma, occasionally a little longer, the cleistogamous spikelets of the enclosed inflorescences usually approaching the lower extremes of the measurements given above. Incl. var. *clandestinus* (Biehler) Shinnars and var. *canovirens* (Nash) Shinnars, *S. clandestinus* (Biehler) Hitchc., *S. canovirens* Nash. Often weedy, in a variety of circumstances, e. and s.e. Tex., w. to e. Plains Country and n.e. Rio Grande Plains, common, Sept.-Dec.; e. U.S. w. to N.D., S.D., Neb., Kan., Okla. and e. Tex.; also scattered to Mont., Wash., Colo., Ut., N.M. and Ariz.

The plants with rhizomes of loose, sandy soil are called *S. asper* var. *macer* (Trin.) Shinnars or *S. macer* (Trin.) Hitchc. but they are otherwise inseparable from the typical *S. asper*. Some plants have various combinations of the characteristics of more diffuse, less strongly perennial, less robust habit, more geniculate stems, shorter leaves, shorter and more numerous and usually more hidden and axillary panicles, and small spikelets, showing intergradation to *S. vaginaeflorus*; these plants are called *S. asper* var. *Hookeri* (Trin.) Vasey or *S. asper* var. *pilosus* (Vasey) Hitchc., the latter name applying to the plants in which the basal parts of the blades and the upper parts of the sheaths are pilose. Certain plants are so nearly intermediate that they cannot be referred with certainty to either *S. asper* or *S. vaginaeflorus*.

21. *Sporobolus vaginaeflorus* (Torr.) Wood. Tufted annual; culms 15-55 cm. long, 0.5-1 mm. thick, leafy, usually reclining in the lower part, distally ascending, geniculate; ligule a minute ciliate-fringed scale 0.1-0.2 mm. long; blades of the lower part of the plant 3-5 cm. long (or those at the very base to 13 cm. long), 1-2 mm. broad at the base, flat or soon tightly involute-filiform, often pilose near the ligule and on the margins; sheaths often pilose at the corners; panicles mostly axillary (usually each culm with one terminal and 2 to 4 axillary), 1-3 (-4.5) cm. long, 2-3 mm. thick, spike-like, partly or all hidden in the sheaths; first glume (1.5-) 2-3.5 (-4.5) mm. long; second glume (1.5-) 3-4 (-4.5) mm. long; lemma (1.7-) 3-4 (-4.5) mm. long, pubescent or glabrous; palea about as long as lemma or longer or shorter. E. and n.-cen. Tex., w. to e. Edwards Plateau and e. Plains Country, common, fall (rarely late summer); e. U.S. w. to the Dakotas, Neb., Kan., Okla. and Tex.; also scattered to N.M., Ariz., Colo. and Wash.

The names *S. neglectus* Nash or *S. vaginaeflorus* var. *neglectus* (Nash.) Scribn. apply especially to those plants with more glabrous, mostly cleistogamous, enclosed spikelets. *S. vaginaeflorus* var. *inequalis* Fern. is the name applied to the scattered form in which the palea is apically prolonged. Some of the pilose plants, mostly in limestone hills on the eastern edge of the Edwards Plateau, are of the form known as *S. vaginaeflorus* var. *ozarkanus* (Fern.) Shinnars. They belong mostly among the common plants showing intergradation to *S. asper* var. *pilosus*.

88. BLEPHARONEURON NASH

A monotypic genus.

1. *Blepharoneuron tricholepis* (Torr.) Nash. HAIRY DROPSEED. Tufted perennial; culms 2-6 dm. tall, about 1 mm. thick, unbranched, erect; ligule a membranous scale 2-5 mm. long; blades aggregated toward the base of the plant, 3-15 cm. long, 1-1.5 mm. broad when flat but mostly folded or tightly involute, arched; panicles 5-20 cm. long,

1-7 cm. thick, diffuse, the branches ascending, few-flowered; pedicellary branchlets very slender, flexuous; spikelets 1-flowered, not markedly compressed, plumbeous, awnless; first glume 2-2.5 mm. long; second glume 2.3-3 mm. long; zone of abscission between the glumes and the floret; lemma a little longer than second glume, the 3 nerves dorsally densely villous; palea slightly longer than lemma, with a median dorsal band densely villous like the nerves of the lemma. Open pine woods on rocky slopes at elev. greater than 5,000 ft., Trans-Pecos mts., locally abundant, Aug.-Sept.; Colo. to Ut. and s. to Dgo.

89. LYCURUS H.B.K.

A genus of 3 species occurring from southwestern United States to northern tropical South America.

1. *Lycurus phleoides* H.B.K. WOLFTAIL. Tufted perennial; culms erect, rarely branched, 15-60 cm. long, 1 mm. thick, sparsely leafy; ligule a pointed scale 3-9 mm. long; blades aggregated toward the base of the plant, 4-15 cm. long, tightly folded, the white midrib forming a dorsal keel, 1.5-2.5 mm. broad when unfolded; panicle spike-like, 5-9 cm. long, 5-7 mm. thick, the pedicellary branchlets very short, borne in pairs, unequal, with a zone of abscission at the base of each pair, the 2 spikelets and their pedicels then falling together as a unit; spikelet on shorter pedicel sterile; first glume bicuspid, 1-1.5 mm. long, bearing on each tooth a persistent awn much longer than the body of the glume; lemma firm, folded or involute, 2-4 mm. long, lanceolate, acute, bearing a persistent awn shorter than the lemma; palea about as long as lemma. Grasslands and semidesert scrub on rocky slopes, common in the Trans-Pecos, less common in w. Edwards Plateau and w. Plains Country, summer; Okla., Colo. and Ut. to s. Mex.

Wolftail has considerable forage value.

90. MUHLENBERGIA SCHREB. MUHLY

Spikelets small, one-flowered (rarely 2-flowered in *M. arenacea* and *M. asperifolia*); glumes usually shorter than (or in *M. rigens*, *M. Lindheimeri*, and *M. Emersleyi* equaling or in *M. andina* surpassing) the lemma, in *M. Schreberi* the first glume nearly obsolete; zone of abscission between the glumes and lemma (another zone of abscission sometimes present below the spikelets, and in 2 species, *M. depauperata* and *M. brevis*, a zone of abscission at the base of each 2-flowered branchlet); lemma 3-nerved (nerves commonly inconspicuous), basally with a minute callus and awnless or with a mucro or a short or long awn. *Epicampes* J. & C. Presl.

A genus of more than 100 species that occur from the Himalaya Mts. to Japan, and from North America to the Andes. The genus, as now interpreted, is very diverse, being a taxonomic dumping ground. Some of the muhlys are quite abundant and are valuable forage.

1. Both glumes and lemmas shorter than 2 mm. or barely attaining 2 mm. in length (2)
1. Either glumes or lemmas or both longer than 2 mm. (7)
- 2(1). Panicles spike-like; leaves all involute and of 2 size-classes 4. *M. utilis*.
2. Panicles not spike-like, open and mostly diffuse; leaves various but not obviously of 2 size-classes (3)
- 3(2). Rhizomatous perennials (4)
3. Tufted annuals (5)
- 4(3). Lemma 1.5-2 mm. long; lateral portions of ligule elongated over corners of sheaths into pointed auricles 33. *M. arenacea*.
4. Lemma 1.2-1.5 mm. long; auricles absent 34. *M. asperifolia*.
- 5(3). Glumes 1-1.5 mm. long; lemma with a deciduous awn 1-2 mm. long 37. *M. eludens*.
5. Glumes 0.6-1 mm. long; lemma awnless or with an awn to 1 mm. long (6)

- 6(5). Glumes pubescent (use lens); main panicle branches often flexuous, ascending35. *M. minutissima*.
6. Glumes glabrous; main panicle branches diverging at right angles, nearly straight36. *M. fragilis*.
- 7(1). Annuals; panicles spikelike, each branchlet of panicle short, appressed, with one basal spikelet and one terminal spikelet, and a zone of abscission at base of each branchlet, the spikelets thus falling in pairs (8)
7. Perennials; panicles not so composed (9)
- 8(7). Glumes and lemma about 3 mm. long, the latter with an awn 1.5-11 mm. long 1. *M. depauperata*.
8. First glume 1.5-2 mm. long, the second one 2-3 mm. long; lemma about 5 mm. long, with an awn 9-20 mm. long 2. *M. brevis*.
- 9(7). Glumes 3-4 mm. long but lemma 2-3 mm. long, the callus of the lemma bearing hairs as long as the body of the lemma12. *M. andina*.
9. Lemma equaling or surpassing glumes and hairs of the lemma proportionately much shorter (10)
- 10(9). Second glume a fourth to a tenth as long as the lemma (excluding awn) (11)
10. Second glume at least a third as long as the lemma (13)
- 11(10). Glumes 0.1-0.3 mm. long; lemma about 2 mm. long; plants stoloniferous19. *M. Schreberi*.
11. Glumes at least 0.5 mm. long; lemma at least 3 mm. long; stolons absent (12)
- 12(11). Glumes 0.5-1 mm. long; lemma 3-4 mm. long; awn 19-37 mm. long; culms geniculately branched in the lower part; panicle about 1 cm. thick18. *M. parviglumis*.
12. Glumes 1-1.3 mm. long; lemma 4-5 mm. long; awn 10-22 mm. long; culms essentially unbranched above the base; panicle at least 2 cm. broad, usually much broader20. *M. rigida*.
- 13(10). Mature panicles less than 11 mm. thick and less than 17 cm. long (14)
13. Mature panicles more than 11 mm. thick or more than 17 cm. long, or both (29)
- 14(13). Sheaths sharply keeled (15)
14. Sheaths not sharply keeled (16)
- 15(14). Lemmas glabrous or minutely pubescent29. *M. Lindheimeri*.
15. Lemmas villous on the lower half30. *M. Emersleyi*.
- 16(14). Lemmas (including callus) glabrous (17)
16. Lemmas with some pubescence (20)
- 17(16). Awn 5-20 mm. long15. *M. pauciflora*.
17. Lemma awnless, mucronate or with an awnlike tip less than 5 mm. long (18)
- 18(17). Panicles 3-10 cm. long; leaf blades not distinctly falling into 2 size-classes, flat; plants of moist places, north-central Texas 9. *M. glabriflora*.
18. Panicles 1-4 cm. long; leaf blades of 2 size-classes, those of the innovations from the rhizome larger than those of the floriferous branches, the latter sort involute (19)
- 19(18). Lemma 2.5-4 mm. long including the mucro or short awn 3. *M. repens*.
19. Lemma 1.6-2 mm. long 4. *M. utilis*.
- 20(16). Lemma mucronate or with an awn 3 mm. long or shorter (21)
20. Lemma with an awn more than 3 mm. long (26)
- 21(20). Blades 15-30 mm. long, about 1 mm. thick (as rolled), involute 5. *M. villosa*.
21. Blades mostly more than 30 mm. long, flat at least in the lower half (22)

- 22(21). Spikelets (excluding awns) about twice as long as broad; plants of Trans-Pecos mountains 13. *M. glauca*.
22. Spikelets (excluding awns) more than twice as long as broad; plants not occurring in Trans-Pecos mountains (23)
- 23(22). Glumes with stiff awn tips 2-5 mm. long, much-exceeding the lemma; blades stiffly appressed or ascending 11. *M. racemosa*.
23. Glumes with or without awnlike tips but shorter than the body of the lemma or else exceeding it by only about 0.5 mm. (24)
- 24(23). Glumes 2.5-3.5 mm. long including short awnlike tips; lemma about 3 mm. long including the awnlike tip; leaves soft and neither stiffly appressed nor divergent; panicles dense 8. *M. frondosa*.
24. Glumes 1-2.5 mm. long including the mucro; lemma 2-3 mm. long, awnless or with a mucro or short awn to 3 mm. long; blades markedly divaricate from the culm (25)
- 25(24). Panicles 1-2 mm. thick; lemma about 3 mm. long and with a mucro or short awn to 1 mm. long 7. *M. brachyphylla*.
25. Panicles 2-3 mm. thick; lemma 2-2.5 mm. long and with a mucro or a short awn 1-3 mm. long 6. *M. sobolifera*.
- 26(20). Awn 3-10 mm. long; rhizomes whitish, conspicuous; plants of shady woods, eastern Edwards Plateau and north-central Texas .. 10. *M. sylvatica*.
26. Awn 9-25 mm. long; rhizomes sordid, inconspicuous or absent; plants of dry slopes, Trans-Pecos Texas and western Edwards Plateau (27)
- 27(26). Panicle 9-20 mm. thick; second glume 3-toothed; rhizomes absent; old sheaths usually drying curled up like wood-shavings 16. *M. montana*.
27. Panicles less than 9 mm. thick; second glume not 3-toothed (28)
- 28(27). Rhizomes present (but often broken off the dried specimens); lower portions of culms not markedly geniculate; lower half of lemma usually densely pubescent; glumes with awns 0.5-3 mm. long, equaling the lemma 14. *M. polycaulis*.
28. Rhizomes absent; lower part of plant geniculate and much-branched; pubescence of lemma usually confined to callus and basal margins; glumes not awned, only about two thirds as long as lemma 17. *M. monticola*.
- 29(13). Mature panicles 2 cm. or less thick, mostly spikelike (30)
29. Mature panicles 2 cm. thick or mostly much thicker, often open and not at all spikelike (35)
- 30(29). Sheaths sharply keeled (31)
30. Sheaths not sharply keeled (32)
- 31(30). Lemmas glabrous or very finely pubescent 29. *M. Lindheimeri*.
31. Lemmas densely villous in the lower part 30. *M. Emersleyi*.
- 32(30). Second glume 3-toothed 16. *M. montana*.
32. Second glume not distinctly 3-toothed (33)
- 33(32). Culms 1 mm. or less thick, much-geniculately-branched in the lower part
..... 17. *M. monticola*.
33. Culms more than 1 mm. thick, essentially unbranched above the base (34)
- 34(33). Glumes about as long as lemma; lemma about 3 mm. long
..... 31. *M. rigens*.
34. Glumes about half as long as lemma; lemma 3.5-4.5 mm. long
..... 32. *M. dubia*.
- 35(29). Glumes less than half as long as lemma (36)
35. Glumes more than half as long as lemma (37)
- 36(35). Awn 10-28 mm. long 21. *M. setifolia*.
36. Awn 0.5-7 mm. long 27. *M. Reverchonii*.
- 37(35). Blades mostly less than 4 cm. long (38)

37. Blades mostly more than 4 cm. long (40)
 38(37). Awn 5-13 mm. long; nodes swollen24. *M. Porteri*.
 38. Awn shorter than 5 mm. long (39)
 39(38). Ligule about 1 mm. long; blades sharp-pointed, not confined to the base of the plant25. *M. pungens*.
 39. Ligule 3-10 mm. long; blades markedly arcuate, curled almost into ringlets, confined to the base of the plant23. *M. Torreyi*.
 40(37). Sheaths not keeled, the old ones commonly frayed into a fibrous mass at the base of the plant; panicles very open and diffuse ..26. *M. capillaris*.
 40. Sheaths keeled, sometimes somewhat rounded (41)
 41(40). Mature panicles 5-13 cm. broad; blades when unrolled only 1-2 mm. broad ..
22. *M. arenicola*.
 41. Mature panicles less than 5 cm. broad; blades 2-5 mm. broad (42)
 42(41). Lemma minutely pubescent all over or glabrous ..29. *M. Lindheimeri*.
 42. Lemma densely pubescent in the lower part at least on the margins (43)
 43(42). Blades involute; pubescence of the lemma nearly confined to the margins
28. *M. involuta*.
 43. Blades folded at least near the base, involute near the tip; pubescence of lemma well-distributed on the lower part30. *M. Emersleyi*.

1. *Muhlenbergia depauperata* Scribn. Tufted annual; culms 2-15 cm. long, about 0.5 mm. thick, geniculately branched in the lower half, erect; ligule a dissected hyaline scale 2 mm. long, the lateral "auricles" simply continuations of the hyaline sheath margins; blades 9-25 mm. long, 1-1.5 mm. broad, flat or often folded and arcuate, the white midrib forming a keel; panicles 1-6 cm. long, about 2 mm. thick, spike-like but interrupted; spikelets all perfect but borne in pairs on the branchlets, one appearing sessile at the base of each branchlet, the other terminal, the zone of abscission at the base of the branchlet, the spikelets thus falling in pairs (cf. *Lycurus*); first glume about 3 mm. long, shallowly and often unequally bicuspid, each tooth mucronate; second glume about 3 mm. long, acuminate; lemma about 3 mm. long, very minutely bifid, with an awn 1.5-11 mm. long; palea equaling lemma. Grassy slopes of dark volcanic rock, Trans-Pecos mts. (Davis and Chisos) at elev. of about 5,000 ft., rare, Aug.-Oct.; N.M. to Ariz. and s. to cen. Mex.

Perhaps to be referred to the genus *Lycurus* but differing essentially in that both spikelets of each pair are fertile.

2. *Muhlenbergia brevis* C. Goodd. Like *M. depauperata* but first glume 1.5-2 mm. long; second glume 2-3 mm. long; lemma about 5 mm. long, with an awn 9-20 mm. long. Grassy slopes of dark volcanic rock, Trans-Pecos mts. at elev. of about 8,000 ft., rare (Mt. Livermore), Aug.; Colo. to Ariz. and s. to Mex.

3. *Muhlenbergia repens* (Presl) Hitchc. CREEPING MUHLY. Perennial from firm creeping rhizomes 1-2 mm. thick; aerial culms 10-35 cm. long, 1-1.5 mm. thick, stramineous, mostly reclining, only the last few cm. erect, leafy, bearing numerous short floriferous branches; ligule a scale 0.5-1 mm. long, not auricled; blades of 2 classes, those of the long innovations from the rhizome large (3-9 cm. long), flat, about 2 mm. broad basally and tapering to an involute point, those of the short erect floriferous branches 5-30 mm. long and mostly closely involute and arcuate; panicles 1-4 cm. long, 2-3 mm. thick, much-interrupted, the spikelets remote; glumes 1.5-3 mm. long, ovate, often mucronate; lemma 2.5-4 mm. long including a mucro or short awn; palea almost as long as lemma. *M. abata* I. M. Johnst. Rocky slopes and gravelly flats in the Trans-Pecos and s. Plains Country, locally abundant, usually Oct.-Nov., rarely spring-summer; Tex. to Ariz. and s. to s. Mex.

4. *Muhlenbergia utilis* (Torr.) Hitchc. APAREJO MUHLY. Like *M. repens* but the larger blades 15-35 mm. long, about 1 mm. broad and mostly involute, the smaller blades 5-20 mm. long and closely involute and arcuate, 0.2-0.4 mm. thick as rolled; glumes 0.6-1.5 mm. long; lemma 1.6-2 mm. long, scarcely mucronate. Calcareous seasonally muddy soil along streams, Edwards Plateau, locally abundant, usually fall-early winter, occasionally spring-summer; Tex. and n.e. Mex.; also Calif. and Nev.

5. *Muhlenbergia villosa* Swall. Perennial from long firm rhizomes 1-3 mm. thick; aerial culms 4-26 cm. long, 0.5-1 mm. thick, leafy, profusely branched near the ground, ascending; ligule an erose scale 0.5-1.7 mm. long; blades 15-30 mm. long, less than 1 mm. thick, closely involute and reflex-arcuate; panicles 1-4 cm. long, 1-2 mm. thick, spikelike but interrupted; glumes 1-1.5 mm. long, ovate, awnless; lemma 2.2-2.7 mm. long, copiously pubescent on the lower half, lanceolate, mucronate; palea about as long as lemma. Alkaline desert flats in the Trans-Pecos and w. Edwards Plateau, rare, July-Aug.; endemic.

6. *Muhlenbergia sobolifera* (Muhl.) Trin. Perennial from scaly white rhizomes 1-2 mm. thick; aerial culms 4-10 dm. tall, about 1 mm. thick, erect, sparingly branched, leafy but the upper 5-15 cm. of the culm naked and pedunculiform; ligule a scale 0.3-1 mm. long, not auricled; blades 4-16 cm. long, 1.5-8 mm. broad, flat, divergent, the lower older ones falling readily; panicles 5-17 cm. long, 2-3 mm. thick, weak and nodding, usually interrupted near the base; glumes 1-2.2 mm. long, usually merely acute but sometimes acuminate or mucronate; lemma 2-2.5 mm. long including the mucro or the mucro absent, or occasionally with an awn 1-3 mm. long, pubescent on the lower part. Incl. var. *setigera* Scribn. Dry rocky woods, n.-cen. Tex., rare (Dallas), also recently reported from the Panhandle (Hemphill Co.), Sept.-Oct.; N.H. to Va. and w. to Neb., Kan., Okla. and Tex.

7. *Muhlenbergia brachyphylla* Bush. Perennial from scaly white rhizomes 1-2 mm. thick; aerial culms 3-10 dm. long, 0.5-1.3 mm. thick, erect, moderately geniculately branched near the middle, leafy but the upper 1-10 cm. of the culm usually naked and pedunculiform; ligule a scale about 0.5 mm. long; blades 3-7 cm. long, 2-5 mm. broad, flat, divergent, the older ones falling readily; panicles 3-13 cm. long, 1-2 mm. thick, weak and nodding, usually interrupted in the lower part; glumes 1.2-2.5 mm. long, usually mucronate, the first one conspicuously shorter than the second; lemma about 3 mm. long and with a mucro or short awn usually less than 1 mm. long, pubescent on the lower part; palea about 3 mm. long. Woods near streams, n.-cen. Tex., infrequent, Oct.; Md., Va., and N.C.; also Ind. and Mich. s.w. to Tex.

Perhaps conspecific with *M. sobolifera*.

8. *Muhlenbergia frondosa* (Poir.) Fern. WIRESTEM MUHLY. Perennial from scaly white rhizomes 1-2 mm. thick; aerial culms 3-10 dm. long, 1-2 mm. thick, leafy, profusely geniculately branched near the middle, top-heavy and falling over (then often rooting at the nodes), the naked pedunculiform terminal internodes only 1-4 cm. long or absent; ligule an erose scale 0.5-1 mm. long, not auricled; blades 4-11 cm. long, 1.5-5 mm. broad, flat, ascending or appressed; panicles 3-10 cm. long, when only 1-2 mm. thick then linear but when 3-6 mm. thick tapered to both ends, loose and interrupted; glumes 2.5-3.5 mm. long including the awnlike tip, linear-lanceolate; lemma about 3 mm. long, awnless, pubescent on the lower part; palea about 3 mm. long. Woods, n.-cen. Tex., rare (Dallas and Grayson cos.), Oct.; e. Can. s. to n. Ala. and Tex.

9. *Muhlenbergia glabriflora* Scribn. Like *M. frondosa* but the lemma glabrous and the internodes minutely strigose in a zone just below the nodes (use a strong lens). Woods, n.-cen. Tex., rare (Dallas Co.), late Sept.; Va. s. to N.C.; also Ind. and Ill. s.w. to Tex. No doubt merely a form of *M. frondosa*.

10. *Muhlenbergia sylvatica* (Torr.) Torr. Perennial from scaly rhizomes 1-2.5 mm. thick; aerial culms 4-10 dm. long, 1-3 mm. thick, leafy, moderately branched near the middle, weak and often reclining, the lower nodes rooting, the internodes minutely strigose in a zone just below the nodes (use lens), the terminal internodes short and not pedunculiform; ligule an erose scale 0.5-1.2 mm. long; blades 6-18 cm. long, 2-7 mm. broad, flat, ascending; panicles 4-10 cm. long, 3-5 mm. thick, somewhat spikelike, interrupted, nodding; glumes about 2 mm. long, awnless or with an awnlike tip 0.1-1 mm. long; lemma about 3 mm. long, pubescent in the lower part, with an awn 3-10 mm. long; palea about 3 mm. long. Dense woods, n.-cen. Tex. and e. Edwards Plateau, rare, Aug.-Sept.; s.e. Can. s. to n. Ala. and Tex.

11. *Muhlenbergia racemosa* (Michx.) B.S.P. Perennial from scaly white rhizomes 1-2 mm. thick; aerial culms 3-7 dm. long, 0.5-2.5 mm. thick, erect, leafy, sparingly branched; ligule an erose scale 0.5-1 mm. long, without auricles; blades 4-16 cm. long, 1-7 mm. broad, flat, rather stiffly erect; panicles 2-14 cm. long, 4-11 mm. thick, spikelike but usually interrupted; glumes 1.5-2 mm. long, lanceolate, apically with a stiff awn

2-5 mm. long; lemma 2.5-3.5 mm. long, short-pilose on the lower half, acuminate or the apical portion awnlike; palea nearly equaling lemma. Moist ground, Plains Country, rare (one collection from Perryton, Ochiltree Co.), Sept.-Oct.; most of U.S. w. of Miss. River.

12. *Muhlenbergia andina* (Nutt.) Hitchc. FOXTAIL MUILLY. Perennial from scaly white rhizomes 1-2 mm. thick; aerial culms 25-80 cm. long, 1-1.5 mm. thick, erect, leafy, sparingly branched; ligule a scale about 1 mm. long, laterally with very short auricular points; blades 5-18 cm. long, 1-3 mm. broad (rarely to 5 mm.), flat; panicle 4-12 cm. long, 6-15 mm. thick, spikelike but usually interrupted; glumes 3-4 mm. long, shining, grayish, keeled, awnless; lemma 2-3 mm. long, linear, grayish, glabrous but with a basal callus bearing a beard of hairs 2-3 mm. long and an apical awn 4-8 mm. long; palea nearly equaling lemma. Trans-Pecos, rare (one collection from "Sierra Blanca" suspected of being mislabeled), otherwise known from moist ground at high elev.; w. U.S. e. to Wyo., Colo. and N.M.

13. *Muhlenbergia glauca* (Nees) Mez. Perennial from firm rhizomes 1-2 mm. thick; aerial culms 2-5 dm. long, 1-2 mm. thick, leafy, branched near the ground, stiffly erect; ligule a scale 0.5-1 mm. long, not auricled; blades 2-11 cm. long, 1-3 mm. broad, ascending or usually stiffly appressed, flat, narrowed to a short involute tip; panicles 4-12 cm. long, 3-6 mm. thick, much-interrupted but somewhat spikelike; glumes 1.3-2.5 mm. long, ovate, acute, with a mucro or awn 0.2-1.5 mm. long, occasionally the tip minutely bifid and the awn or mucro borne between the teeth; lemma 2.5-3.5 mm. long, lanceolate, copiously pubescent in the lower part, with an awn 0.5-3 mm. long; palea about as long as lemma. Rocky slopes, usually under shrubbery, at elev. of 4,500-7,000 ft., Trans-Pecos mts., infrequent, July-Oct.; Tex. to s. Calif. and s. to cen. Mex.

14. *Muhlenbergia polycaulis* Scribn. Perennial from numerous short firm rhizomes 1-2 mm. thick; aerial culms 25-40 cm. long, about 1 mm. thick, leafy, profusely branched near the ground, ascending; ligule an erose scale 0.5-1 mm. long, not auricled; blades 3-8 cm. long, about 1 mm. broad, ascending, flat, tapering to an involute point; panicles 3-9 cm. long, 3-6 mm. thick, greatly interrupted, spiciform or the branches occasionally slightly divergent; glumes 1.5-2.3 mm. long, ovate, acute, with an awn 0.5-3 mm. long, occasionally 1 or both minutely bifid, the awn then emerging between the two lobes; lemma 2.2-3.5 mm. long, lanceolate, copiously pubescent in the lower part, with an awn 9-25 mm. long; palea about as long as lemma. Rocky grassy slopes at elev. of 5,500-8,000 ft., Trans-Pecos mts., infrequent, Aug.-Oct.; Tex. to s. Ariz. and s. to cen. Mex.

15. *Muhlenbergia pauciflora* Buckl. Perennial from very short firm rhizomes 1-2 mm. thick or these absent in many prepared specimens; aerial culms 22-60 cm. long, 1-2 mm. thick, often glaucous, leafy, sparingly branched in the lower part, erect or occasionally the lowermost internodes reclining (the nodes then rooting); ligule a lacerate-ciliate scale about 1 mm. long, with slightly longer auricles as extensions of the corners of the sheath; old sheaths becoming flat and often corkscrewlike with age; blades 4-11 mm. long, filiform-involute, deciduous from the sheaths; panicles 4-12 cm. long, 3-15 mm. thick, with short ascending densely-flowered branches; glumes 1.3-3 mm. long, ovate, often mucronate; lemma 3-4.5 mm. long, linear-lanceolate, essentially glabrous (including the callus) or rarely minutely strigose (use lens), with an awn 5-20 mm. long; palea about as long as lemma. Rocky slopes, Trans-Pecos mts. at elev. of 4,500-7,000 ft., infrequent, June-Oct. (usually Aug.-Sept.); Colo. and Ut., s. to Baja Calif., Son. and Chih.

16. *Muhlenbergia montana* (Nutt.) Hitchc. MOUNTAIN MUHLY. Tufted perennial; culms 3-8 dm. long, 0.7-1.7 mm. thick, erect, unbranched; ligule a fragile hyaline scale 3-11 mm. long; blades 1-2 dm. long, about 2 mm. broad, soon involute and arcuate; old sheaths persistent and becoming flat, stramineous and taking on a corkscrewlike twist; panicles 8-25 cm. long, 9-20 mm. broad, much-interrupted and open (or when immature somewhat spikelike); first glume 0.5-1.5 mm. long, elliptic, usually mucronate; second glume 1-2.2 mm. long, with three mucronate teeth; lemma 3-4.5 mm. long, linear-lanceolate, scaberulous in upper half, usually discolored or splotched, the awn 1-2 cm. long. Forested slopes of igneous rocks at elev. of 7,500-8,300 ft., Trans-Pecos mts. (Davis), infrequent, Sept.; Rocky Mts. and Sierra Madre from w. Mont. and Calif. s. to s. Mex.

17. *Muhlenbergia monticola* Buckl. MESA MUHLY. Tufted perennial; culms 13-70 cm. long, 0.5-1 mm. thick, ascending, leafy, densely geniculately branched in the lower part, the sheaths separating from the internodes and exposing the well-developed prophylls; ligule a lacerate-ciliate scale 0.5-2 mm. long; blades 2-11 cm. long, about 1 mm. broad, flat but soon involute; panicle 2-22 (usually 5-10) cm. long, 3-6 mm. thick, spikelike but lax and interrupted, the branches appressed; glumes acute, the first 1.3-1.9 mm. long, the second 1.8-2.3 mm. long; lemma lanceolate, 2.5-3 mm. long, the callus and also usually the lower half pubescent, the awn 10-23 mm. long. Rocky slopes in the Trans-Pecos and w. Edwards Plateau, frequent, summer-fall; Tex. and N.M. to Ariz. s. to cen. Mex.

18. *Muhlenbergia parviglumis* Vasey. Tufted perennial; culms 3-8 dm. long, about 1 mm. thick, ascending, leafy, geniculately branched in the lower part, the sheaths spreading from the internodes and exposing the well-developed prophylls, occasionally the lowest nodes rooting; ligule a lacerate-ciliate scale 1-2 mm. long; blades 4-15 cm. long, 1-2.5 mm. broad, flat or soon involute; panicle 5-22 (usually 8-12) cm. long, 3-10 mm. thick, spikelike but lax and interrupted, the branches appressed; glumes 0.5-1 mm. long, the first slightly shorter than the second; lemma 3-4 mm. long, linear-lanceolate, the callus and occasionally the lower half pubescent, the awn 19-37 mm. long. Rocky slopes, Trans-Pecos mts., infrequent, summer-fall; Tex. and N.M., s.e. to n.e. Mex.

19. *Muhlenbergia Schreberi* J. F. Gmel. NIMBLEWILL MUHLY. Perennial with stolons about 1 mm. thick, freely rooting; flowering culms 1-4 dm. long, 0.5-1 mm. thick, weak, ascending; ligule an erose scale about 0.5 mm. long, not auricled; blades 3-8 cm. long, 1-4 mm. broad, weak, flat, diverging from culm at right angles; panicles 5-12 cm. long, 1-3 mm. thick, spikelike but lax and interrupted, weak and nodding; glumes minute, 0.1-0.3 mm. long, muticous; lemma about 2 mm. long, linear-lanceolate, with an awn 1.5-6 mm. long; palea about 2 mm. long. Moist usually shaded ground near streams and marshy areas, e., s.e. and n.-cen. Tex. and e. Edwards Plateau and n. Rio Grande Plains, scattered but locally abundant, spring-fall; e. U.S., w. to Neb., Kan., Okla. and Tex.

20. *Muhlenbergia rigida* (H.B.K.) Kunth. PURPLE MUHLY. Tufted perennial; culms 5-10 dm. long, 1-2 mm. thick (thicker at the very base), erect, unbranched; ligule a lacerate stiff scale 3-15 mm. long, splitting in age and then resembling auricles on the sheaths; blades mostly in the lower half of the plant, mostly 15-35 cm. long, flat and 1.5-3 mm. broad or usually involute; old sheaths occasionally flattened and assuming a corkscrew twist; panicles 15-40 cm. long, either 2-4 cm. thick or usually at length broader and subpyramidal, diffuse and open; glumes 1-1.3 mm. long, ovate; lemma 4-5 mm. long, linear-lanceolate, dark-purple, essentially glabrous, with an awn 10-22 mm. long; palea slightly shorter than lemma. Sunny rocky slopes usually in soil derived from dark igneous rocks, at elev. of 5,000-7,500 ft., Trans-Pecos mts., frequent, late Aug.-early Nov.; Tex. to Ariz. and s. to s. Mex.

21. *Muhlenbergia setifolia* Vasey. Tufted perennial; culms 2-8 dm. long, about 1 mm. thick, erect, unbranched; ligule a lacerate stiff scale 2-7 mm. long, in age splitting and resembling auricles on the sheath; blades mostly crowded in the lower half of the plant, mostly 5-17 (rarely to 25) cm. long, about 1 mm. broad but usually closely involute, very fine and irregularly arcuate (the old sheaths occasionally becoming flattened and assuming a corkscrew twist); panicles 7-20 cm. long, usually 2-3 cm. thick, with ascending branches but occasionally open and subpyramidal, diffuse glumes 1.5-2.1 (rarely to 2.5) mm. long, ovate; lemma 3.5-5 mm. long, linear-lanceolate, stramineous, essentially glabrous except on the callus, with an awn 10-28 mm. long; palea slightly shorter than lemma. Sunny rocky slopes usually in shallow soil derived from limestone, at elev. of 3,500-7,000 ft., frequent in the Trans-Pecos, rare to w. Edwards Plateau, summer-fall; Tex. and N.M. s. to Coah.

22. *Muhlenbergia arenicola* Buckl. SAND MUHLY. Tufted perennial, the innovations at the crown short and subrhizomatously spreading; culms 15-65 cm. long, 0.5-1 mm. thick, erect, unbranched, with few remote leaves; ligule a hyaline delicate scale 3-10 mm. long, often splitting and the parts resembling auricles on the corners of the sheaths; sheaths often inconspicuously keeled; blades mostly aggregated at the base of the plant, 4-14 cm. long, 1-2 mm. broad, usually folded or sometimes involute and irregularly arcuate; panicles 10-25 cm. long at maturity, 5-13 cm. broad and subpyramidal, very

open and diffuse; glumes 1.7-3 mm. long, lanceolate, acuminate, often mucronate; lemma 2.5-3.5 mm. long, linear-lanceolate, glabrous, with an awn 0.5-3.5 mm. long; palea about as long as lemma. Dry grassy hills and alluvial flats in the Trans-Pecos, w. Edwards Plateau and Plains Country, abundant, summer-fall; Kan. to Ariz. and s. to n. Mex.

Intergrading with *M. Torreyi* and perhaps not separable from it.

23. *Muhlenbergia Torreyi* (Kunth) Hitchc. RINGGRASS MUHLY. Much like *M. arenicola* but the blades only 2-4 cm. long and 0.3-0.5 mm. broad when unfolded, mostly involute-filiform and distinctly regularly arcuate to form a compact curly mass at the base of the plant. Arid limestone slopes, Trans-Pecos (Hueco and Delaware) mts., apparently infrequent, summer-fall; Wyo. s. to Ariz. and e. to Kan. and Tex.

24. *Muhlenbergia Porteri* Scribn. BUSH MUHLY. Perennial from hard but rather loose knotty bases; culms 3-11 dm. long, 0.5-1 mm. thick, very weak, growing up through shrubbery, much-geniculate bushy-branched; sheaths often separating from the internodes revealing the well-developed prophylls; nodes commonly swollen; ligule a lacerate-ciliate hyaline scale 1-2 mm. long; blades 1-4 (-8) cm. long, 1-2 mm. broad, flat or soon involute; panicle 5-10 cm. long, 4-8 cm. broad, ovoid, very open, diffuse, few-flowered; glumes 1.8-3 mm. long, linear, often very attenuate apically; lemma about 3 mm. long, purple, linear-lanceolate, glabrous, with an awn 5-13 mm. long. Among desert shrubs on loamy soil or rocky slopes, common in the Trans-Pecos, infrequent in Edwards Plateau and s. Plains Country, summer-fall; Colo. to Nev. and s. to n. Mex.

25. *Muhlenbergia pungens* Thurb. Loosely tufted perennial; culms 15-50 cm. long, rhizomatously spreading and rooting at the base, then ascending, 1.5-3 mm. thick below, the erect flowering culms less than 1 mm. thick; ligule a lacerate-ciliate scale about 1 mm. long; blades 2-4 cm. long, narrow, closely involute, firm and stiff-pointed; panicles 5-15 cm. long, 3-7 cm. broad, very open, diffuse, peculiarly interrupted, consisting of 2 to 8 main branches (each of these paniculate-branched and few-flowered); first glume 2-2.5 mm. long, ovate, stramineous, acute, entire or 3-toothed; second glume 2.5-3 mm. long, broadly ovate, stramineous, acute, entire or 3-toothed; lemma 3-4 mm. long, linear-lanceolate, purple, with an awn about 1 mm. long; palea 3-4 mm. long, slightly surpassing the body of the lemma, apically minutely bidentate by the excurrence of the 2 nerves. Loose sandy soil, dune areas and sandy-clay hills in Plains Country, rare, late summer; w. S.D., to Ut. and s. to Tex., N.M. and Ariz.

26. *Muhlenbergia capillaris* (Lam.) Trin. GULF MUHLY. Tufted perennial; culms 6-11 dm. long, 1-2 mm. thick, erect, leafy, unbranched; ligule a firm scale 3-7 mm. long, lacerate with age, not auricled; blades 1-4 dm. long, 1.5-3 mm. broad when flat but soon closely involute, ascending; old sheaths at base of plant (especially after fire or severe grazing) persisting and tending to fray into a fibrous mass; panicles 20-35 cm. long, ovoid to subpyramidal, very open and diffuse, the branches numerous and spreading; glumes 1.5-3 mm. long, lanceolate, acuminate or irregular apically, the second glume with a mucro or short awn; lemma 3.5-5 mm. long, linear-lanceolate, purple, often bifid apically, with an awn 5-15 mm. long; palea as long as lemma, apically often minutely bifid. Incl. var. *filipes* (M. A. Curtis) Beal and var. *trichopodes* (Ell.) Vasey, *M. expansa* (DC.) Trin. Sandy prairies and openings in pine forests, e. and s.e. Tex., infrequent, late summer-fall; Mass. to Ind. and Kan., s. throughout s.e. U.S.; W. I.; s.e. Mex.

27. *Muhlenbergia Reverchonii* Vasey & Scribn. Tufted perennial; culms 35-80 cm. long, about 1 mm. thick, erect, unbranched; ligule a firm scale 3-7 mm. long, lacerate with age, not auricled; blades 7-35 cm. long, 1-2 mm. broad when flat but soon closely involute, arcuate toward the fine point, aggregated in the lower half of the plant; panicles 2-3 dm. long, oblong to subpyramidal, very open and diffuse, the branches numerous and spreading; glumes 1-2.5 mm. (rarely to 3 mm.) long, lanceolate, usually acute; lemma 3.5-5 mm. long, linear-lanceolate, apically rarely minutely bifid, with an awn 0.5-7 mm. long; palea as long as lemma, occasionally minutely bifid. Grassy limestone slopes, e. Edwards Plateau and n.-cen. Tex., frequent, often abundant, summer-fall; also Okla.

28. *Muhlenbergia involuta* Swall. Tufted perennial; culms 6-15 dm. long, 1.5-2 mm. thick, erect, unbranched; ligule a scale 3-11 mm. long, lacerate with age, not auricled;

blades 10-45 cm. long, 2-5 mm. broad when flat but soon closely involute and arcuate, the sheaths folded and often roundly or somewhat obscurely keeled; panicles 17-45 cm. long, 2-5 cm. broad, open and loose, the branches ascending and with only very short naked portions basally; glumes 1.8-3 mm. long, usually acute; lemma 3.5-4 mm. long, lanceolate, usually very minutely bifid apically, with an awn from between the teeth 0.5-2 mm. long; palea as long as lemma. Rocky prairies and uplands, usually near small streams, e. Edwards Plateau, frequent, fall; endemic.

Perhaps not distinct from *M. Lindheimeri* or perhaps representing the products of ancient hybridization between *M. Lindheimeri* and *M. Reverchonii*.

29. *Muhlenbergia Lindheimeri* Hitchc. Tufted perennial; culms 7-15 dm. long, 1.5-3 mm. thick, erect, unbranched; ligule a thin pointed scale 8-15 mm. long, lacerate with age, not auricled; blades 15-50 cm. long, 2.8-5 mm. broad when flat but usually sharply folded or soon closely involute and arcuate; sheaths folded and sharply keeled; panicles 15-45 cm. long, 1-2 (-3) cm. thick, nearly spikelike but much-interrupted, the branches 1-4 cm. long, appressed, floriferous to the base; glumes 2-4 mm. long, linear, acute; lemma 2.7-4 mm. long, acute, glabrous or only minutely pubescent, awnless or with an awn to 3 mm. long. Limestone uplands, usually near small streams, Edwards Plateau, infrequent, fall; endemic.

30. *Muhlenbergia Emersleyi* Vasey. BULL MUHLY. Tufted perennial; culms 5-10 dm. long, 2-3 mm. thick, erect (except at the very base shortly subrhizomatous), leafy; ligule a thin soon lacerate scale 10-25 mm. long; blades 1-3 (-5) dm. long, 2-5 mm. broad when flat, soon folded and sharply keeled; sheaths folded and sharply keeled; panicles 12-40 cm. long, 1-4 cm. broad, rather densely flowered; much-interrupted, the branches 3-10 cm. long, mostly appressed, the basal third of each branch naked; glumes 2-3.5 mm. long, linear, acute or obtuse; lemma 2.3-4 mm. long, dark-gray or purplish-gray, lanceolate, acute, shortly villous in the lower part, awnless or with an awn to 15 mm. long. Rocky grassy slopes in the Trans-Pecos, abundant, late summer-fall; Tex. and N.M. to Ariz. and s.e. to Guat.

31. *Muhlenbergia rigens* (Benth.) Hitchc. DEERGRASS. Coarse tufted perennial; culms 10-15 dm. long, 1.5-4 mm. thick, erect, unbranched; ligule a firm mucicous scale 1-2 mm. long; blades very firm, 2-5 dm. long, 3-4 mm. broad at the very base where flat but mostly firmly involute, nearly straight; panicle 2-6 dm. long, 4-13 mm. thick, dense and spikelike, rarely branched and interrupted in the lower part; glumes about 3 mm. long, rarely as short as 2 mm., usually mucronate or with a minute awn; lemma about 3 mm. long, often with a mucro or minute awn, often surpassed by the glumes; palea almost equaling lemma. *M. Marshii* I. M. Johnst. Loamy flats, usually along small streams, Trans-Pecos mts., locally abundant, July-Oct.; Tex. and N.M. to Calif. and s. to n. Mex.

32. *Muhlenbergia dubia* Fourn. PINE MUHLY. Tufted perennial; culms 5-10 dm. long, 1-2 mm. thick, erect, unbranched; ligule a firm scale 3-15 mm. long; blades mostly aggregated toward the lower part of the plant, 1-4 dm. long, closely involute and irregularly arcuate; panicles 15-30 (-40) cm. long, 5-10 mm. thick, spikelike, the slender branches appressed, naked basally; glumes 1.2-2.3 mm. long, oval; lemma (3.5-) 4-5 mm. long, linear-lanceolate, stramineous to purpurescent, essentially glabrous, with a mucro or an awn 0.2-6 (or rarely to 15) mm. long. *M. acuminata* Vasey, *M. Metcalfei* M.E. Jones. Rocky slopes, Trans-Pecos mts. at elev. of 5,000-7,000 ft., infrequent, Aug.-Oct.; Tex. and N.M. to S. L. P.; Pue.

33. *Muhlenbergia arenacea* Buckl. EAR MUHLY. Perennial with creeping scaly much-branched rhizomes 1-2 mm. thick; aerial culms 10-35 cm. long, 0.5-1 mm. thick, ascending, bushy-branched at the base and leafy in the lower half with numerous short internodes; ligule a thin often lacerate white scale about 0.5 mm. long, with longer points or acute auricles over the corners of the sheaths; blades 1-2 (rarely to 4) cm. long, about 1 mm. broad, flat or folded, the whitish midrib forming a keel; panicles 7-15 cm. long, 5-12 cm. broad, ovoid-acute to subpyramidal, very open and diffuse; glumes 0.9-1.3 mm. long, narrowly ovate, acute; lemma 1.5-2 mm. long, usually dark-brown, linear-lanceolate, awnless but occasionally mucronate, glabrous; palea about equaling lemma. Alluvial sandy or loamy soil in desert flats and stream valleys in the Trans-Pecos, Edwards Plateau and s. Plains Country, locally forming nearly pure cover over acres of ground, summer-fall; Colo. and Ariz. s. to Zac.

34. *Muhlenbergia asperifolia* (Nees & Mey.) Parodi. SCRATCHGRASS MUHLY. Perennial from elongate scaly rhizomes 1.5-2 mm. thick; aerial culms 1-6 dm. long, about 1 mm. thick, mostly weak and reclining, ascending only at the floriferous ends, sparsely branched; ligule a mucous scale about 0.5 mm. long, not auricled; blades 2-7 (-14) cm. long, 1-3 mm. broad, flat or folded, mostly rapidly ascending; panicle 5-18 cm. long, 4-15 cm. broad, ovoid, very open, diffuse, few-flowered; glumes 0.6-1 (rarely to 1.5) mm. long, acute; lemma 1.2-1.5 mm. long, dark, awnless; palea about equaling lemma. Moist alluvial soil near streams and ditches, Plains Country and Trans-Pecos, infrequent, late summer-fall; w. N. A. e. to Ill., Okla. and Tex.; s. S. A.

35. *Muhlenbergia minutissima* (Steud.) Swall. Tufted annual; culms 10-35 cm. long, 0.4-1 mm. thick, geniculately branched near the base; ligule a hyaline soon lacerate scale about 2 mm. long, not auricled; blades 3-10 cm. long, 1-2 mm. broad, usually flat, folded or involute on drying, minutely pubescent; panicles 1-2 dm. long, 2-3 cm. broad, open and diffuse, the numerous main branches often flexuous, ascending, much-branched secondarily; glumes 0.6-1 mm. long, minutely pubescent (use strong lens); lemma 1.2-2 mm. long, very finely pubescent, broadly elliptical, blunt or apically minutely bifid, awnless or with an awn to about 1 mm. long; palea about equaling lemma. *M. texana* Buckl., *M. sinuosa* Swall. Rocky grassy slopes at high elev. of about 8,000 ft., Trans-Pecos (Davis Mts.), rare, late summer-fall; Mont. to Wash. and s. to Mex.

36. *Muhlenbergia fragilis* Swall. Tufted annual; culms 10-35 cm. long, 0.4-1 mm. thick, remarkably geniculately branched near the base; ligule a hyaline soon lacerate scale about 2 mm. long, not auricled; blades 3-10 cm. long, 1-2 mm. broad, minutely pubescent, flat or folded; panicles 7-20 cm. long, 3-7 cm. broad, open and diffuse, the numerous main branches diverging at nearly right angles, nearly straight, much-branched secondarily, the branchlets also divaricate, nearly straight; glumes 0.6-0.7 mm. long, glabrous; lemma 1-1.3 mm. long, glabrous or very finely pubescent, broadly elliptical, blunt or minutely apically bifid, awnless; palea about equaling lemma. Rocky grassy slopes at elev. of 4,000-7,000 ft., Trans-Pecos mts., infrequent, late summer-fall; Tex. and N.M. to Ariz., s. to s. Mex.

37. *Muhlenbergia eludens* C. G. Reeder. Tufted annual; culms 10-35 cm. long, 0.5-1 mm. thick, sparsely and slightly geniculately branched near the base; ligule a hyaline scale about 2 mm. long, not auricled; blades 3-8 cm. long, 1-2 mm. broad, minutely pubescent, flat or soon involute; panicles 7-22 cm. long, 2-5 cm. broad, open and diffuse, the numerous main branches arcuately ascending, weak, with short mostly appressed secondary branchlets; glumes 1-1.5 mm. long, minutely pubescent (use strong lens); lemma 1.5-2 mm. long, lance-elliptic, very finely pubescent, apically minutely bifid and with a readily deciduous awn 1-2 mm. long; palea about equaling lemma. Rocky slopes, Trans-Pecos mts., rare, fall; Tex. and N.M. to Ariz. and s. to Baja Calif., Son. and Dgo.

91. LEPTOCHLOA BEAUV.

SPRANGLETOP

Spikelets 3- to 12-flowered, the lower 1 or 2 florets perfect, the rest staminate or neutral; spikelets sessile and overlapping, appressed in two rows along one side of a nearly terete rachis (the rachis with its two rows of spikelets being called a "raceme," the total inflorescence being a panicle of 4 to 90 of these racemes attached along an axis, the axis being elongate, or in *L. chloridiformis* reduced and subdigitate, much as in *Chloris*); zone of abscission just below each lemma, the marginal basal portion of the lemma pubescent or (in *L. dubia*) nearly glabrous.

A genus of about 27 species in the warmer parts of the world.

1. Racemes subdigitate8. *L. chloridiformis*.
1. Raceme attachments more remote, scattered along at least several cm. of the panicle axis (2)
- 2(1). Lemma 1-1.5 mm. long (3)
2. Lemma at least 1.8 mm. long (5)
- 3(2). Panicles more than 10 times as long as broad; racemes stiffly ascending or appressed5. *L. Nealleyi*.
3. Panicles much less than 10 times as long as broad (4)

- 4(3). Sheaths papillose-pilose; lemma blunt; plants annual
7. *L. filiformis*.
4. Sheaths glabrous or if pilose not papillose; lemma acute; plants perennial
6. *L. virgata*.
- 5(2). Glumes 3-5 mm. long; lemma emarginate; plant perennial
1. *L. dubia*.
5. Glumes shorter; lemma sometimes minutely bifid but not emarginate; plants annual
 (6)
- 6(5). Racemes usually more than 40 per panicle; spikelets 3.5-4.5 mm. long; lemmas
 about 2 mm. long, acute4. *L. panicoides*.
6. Racemes usually fewer than 40 per panicle; spikelets 4-10 mm. long; lemmas 1.8-4
 mm. long (7)
- 7(6). Lemmas lance-elliptic, acute and acuminate, 2.5-4 mm. long
2. *L. fascicularis*.
7. Lemmas obovate, blunt, 1.8-3 mm. long3. *L. uninervia*.

1. *Leptochloa dubia* (H.B.K.) Nees. GREEN SPRANGLETOP. Tufted perennial; culms 25-115 cm. long, 1-4 mm. thick, erect, leafy, unbranched; ligule a dense row of cilia 0.3-1.2 mm. long; blades 5-30 cm. long, 1-10 mm. broad, flat or soon involute; sheath keeled and corner of sheath (and also less commonly the entire summit dorsally) pilose; panicles 5-20 cm. long; racemes 3 to 13, remote, ascending, 2-15 cm. long, 3-6 mm. thick; spikelets not laterally compressed, overlapping, 5-10 mm. long, 3- to 9-flowered; glumes 3-5 mm. long, acute; lemma oblong, emarginate, sometimes mucronate, glabrous except commonly minutely appressed-strigose near the margins on the lower half. Rocky slopes and alluvial loams in the Trans-Pecos, Plains Country, Edwards Plateau and Rio Grande Plains, abundant, spring-fall; w. Okla. to Ariz. and s.e. to s. Mex.; also s. Fla. and Arg.

Green sprangletop is locally abundant enough to have considerable forage value.

2. *Leptochloa fascicularis* (Lam.) Gray. Tufted annual; culms 2-9 dm. long, 2-3 mm. thick, erect or geniculately ascending, sparingly branched, leafy, soft; ligule a hyaline scale 2.5-6 mm. long, usually lacerate into several strap-shaped parts, the lateral portions resembling auricles on the sheaths; blades 5-35 cm. long, 2-10 mm. broad, flat or soon involute; panicles 15-30 cm. long, 2-5 cm. broad, usually partly included in the sheath; racemes 14 to 35, widely spaced on the panicle axis but appressed or ascending and overlapping, 3-11 cm. long, 3-5 mm. thick; spikelets scarcely laterally compressed, overlapping, 5-10 mm. long, 6- to 12-flowered; glumes 1.5-3.5 mm. long, acute; lemma lance-elliptic, 2.5-4 mm. long, acute or acuminate to mucronate or short-awned, pubescent near the margin in the lower half, the hairs conspicuous from the side of the spikelet under a lens. Muddy areas, sometimes alkaline or subsaline mud, Plains Country, Trans-Pecos, Rio Grande Plains, and n.-cen. and s.e. Tex., scattered but locally abundant, summer-fall; widespread in the warmer parts of the New World n. to N. E., N.D. and Wash. (See remark under *L. uninervia*.)

3. *Leptochloa uninervia* (Presl) Hitchc. & Chase. Much like *L. fascicularis*, identical in habit; racemes 20 to 40, 2-8 cm. long; spikelets 4-9 mm. long; glumes and lemmas much less acute, the latter 1.8-3 mm. long, obovate and obtuse or mucronate, sometimes mucronate, the pubescence inconspicuous or hidden when spikelet is viewed from the side. Mud, sometimes alkaline or subsaline mud, Edwards Plateau, Rio Grande Plains, s.e. and Trans-Pecos Tex., to be expected in n.-cen. Tex. and the Plains Country, scattered, spring-summer, rarely into fall; widespread but scattered in the warmer parts of the New World n. to N. E., Okla., Colo., Ut. and Ore. Perhaps only a form of *L. fascicularis*.

4. *Leptochloa panicoides* (Presl) Hitchc. Tufted annual; culms 5-10 dm. long, 2-6 mm. thick, erect, sparingly or not branched, leafy, soft; ligule a hyaline usually lacerate scale 2-4 mm. long; blades 2-5 dm. long, 3-10 mm. broad, folded or drying involute; sheaths sharply keeled; panicles 1-2 dm. long, 3-6 cm. wide; racemes 40 to 90, crowded, ascending, 2-5 cm. long, 2-3 mm. thick; spikelets laterally compressed, closely overlapping, 5- to 7-flowered, 3.5-4.5 mm. long; glumes and lemma acute, about 2 mm. long, mucronate, pubescent laterally on the lower part. Mud, e. and s.e. Tex., rare, spring-fall; nat. of Braz.; Mo. to Miss., Ark. and Tex.; adv. in India.

5. *Leptochloa Nealleyi* Vasey. Tufted annual; culms 5-15 dm. long, 1.5-6 mm. thick, erect, unbranched, leafy; ligule a somewhat lacerate scale 1-3 mm. long; blades 1-4 dm. long, 2-7 mm. broad, flat or basally folded or drying involute; sheaths sharply keeled; panicles 2-5 dm. long, 1-3 cm. broad; racemes 25 to 85, overlapping, 1-10 cm. long, about 2 mm. thick, stiffly ascending or appressed; spikelets laterally compressed, closely overlapping, 3- or 4-flowered, 2-3 mm. long; glumes and lemmas about 1 mm. long, the former acute, the latter blunt and awnless with slightly pubescent nerves. Mud, near the coast, s.e. Tex. and Rio Grande Plains, scattered, spring-fall; coastal areas, Tam. to La.

6. *Leptochloa virgata* (L.) Beauv. Tufted perennial (sometimes flowering the first year); culms 25-90 cm. tall, 1-2 (-3) mm. thick, erect, sparingly geniculately branched in the lower part; ligule a lacerate-ciliate scale 0.3-0.5 mm. long, usually with longer cilia to 2 mm. long; blades 3-25 cm. long, 1.5-7 mm. broad, flat or quickly involute, glabrous or somewhat pilose basally; sheaths glabrous or pilose; panicles 4-20 cm. long; racemes 4 to 14, remote, ascending, 2-12 cm. long, 2-3 mm. thick; spikelets strongly laterally compressed, 2-4 mm. long, 3- to 8-flowered; lemma about 1.5 mm. long, acute, awnless or the lower ones with awns to 3 mm. long, pubescent near the margins, apically minutely bifid. *L. domingensis* (Jacq.) Trin. Loamy soil, Rio Grande Plains, locally common, summer-early winter; widespread in the warmer parts of the New World n. to s. Fla. and Tex.

7. *Leptochloa filiformis* (Lam.) Beauv. RED SPRANGLETOP. Tufted annual; culms 2-9 dm. long, 1-3 mm. thick, geniculate and occasionally rooting at lower nodes, sparingly branched, ascending, leafy, soft; ligule a hyaline somewhat lacerate scale about 1 mm. long; blades 2-20 cm. long, 1.5-10 mm. broad, flat; sheaths papillose-pilose; panicles 7-35 cm. long, 2-21 cm. broad; racemes 7 to 70, remote, 1-15 cm. long, 1-2 mm. thick, diverging from axis at angles of 40°-90°; spikelets not much-compressed laterally, 1.4-2.6 mm. long, 3- or 4-flowered, barely overlapping; glumes lanceolate, acute, the second one surpassing the lowest lemma; lemma blunt, 1-1.5 mm. long, awnless, pubescent on the nerves. Moist soil and mud, e., s.e. and n.-cen. Tex., Rio Grande Plains and rarely w. to e. Plains Country, scattered, late spring-fall; widely distributed in the warmer parts of the New World n. to Va., Ind., Ill., Mo., Kan., N.M., Ariz. and Calif.

8. *Leptochloa chloridiformis* (Hack.) Parodi. Tufted perennial; culms 5-15 dm. long, 1.5-5 mm. thick, erect, unbranched; ligule a lacerate-ciliate scale about 1 mm. long and sometimes also a loose fringe of cilia 5-10 mm. long; blades 25-70 cm. long, 2-7 mm. broad, pilose near the ligule, flat or soon involute; panicles 10-17 cm. long, flabellate; racemes 5 to 20, originating at near the same level (subdigitate), 10-15 cm. long, 2-3 mm. thick; spikelets strongly laterally compressed, about 4 mm. long, mostly 3-flowered; lemma about 3 mm. long, acute, pubescent near the margins, minutely apically bifid and with a mucro between the teeth. Disturbed clay-loam soil, extreme s. Rio Grande Plains (Cameron Co.), rare, introd. and not persistent; Parag., Arg.; Tex.

92. TRICHONEURA ANDERSS.

A genus of 9 species, 6 in Africa, 1 in Peru, 1 in the Galapagos Islands and our species.

1. *Trichoneura elegans* Swall. SILVEUS-CRASS. Tufted annual; culms 3-11 dm. long, 1-3 mm. thick; markedly geniculate in basal half, reclining and occasionally rooting at lowermost nodes and somewhat branched, ascending in the distal half; ligule a hyaline scale 1-3 mm. long; blades of midculm 7-35 cm. long, 4-8 mm. broad, flat or eventually drying loosely involute, appressed or ascending; sheaths with a very slight auricular point at the corner; panicle 6-22 cm. long, 2-8 cm. broad, vaguely ovoid, the axis viscid; racemes 5 to 23 per panicle, 1-6 cm. long, 3-7 mm. thick, ascending or at length deflexed and arcuate-reflexed; spikelets nearly sessile, broadly overlapping, yellowish green, 5- to 8-flowered, 7-10 mm. long, laterally somewhat compressed, subsecund in 2 rows along the abaxial side of the rachis; glumes about equal, lanceolate, 7-10 mm. long including a long almost awnlike acumination, surpassing most or all the lemmas, persistent; rachilla long-hirsute near the florets; zone of abscission just below the florets; lemmas strongly nerved, long white-hirsute on the lateral nerves, apically minutely notched; florets mostly perfect, only the upper 1 to 3 of them neutral or merely staminate.

Dry loose sandy soil, often in dune areas, Rio Grande Plains, locally abundant, fall, rarely also early spring; also Tam.

93. TRIPOGON R.&S.

A genus of 20 species of tropical Africa and Asia; one in the Western Hemisphere.

1. *Tripogon spicatus* (Nees) Ekman. Densely tufted perennial; culms 10-25 cm. long, 0.2-0.3 mm. thick, erect, unbranched; ligule a ciliate fringe about 0.3 mm. long; blades aggregated toward the base of the plant, 2-6 cm. long, about 0.5 mm. broad when flat but soon involute-filiform, erect; corners of sheaths with a minute tuft of white hairs; spike solitary, erect or slightly nodding, interrupted, 2-9 cm. long, about 2 mm. thick; spikelets slightly overlapping or at the base of the spike so remote as not to overlap, 8- or 12-flowered, 5-10 mm. long, about 1 mm. broad, sessile, attached in 2 rows along one side of the spike, slightly laterally compressed, usually plumbeous; first glume about 1 mm. long; second glume about 2 mm. long; both glumes narrow, elongate, acuminate, persistent; zone of abscission below each lemma; lemma strongly 3-nerved, about 2 mm. long, apically notched and with a very short awn, basally tufted; most of the florets perfect, only the upper 1 to 3 neutral or merely staminate. In crevices of granite and on slopes among granite boulders, e. part of Edwards Plateau, locally frequent, also rare in sandy soil in s. part of n.-cen. Tex., spring-fall, after rains; Tex.; Mex.; Cuba; S. A.

94. ELEUSINE GAERTN.

A genus of about 9 species of warmer parts of the Old World; one adventive in Texas.

1. *Eleusine indica* (L.) Gaertn. GOOSEGRASS. Tufted annual; culms 2-10 dm. long, 1.5-5 mm. thick, the lower few internodes commonly reclining and stoloniform, rooting at the nodes, the rest ascending, leafy, sparingly branched; ligule a lacerate scale 0.1-1 mm. long or nearly obsolete; blades 7-38 cm. long, 2-8 mm. broad, ascending, often pilose near the ligule; sheaths often pilose on the corners; panicle flabellate, the axis only 5-40 cm. long, usually with most of the spikes digitate and terminal but often with 1 or 2 spikes attached at a lower level; spikes (1 or) 2 to 6 per panicle; (1-) 3-9 (-16) cm. long, 3-5 mm. thick, ascending; spikelets nearly sessile, very crowded, 4- to 7-flowered, 3-7 mm. long, strongly laterally compressed, arranged in 2 rows along one side of the narrow flattened rachis; glumes unequal, usually shorter than the lowermost lemma, persistent; zone of abscission below each lemma; lemmas essentially glabrous, the strong 3 nerves close together, forming a keel; most of the florets perfect. Weed in disturbed areas, especially in gardens, yards and around farm houses, common in Rio Grande Plains and s.e. Tex., less abundant in e. and n.-cen. Tex., e. Plains Country and Edwards Plateau, summer-fall; nat. of Euras., adv. and widespread in the warmer parts of Am., n. to N. E., Mich., Wisc., S.D., Colo., Ut. and Ore.

95. DACTYLOCTENIUM WILLD.

A genus of 10 species of the warmer parts of the Old World; at least one of them now widely adventive in the New World.

1. *Dactyloctenium aegyptium* (L.) Beauv. CROWFOOT. Annual; culms (3-) 15-40 (-100) cm. long, 1-3 mm. thick, stoloniferous below and rooting at the nodes, distally ascending, leafy; ligule a lacerate scale 0.1-0.4 mm. long or obsolete; blades 2-20 cm. long, 2-9 mm. broad, flat or folded, papillose-pilose on the margins and upper surface; sheaths loose, roundly keeled at dorsal summit; panicles flabellate, of digitately arranged spikes (rarely 1 spike attached at a lower level than the rest); spikes (1 or) 2 to 7 per panicle; 1-6 cm. long, 3-7 mm. thick, divergent-ascending; spikelets sessile, very crowded, 3- to 5-flowered, 2-4 mm. long, strongly laterally compressed, arranged in 2 rows along one side of the narrow flattened rachis; glumes shorter than the lowermost lemma, about 2 mm. long, the first one acute and awnless, persistent; second glume blunt but with a

hooked awn about 1 mm. long and deciduous; zones of abscission between the first and second glumes and below each lemma; lemmas 3-nerved (the lateral nerves near the margin and indistinct), about 2 mm. long, with an awn or narrow acuminate awnlike tip about 1 mm. long; all but the terminal floret perfect. Weedy sandy soil or moist garden loam, disturbed areas, common in Rio Grande Plains and s.e. Tex., less common n. to e. and n.-cen. Tex. and Edwards Plateau, summer-fall; nat. of Old World trop., introd. and widespread in Am., n. to N. E., Ill., Colo. and Calif. (persistent n. only to Va., the Gulf States, Ariz. and Calif.).

96. CYNODON RICH.

A genus of perhaps 10 species of the warmer parts of the Old World; one species now nearly ubiquitous in warmer parts of the whole world.

1. *Cynodon Dactylon* (L.) Pers. BERMUDA GRASS, PATA DE GALLO. Rhizomatous and stoloniferous perennial; aerial culms 1-4 (-10) dm. long, 1-2 mm. thick, the lower portions stoloniferous and much-branched, distal portions ascending; ligule a double fringe of cilia, a shorter denser fringe about 0.5 mm. long and sparser hairs 1-2 mm. long; blades 1-8 (-13) cm. long, 1-4 mm. broad, mostly flat or folded, ascending; sheaths pilose at the corners; panicles flabellate, of digitate spikes; spikes 3 to 7 (usually 4 or 5) per panicle, 1-6 cm. long, about 1 mm. thick, ascending; spikelets sessile, very crowded, 1-flowered, 1.5-2 (-2.5) mm. long, strongly compressed, arranged in 2 rows along and appressed to one side of the very narrow rachis; glumes 1-1.5 mm. long, narrow, acute, persistent, the single nerve forming a keel; zone of abscission below the lemma; lemma 1.5-2 mm. long, awnless, slightly cartilaginous, pubescent on the dorsal keel, with lateral nerves very near the margin. *C. maritimus* H.B.K. Loamy, usually alluvial, seasonally moist, sometimes alkaline or subsaline, soils, nearly throughout the state, most abundant in the coastal areas of s.e. Tex. and Rio Grande Plains, spring-summer-fall and in the extreme s. in winter; nat. of Euras., introd. and ubiquitous in disturbed areas, warmer parts of Am. n. to N.E., Mich., Ia., Colo., Ut., Nev. and Ore.

Very important as a forage in tame pastures, and as a lawn grass.

97. WILLKOMMIA HACK.

A genus with 3 species in Africa, one in temperate South America and one in Texas.

1. *Willkommia texana* Hitchc. Tufted perennial; culms 2-4 dm. long, 0.5-1 mm. thick, erect, unbranched; ligule obsolete or a fringe of cilia 0.1-0.6 mm. long; blades mostly crowded toward the base of the tuft, 3-11 cm. long, 1-3 mm. broad, flat or round-keeled or usually involute at least distally and in age; panicles almost spikeletlike, 8-18 cm. long, 3-7 mm. broad, often partially included in the uppermost sheath; spikes 6 to 20 per panicle, 2-4 cm. long, about 1 mm. thick, strictly ascending or usually appressed; spikelets sessile, very crowded, 1-flowered, 3.1-4.6 mm. long, not much-compressed, arranged in 2 rows along and appressed to one side of the narrow flattened rachis; first glume about two thirds as long as the spikelet, obtuse; second glume acute, 1-nerved, surpassing the lemma; zone of abscission just below the lemma; lemma awnless, densely pubescent dorsally, 3-nerved, the lateral nerves near the margins. Bare tight calcareous clay-loam, s.e. Tex. and n. Rio Grande Plains, rare, also said to occur in n.-cen. Tex., Apr.-May; endemic.

98. SCHEDONNARDUS STEUD.

TUMBLEGRASS

A monotypic genus in Canada and the United States.

1. *Schedonnardus paniculatus* (Nutt.) Trel. Tufted perennial (flowering first year); culms 7-50 cm. long, 0.5-1.5 mm. thick, much-geniculate and -branched in the lower half, ascending; ligule a pointed eventually lacerate scale 1-3.5 mm. long; blades 1-7 (-13) cm. long, 0.6-3 mm. broad, ascending, mostly folded, eventually drying wavy and taking on a corkscrewlike twist; upper part of sheath keeled; panicles very diffuse, at anthesis 1-2 dm. long, eventually elongating to 2-4 dm. long, the axis taking on a

loose helical curve, breaking basally and the whole panicle rolling before the wind as a tumbleweed; spikes 3 to 12 per panicle, 1-15 cm. long (the lower ones much longer than the upper), about 1 mm. thick, spreading or divaricate, straight and stiff; spikelets sessile, remote and scarcely or not overlapping, 1-flowered, 3-4 mm. long, very narrow, compressed, arranged in 2 rows along and appressed to one side of the narrow flattened rachis; glumes somewhat unequal, narrowly acute, the single nerve forming a dorsal keel, the second glume equaling or surpassing the lemma; zone of abscission below the lemma; lemma very narrow, acute, 3-nerved. Prairies and somewhat disturbed openings on tight usually clayey loam, nearly throughout the state, most common in the prairies of the Plains Country and in n.-cen. Tex., rare in the Trans-Pecos, Edwards Plateau, e. Tex. and s. Rio Grande Plains, spring-fall; in a cen. zone in N. A. e. to Wisc., Ill., Mo. and La., w. to Sask., Mont., Wyo., Ut. and Ariz.; not yet collected in Mex.

99. GYMNOPOGON BEAUV.

Clumped perennials from short scaly rhizomes; culms short; leaves short, crowded, with flat divergent sharp-pointed deciduous blades, the lower corner of blades and upper corners of sheaths separated by a sinus; ligule a fringed scale about 0.2 mm. long; inflorescence a panicle of numerous long spreading lax linear spikes; spikelets arranged in 2 rows along one side of the slender slightly flattened rachis of the spike, remote, appressed, with one perfect floret; glumes lance-linear, with awnlike tips, surpassing the body of the lemma, 1-nerved; zone of abscission at base of lemma; lemma 3-nerved, apically bifid and with a short awn; rachilla prolonged beyond the perfect floret a little more than half the length of the body of the lemma and bearing a very minute rudiment of a reduced floret, this awned or awnless; lemma with some pubescence.

A genus of about 10 species in the warmer parts of America.

1. Spikes floriferous to the base, at the base bearing a spikelet and a slight beard; rudiment awned 1. *G. ambiguus*.
1. Spikes naked in the basal part, at the very base naked and nearly beardless; rudiment awnless 2. *G. brevifolius*.

1. *Gymnopogon ambiguus* (Michx.) B.S.P. Rhizomes 2-3 mm. thick, very short; aerial culms 25-60 cm. long, 1-2 mm. thick, erect, leafy; blades 3-10 cm. long, 4-13 mm. broad; spikes 12 to 35 per panicle, 10-25 cm. long, about 2 mm. thick, much-interrupted, at the base with a spikelet and a very short beard; first glume 3-6 mm. long; second glume 5-7 mm. long; lemma 3-4 mm. long, with an awn 4-11 mm. long; awn of rudiment 1-6 mm. long. Loose sandy podsol, open woods, infrequent in e. Tex. and rare w. to n.-cen. Tex., Aug.-early Nov.; N.J. to Fla. and w. to Neb., Kan. and Tex.

2. *Gymnopogon brevifolius* Trin. Rhizomes 1-2 mm. thick; aerial culms 25-60 cm. long, 0.5-1 mm. thick, erect, leafy; blades 2-7 cm. long, 2-7 mm. broad; spikes 6-21 cm. long, 1-2 mm. thick, much-interrupted, at the basal third naked, at the very base (axil) essentially naked; first glume 2-4 mm. long; second glume 3-6 mm. long; lemma 1.5-3 mm. long, with an awn 0.5-7 mm. long; rudiment awnless. Loose sandy soil, open woods and savannahs, e. Tex., uncommon; Coastal States, N.J. to Tex.; also Ark.

100. CHLORIS Sw. FINGERGRASS

Sheaths commonly keeled; spikes elongate, commonly in one or several whorls on the panicle axis, thus nearly digitate; spikelets arranged in 2 rows along one side of the rachis of the spike, either laterally compressed or not noticeably compressed, with one perfect floret (or occasionally 2 in *C. Gayana*) and a floret or 2 above the perfect floret either staminate or neutral (everything above the fertile floret being called the "rudiment"); zone of abscission at the base of the fertile floret; lemma 3-nerved, usually apically bifid and mucronate or awned, the nerves variously glabrous or pubescent.

A genus of perhaps 40 species in the warmer parts of the world. Many specimens of fingergrass, especially those related to *C. verticillata*, *C. andropogonoides* and *C. cucullata*, show combinations of characters of more than one species. They are interpreted as intermediate or genetically contaminated. These specimens will not "key out" satis-

factorily, nor can they be determined to "species". A perusal of the key and descriptions will usually reveal which species they most closely resemble.

1. Panicle axis 12-100 mm. long, the spikes thus attached at more than one level, usually in 2 to 4 whorls (2)
1. Spikes in one whorl or if in 2 whorls then the panicle axis 10 mm. long or shorter (3)
 - 2(1). Lemma 6-7 mm. long, with an awn 8-20 mm. long . 2. *C. chloridea*.
 2. Lemma 2-3 mm. long, with an awn 4-7 mm. long 5. *C. verticillata*.
 - 3(1). Awn of lemma less than 2 mm. long or absent (4)
 3. Awn of lemma more than 1.8 mm. long (8)
 - 4(3). Spikes 2-5 cm. long, flexuous; lemma reniform when spread out, 1.3-2 mm. long, with an awn 0.3-1.1 mm. long and nearly glabrous lateral nerves 6. *C. cucullata*.
 4. Spikes 5-15 cm. long or if shorter than 5 cm. then the lemma not reniform and its lateral nerves ciliate (5)
 - 5(4). Spikes numbering 16 to 32 per panicle 11. *C. distichophylla*.
 5. Spikes numbering 2 to 11 per panicle (6)
 - 6(5). Lemma and rudiment with awns 0.5-1 mm. long . . 10. *C. ciliata*.
 6. Lemma and rudiment awnless (7)
 - 7(6). Spikes 5 to 11 per panicle, 4-15 cm. long; lemma yellowish-brown at maturity, its lateral nerves with cilia 0.5-1.1 mm. long 12. *C. argentina*.
 7. Spikes 2 to 6 per panicle, 3-8 cm. long; lemma brownish-black at maturity, its lateral nerves with cilia only 0.1-0.3 mm. long 13. *C. petraea*.
 - 8(3). Lateral nerves of lemma with cilia at least 1 mm. long (9)
 8. Lateral nerves of lemma with cilia less than 1 mm. long or not ciliate (11)
 - 9(8). Awn of lemma 2.5-3 mm. long; plants perennial . . 9. *C. Canterai*.
 9. Awn of lemma 5-9 mm. long; plants annual (10)
 - 10(9). Sterile florets usually solitary; cilia at summit of lateral nerves of fertile lemma more than 1.5 mm. long; fertile lemmas more than 3 mm. long, each with a prominent bulge on the keel 7. *C. virgata*.
 10. Sterile florets usually 2; cilia at summit of lateral nerves of fertile lemma usually less than 1.5 mm. long; fertile lemmas usually less than 3 mm. long; lemma keel without a prominent bulge 8. *C. inflata*.
 - 11(8). Awn of lemma 9-10 mm. long; awn of rudiment 4-6 mm. long; spikes 5 or 6 per panicle, 10-18 cm. long 3. *C. texensis*.
 11. Awn of lemma 1.8-3 mm. long; awn of rudiment 1-3 mm. long; spikes 6 to 23 per panicle, 3-12 cm. long (12)
 - 12(11). Principal culms (not stolons) 60-150 cm. long, 2-3 mm. thick; blades 3-6 mm. broad, usually flat 1. *C. Gayana*.
 12. Principal culms 15-40 cm. long, 1-1.5 mm. thick; blades 1-2.3 mm. broad, usually folded 4. *C. andropogonoides*.

1. *Chloris Gayana* Kunth. RHODES GRASS. Tufted perennial; some of the culms commonly stoloniform and much-geniculate, others 6-15 dm. long and 2-5 mm. thick, compressed, erect, sparingly branched; ligule a scale about 0.5 mm. long; blades 5-35 cm. long, 3-6 mm. broad, usually flat, ascending; the lower corner and a line at the ligule pilose; sheath obscurely keeled; panicle axis usually 1 mm. long, rarely to 1 cm.; spikes mostly in one whorl, rarely 2, totalling 6 to 23 per panicle, 6-12 cm. long, 3-5 mm. thick, nearly straight, ascending; spikelets laterally compressed, crowded, not appressed; first glume 1-1.5 mm. long, lanceolate; second glume 2-3 mm. long, lanceolate, mucronate; lemma about 3 mm. long, obovate-oblong, apically bifid, with an awn 2-5 mm. long, the lateral nerves with appressed stiff hairs 0.5-1 mm. long; rudiment commonly of 2 florets, these usually staminate or the lower occasionally perfect and with an awn 1-3 mm. long. Disturbed loamy soil in fields and along roads, common in Rio Grande

Plains, infrequent n. to s. part of s.e. and e. Tex., spring-fall; nat. to Afr., introd. and well-naturalized in scattered warmer parts of N. A.

A very important forage in south Texas, often planted in large acreages.

2. *Chloris chloridea* (Presl) Hitchc. Tufted perennial; some culms from the base slender, rhizomatiform, bearing cleistogamous subterranean spikelets; serial culms 35-100 cm. long, 1-3 mm. thick, erect, sparingly branched, leafy; ligule a fringed scale about 0.5 mm. long; blades 5-35 cm. long, 3-7 mm. broad, flat or upon drying loosely involute, on the corner and near the ligule pilose with hairs 3-5 mm. long; sheaths obscurely keeled; panicle axis 2-10 cm. long, bearded in the axils; spikes attached in 2 or 3 whorls or individually attached and not whorled, pubescent at the axils, totaling 3 to 11 per panicle, 6-16 cm. long, 2-4 mm. thick, straight or nearly so, ascending or widely spreading, floriferous nearly to the base; spikelets not laterally compressed, somewhat overlapping but not crowded, appressed to the rachis; first glume 1-2 mm. long, lanceolate; second glume 3-5 mm. long, lanceolate; lemma 6-7 mm. long, lanceolate, apically minutely bifid, with an awn 8-20 mm. long, the lateral nerves toward the summit glabrous or with some very short stiff hairs about 0.2 mm. long; rudiment much shorter than the lemma, linear, with an awn 3-10 mm. long. Heavy clay soil near the coast, Rio Grande Plains and s.w. part of s.e. Tex., infrequent, fall (rarely late summer); warm parts of N.A. n. to s. Ariz. and Tex.

3. *Chloris texensis* Nash. Tufted perennial, occasionally stoloniferous basally; culms 25-50 cm. or more tall, about 2-3 mm. thick, compressed, mostly erect, sparingly geniculate and branched in the lower part; ligule a minute fringed scale or obsolete; blades 3-30 cm. long, 4-6 mm. broad, flat or usually folded, ascending; sheath keeled; culms below the panicle much elongating after anthesis; spikes in one whorl, pubescent near the axils, about 5 or 6 per panicle, 10-18 cm. long, about 3 mm. thick, naked in the lower 1-4 cm., weak and spreading; spikelets laterally compressed, slightly overlapping, appressed; first glume 2-3 mm. long, lanceolate; second glume about 4 mm. long, lanceolate; lemma about 4 mm. long, elliptic-oblong or as viewed from the side narrowly elliptical, apically bifid with an awn about 9-10 mm. long, the lateral nerves toward the summit with some stiff hairs about 0.4-0.5 mm. long; rudiment about equaling lemma, very narrow, with an awn 4-6 mm. long. Silty loam, coastal prairies, s.e. Tex. and n.e. Rio Grande Plain, rare, fall; endemic.

4. *Chloris andropogonoides* Fourn. Tufted perennial, commonly shortly substoloniferous basally; culms 15-40 cm. long, 1-1.5 mm. thick, compressed, mostly erect, sparingly geniculate and branched in the lower part, the culm below the panicle much-elongating after anthesis, fragile; ligule a fringed scale 0.5-1 mm. long; blades 3-12 (-17) cm. long, 1.3-2.3 mm. broad, flat or usually folded, glabrous or with a few hairs scattered on the underside; sheaths keeled; panicle axis 2-4 (-10) mm. long, slightly pubescent at the axils; spikes in one whorl or less commonly 2 whorls (often the panicle axis elongates above the spikes but fails to bear a second whorl) or rarely 3 whorls, totalling 6 to 11 (to 14) per panicle, 3-10 cm. long, 1.5-2 mm. thick, straight or nearly so, eventually spreading at nearly right angles, floriferous usually to the base; spikelets laterally compressed, somewhat overlapping but not crowded, appressed; first glume 1-2 mm. long, narrowly lanceolate; second glume 2-2.5 (-3) mm. long, including an awnlike tip; lemma 1.8-2.3 mm. long, elliptical or from the side lanceolate, apically bifid with an awn 3-5 mm. long, the lateral nerves glabrous or with a few appressed hairs about 0.2 mm. long; rudiment slightly shorter than to equaling the lemma, obovate, with an awn 1.5-3 mm. long. *C. tenuispica* Nash. Tight black clay soil or less commonly tight sandy loam, prairies and openings in brush, frequent in Rio Grande Plains and s. part of s.e. Tex., rare n. to s. part of n.-cen. Tex. and e. Edwards Plateau, spring-fall; Tex. to Coah., N.L. and Tam.

The type of *C. andropogonoides* was from S. L. P., but the species here described is not known from that state; perhaps ours should go by the name *C. tenuispica*. In the northwest part of the range and farther northwest in west Texas occur plants intermediate between this and *C. verticillata*; and in the Rio Grande Plains and southeast Texas occur plants intermediate between this and *C. cucullata*. Plants which appear to be of hybrid origin between *C. andropogonoides* and those genetically contaminated plants called "*C. latisquamea*" (see remarks under *C. cucullata*) have been given the name *C. subdolichostachya* C. Muell.

5. *Chloris verticillata* Nutt. WINDMILL FINGERGRASS, TUMBLE WINDMILL GRASS. Densely tufted perennial, commonly shortly stoloniferous basally; culms 15-30 cm. long, 1-2 mm. thick, compressed, mostly erect, somewhat geniculate and sparingly branched in the lower part; ligule a fringed scale 0.5-1 mm. long, often apparently with some cilia 3-5 mm. long (these actually attached to the base of the blade); blades 2-14 (-20) cm. long, 2.5-4 mm. broad, flat or usually folded, ascending, the lower corner and a line at the ligule glabrous or usually with a few hairs 2-5 mm. long; sheaths keeled; culm below the panicle much-elongating after anthesis, weak and breaking off, the entire panicle blowing before the wind as a tumbleweed; panicle axis 12-52 mm. long, densely bearded in the axils; spikes attached in (2 or) 3 or 4 (or 5) whorls (the lowest whorl usually with more spikes than the other whorls), totalling (9 to) 14 to 20 (to 24) per panicle, 6-12 (-15) cm. long, 2-4 mm. thick, straight or nearly so, eventually spreading at right angles or even deflexed, floriferous usually to the base; spikelets laterally compressed, relatively remote, appressed to the rachis; first glume 1.5-2 mm. long, lanceolate; second glume 2.5-3.8 mm. long, including an awnlike tip; lemma 2.2-2.6 mm. long, broadly elliptical or as viewed from the side narrowly elliptical, apically bifid and with an awn 4-7 mm. long, the lateral nerves glabrous or with a few appressed hairs 0.1-0.2 mm. long; rudiment about equaling lemma, elliptical and acute to narrowly obdeltoid and truncate, with an awn 3-5 mm. long. Packed rocky or calcareous gravelly and sandy loam, disturbed areas, roadsides and eroded plains, somewhat weedy, in the Trans-Pecos, Plains Country and Edwards Plateau, rare e. to n.-cen. Tex. and n. Rio Grande Plains, late spring-summer; Neb. and Colo. s. to Tex. and N.M. and s.w. to Ariz. and s. Calif., also adv. and not persistent farther e.

The description and geography given above apply to the typical windmill fingergrass. For a discussion of the plants intermediate to *C. cucullata* and *C. andropogonoides* see the remarks under those species.

6. *Chloris cucullata* Bisch. HOODED FINGERGRASS, HOODED WINDMILL GRASS. Tufted perennial; lower internodes often stoloniferous and the nodes rooting; culms 1-9 dm. long, 1.5-3 mm. thick, compressed, erect except the stolons, somewhat geniculate and sparingly branched in the lower part; ligule a scale 0.3-0.9 mm. long; blades 3-15 (-22) cm. long, 2-4 mm. broad, flat or usually folded, ascending; sheaths keeled; spikes digitate (rarely distributed over the axis for a distance of 2-5 mm.), 6 to 16 (usually 8 to 12) per panicle, 2-4 (-5) cm. long, about 2 mm. thick, distinctly curviflexuous, ascending or usually diverging at angles of 10°-45° (-90°); spikelets very crowded, in intimate contact, spreading from the rachis, not at all appressed, scarcely laterally compressed; first glume 0.6-1 mm. long, acute; second glume 1-1.8 mm. long, obovate, often mucronate; lemma 1.3-2 mm. long, broadly reniform or as viewed from the side obdeltoid and truncate and about as broad as long, with an awn 0.3-1.1 mm. long, the lateral nerves glabrous or with a few appressed hairs 0.1-0.4 mm. long; rudiment about equaling lemma, also broadly obdeltoid and truncate, with an awn 0.2-0.9 mm. long. Prairies, sandy and gravelly soils, less commonly on clayey soils, practically throughout the state but rare in w. Plains Country and Trans-Pecos, e. and s.e. Tex., most abundant in the Rio Grande Plains, spring-fall; s.-cen. Okla. and s.e. N.M., s.e. to N. L. and Tam.

Throughout the distribution of this species, but especially common in the Rio Grande Plains, occur plants with various character combinations showing intermediacy to *C. cucullata*-*C. verticillata*. The plants ordinarily are in stature more like *C. cucullata* but have various of the panicle and spikelet characters of *C. verticillata*, such as beards in the axils, elongate axes with more than one whorl, numerous fairly long straight spreading spikes on which the spikelets are less crowded and more appressed, the scales longer and narrower and the awns longer, etc. These plants have in recent treatments mostly passed under the name *C. latisquamea* Nash. They probably represent backcross types produced after ancient hybridization between the 2 species. In tight soil, disturbed habitats in the Rio Grande Plains, "*C. latisquamea*" is often more abundant than the "pure" *C. cucullata*.

7. *Chloris virgata* Sw. FEATHER FINGERGRASS. Tufted annual; lowermost internodes occasionally stoloniferous, the lower nodes then rooting; culms 25-90 cm. long, 1.5-5 mm. thick, compressed, mostly ascending, leafy, geniculate and sparingly branched in the lower part; ligule a scale 0.1-0.9 mm. long; blades 3-20 cm. long, 3-7 mm. broad, flat or usually folded, long-attenuate into a fine involute point; sheaths keeled, the margins of

the base of blade and corner of sheath glabrous or often sparsely pilose; spikes digitate, 5 to 16 per panicle, 2-10 cm. long, 3-4 mm. thick, straight or flexuous, ascending; glumes lanceolate, the first glume 1.5-2 mm. long, the second about 3-4 mm. long, the tip weakly awnlike; lemma about 3 mm. long, abruptly narrowed and acute apically, with an awn 5-9 mm. long, the dorsal keel and lateral nerves with abundant cilia, those cilia of the summits of the lateral nerves 2-3 mm. long, the lemma keel with a prominent bulge; rudiment about equaling lemma, truncate, with an awn 2-7 mm. long. Usually disturbed areas, prairies, roadsides and streambeds, Plains Country, Trans-Pecos and Edwards Plateau, frequent, weedy, rare farther e., summer-fall; widespread in the warmer parts of Am., n. to N.E., O., Ind., Mo., Neb., Colo., Ut. and Nev.

8. *Chloris inflata* Link. Very similar in character to *C. virgata* but sterile florets 2; cilia at the summits of lateral nerves of the lemma usually less than 1.5 mm. long; fertile lemma usually less than 3 mm. long; lemma keel without a prominent bulge. Very rare in extreme s. Tex. (Cameron Co.), Oct.; widespread in warmer parts of Am.

9. *Chloris Canterai* Arech. Tufted perennial, occasionally the lower internodes stoloniferous and lower nodes rooting; culms 50-145 cm. long, 1.5-3 mm. thick, somewhat geniculate and sparingly branched, erect; ligule a scale 0.1-0.2 mm. long; blades 1-4 dm. long, 2-7 mm. broad, flat, the tips sharply attenuate and involute or the whole blades involute on drying; margin of base of blade and corner of sheath ciliate, the sheath obscurely keeled; spikes digitate, 3 to 6 per panicle, 6-12 cm. long, 3-5 mm. thick, flexuous, ascending; first glume 1.5-2 mm. long; second glume 2.5-3.5 mm. long, narrow; lemma 3-3.5 mm. long, acute, apically bidentate and with an awn 2.5-3 mm. long, the dorsal keel and lateral nerves with abundant white cilia 1-2 mm. long; rudiment slightly shorter than the lemma and broadly truncate and with an awn 1.5-2.5 mm. long. Tight often moist clayey loamy soil, s.e. and s. part of e. Tex. and n. part of Rio Grande Plains (Atascosa, Bexar, Jackson, Milam and Wharton cos.), spring-fall; Parag.; Tex. (where introd.).

Reports of *C. polydactyla* (L.) Sw. in Texas are based on misdetermined specimens of *C. Canterai*.

10. *Chloris ciliata* Sw. Tufted perennial; culms 25-100 cm. long, 1-2.5 mm. thick, slightly geniculate at the lower nodes, erect, sparingly branched; ligule a scale 0.1-0.3 mm. long; blades 7-35 cm. long, 2-7 mm. broad, flat, the tip sharply attenuate and involute or the whole blade involute on drying; sheath obscurely if at all keeled; spikes digitate, 3 to 6 per panicle, 4-9 cm. long, 2-3 mm. thick, flexuous, ascending; first glume 1-2 mm. long; second glume 2-3 mm. long, narrow, the tip awnlike; lemma 2-2.5 mm. long, acute, apically bidentate and with an awn 0.5-1 mm. long, the dorsal keel and lateral nerves with abundant white cilia 0.5-1.3 mm. long; rudiment about equaling lemma and broadly truncate, with an awn 0.5-1 mm. long. Tight calcareous loam, frequent in Rio Grande Plains and infrequent in s.e. Tex., rare to s. part of n.-cen. Tex., spring-fall; also Mex.

11. *Chloris distichophylla* Lag. Tufted perennial; culms compressed, about 1 m. tall, erect; blades 7-15 cm. long, 7-10 mm. broad, very numerous and crowded at the base of the plant; sheaths keeled; spikes digitate, 16 to 32 per panicle, 8-15 cm. long, 2-3 mm. thick; first glume about 1-1.3 mm. long; second glume about 2 mm. long, emarginate, with an awn 0.3-0.5 mm. long; lemmas 2.5-3 mm. long, tawny or chestnut-brown at maturity, awnless, with cilia on the nerves and keel 0.9-1.5 mm. long. Sandy soil, disturbed areas, rarely cult. and even more rarely escaped in s. part of e. Tex., (?) said to have escaped near Bastrop, Tex.; nat. of temp. S. A., cult. and escaped in Calif. and perhaps in Tex.

12. *Chloris argentina* (Hack.) Lillo & Parodi. Tufted perennial; culms compressed, 3-10 dm. long, 1.5-4 mm. broad on the broad axis, sparingly or not geniculate at the lower nodes, erect; ligule a scale about 0.5 mm. long; blades 5-25 cm. long, 4-7 mm. broad, flat or usually folded; sheaths keeled; spikes digitate, 5 to 11 per panicle, 4-15 cm. long, 2-3 mm. thick; first glume 1-1.3 mm. long; second glume 1.3-1.7 mm. long, emarginate, with an awn 0.1-1 mm. long; lemma 1.8-2.2 mm. long, tawny or yellowish-brown at maturity, awnless, with cilia on the nerves and keel 0.5-1.1 mm. long. Disturbed shady loam along roadsides, s. part of n.-cen. Tex., infrequent, spring-summer; nat. of Arg., introd.

13. *Chloris petraea* Sw. Tufted perennial; culms compressed, 2-9 dm. long, 2-4 mm. broad on the broad axis, the lower internodes shortly stoloniferous and nodally geniculate, the rest erect; ligule a scale 0.2-0.3 mm. long; blades 3-25 cm. long, 2-5 (-8) mm. broad, flat or folded; sheaths keeled; spikes digitate, 2 to 6 per panicle, 3-8 cm. long, 1-2 mm. thick; first glume about 1 mm. long; second glume 1.3-1.5 mm. long, emarginate, with an awn about 0.5 mm. long; lemma 1.5-2 mm. long, dark-brown or almost black at maturity, awnless, with cilia on the nerves and keel 0.1-0.3 mm. long. Seasonally moist sandy soil near the coast, s.e. Tex. and Rio Grande Plains, frequent, spring-fall; widely distributed near warm coasts of Am. n. to N.C. and the Gulf States.

101. TRICHLORIS FOURN.

Coarse densely tufted perennials; spikes elongate, numerous, either digitate or attached to the panicle axis at more than one level; spikelets crowded in 2 rows along one side of the rachis of the spike, scarcely laterally compressed, either with a single perfect flower and an additional rudimentary floret ("rudiment") or with 1 to 3 perfect lower florets and 1 to 3 staminate or neuter florets; zone of abscission at the base of each staminate or perfect floret; lemmas 3-nerved, either both the lemmas with 3 equal awns or all the lemmas 3-awned but the lateral awns reduced.

A very small American genus, included by some authors in *Chloris*.

1. Spikes nearly digitate, strictly ascending; each spikelet with one fertile floret and one staminate or neutral one, both the fertile and the other lemma with 3 awns of nearly equal length1. *T. crinita*.
1. Panicle axis 15-70 mm. long, the spikes attached at more than one level and often spreading; each spikelet with a total of 3 to 5 lemmas, the lower 1 to 3 fertile, the upper 3 or 2 staminate or neutral, the central awn of each lemma more than twice as long as the laterals2. *T. pluriflora*.

1. *Trichloris crinita* (Lag.) Parodi. Tufted perennial; culms 4-12 dm. long; blades elongate, 2-4 mm. broad, pilose near the ligule; spikes digitate, 8 to 25 per panicle, 5-12 cm. long, feathery, nearly straight, strictly ascending; spikelets each with one fertile floret and one staminate or neutral; fertile lemma about 3 mm. long, both lemmas with 3 awns about 1 cm. long. Deep alluvial silty soil along or near intermittent creeks and along ditches, infrequent in the Trans-Pecos and rare in w. Rio Grande Plains, spring-fall; Tex. to Ariz. and s. to Dgo. and Coah.; also arid-temp. areas in s. S. A.

2. *Trichloris pluriflora* Fourn. Tufted perennial; culms 4-15 dm. long; blades elongate, (2-) 3-12 mm. broad; panicle axis 15-70 mm. long; spikes 6 to 20 per panicle, 6-15 cm. long, nearly straight, ascending or somewhat spreading; spikelets each with 1 to 3 lower fertile flowers and 3 or 2 staminate or neutral; lowest lemma the longest, about 4 mm. long, the central awn of each lemma 5-15 mm. long, the lateral ones less than half as long as the central. Deep silty and clayey soil, less commonly sandy loam, low areas in brush, common in the Rio Grande Plains and rare n.w. to the s. Edwards Plateau (to the Terrell-Brewster county line), summer-fall; Tex. to Coah., N. L. and Tam.; also dry temp. parts of s. S. A.

102. BOUTELOUA LAG. GRAMA

Inflorescence a panicle of (1 or) 2 to 50 spikes, these often subsecund or in 2 rows on one side of the panicle axis, either persistent and many-spikeletted or deciduous and few-spikeletted; rachis often prolonged beyond the most distal fertile spikelet into a needle or this often bearing terminally a reduced or rudimentary sterile floret; spikelets either solitary or numbering 2 to 130 per spike, when more than one attached in 2 rows along one side of the usually somewhat flattened rachis, each with a single fertile floret and often a rudiment of 1 or 2 reduced sterile or staminate florets above; glumes 1-nerved, the second glume visible from the side of the spike; zone of abscission in those species with persistent spikes and numerous spikelets at base of fertile floret; lemma 3-nerved, the nerves commonly prolonged into awns. *Chondrosium* Desv.

About 40 species in North America and South America. Then generic name originally

was spelled *Botelua*, and possibly we should revert to that spelling. Some of our most valuable forage grasses belong to this genus, especially such species as *B. gracilis* and *B. curtipendula*. Various grasses of other genera are also often referred to as "grama," this being a Spanish word for grass. On the other hand, some of our short gramas are often indiscriminately and incorrectly referred to as "mesquite grasses."

1. Lower internodes covered with dense white wool or a white waxy bloom obscuring the epidermis (2)
1. Epidermis of lower internodes visible, the pubescence or bloom (if any) not thick enough to obscure the epidermis (3)
- 2(1). Lower internodes covered by a waxy bloom; spikelets 30 to 40 per spike 7. *B. breviseta*.
2. Lower internodes woolly; spikelets 9 to 20 per spike .. 9. *B. eriopoda*.
- 3(1). Low annual with solitary spikes 6. *B. simplex*.
3. Spikes more than one or if solitary on some culms then plants obviously perennial (4)
- 4(3). Spikelets more than 13 per spike or if fewer then spikes and glumes obviously persistent (5)
4. Spikelets fewer than 13 per spike, each spike deciduous as a unit (10)
- 5(4). Perennial; base of plants knotty; culms remarkably branched in the lower third; second glumes more or less smooth 8. *B. ramosa*.
5. Base of plants not hard and knotty; culms essentially unbranched or if branched then second glume tuberculate under a lens (6)
- 6(5). Spikes 1 to 3 per culm, the rachis terminally bearing a rudimentary spikelet; second glume not tuberculate-roughened or only microscopically so; spikelets 40 to 130 per spike 1. *B. gracilis*.
6. Spikes more than 3 per culm or if only 2 or 3 then rachis merely needlelike and not rudiment-tipped or else the second glumes tuberculate or the spikelets fewer than 40 (7)
- 7(6). Second glumes tuberculate 2. *B. hirsuta*.
7. Second glumes not tuberculate (8)
- 8(7). Rachis terminating in a rudimentary spikelet; spikelets (22 to) 30 to 52 per spike 5. *B. barbata*.
8. Rachis not terminating in a rudimentary spikelet; spikelets 8 to 23 (to 32) per spike (9)
- 9(8). Spikes 2 to 7 per culm 3. *B. trifida*.
9. Spikes 5 to 7 (or 8, to 20?) per culm 4. *B. Kayi*.
- 10(4). Spikelets 2 to 4 per spike; spike 12-20 mm. long; annual with geniculate culms 13. *B. aristidoides*.
10. Spikelets more than 4 or if only 2 or 3 then plants obviously perennial or spikes shorter than 12 mm. (11)
- 11(10). Rachis densely raised-pubescent, the pubescence visible without a lens 10. *B. chondrosioides*.
11. Rachis glabrous or only microscopically appressed-pubescent (12)
- 12(11). Panicle mostly 3-8 cm. long; spikes 5 to 14 in number; spikelets always more than 1 per spike (13)
12. Panicles mostly 8-30 cm. long; spikes 10 to 50 in number or if the panicles shorter and spikes fewer then most spikes with solitary spikelets (14)
- 13(12). Spikelets 2 to 5 per spike; second glumes appressed-pubescent; rachis apically appearing trifurcate 11. *B. rigidiseta*.
13. Spikelets 5 to 8 per spike; second glume essentially glabrous; rachis merely needle-like 12. *B. repens*.
- 14(12). Spikes mostly 20 to 40 (to 50) per panicle; panicles mostly 13-30 cm. long; blades mostly broader than 2 mm. 14. *B. curtipendula*.

14. Spikes 10 to 30 per panicle; panicles mostly less than 15 cm. long; blades only about 2 mm. broad or narrower (15)

15(14). Anthers dark-purple; stolons absent; spikelets 2 to 6 per spike
.....15. *B. Warnockii*.

15. Anthers yellow; stolons usually abundant; spikelets 1 (to 3) per spike
.....16. *B. uniflora*.

1. *Bouteloua gracilis* (H.B.K.) Griffiths. BLUE GRAMA. Tufted perennial, base often very shortly subrhizomatous; culms 15-60 cm. long, 0.5-1 mm. thick, very slightly geniculate at some nodes, essentially unbranched above the base; ligule a scale 0.2-0.3 mm. long; blades mostly crowded at the base of the tuft, 5-18 cm. long, 1-2.3 mm. broad, flat basally, passing into a closely involute arcuate tip, usually pilose near the ligule; spikes persistent, 1 to 3, usually 2, rarely 4 to 6 (if 2 or 3 then distributed over a panicle axis 2-4 (-7) cm. long), 15-60 mm. long, 3-7 mm. thick, the rachis slightly prolonged beyond the most distal fertile spikelets and terminating in a rudimentary sterile spikelet; second glume glabrous or usually sparingly pilose or papillose-pilose or occasionally even with low tubercles (invisible without a lens), usually purplish at maturity; spikelets 40 to 100 per spike (usually 50 to 70) in our area or up to 130 per spike in parts of n. Mex. Prairies and open low scrub on plains, usually in gravelly or sandy loam, very abundant in the w. Plains Country and Trans-Pecos, rare e. to e. Plains Country and w. Edwards Plateau, summer-fall; plains and foothills of cen. N. A. from s. Can. to s. Mex. and e. to Wisc., Ill. and Okla., w. to Mont., Nev. and s. Calif.; also adv. in O., S.C. and N.E.

Blue grama is one of the most important forage grasses in native ranges of west Texas. The occurrence of tubercles on the second glumes in scattered clones of this species apparently evinces genetic contaminations through ancient hybridization with the very closely related *B. hirsuta* var. *pectinata*. *B. gracilis* var. *stricta* (Vasey) Hitchc. is the name of the rare form that possesses more than 3 spikes on a single culm.

2. *Bouteloua hirsuta* Lag. HAIRY GRAMA. Tufted perennial (but flowering the first year); culms numerous, 10-75 cm. long, 0.5-2 mm. thick, slightly geniculate at the lower nodes, essentially unbranched above the base; ligule a scale 0.1-0.3 mm. long; blades occurring mostly in the lower half of the plant, 5-12 (-20) cm. long, 1-2.2 mm. broad, flat basally, passing into a closely involute arcuate tip, usually pilose near the ligule and on the lower margins; spikes persistent, (1 or) 2 to 4 (to 6) per culm, 10-35 (-60) mm. long, 3-6 mm. thick, distributed over a panicle axis 1-8 (-19) cm. long, the rachis apically subspinose, i.e., prolonged beyond the most distal fertile spikelet into a semirigid needle 3-11 mm. long (in one variety the needle terminating in a rudimentary spikelet); second glume on and near the keel, with tubercles (at maturity of the spikelet these black and usually visible to the unaided eye) and these with long white whiskers, rarely only short-pilose; spikelets 18 to 50 (to 70) per spike. Frequent practically throughout Tex. but rare in e. Tex., late spring-fall; Great Plains e. to Wisc., Ill., Okla. and Tex., w. to Colo. and N.M., and in the Mex. highlands from Oax. n. to s. Nev. and Ariz. (The var. *pectinata* in Okla. and Tex. only).

In the Edwards Plateau and similar dry limestone uplands in the Plains Country and Trans-Pecos Texas many of the plants exhibit a combination of characters including robust stemmy habit with leaves restricted to the base of the plant, more extensively involute leaves (flat only at the very base), spikes 3 to 6 on a prolonged axis, and spikelets usually 50 to 70 per spike, and the rachis terminating in a rudimentary sterile spikelet (this appearing as a continuation of the "needle"); these plants are called *B. hirsuta* var. *pectinata* (Featherly) Cory (*B. pectinata* Featherly), but the recombination of these characteristics with more typical hairy grama characteristics is so complete that the "variety" is a weak one, impossible to delineate precisely.

3. *Bouteloua trifida* Thurb. RED GRAMA. Densely tufted perennial; at the very base of old plants the culms very shortly subrhizomatous, otherwise culms (5-) 10-20 (-40) cm. long, 0.5-1 mm. thick, erect (occasionally slightly geniculate at lower nodes), essentially unbranched; ligule a line of cilia 0.2-0.5 mm. long; blades 7-50 (-90) mm. long, 0.7-1.3 mm. broad, flat or folded or involute; spikes persistent, (2 or) 3 to 7, 7-25 (-40) mm. long, distributed over a panicle axis 1-5 (-8) cm. long, the rachis not prolonged

beyond the most distal fertile spikelet; second glume smooth and glabrous, often purplish-red; spikelets 8 to 23 (to 32) per spike. Abundant on dry calcareous slopes among scrubby vegetation, Rio Grande Plains, Edwards Plateau and the Trans-Pecos n. to Plains Country and s. part of n.-cen. Tex., spring-fall; Tex. to s. Ut., s. Nev. and s. Calif., s.e. to S. L. P.

4. *Bouteloua Kayi* Warnock. Densely tufted perennial, rather like *B. trifida*; culms 1-5 dm. long, erect, essentially unbranched; ligule a fringe about 0.5 mm. long; blades 2-10 cm. long, 1-1.5 mm. broad, involute at least after drying; spikes persistent, 5 to 7 (or 8, or 20?), 8-40 mm. long, distributed over a panicle axis 3-8 cm. long; second glume smooth; spikelets about 18 to 20 per spike; rachis not prolonged beyond the most distal fertile spikelet. Crevices, limestone ledges, in the Trans-Pecos (s.e. Brewster Co. only), rare, late summer.

Probably only a form of *B. trifida*, the type collection being very dry, well past anthesis and very difficult to interpret.

5. *Bouteloua barbata* Lag. SIXWEEKS GRAMA. Tufted annual; culms 8-41 cm. long, 0.5-1 mm. thick, markedly geniculate, sprawling or less commonly erect; ligule a fringe about 0.5 mm. long; blades 1-5 (-10) cm. long, 1-2 mm. broad, mostly flat with an involute tip; spikes persistent, (2 to) 4 to 6 (to 10), 8-26 mm. long, distributed over a panicle axis (3-) 6-12 cm. long, the rachis not prolonged beyond the most distal fertile spikelet; second glume smooth and glabrous, often dull-purplish; spikelets (22 to) 30 to 52 per spike. Abundant on alluvial flats and hillsides, Trans-Pecos and Plains Country, infrequent e. to Rio Grande Plains and n.-cen. Tex. where repeatedly introd. but not persistent, late spring-early fall; Tex. to s. Ut. and Calif.; Mex.

The awns of the rudiment and lemma are shortest on the plants with the greatest number of spikelets (34 to 52), and longest on the plants with the lower spikelet counts (22 to 34); the latter plants greatly resemble first-year plants of *B. trifida* but can be identified by the more geniculate culms and longer panicle axes.

6. *Bouteloua simplex* Lag. MAT GRAMA. Tufted annual; culms numerous, 7-23 cm. long, about 0.5 mm. thick, markedly geniculate and sparingly branched in lower part, usually decumbent, ascending only at the ends; ligule a fringe 0.1-0.2 mm. long; blades 2-4 (-7) cm. long, 0.5-1.1 mm. broad, basally flat, distally involute; spikes persistent, solitary, 10-25 mm. long, at maturity strongly arcuate, the rachis very slightly prolonged beyond the most distal fertile spikelet and terminating in a rudimentary sterile spikelet so reduced that it often appears as merely a continuation of the rachis; second glume smooth; spikelets (10 to) 20 to 40 (to 62) per spike. Grasslands on slopes of volcanic rock at elev. of 6,000-8,000 ft., Davis Mts. in the Trans-Pecos, locally frequent, late summer-fall; Colo. and Ut. s. to cen. Mex.; also Andean S. A.

7. *Bouteloua breviseta* Vasey. GYP GRAMA. Tufted perennial, with tough creeping scaly short or elongate rhizomes 1-3 mm. thick; aerial culms numerous, firm, 2-4 dm. long, branched near the base, otherwise strictly erect, not geniculate, very leafy, the upper parts of the lower internodes covered with a white waxy bloom; ligule a scale 0.1-0.2 mm. long; blades 1-4 cm. long, 1-2 mm. broad, very shortly flat basally, the rest closely involute and reflex-arcuate; spikes persistent, 1 to 3, usually 2, 15-36 mm. long, distributed over a panicle axis 2-4 cm. long, the rachis prolonged beyond the most distal fertile spikelet into a semirigid needle 2-5 mm. long (the terminal portion of this distinctly constituting a rudimentary spikelet); second glume essentially smooth; spikelets 30 to 40 per spike. Trans-Pecos, locally abundant in areas of gypsum sands at the leeward sides of gypsum lake-beds, summer-fall; also s. N.M.

8. *Bouteloua ramosa* Vasey. CHINO GRAMA, CHINOGRASS. Tufted perennial from hard knotty bases; culms numerous, 25-60 cm. long, 0.5-1 mm. thick, geniculate and abundantly bushy-branched in the lower third, ascending, leafy; ligule a scale 0.1-0.2 mm. long; blades 2-5 (-7) cm. long, 1-2 mm. broad, mostly flat with an involute tip; spikes persistent, 1 to 3, mostly 2, very rarely 4, 10-25 (-35) mm. long, 2-4 (-5) mm. thick, distributed over a panicle axis 1-3 (-5) cm. long, the rachis slightly prolonged beyond the most distal fertile spikelet and bearing the remains of a sterile rudimentary spikelet resembling an extension of the rachis; second glume essentially smooth or with sparse microscopic pubescence near the keel; spikelets 24 to 45 (to 64) per spike. Trans-Pecos and w. Edwards Plateau, locally frequent on rocky desertic slopes among shrubbery and lechuguilla, summer-fall; Tex. and s. N.M. s. to Chih., Coah. and Zac.

This is perhaps the best forage grass in the true desert areas. The plants of Val Verde and Terrell counties tend to have longer spikes and more spikelets than those from farther west.

9. *Bouteloua eriopoda* (Torr.) Torr. BLACK GRAMA, WOOLLYFOOT GRAMA. Tufted perennial from hard knotty bases; culms sprawling, strongly genuflexed and occasionally rooting at the nodes, ascending only at the floriferous ends, essentially unbranched above the base, 25-60 cm. long, about 1 mm. thick, the internodes densely white-woolly; ligule a fringe 0.2-0.5 mm. long; blades 2-10 (-14) cm. long, 1-2 mm. broad, flat or usually mostly involute-filiform; spikes persistent, 3 to 8, 1-5 cm. long, distributed over a panicle axis 3-10 (-18) cm. long, the axils bearded, the rachis slightly prolonged beyond the most distal fertile spikelet into a needle, this not readily perceptible because of the appression of the spikelets, not bearing any trace of a rudimentary spikelet; second glume essentially glabrous, stramineous or often a dark-dull-purple; spikelets 9 to 20 per spike, not crowded, often somewhat appressed to the rachis. Abundant on arid rocky slopes, Trans-Pecos and Plains Country, summer-fall; w. Okla. to s. Ut. and s. to Coah., Chih. and Son.

10. *Bouteloua chondrosioides* (H.B.K.) Wats. Tufted perennial; culms 2-5 dm. long, 1-2 mm. thick, somewhat geniculate at the nodes, essentially unbranched; ligule a fringe 0.2-0.3 mm. long; blades mostly aggregated at the base of the plant, 3-10 (-18) cm. long, 2-3 mm. broad, mostly flat, marginally papillose-pilose; spikes 3 to 8, 9-20 mm. long, distributed over a panicle axis 3-6 cm. long, at length each deciduous as a unit, the rachis densely pubescent and prolonged beyond the most distal fertile spikelet as a needle; glumes densely pubescent; spikelets 8 to 12 per spike, at maturity the largest of them about as long as the rachis of the spike. Grasslands on rocky slopes and flats at elev. usually greater than 4,000 ft., Trans-Pecos, summer-fall; Tex. to Ariz., s.e. to Guat.

11. *Bouteloua rigidiseta* (Steud.) Hitchc. TEXAS GRAMA. Tufted perennial; culms numerous, 15-40 cm. long, 0.5-1 mm. thick, erect, very sparingly branched in lower part; ligule a fringe about 0.1 mm. long; blades 3-10 (-17) cm. long, 1-2 mm. broad, flat with involute-filiform tip, on drying mostly involute, sparingly papillose-pilose; spikes 5 to 14, 7-13 mm. long, distributed in 2 rows along one side of a panicle axis 3-6 cm. long, mostly spreading or slightly pendulous, at length each spike deciduous as a unit, the rachis prolonged beyond the most distal spikelet, apically trifurcate, basally and laterally with much pubescence; glumes appressed-pubescent near the midnerve; spikelets (2 or) 3 to 5 per spike, at maturity the longest of them much longer than the rachis. Brush and overgrazed prairies and other disturbed areas such as roadsides, Rio Grande Plains, Edwards Plateau, e. Plains Country, s. and w. parts of e. Tex. and n.-cen. Tex., frequent, spring-fall; Okla. s. to e. Coah. and N. L.

12. *Bouteloua repens* (H.B.K.) Scribn. & Merr. SLENDER GRAMA. Tufted perennial (flowering first year and often behaving as annual); culms 15-40 cm. long, 0.4-1 mm. thick, mostly erect, very slightly geniculate and sparingly branched at the lower nodes; ligule a scale, sometimes fringed, about 0.2 mm. long; blades 3-18 cm. long, 1-3 mm. broad, mostly flat, marginally sparsely papillose-pilose; spikes 5 to 9, 9-16 (-20) mm. long, distributed over a panicle axis 3-8 cm. long, at length each deciduous as a unit, the rachis smooth, prolonged beyond the most distal fertile spikelet as a needle; glumes essentially smooth and glabrous; spikelets 5 to 8 per spike, at maturity the longest of them about as long as the rachis. *B. filiformis* (Fourn.) Griffiths. Grasslands and open brush on sandy or gravelly loam, Rio Grande Plains, infrequent, spring-fall; Tex. to Ariz. and s.e. to s. Mex. and C. A.

13. *Bouteloua aristidoides* (H.B.K.) Griseb. NEEDLE GRAMA. Tufted annual; culms 1-5 dm. long, 0.5-1 mm. thick, geniculate and somewhat branched at the lower nodes, often mostly decumbent, distally ascending; ligule a fringe 0.2-0.5 mm. long; blades 2-5 (-9) cm. long, 0.7-1.7 mm. broad, basally flat, mostly involute; spikes 6 to 16, 12-20 mm. long, in 2 rows along one side of a panicle axis 4-15 cm. long, spreading or slightly pendulous, at length each deciduous as a unit, the rachis densely short-pubescent basally and prolonged beyond the most distal spikelet as a needle; glumes scabrous, appressed-strigulose near the midrib; spikelets 2 to 4, closely appressed to the rachis, at maturity the longest of them about equaling the rachis needle. Loamy usually alluvial soils in creek beds and along roadsides, frequent in the Trans-Pecos, infrequent in s. Edwards

Plateau and Rio Grande Plains, summer-fall; Tex. to s. Nev. and s. to cen. Mex.; also Arg.

14. *Bouteloua curtipendula* (Michx.) Torr. **SIDE-OATS GRAMA**. Tufted perennial, often with rhizomes basally by means of which the tufts expand peripherally and rarely with a few stoloniform culms; most aerial culms (3-) 6-9 (-11) dm. long, 1-2 mm. thick, erect, essentially unbranched; ligule a fringe or fringed scale 0.5-1 mm. long; blades 5-20 (-35) cm. long, (2-) 3-6 mm. broad, usually flat with an involute tip or more extensively involute; spikes (20 to) 30 to 40 (to 50), 6-20 (-40) mm. long, in 2 rows on one side of a panicle axis 13-30 cm. long, somewhat pendulous, at length each deciduous as a unit, the rachis prolonged beyond the most distal spikelet as a needle, sparsely appressed-strigose or glabrous; glumes sparsely appressed-strigose or glabrous; spikelets (3 to) 5 to 8 (to 13), at maturity the longest of them much exceeding the rachis needle; anthers red, orange or yellow. Prairies and grasslands or open brush or forest-openings on alluvial loam or among rocks on steep slopes, nearly throughout Texas except the extreme e. forests and s.e. Rio Grande Plains, often abundant (especially in cen. and w. Tex.), exceedingly variable, late spring-fall; s.e. Can., nearly throughout U.S. (except extreme s.e. and extreme n.w. portions) and s.e. to C. A.; Andean S. A. from Ecu. to Arg.

An important forage species. The forms with narrow tufts connected by rhizomes constitute var. *curtipendula*; those with large thick tufts and very short rhizomes or none are var. *caespitosa* Gould & Kapadia.

15. *Bouteloua Warnockii* Gould & Kapadia. Tufted perennial, some with a few very short rhizomes; most culms 20-35 (-50) cm. long, about 0.5 mm. thick, erect, unbranched; ligule a fringe 0.5-1.5 mm. long; blades 5-15 (-25) cm. long, 1-1.5 (-2.5) mm. broad when flat but mostly tightly involute and arcuate; spikes 9 to 25 (to 35), usually 7-9 mm. long, in 2 rows along one side of a panicle axis 5-12 cm. long, spreading, at length each deciduous as a unit, the rachis prolonged beyond the most distal spikelet as a needle, sparsely and minutely appressed-strigose or scabrous; glumes appressed-strigose; spikelets 2 to 6, slightly exceeding the rachis needle; anthers dark-purple. Rocky limestone slopes in the Trans-Pecos (Culberson, Hudspeth and El Paso cos.), infrequent to rare, summer-fall; Tex. and s. N.M. s. to Coah.

16. *Bouteloua uniflora* Vasey. Tufted perennial, rarely with a few short rhizomes but prolifically stoloniferous, thereby forming large colonies; most culms (15-) 45-60 cm. long, 0.5-1 mm. thick, erect, unbranched; ligule a short fringe; blades 3-20 (-30) cm. long, about 2 mm. broad, mostly subinvolute, the tip closely involute; spikes 10 to 30, usually 7-9 mm. long, in 2 rows along one side of a panicle axis (5-) 10-15 cm. long, somewhat pendulous, at length each deciduous as a unit, the rachis prolonged beyond the most distal spikelet as a conspicuous needle, sparsely appressed-strigose or merely scabrous; glumes sparsely appressed-strigose or glabrous; spikelets solitary or in the lowest spikes occasionally 2 or 3, slightly exceeding the rachis needle; anthers yellow. Rocky limestone slopes and flats, Edwards Plateau and s.c. Trans-Pecos, infrequent to rare, summer-fall; Tex. to Coah. and N. L.

103. CATHESTECUM J. PRESL

A genus of perhaps 6 species in southwestern United States and Mexico; much in need of a revision.

1. *Cathestecum erectum* Vasey & Hack. **FALSE GRAMA**. Colonial, remarkably stoloniferous perennial, the slender stolons naked and 1-3 dm. long; erect culms in small tufts, 12-28 cm. long, 0.5-1 mm. thick, essentially unbranched; ligule a fringe about 0.5 mm. long; blades mostly aggregated at the base of the tuft, 2-10 cm. long, about 1 mm. broad, flat or often mostly involute; spikes 4 to 8, 4-6 mm. long, subsecund in 2 rows on one side of a panicle axis only 2-3 cm. long, each spike eventually deciduous as a unit, the rachis of each very short, densely short-pubescent, supporting laterally and subterminally 2 staminate or neutral spikelets and 1 terminal spikelet consisting of a basal pistillate floret and above that a rudiment of 2 reduced florets, one or both of which may be staminate; glumes one-nerved, the first short and mucous, the second (external) lanceolate and pubescent; lemma 3-nerved, the nerves produced into lobes. Locally frequent in gravelly soil in deserts, s. Trans-Pecos, summer; cen. Mex. n. to s. Ariz. and Tex.

104. BUCHLOË ENGELM.

A monotypic genus.

1. *Buchloë dactyloides* (Nutt.) Engelm. BUFFALO GRASS. Colonial, remarkably stoloniferous perennial, the slender stolons 3-15 cm. long; erect culms in small subrhizomatous tufts, 4-30 cm. long, 0.5-1 mm. thick, essentially unbranched; ligule a fringe about 0.5 mm. long; blades 2-10 (-21) cm. long, 1-2 mm. broad, mostly flat with an involute-filiform tip, marginally papillose-pilose; panicles of 2 quite different sorts, staminate and pistillate, these on separate plants or on separate tufts of the same clone; *staminate panicle* on an elongate culm and elevated above the leaves, comprising (1 or) 2 to 4 spikes on an axis about 1 cm. long, each spike 5-13 mm. long, consisting of 7 to 12 spikelets attached in 2 rows along the abaxial side of a smooth somewhat flattened rachis, the latter not at all prolonged beyond the most distal spikelet, the spike eventually falling as a unit, the spikelets 2-flowered, rather smooth, stramineous; *pistillate panicles* burlike on much-abbreviated culms and hidden among the sheaths, comprising (1 or) 2 or 3 spikes on an axis only 1-8 mm. long, each spike 3-7 mm. long, eventually falling as a unit, consisting of 3 to 7 spikelets in 2 rows along one side of a short rachis, nutlike, urceolate by virtue of the thickening and induration of the rachis and second (outer) glumes and burlike by virtue of the spinescent apexes of the second glumes; each spikelet one-flowered. Abundant in fine black calcareous clay loam, in prairies and along roadsides, nearly throughout the state except w. Trans-Pecos and e. Tex., spring-summer-fall; cen. N. A. from Minn. to Mont. and s. through e. Mex. to Pue.

Buffalo grass is sometimes confused with curly mesquite grass (*Hilaria Belangeri*) which also forms close sod in calcareous prairies. Curly mesquite grass has auricled ligules and its blades are usually not papillose-pilose. Buffalo grass is an extremely valuable forage on the Texas plains.

105. SPARTINA SCHREB. CORDGRASS

Perennials; ligule a fringe of cilia; panicle of several spikes; zone of abscission at the base of the spikelet; spikelets strongly laterally compressed, very closely imbricate, arranged in 2 rows on the abaxial side of the flattened rachis of the spike, 1-flowered, firm; glumes very unequal, the first shorter than the lemma, the second longer than the lemma; palea often longer than the lemma but shorter than the second glume.

A genus of about 16 species, mostly American but a few on the coasts of Europe and Africa.

1. Spikelets 15-25 mm. long, including the awn; second glume with an awnlike tip a third to a half its entire length; keels of second glume and lemma with bristles 0.2-0.4 mm. long5. *S. pectinata*.
1. Spikelets 5-15 mm. long, awnless; keel of second glume and lemma often minutely pubescent but not pectinate (2)
- 2(1). Spikes numbering only 2 to 7 (to 10) per panicle, remote (the panicle axis being 9-20 cm. long); culms only 2-4 mm. thick and rhizomes present4. *S. patens*.
2. Spikes more numerous per panicle and more crowded or if few then culms thicker and/or rhizomes absent (3)
- 3(2). Spikes 1-3.5 cm. long; panicle spikelike, 5-10 mm. thick; rhizomes absent; leaf blades nearly wholly involute, 2-5 mm. broad at base1. *S. spartinae*.
3. Spikes 4-15 cm. long; panicles 7-70 mm. broad; rhizomes present; leaf blades 4-25 mm. broad at base, mostly flat (4)
- 4(3). Panicle mostly less than 3 cm. broad; spikes only 5 to 30 per panicle; rhizomes soft; culms 6-15 dm. long2. *S. alterniflora*.
4. Panicle mostly more than 3 cm. broad; spikes usually 25 to 45 per panicle; rhizomes firm; culm firm and tough, 9-30 dm. long3. *S. cynosuroides*.

1. *Spartina spartinae* (Trin.) Hitchc. SACAHUISTA, GULF CORDGRASS. Tufted perennial; lowermost internodes occasionally shortly subrhizomatous toward the outside of the large tuft but true rhizomes absent; culms numerous, 5-20 dm. long, 2.4 mm. thick, erect, unbranched; ligule 1-2 mm. long; blades 2-7 dm. long, 2-5 mm. broad at the base, closely involute essentially the entire length, the tips sharp and spinelike; panicle spike-like, 6-40 cm. long, 5-9 mm. thick, usually tapered to both ends; spikes 10 to 75 per panicle, 10-35 mm. long, 3-4 mm. thick, closely appressed and overlapping; spikelets 16 to 40 per spike, 5-8 mm. long; first glume 2-6 mm. long; second glume 4-8 mm. long; lemma about equaling second glume; keels of glumes and lemma minutely hispid. Abundant in tight loamy somewhat saline poorly drained flats, s.e. Tex. and Rio Grande Plains, extremely abundant near the coast, rare and scattered inland (e.g., Gonzales Co.), spring-summer, rarely fall; Gulf and Carib. shores, U.S., Mex. and C.A.; also inland in S.L.P., Coah. and N.L.; also inland in Arg. and Parag.

The young shoots emerging after fires are good forage but the older shoots are much too tough even for horses. Formerly vast acreage of sacahuista were therefore burned over purposely in the ranches of southern Texas; the practice is less common now.

2. *Spartina alterniflora* Lois. SMOOTH CORDGRASS. Perennial from relatively soft deeply buried (and seldom collected) branched rhizomes 4-7 mm. thick; aerial culms 6-15 dm. long, 3-14 mm. thick, erect, unbranched, leafy; ligule 1-2 mm. long; blades 20-55 cm. long, 4-16 (-25) mm. broad at the very base, flat, distally involute and wholly involute on drying; panicle 1-4 dm. long, 7-22 mm. thick, tapered to both ends, somewhat spike-like but lax; spikes 5 to 30 per panicle, 4-10 cm. long, 3-5 mm. thick, appressed or usually diverging at angles of 10°-20°, closely overlapping; spikelets 10 to 40 per spike, 8-14 mm. long; first glume 4-10 mm. long; second glume as long as spikelet, the lemma a little shorter; keels of glumes and lemma with some minute pubescence. Abundant in colonies at the tidally-inundated shores of brackish to hypersaline bays and river-mouths, along the Tex. coast, locally common, summer-fall; nat. to the e. coast of N.A. from the Maritime Provinces to Tex., and also S.A. from Gui. to Arg.; introd. in Wash., and in Fr. and Eng.

3. *Spartina cynosuroides* (L.) Roth. BIG CORDGRASS. Perennial from deeply buried (rarely collected) rhizomes 7-15 mm. thick; aerial culms 9-30 dm. long, 4-25 mm. thick, erect, unbranched, leafy; ligule 1-3 mm. long; blades 25-70 cm. long, 10-22 mm. broad at base, flat, at the tip involute; panicle 15-30 cm. long, 4-7 cm. broad, more or less ellipsoidal; spikes 5 to 67 (usually 25 to 45) per panicle, 5-15 cm. long, 3-6 cm. thick, basally shortly naked, usually diverging at angles of 20°-30°, overlapping; spikelets 30 to 70 per spike, 9-14 mm. long; first glume 3-7 mm. long; second glume as long as spikelets, the lemma a little shorter; glumes and lemmas minutely pubescent on the keels or wholly glabrous. Locally abundant in colonies in muck at tidally submerged shores of brackish bays and river-mouths, s.e. Tex. (Chambers, Galveston and Harris cos.), summer; coasts from Mass. to Tex.

4. *Spartina patens* (Ait.) Muhl. SALTMEADOW CORDGRASS. Perennial from creeping rhizomes 2-4 mm. thick; aerial culms 25-90 cm. long, 1-3 mm. thick, erect, unbranched; ligule about 0.5 mm. long; blades 15-40 cm. long, 1.5-3 mm. broad, mostly involute, the tip subspinose; panicle 9-20 cm. long, about 1 cm. broad; spikes 2 to 7 per panicle, 1-7 cm. long, 2-3 mm. thick, usually diverging at angles of 5°-45°, remote; spikelets 24 to 50 per spike, 7-12 mm. long; first glume 3-8 mm. long; second glume 7-12 mm. long; lemma shorter than second glume; glumes and lemma hispid on keel, at least distally. Sandy seasonally moist soil near the coast, s.c. Tex. and Rio Grande Plains, common, summer-fall; shores of Great Lakes, Atl. and Gulf coasts, cont. N.A. and W.I.; also s. Fr., Corsica and It.

5. *Spartina pectinata* Link. PRAIRIE CORDGRASS. Perennial from firm creeping rhizomes 3-8 mm. thick; aerial culms 75-200 cm. long, 3-10 mm. thick, erect, unbranched, leafy; ligule 1-3 mm. long; blades 2-6 dm. long, 5-10 mm. broad at base and flat, involute toward the tip and more extensively involute on drying; panicle 1-3 dm. long, 2-6 cm. broad; spikes 5 to 20 (rarely more) per panicle, 2-15 cm. long, 3-7 mm. thick, appressed or usually diverging at angles of 10°-20°, overlapping; spikelets 40 to 80 (rarely fewer) per spike; first glume 5-10 mm. long including an awnlike tip, the keel minutely hispid; second glume 15-25 mm. long including an awn-tip about a third to half the entire length, the keel pectinate with erect bristles 0.2-0.4 mm. long; lemma much shorter than the second glume, apically narrowed and bidentate, on the upper half of the dorsal keel

pectinate. N.-cen. and e. Tex., Plains Country and Trans-Pecos, scattered or rare, summer; s. Can. s. to N.C., Tenn., Ark., Tex., N.M., Ut. and Ore.

106. COTTEA KUNTH

A monotypic genus.

1. *Cottea pappophoroides* Kunth. Tufted annual or short-lived perennial; culms 35-60 cm. long, weak, often sprawling, geniculate at the nodes and terminally ascending, finely viscid-pubescent; blades ascending, 10-15 cm. long, 3-6 mm. broad, flat or when droughty folded; exerted panicles (not the cleistogamous ones in the lower sheath) 10-18 cm. long, conical or elongate-ovoid, loosely-flowered, sometimes nodding; spikelets oblong, 7-10 mm. long, about 6 mm. broad, slightly laterally compressed, mostly 8- to 10-flowered (the uppermost 1 or 2 flowers sometimes sterile); rachilla with a zone of abscission at each node; glumes slightly shorter than lowermost lemmas; lemmas 9- to 11-nerved; dissected into awned ciliate lobes almost half the length, densely pubescent along the nerves below with especially long hairs along the nerves nearest the lateral margin. Infrequent on desert flats and in rock crevices in the Trans-Pecos, summer-fall; Tex. to Ariz. and s. to cen. Mex.; also Andean S.A.

107. PAPPOPHORUM SCHREB.

PAPPUS GRASS

Tufted perennials; culms slender, 3-10 dm. long, erect, not or rarely branched; ligule an irregular fringe; blades 15-30 cm. long, 3-5 mm. broad basally, the tip long-attenuate and involute; panicle spikelike or nearly so, 8-20 cm. long, many-flowered; spikelets not compressed, 4- or 5-flowered, the lower 1 or 2 (or 3) fertile, the rest reduced to a rudiment; rachilla with a zone of abscission above the glumes; lemmas 13- to 15-nerved (nerves obscure in the body of the lemma), dissected more than half the length into numerous awns, pubescent near the base.

About 7 species in North America and South America.

1. Body of spikelets (not including awns) 3-4 mm. long, about equaling the awns; fertile florets at least 2 in number, usually 3 1. *P. bicolor*.
1. Body of spikelet 2-2.5 mm. long, shorter than the awns; fertile florets solitary (rarely 2) per spikelet 2. *P. mucronulatum*.

1. *Pappophorum bicolor* Fourn. Panicles rather loosely spikelike, with some branches 1-3 cm. long and sometimes not strictly appressed; pedicels 1-5 mm. long; spikelets with 2 or 3 fertile flowers, relatively large, usually pinkish-purple in the distal half. Brush-covered Rio Grande Plains, Edwards Plateau and streamsides and wastes in s.e. part of the Trans-Pecos, spring-summer; Tam. to Dgo., n. to Ariz. and Tex.

2. *Pappophorum mucronulatum* Nees. Panicles strict; pedicels 1 mm. long or less; spikelets with 1 fertile floret (rarely 2), small, whitish or buffy-white. Rio Grande Plains and Trans-Pecos, infrequent, spring-fall; Tam., S.L.P., to Dgo. and Son., n. to Ariz. and Tex.; s. Braz. to Arg.

108. ENNEAPOGON BEAUV.

A genus of about 30 species in warm regions.

1. *Enneapogon Desvauxii* Beauv. SPIKE PAPPUS GRASS. Tufted perennial (but flowering first year); culms numerous from the base, 15-45 cm. long, 0.5-1 mm. thick, spreading below and geniculate, ascending terminally, sparingly branched, minutely pilose; ligule a minute fringe; leaves finely pilose; blades 3-12 mm. long, 1.5-2 mm. broad, mostly loosely involute; panicles spikelike, 2-9 cm. long, 6-10 mm. thick, grayish; spikelets of the panicle about 5 mm. long, with a single basal fertile floret and a rudiment of 2 sterile florets; rachilla with zone of abscission at base of fertile lemma; glumes equal and nearly equaling spikelets, cymbiform, membranous, strongly 7-nerved near the middle, minutely pilose; fertile lemma with 9 strong nerves extended with 9 strong plumose awns longer

than the body; cleistogamous inflorescences often produced in the lower sheaths (culms breaking easily at the lower nodes). *Pappophorum Wrightii* Wats. Desert flats and hills, common in the Trans-Pecos, infrequent in w. Edwards Plateau and w. Plains Country, summer-fall; Tex. to Ut. and s.e. to Oax.; also Peru, Bol. and Arg.

109. HILARIA H.B.K.

Perennials, either rhizomatous or stoloniferous; culms 1-6 cm. tall; blades narrow; spikelets in groups of 3, the groups nearly sessile in a spikelike terminal panicle a few cm. long and less than 1 cm. thick; spikelet groups falling as units from the axis, the central spikelet (next the axis) fertile and 1-flowered (occasionally 2-flowered), the 2 lateral spikelets of the group staminate and 2-flowered (occasionally 3-flowered); glumes coriaceous, those of the 3 spikelets forming a false involucre, in some species connate at base, more or less asymmetric, usually bearing an awn on one side from about the middle (representing the extension of the midnerve of the asymmetric glume); lemma and palea hyaline, about equal in length.

A small American genus of dry areas.

1. Glumes at summit subhyaline and fimbriate; plants rhizomatous, forming colonies1. *H. mutica*.
1. Glumes at summit firm, not fimbriate; plants forming mats by stolons (2)
- 2(1). Glumes of lateral spikelets much shorter than the florets, pale; groups of 3 spikelets mostly 5 mm. long2. *H. Belangeri*.
2. Glumes of lateral spikelets about equaling the florets, very darkly pigmented; group of spikelets 7-8 mm. long3. *H. Swallenii*.

1. *Hilaria mutica* (Buckl.) Benth. TOBOSA. Rhizomes present; culms 3-6 dm. tall, glabrous, the nodes pubescent; blades flat or somewhat involute, rather rigid, 2-3 mm. broad; spikes 4-6 cm. long; group of 3 spikelets about 7 mm. long, bearded at base; glumes of lateral spikelets very asymmetric, widened toward the ciliate summit, the nerves flabellate, not excurrent or barely so; fertile spikelet about equaling the lateral one, its glumes strongly keeled, cleft into few to several narrow ciliate lobes and slender awns; lemma exceeding the glumes, mucronate between the 2 rounded lobes. Abundant in alluvial flats, w. half of Tex., summer-fall; Tex., Okla., N.M., Ariz., Chih., Coah. and Dgo.

Reports of *H. Jamesii* (Torr.) Benth. from Texas are apparently based on misdetermined specimens of *H. mutica*, but it is not impossible that *H. Jamesii*, the so-called "galleta," may occur in the higher parts of the plains or in the Trans-Pecos; it may be recognized by the glumes of the lateral spikelets narrowed toward the summit.

2. *Hilaria Belangeri* (Steud.) Nash. CURLY MESQUITE. Plants in tufts, sending out slender stolons that produce new tufts, the internodes of the stolons wiry, 5-20 cm. long; culms erect, slender, 1-3 cm. tall, villous at nodes; blades flat, 1-2 mm. broad, scabrous, more or less pilose, usually short, crowded at base, often forming a curly tuft but sometimes longer and erect; spike usually 2-3 cm. long, with mostly 4 to 8 clusters of spikelets, the axis flat, the internodes alternately curved, 3-5 mm. long; groups of spikelets 5-6 mm. long; lateral spikelets attenuate at base; glumes united below, firm, scabrous, the outer lobe broadened upward, 2- or 3-nerved, the inner much-reduced, the midnerve of both glumes extending into short awns, the first glume smaller, the lateral nerves sometimes excurrent into awns or teeth (the glumes variable in a single spike); fertile spikelet usually shorter than the sterile, rounded at base; glumes firm with deeply lobed thinner upper parts, the midnerves extending into awns mostly exceeding the staminate spikelets; lemma compressed, narrowed above, awnless. Common in the w. half of Tex. in open plains and brushlands on calcareous soils, summer-fall; Tex., N.M., Ariz., Chih., Coah., N.L. and Tam.

3. *Hilaria Swallenii* Cory. Resembling *H. Belangeri*; culms to 35 cm. tall; blades usually 2 mm. broad, scarcely curled; spike 20-45 mm. long, with 3 to 8 clusters of spikelets, the internodes of the flat axis 4-6 mm. long; glumes of lateral spikelets similar, oblong, narrowed at base, about equaling the florets, firm and strongly pigmented except toward the summit, the nerves often rather obscure; awns of all glumes slightly longer

than those of *H. Belangeri*; fertile spikelet about equaling the sterile one, the fertile floret slightly larger than that of *H. Belangeri*. Davis Mts. area and plains about their base, in Brewster, Presidio and Jeff Davis cos. in the Trans-Pecos, locally abundant, summer-fall; also Coah.

110. TRAGUS HALL.

Annuals 1-4 dm. tall; blades firm, flat, mostly less than 5 cm. long, 2-4 mm. broad, the cartilaginous margin bearing stiff white hairs or short slender teeth; spikelets borne in groups of 2 to 5 in "burs", with many burs arranged in an erect terminal spike-like raceme 4-10 cm. long; spikelets 1-flowered, 2-4.5 mm. long, sessile on a very short zigzag rachis in the bur; first glumes small, thin or absent, appressed to the rachis; second glumes of the 2 lower spikelets strongly convex with 3 thick nerves bearing a row of squarrose stout hooked prickles along each side, the 2 second glumes forming the halves of a little bur, the upper 1 to 3 spikelets reduced and sterile; lemma and palea thin, the lemmas flat, the palea strongly convex.

A small Old World genus, of which 2 species are introduced in Texas.

1. Spikelets 2-3 mm. long, the apex scarcely projecting beyond the spines, the bur nearly sessile1. *T. Berteronianus*.
1. Spikelets 4-4.5 mm. long, the acuminate apex projecting beyond the spines, the bur pedicelled2. *T. racemosus*.

1. *Tragus Berteronianus* Schult. Characters as in the key. Loamy soil in disturbed dry soil, w. half of Tex., e. to Cameron, Kenedy, Kleberg and Travis cos., summer-fall; warmer parts of the world.

2. *Tragus racemosus* (L.) All. Characters as in the key. Rare and local in dry disturbed soil near the coast, summer-fall; warmer parts of the world.

111. ALLOLEPIS SODERSTROM & DECKER¹⁵

A monotypic North American genus.

1. *Allolepis texana* (Vasey) Soderstrom & Decker. Perennial, stoloniferous, the strongly ribbed stolons to 25 cm. long and 1-4 mm. broad, forming extensive colonies to 20 m. across; culms loosely ascending or spreading, 1-7 dm. long (from point of rooting to base of inflorescence); lower sheaths shorter than the internodes; blades flat when dry, sometimes involute toward the tip, to 3 dm. or more long, 2.5-6 mm. broad; ligule short-ciliate, 0.5-1.4 mm. long; panicle 3-23 cm. long, 1-6 cm. thick, consisting of stiffly appressed or ascending branches 3-6 cm. long, usually floriferous to the base, the panicles containing as many as 70 spikelets; male and female flowers borne on separate plants; *male spikelets* ovate-lanceolate to linear, stramineous, 9-23 mm. long, 3-8 mm. broad, with up to 20 florets per spikelet, apparently not disarticulating; glumes broad, ovate, hyaline; first glume about 4-5 mm. long, 1-nerved; second glume about 1 mm. longer than the first, 1- (to 3-) nerved; lemmas of lower florets 5-5.5 mm. long, strongly 3-nerved; palea equal to or a little longer than the lemma, linear; *female spikelets* ovate-lanceolate, terete or only slightly compressed, stramineous, 1-2 cm. long, 2.5-3 mm. broad, with up to 8 or 9 closely imbricate florets, apparently not disarticulating; glumes broadly ovate, coriaceous with broad scarious margins; first glume a little shorter and narrower than the second, about 7-9 mm. long, strongly 1-nerved (up to 4 or 5 additional faint nerves may be present); second glume 3-nerved, with an additional 1 or 2 pairs of faint nerves sometimes present; lemmas of the lower florets 7.5-10 mm. long, strongly 3-nerved, broadly ovate, coriaceous with irregular scarious margins; palea a little shorter than the lemma, narrow above and strongly bowed out below, the margins overlapping. *Poa texana* Vasey. Local in alluvial soil in the Trans-Pecos at elev. of 3,000-5,000 ft., summer-fall; Tex., Chih., Coah. and Dgo.

¹⁵ Adapted from Thomas R. Soderstrom and Henry F. Decker in *Madroño* 18: 33-39. 1965.

112. *DISTICHLIS* RAF.¹⁶

A small American genus of perhaps 3 or 4 species.

1. *Distichlis spicata* (L.) Greene. SALTCRASS. Perennial, rarely more than 3 dm. tall, forming tight colonies in saline mud by means of very tough slender whitish scaly rhizomes; culms erect, 1-3 (-5) dm. tall, tough and wiry; leaves usually noticeably 2-ranked, narrow (1-3 mm. broad), usually mostly involute, tough, pungent, only 2-6 (-10) cm. long, ascending; male and female flowers on separate plants; spikelets rather similar on both kinds of plants, in terminal erect spikes or spike-like racemes; pistillate racemes often shorter than staminate (the staminate ones often overtopping the foliage); spikelets 5- to 15-flowered, usually 6-10 mm. long; rachilla of the pistillate spikelets disarticulating above the glumes and between the florets; glumes unequal, broad, acute, keeled, 3- to 7-nerved, the lateral nerves sometimes faint; lemmas closely imbricate, firm, the coriaceous pistillate ones acute or subacute and 3-6 mm. long, the pistillate ones more coriaceous and more closely imbricate than the staminate, with 9 to 11 mostly faint nerves; palea as long as the lemma or shorter, the margins bowed out near the base, rather soft, narrow, the keels narrowly winged, the pistillate lemmas coriaceous and enclosing the grain which is brown.

Represented with us by two varieties as follows:

Var. *spicata*. Culms 1-6 dm. tall, slender, erect; blades erect, to 15 cm. long, 10-25 mm. apart on the culm, equaling or exceeding the pistillate spikes and rarely exceeded by the staminate spikes; *pistillate spikes* pale green, 1-6 cm. long, of 8 to 36 congested spikelets that are 5- to 9-flowered, up to but not exceeding 1 cm. long, 4 mm. broad; first glume 3 mm. long; second glume 4 mm. long; lemmas 6- to 10-nerved, 3.5-4 mm. long, closely imbricate; palea keels minutely evenly serrate, the 4 nerves often excurrent; grain about 2 mm. long, somewhat truncate at the tip; *staminate spikes* pale green, 1-6 cm. long, of 6 to 30 congested spikelets that are 7- to 10-flowered, about 1 cm. long, 4 mm. broad; first glume to 3 mm. long; second glume to 4 mm. long; lemmas 6- to 10-nerved, 3 mm. long; palea 2-keeled but otherwise nerveless, about 3 mm. long. Salt marshes near the coast, very abundant, rare in salt marshy areas inland in e. Tex., summer-fall; Can. to Mex. along the coast; also W.I.

Var. *stricta* (Torr.) Beetle. Culms 10-35 cm. tall, erect or rarely decumbent; blades to 2 dm. long, the upper equaling or exceeding the pistillate spikes but exceeded by the staminate ones; *pistillate spike* green drying stramineous-brown, 2-7 cm. long, of 5 to 40 approximate spikelets that are 5- to 20-flowered, 5-20 mm. long and 4-7 mm. broad, the mature florets often strongly reflexed, usually not closely imbricate; first glume 2-3 mm. long; second glume 3-4 mm. long; lemma 2.5-6 mm. long, firm, with a broad hyaline margin; palea 3-5 mm. long, the keels conspicuously serrate to the base, often dentate, narrowed or winged at base, occasionally with a few long hairs on back; grain 2-5 mm. long, sometimes slenderly tapered to a single beak, sometimes truncate with a double beak; *staminate spike* green or rarely purplish, drying stramineous-brown, 2-5 cm. long, of 5 to 25 approximate spikelets that are 5- to 20-flowered, 5-20 mm. long and 4-7 mm. broad, closely imbricate; first glume 2-3 mm. long; second glume 3-4 mm. long; lemmas 5-6 mm. long, firm, equalled by the palea; palea 5-6 mm. long, the keels conspicuously serrate to the base, infrequently dentate, rarely broadly winged, usually with at least one prominent marginal vein. *D. stricta* (Torr.) Rydb. Locally abundant in alkaline or alkaline-saline areas of w. half of Tex., summer-fall; w. U.S. e. to the Dakotas, Neb., Kan., Okla., Tex., Coah. and Chih.

113. *MONANTHOCHLOË* ENGELM.

A monotypic North American genus.

1. *Monanthochloë littoralis* Engelm. Perennial forming extensive mats by rhizomes and/or stolons; flowering culms ascending, 5-25 cm. long; branches of 2 size-classes; few-noded elongate culms with leaves 10-15 cm. long, bearing in the axils many-noded short shoots with crowded leaves 5-10 mm. long; sheaths and blades extremely short,

¹⁶ In part adapted from Alan A. Beetle in Bull. Torrey Club 70: 638-650. 1943.

very firm, indurate-wiry, folded-falcate, grayish-green; male and female flowers on separate plants; panicles reduced to solitary 3- to 5-flowered spikelets, appearing terminal and embedded in the masses of leaves of the short shoots, difficult to find; glumes apparently absent; lemmas coriaceous or in the pistillate spikelet like the leaves; upper florets rudimentary; rachilla of pistillate floret tardily abscising at the lower part of the nodes. Locally abundant in poorly drained brackish or saline flats or cayos near the coast, s.e. Tex. and Rio Grande Plains, also in Gonzales Co., spring; Fla. to Cuba; Tex. to Tam. and Coah.; Calif. to Baja Calif., Son. and Sin.

114. VASEYOCHLOA HITCHC. TEXAS GRASS

A monotypic genus.

1. *Vaseyochloa multinervosa* (Vasey) Hitchc. Perennial with slender fragile short rhizomes and occasionally short fragile stolons (these often with cleistogenes in the lower sheaths); culms 4-11 dm. long, erect; lower sheaths obscurely keeled; blades 2-6 mm. broad, flat or mostly involute on drying; panicle 8-35 cm. long, with few long remote few-flowered branches (these at first ascending, later widely spreading); spikelets remote, on very short pedicels, appressed to the branches to slightly drooping, scarcely at all compressed, 8- to 12-flowered, all the florets perfect but in the uppermost the pistil often abortive; rachilla abscising at the nodes; glumes shorter than first lemma, several-nerved; lemmas 7- to 9-nerved, about 6 mm. long, the 6 to 8 lateral nerves ending well within the distal margin, the midnerve attaining it but not excurrent; palea splitting at maturity by the widening of the large dark grain. Frequent in shady woods on loose sandy soil, Rio Grande Plains, rare in s. part of s.e. Tex., spring-fall; endemic.

115. ARISTIDA L. THREE-AWN GRASS

Spikelets 1-flowered and relatively large; glumes membranous, linear-lanceolate, often acute or acuminate; zone of abscission between the glumes and lemma; lemma indurate, linear, the back rounded and completely enclosing the palea and sex organs, basally with a sharp callus and apically narrowed and bearing 3 awns (the two lateral ones reduced to minute points in some species); the lemma and its appendages and enclosures constitute the "fruit."

The genus comprises about 330 species in the warmer usually arid parts of the world. In our flora it has the reputation of great taxonomic difficulty. The 26 "species" here included could easily be condensed to 20 or fewer if the segregate forms were reduced to synonymy. For the most part only mature material with fully expanded panicles and dry fruits can be determined with confidence.

Three-awn grasses are considered comparatively poor as forage, but they are of importance, especially in the spring and where the more desirable grasses have been removed by the usually abusive practices of overgrazing. The basal, sharp calluses of the fruits are troublesome to stock in summer and fall.

1. Apical portion of lemma with 3 awns attached to it separating from the rest of the lemma at maturity 1. *A. desmantha*.
1. Awn(s) persisting at the top of the lemma (2)
 - 2(1). Panicle much-branched, the ascending or spreading several-flowered branches 3-15 cm. long, straight and basally naked; blades membranous, straight for nearly the entire length, the lower parts usually flat, the upper involute; plants perennials (3)
 2. Panicle narrow, if branched then the branches short, densely-flowered, curved or appressed, or if the branches somewhat spreading then the leaves closely involute, short and curved (7)
 - 3(2). Panicle branches mostly 2-4 cm. long, spreading at right angles; culms erect, mostly less than 3 dm. tall, slender, at maturity usually breaking beneath the panicle; basal flat part of the blades less than 2 mm. broad 22. *A. barbata*.

3. Panicle branches usually ascending or drooping, 3-15 cm. long; culms usually decumbent, stouter; basal flat part of blades several mm, broad (4)
- 4(3). All 3 awns about equal in length (5)
4. Lateral awns minute (6)
- 5(4). Narrow part of lemma just below awns twisted 1 to 3 turns 23. *A. divaricata*.
5. Lemma just below awns not or only slightly twisted .. 24. *A. hamulosa*.
- 6(4). Narrow part of lemma just below awns twisted 1 to 3 turns 26. *A. Orcuttiana*.
6. Lemma just below awns not or only slightly twisted .. 25. *A. ternipes*.
- 7(2). First glume usually less than two thirds as long as the second (almost as long in some plants of *A. glauca*); blades usually closely involute even to the base (except some specimens of *A. purpurea* and *A. Roemeriana*), falcately curved outward and mostly less than 15 cm. long; strong perennials (8)
7. First glume about three fourths or four fifths as long as second (except about two thirds in *A. adscensionis* and *A. longespica*); lower parts of blades flat, the upper parts usually somewhat involute and either straight or becoming irregularly curly when dry; perennials or annuals (15)
- 8(7). Panicles with few straightish ascending branches 2-5 cm. long, diverging at angles of 15°-55°; blades closely involute the entire length (9)
8. Panicle branches closely appressed or else slender and distinctly curved and flexed (10)
- 9(8). Spikelets spreading from the branches of the panicle 21. *A. dissita*.
9. Spikelets appressed to the branches of the panicle 20. *A. pansa*.
- 10(8). Branches of the panicle short, slender, weak, at least some of them *at maturity* reflexed or arched (11)
10. Branches of the panicle (if any) straight and appressed, the panicle thus nearly spikelike (12)
- 11(10). Lemma about 10-13 mm. long; awns 2-5 cm. long; plants mostly 30-100 cm. tall 18. *A. purpurea*.
11. Lemma usually less than 10 mm. long; awns usually 1-2 cm. long; plants mostly 12-50 cm. tall 19. *A. Roemeriana*.
- 12(10). Awns longer than 4 cm.; plants 15-35 cm. tall; culms leafiest at the base but some leaves attached at the middle of the plant or higher 17. *A. longiseta*.
12. Awns shorter, usually less than 4 cm. long (13)
- 13(12). Plants only 10-35 cm. tall; leaves short and very curly, forming a compact tuft at the very base, scarcely attaining a third the height of the plant 16. *A. Fendleriana*.
13. Plant mostly 20-100 cm. tall; lower halves of the culms leafy; awns only 15-30 mm. long (14)
- 14(13). Plants mostly 30-100 cm. tall; lemma just below the awns slightly or not at all twisted 14. *A. Wrightii*.
14. Plants mostly 12-50 cm. tall; lemma just below the awns twisted 1 to 3 turns 15. *A. glauca*.
- 15(7). Strong perennials; culms basally at least 1 mm. thick and mostly 6-12 dm. long, erect, usually simple above the base; usually some of the lowest flat blades of the spring more than 2 dm. long, drying and persisting in the fall as irregular brown curls like wood shavings (16)
15. Annuals; culms basally about 0.4-0.5 mm. thick and mostly less than 6 dm. tall (to 1.1 mm. thick and 10 dm. tall in *A. intermedia*), often weak and sprawling basally and in the lower half repeatedly branched; usually the flat blades shorter than 2 dm. and not curly (20)

- 16(15). Lemma more or less narrowed and twisted just below the awns; plants of mountains of Trans-Pecos Texas13. *A. arizonica*.
16. Lemma not remarkably twisted; plants of sandy soils of eastern Texas (17)
- 17(16). Lemma 7-10 mm. long to the base of the awns (18)
17. Lemma 4-7 mm. long to the base of the awns (19)
- 18(17). Sheaths woolly12. *A. lanosa*.
18. Sheaths essentially glabrous11. *A. affinis*.
- 19(17). Awns all about equally divergent 9. *A. purpurascens*.
19. Central awn more deflexed than the lateral ones10. *A. virgata*.
- 20(15). Lemma below the awns 16-28 mm. long (21)
20. Lemma shorter than 15 mm. (22)
- 21(20). Awns 3-7 cm. long, about equal, the central one with a simple flex basally, otherwise straight 3. *A. oligantha*.
21. Central awn about 2 cm. long, with a semicircular bend or part of a coil basally; lateral awns only 1-5 mm. long 4. *A. ramosissima*.
- 22(20). Lateral awns 10-30 mm. long, nearly or quite as long as central one, none of the awns remarkably reflexed (23)
22. Lateral awns 0.5-9 mm. long, distinctly shorter than the central one which is remarkably bent basally (24)
- 23(22). Panicles mostly less than 15 cm. long, densely flowered owing to the presence of 4 to 20 spikelets on each branch; plants of western and southern Texas
..... 2. *A. adscensionis*.
23. Panicles mostly more than 15 cm. long, narrow and spikelike, each branch with only 1 to 5 spikelets; plants of sandy soils of the Coastal Plains
..... 8. *A. intermedia*.
- 24(22). Central awn not basally coiled 7. *A. longespica*.
24. Central awn basally coiled (25)
- 25(24). Lateral awns half to two thirds as long as the central one
..... 6. *A. basiramea*.
25. Lateral awns 0.5-3 mm. long, less than half as long as the central one
..... 5. *A. dichotoma*.

1. *Aristida desmantha* Trin. & Rupr. Erect annual; culms sparingly branched, 5-10 dm. long, 2-3 mm. thick, often purplish basally; lower sheaths thinly woolly; blades mostly 2-3 dm. long, flattish basally, involute above; panicles 1-2 dm. long, with ascending somewhat flexuous few-flowered flabellate branches; glumes about equal, 12-20 mm. long, apically filiform; lemma 9-10 mm. long to base of awns; awns about equal, slightly contorted basally, divergent, about 25 mm. long. Sandy soils, openings in oak woods, e. Tex. and n. Rio Grande Plains, June-Oct.; reported to occur also in Neb. and Ill.; otherwise restricted to Tex.

2. *Aristida adscensionis* L. SIX-WEEKS THREE-AWN. Annual, much-branched at base and less profusely above; culms 1-8 dm. long, 0.5-1 mm. thick, erect or usually sprawling, often purplish basally; blades 4-15 cm. long, flat in basal half, involute above; panicles narrow and rather dense, 6-15 cm. long; first glume 4-7 mm. long; second glume 7-10 mm. long; lemma 6-9 mm. long to base of awns; awns 10-15 mm. long, flattened basally, about equal (one rare form has the lateral awns much-reduced). Dry soil, especially as weed along roads and other disturbed areas, common in the Trans-Pecos, scarce on Edwards Plateau, Rio Grande Plains and Plains Country, summer-fall (occasionally spring along the Rio Grande); widespread weed in the warmer drier parts of the world.

3. *Aristida oligantha* Michx. PRAIRIE THREE-AWN. Annual, much-branched throughout; culms mostly 3-6 dm. tall, 1-1.5 mm. thick, often purplish basally, erect or ascending; leaves at base of plants with blades 15-30 cm. long and 1-2 mm. broad at the flat basal part; cauline blades 3-15 cm. long, only about 1 mm. broad basally; panicle very open and amorphous; spikelets solitary on the branchlets; glumes apically filiform, 2-5 cm. long; lemmas 18-28 mm. long to base of awns; awns 3-7 cm. long, about equal, simply

bent at the base. Mostly sandy and calcareous sandy soil, open ground, throughout the e. half of Tex., less common w. to e. Edwards Plateau and e. Plains Country, June-Oct.; throughout e. U.S. w. to Tex. and S.D.; also Ariz., Calif. and Ore.

4. *Aristida ramosissima* Gray. Annual, much-branched; culms 3-5 dm. tall; flat part of cauline blades about 1 mm. broad; panicle narrow and short; first glume about 15 mm. long; second glume about 2 cm. long; lemma about 25 mm. long; central awn 15-20 mm. long, spreading, with a semicircular bend or part of a coil basally; lateral awns only 1-5 mm. long. Reported to occur in Tex.; otherwise occurring from Ia. s. to Okla., Ark. and La., e. to Ky. and Tenn.

5. *Aristida dichotoma* Michx. Annual, branched at base and above; culms mostly 2-4 dm. long, 0.5 mm. thick, ascending or erect; blades of basal leaves 8-10 cm. long, those of cauline leaves 2-5 cm. long, the basal flat portion of both kinds 0.5-1 mm. broad; panicle spikelike, 5-10 cm. long, few-flowered; glumes 6-9 mm. long, nearly equal; lemma 5-6 mm. long to base of awn; central awn 5-8 mm. long, basally coiled 2 or 3 turns and deflexed; lateral awns 0.5-3 mm. long. Sandy soils, e. Tex., apparently rare, Sept.-Oct.; throughout e. U.S. (See remark under the next species.)

6. *Aristida basiramea* Vasey. Annual, similar to *A. dichotoma* but the second glume 9-11 mm. long, a little longer than the first, central awn 9-15 mm. long and lateral awns 2-7 mm. long. Incl. var. *Curtissii* (Gray) Shinnery, *A. Curtissii* (Gray) Nash. Sandy open ground, n.-cen. Tex. (Dallas and Red River cos.), apparently rare, Aug.-Oct.; Va. and Me., w. to Wyo. and Colo., s. to Okla. and Tex. Probably just a form of *A. dichotoma*.

7. *Aristida longespica* Poir. Annual, branched at base and less profusely so above; culms 3-6 dm. long, 0.3-0.8 mm. thick, erect or decumbent at base and geniculate at lower nodes; basal blades 5-12 cm. long, the cauline ones 2-5 cm. long, the basal flat portion of both kinds 0.5-1 mm. broad; panicle spikelike, 5-18 cm. long, few-flowered; glumes 3-6 mm. long, nearly equal or occasionally the first only two thirds as long as the second; lemma 4-6 mm. long to base of awns; central awn basally markedly deflexed but not twisted nor coiled, 5-13 mm. long; lateral awns 0.5-9 mm. long, up to five eighths as long as the central one and not or only slightly deflexed. Incl. var. *geniculata* (Raf.) Fern. Sandy open ground, e. and s.e. Tex., frequent, Aug.-Oct.; nearly throughout e. U.S., w. to Kan., Okla. and Tex.

Toward the coast and the Rio Grande Plains passing into *A. intermedia*, the intermediate plants more robust, with longer panicles, with central awns longer and not deflexed and the laterals proportionately longer.

8. *Aristida intermedia* Scribn. & Ball. Annual but becoming hard and knotty basally late in the fall and resembling a perennial, much-branched at the base and in the lower half; culms 3-10 dm. long, 0.9-1.2 mm. thick, erect, often decumbent basally and geniculate at the lower nodes; blades (even cauline ones) 5-20 cm. long, the basal flat part 1.5-2 mm. broad; panicle spikelike, 10-21 cm. long; first glume 5-7 mm. long; second glume 6-9 mm. long, very narrow; lemma 7-9 mm. long to base of awns; central awn 20-37 mm. long, the laterals 15-30 mm. Loose sandy ground, Rio Grande Plains and s.c. Tex., Aug.-Nov.; from the Gulf Coastal States; also Ga., Ark., Okla. and Kan.

This describes the common robust plant of the Rio Grande Plains and may not apply to the true *A. intermedia*, which is one of the numerous forms intermediate between the plant described here and *A. longespica*.

9. *Aristida purpurascens* Poir. ARROWFEATHER THREE-AWN. Perennial, tufted, very sparingly branched near the base, the herbage green or often purplish-glaucous; culms strictly erect, mostly 5-10 dm. tall, 1-2 mm. thick; basal blades 2-3 dm. long, the basal flat part 2-3 mm. broad, the cauline leaves shorter and somewhat narrower; blades often remaining flat in the lower part and persisting after drying in the form of brown ribbons curling at the lower half of the tuft; panicles 16-30 cm. long, spikelike; glumes 5-10 mm. long, nearly equal; lemma 4-7 mm. long to base of awns; awns nearly equal, not markedly deflexed basally, 15-30 mm. long. Sandy woods and openings, n.-cen., e. and s.e. Tex., Aug.-Oct.; e. U.S. w. to Kan., Okla. and Tex. (See remarks under *A. virgata*.)

10. *Aristida virgata* Trin. Similar to *A. purpurascens* but the central awn markedly more deflexed than the laterals. Sandy prairies and openings in sandy woods, e. and s.e. Tex., Aug.-Oct.; Coastal States, N.J. to Tex.

The measurements of the spikelets are those of *A. purpurascens*, of which this is

probably only a form. The characters of the awn are those of the next 2 species. *A. affinis* and *A. lanosa*.

11. *Aristida affinis* (Schult.) Kunth. Perennial, tufted from hard bases; culms 7-15 dm. tall, 1.1-2.3 mm. thick, strictly erect; basal blades 2-4 dm. long, the cauline ones a little shorter, the flat basal portion 2-4 mm. broad; leaves often remaining partly flat and persisting after drying in the fall in the form of brown ribbons; panicles 16-30 (-50) cm. long, narrow, somewhat branched, the branches mostly appressed; glumes 9-14 mm. long; lemma 7-10 mm. long to base of awn; central awn 15-30 mm. long and deflexed, the laterals less deflexed and shorter. Loose sandy soil, openings in forests, e. and s.e. Tex., uncommon, Sept.-Oct.; Coastal States, N.C. to Tex.

Probably only a glabrous form of *A. lanosa*.

12. *Aristida lanosa* Ell. Perennial, like *A. affinis* but the sheaths woolly. Same habitats, dates and range in Tex.; Coastal States, N.J. to Tex.; also Mo., Ark., Okla. and W.Va.

13. *Aristida arizonica* Vasey. Perennial, tufted at the base; culms erect, 3-12 dm. tall, 1-2 mm. thick, not or rarely branched; basal blades 15-30 cm. long, the cauline ones shorter, the flat basal portions 1.2-3 mm. broad, persisting after drying as irregular brown curls; panicles 10-25 cm. long, rather spikelike; glumes nearly equal, 10-15 mm. long; lemma 13-16 mm. long to base of awns, the upper narrow portion twisted 1 to 3 turns; awns about equal, not markedly deflexed, 10-25 mm. long. Rocky slopes at alt. of 4,500 ft. or more in the Trans-Pecos, apparently rare (known from Culberson, Jeff Davis and Brewster cos.), Aug.-Sept.; Colo. and Ariz. s. to Son., Chih. and Tex.

14. *Aristida Wrightii* Nash. Tufted perennial; culms erect, rarely branched, 3-8 dm. tall; blades 3-15 cm. long, involute, curved; panicles 12-25 cm. long, narrow, generally spikelike or with the short branches divergent from the axis at angles of 5°-20°; first glume about half to two thirds as long as the second; second glume 11-14 mm. long; lemma about as long as second glume or 1-1.5 mm. longer, stout just below the awns, 0.2-0.5 mm. thick, straight or twisted up to 200°; awns 11-28 mm. long, about equal and equally divergent. Rocky usually limestone slopes, Trans-Pecos (abundant locally) and Plains Country, e. to n.-cen. Tex. and n. part of Rio Grande Plains, May-Dec.; Okla. to Ut. and s. to cen. Mex. Passing into *A. purpurea* and probably not distinct from *A. glauca*.

15. *Aristida glauca* (Nees) Walp. Tufted perennial; culms erect, sparingly branched, 2-6 dm. long; blades 3-15 cm. long, involute, arched, mostly crowded at the base of the plant; panicles 10-25 mm. long, very narrow, spikelike; first glume half to three fourths as long as the second; second glume 8-12 mm. long; lemma about 1-3 mm. longer than the second glume, just below the awns 0.1-0.2 mm. thick and twisted 1 to 3 turns; central awn 8-25 mm. long, the laterals usually equally long but in one rare form reduced to 1-2 mm. in length. Rocky usually limey slopes, Trans-Pecos (abundant locally) and Plains Country, c. to n.-cen. Tex. and n. Rio Grande Plains, May-Dec.; Okla. to s. Calif. and s. to Pue. Passing freely into several other species.

16. *Aristida Fendleriana* Steud. Tufted perennial; culms erect, essentially unbranched, 1-3 dm. long; blades 4-10 cm. long, essentially confined to the very base of the plant, those of the culms very few and reduced, involute, strongly curly; panicle 5-10 cm. long, few-flowered, lax, loosely spikelike or with short flexuous branches; first glume half to two thirds as long as second; second glume about 1 cm. long; lemma 1-2 mm. longer than the second glume, just below the awns narrowed and straight or twisted as much as one turn (360°); awns 2-3 cm. long, equal and equally divergent. Rocky limey slopes, Plains Country and n.-cen. Tex., rare, spring-summer; N.D., Mont. and Nev. s. to Mex. Passing into the next and other species.

17. *Aristida longiseta* Steud. Tufted perennial; culms erect, essentially unbranched, 15-35 cm. long; blades 4-10 cm. long, mostly aggregated toward the base of the plant, involute, arcuate; panicle 5-11 cm. long, lax and few-flowered, loosely spikelike or usually with short flexuous branchlets; first glume about half as long as the second; second glume 15-22 mm. long; lemma a little shorter than the second glume; awns 4-9 cm. long, equal and equally divergent. Rocky or sandy slopes, Trans-Pecos and Plains Country e. to n.-cen. Tex. and Rio Grande Plains, abundant locally, spring-fall; Ia. and N.D., w. to Wash. and s. to Mex.

18. *Aristida purpurea* Nutt. PURPLE THREE-AWN. Tufted perennial; culms erect, usually branched and leafy, 3-8 dm. tall; blades 3-17 cm. long, involute and arched or less com-

monly flat and 1-2.5 mm. broad; panicles 10-25 cm. long, lax, the axis straight or commonly weak and nodding, the lower parts of some of the branchlets naked, capillary, reflexed and curved; first glume about half as long as second glume; second glume 10-15 mm. long; lemma about as long as second glume; awns 24-56 mm. long, about equal and equally divergent. Loamy or rock soils, open ground, throughout w. Tex. e. to w. parts of e. Tex., locally abundant, spring-fall; Ut., Colo. and Kan. s. to n. Mex.

19. *Aristida Roemeriana* Scheele. Tufted perennial; culms erect, usually much-branched and leafy, 15-60 cm. long; blades 3-10 cm. long, usually involute and curved but occasionally flat, nearly straight, about 1 mm. broad; panicle 5-20 cm. long, fairly narrow but not spikelike, lax, the axis weak and often nodding, the lower parts of some of the branchlets naked, capillary, reflexed and curved; first glume about half as long as the second; second glume 8-10 mm. long; lemma about as long as second glume; awns 19-31 mm. long, about equal and equally divergent. Loamy soils, prairies and brushlands, abundant in Rio Grande Plains and infrequent n. to n.-cen. Tex. and the Plains Country, and w. to the Trans-Pecos, spring-fall; also N.M. and n.e. Mex.

20. *Aristida pansa* Woot. & Standl. Tufted perennial; culms erect, sparingly branched, leafy, 25-55 cm. long; blades 4-13 cm. long, involute, arched; panicle 12-20 cm. long, open, few-flowered, much-branched, the branches 3-6 cm. long, diverging at angles of 10°-40°, stiffly ascending, naked in the lower part, the few spikelets appressed to the branchlets or diverging from them at angles of 10°-20°; first glume about two thirds as long as the second; second glume 8-12 mm. long; lemma about as long as the second glume, just below the awns straight or twisted as much as one full turn (360°); awns 10-26 mm. long, about equal and equally divergent. Rocky usually limestone dry slopes and flats in the Trans-Pecos and w. Edwards Plateau, infrequent, spring-fall; Tex., N.M. and Ariz. s. to n. Mex.

21. *Aristida dissita* I. M. Johnst. Tufted perennial; culms erect, essentially unbranched, leafy, 20-45 cm. long; blades 4-15 cm. long, involute, arched; panicle 1-2 dm. long, open, few-flowered, much-branched, the main axis straight, the branches 1-5 cm. long, diverging at angles of 20°-90°, naked in the lower part, the few spikelets diverging at angles of 20°-100°; first glume usually at least three fourths as long as second; second glume 7-10 mm. long, usually dark purple; lemma 1-2 mm. longer than the second glume, usually twisted 1 or 2 turns just below the awns; awns 5-15 mm. long, about equal and equally divergent. Rocky usually limestone dry slopes and flats in the Trans-Pecos, infrequent, summer-fall; also N.M. to n. Mex.

Perhaps not distinct from *A. pansa*; passing into *A. barbata*.

22. *Aristida barbata* Fourn. Densely tufted perennial; culms numerous, erect, sparingly or not branched, 14-32 cm. long; lower blades very numerous, slender, involute, nearly straight, densely clustered at base of plant, 5-12 cm. long; blades of midculm few, 2-10 cm. long, straight, usually at least some of them basally flat, 0.7-1.5 mm. broad; panicles 6-15 cm. long, very diffuse, the main axis curved or sinuous and very slender, the branches 2-7 cm. long, at least some of them diverging at right angles, often curved in some segments, the spikelets attached at remote points along the branches and diverging from them at angles of 20°-45°; first glume nearly as long as second; second glume 9-12 mm. long; lemma 0-2 mm. longer than second glume, just below the awns very slender and twisted 1 to 3 turns; awns 12-22 mm. long, about equal and equally divergent. Loamy desert flats or less commonly dry rocky slopes, abundant in the Trans-Pecos, rare in w. Plains Country, summer-fall; Tex., Ariz. and N.M. s. to cen. Mex.

23. *Aristida divaricata* Willd. Perennial; culms few, often decumbent, sparingly branched, 3-7 dm. long; blades 3-12 cm. long, straight, the cauline blades usually basally flat and about 2 mm. broad, the rest involute; panicles 2-3 dm. long, very diffuse, the main axis essentially straight, the principal branches remote, 5-11 cm. long, spreading mostly at right angles, straight except sometimes arched upward near the base, naked basally more than half the length, bearing short appressed secondary branches distally; spikelets mostly appressed, congested at the ends of the branches; glumes 10-12 mm. long; lemma 10-13 mm. long to base of awns, just below the awns about 0.2 mm. thick and twisted 1 to 4 turns; awns 7-17 mm. long. Grasslands and scrub on slopes at elev. greater than 4,000 ft., Trans-Pecos mts., infrequent, also recently reported to occur in the Plains Country (Castro and Parmer cos.), summer-fall; Kan. to Calif. and s.e. to Guat.

24. *Aristida hamulosa* Henr. Perennial; culms few, often decumbent, sparingly branched, 5-7 dm. long or more; blades 5-30 cm. long, straight, the cauline blades usually basally flat and about 3 mm. broad, the rest involute; panicles 25-40 cm. long, very diffuse, the main axis essentially straight, the principal branches remote, 6-18 cm. long, spreading mostly at right angles, straight except sometimes arched upward near the base, naked basally half the length, branched distally, the branches appressed or diverging at angles of 10°-30°; glumes 11-15 mm. long; lemma 11-15 mm. long to base of awns, just below the awns about 0.3 mm. thick and not or only very slightly twisted; awns 10-23 mm. long. Grasslands and scrub on slopes at elev. greater than 4,000 ft., Trans-Pecos mts., infrequent, summer-fall; Tex. and N.M. to Calif. and s. to Guat.

Perhaps only a form of *A. divaricata*, but averaging larger in all measurements, and the lemma not twisted.

25. *Aristida ternipes* Cav. SPIDER GRASS. Perennial; culms few, erect or often weak and sprawling, sparingly branched, 25-100 cm. long; blades 8-40 cm. long, straight, the cauline blades usually basally flat and 2-4 mm. broad, the rest involute; panicle 15-40 cm. long, very diffuse, the main axis essentially straight, the principal branches remote, 5-15 cm. long, spreading mostly at right angles, straight except arched upward near the base, naked basally, branched distally, the branches appressed or diverging; glumes 10-14 mm. long; lemma to base of awns about as long as glumes, just below the awns about 0.3 mm. thick, not or only very slightly twisted; central awn 8-15 mm. long; lateral awns only 1 mm. long or shorter. Incl. var. *minor* (Vasey) Hitchc. Grasslands and scrub on slopes at elev. usually greater than 4,000 ft., Trans-Pecos mts., frequent, summer-fall; Tex. and N.M. to Ariz. and s. to Nic.; S.A.; W.I.

26. *Aristida Orcuttiana* Vasey. BEGGARTICK THREE-AWN. Perennial; culms erect or sprawling, sparingly branched, 25-70 cm. long; blades 6-25 cm. long, straight when fresh, basally usually flat and about 2 mm. broad, with a finely involute distal portion but often some of the lowest blades drying flat and remaining in the fall as brown curls around the base of the plant; panicle 1-3 dm. long, rarely narrow, usually very diffuse, the main axis essentially straight, the principal branches very few and remote, 2-15 cm. long, mostly spreading at right angles basally then curved upward, naked basally; spikelets appressed to the branches and branchlets; glumes 8-11 mm. long; lemma to base of awns 11-15 mm. long, just below the awns 0.1-0.2 mm. thick and twisted 2 to 5 turns; central awn 5-10 mm. long or rarely longer, set at a marked angle of 20°-80° from apex of lemma; lateral awns about 0.5 mm. long. Grasslands and scrub, rocky slopes at elev. of 4,500-6,000 ft., Trans-Pecos mts., rare, summer-fall; Tex. to s. Calif. and s. to n. Mex.

FAM. 27. CYPERACEAE JUSS.

SEDGE FAMILY

Herbs with tristichous leaves and often triangular stems; blades often long and linear or gradually tapered; inflorescences diverse; florets often borne grouped into spikelets, each floret subtended by a single abaxial scale (apparently 2 scales in *Hemicarpha*; pistillate flower surrounded by a sac in *Carex*); perianth either of bristles or plumes or more elaborate structures or absent; fruit an achene.

About 4000 species in 90 genera of world-wide distribution.

1. The unit of the infructescence (i.e., the object bearing one seed and which falls from the plant at maturity) comprising not only an achene and usually a portion of the style but also a thin bag surrounding those structures; monoecious or dioecious 15. *Carex*, p. 316.
1. The unit of the infructescence merely an achene with or without attached stylar or other floral tissue, but never surrounded by a sac (2)
- 2(1). Perianth of 3 stalked scalelike or paddlelike structures, often thickened at maturity, with or without 3 bristles in addition 3. *Fuirena*, p. 267.
2. Perianth of bristles or plumose structures or absent (3)
- 3(2). All or virtually all florets of each spikelet perfect (4)
3. In each spikelet either the florets all pistillate or all staminate or merely some of them strictly staminate (11)

- 4(3). Each achene subtended by 2 scales, the lower scale easily visible, the adaxial one hyaline, very inconspicuous and often split or torn by the growing achene or adhering to it 7. *Hemicarpha*, p. 284.
4. Each achene subtended only by one abaxial scale (5)
- 5(4). Culms naked, the sheath solitary on the extreme base of the culms and entirely bladeless 4. *Eleocharis*, p. 268.
5. Culms not so naked, if some of the sheaths bladeless then each culm with several of them (6)
- 6(5). Scales of spikelets distichous and perianth bristles present; base of style not much swollen but almost the entire style below the fork persistent on the achene 1. *Dulichium*, p. 262.
6. Scales of spikelet distichous or spirally imbricate and perianth bristles present or absent, but if scales distichous then bristles absent; base of style swollen or not, persistent or deciduous (7)
- 7(6). Swollen style base persistent on the achene as a tubercle of a color and texture distinct from those of the achenial body (8)
7. Style swollen or not but not persistent on the achene (9)
- 8(7). Style 3-branched; achene trigonous 5. *Bulbostylis*, p. 278.
8. Style 2-branched; achene biconvex 13. *Psilocarya*, p. 313.
- 9(7). Scales of spikelets distichous on the spikelet axis (this obscure in *C. sesquiflorus*, *C. tenuifolius* and *C. brevifolius*) 8. *Cyperus*, p. 284.
9. Scales of spikelets spirally arranged (10)
- 10(9). Style base swollen 6. *Fimbristylis*, p. 279.
10. Style slender, nearly uniform in diameter from the apiculus of the achene to the base of the branches 2. *Scirpus*, p. 263.
- 11(3). Inflorescence bracts basally white, distally green .. 11. *Dichromena*, p. 305.
11. Inflorescence bracts essentially unicolored, green (12)
- 12(11). Scales of spikelets visibly distichous; spikelets agglomerated into a tight head 10. *Schoenus*, p. 305.
12. Scales of spikelets spirally disposed (this obscure in *Scleria*) or at least not definitely distichous (13)
- 13(12). Style base enlarged and persistent as a tubercle of a color and texture distinct from those of the achenial body; perianth bristles or plumes usually present 12. *Rhynchospora*, p. 306.
13. Style base not persistent; perianth absent (14)
- 14(13). Achene often bony, pearly or crustaceous, supported on a disk or appearing sculptured basally; pistillate flowers solitary and borne in separate spikelets ... 14. *Scleria*, p. 313.
14. Achene otherwise; spikelets all alike and borne in very large inflorescences 9. *Cladium*, p. 304.

I. DULICHIMUM PERS.

The genus comprises only one species; confined to North America.

1. *Dulichium arundinaceum* (L.) Britt. THREE-WAY SEDGE. Perennial with creeping rhizomes 2-3 mm. thick and with internodes 2-5 cm. long; culms simple, solitary from the nodes of the rhizomes, 2-10 dm. long, 2-5 mm. thick, erect, with short internodes; lowest leaves with nearly bladeless sheaths, the upper with short stiff pointed ascending blades 2-10 cm. long, the upper 5 to 20 leaves functioning as bracts, each subtending a peduncled spike; peduncle of spike only slightly longer than the bract sheath; spike 2-6 cm. long, 15-50 mm. thick, of 6 to 15 ascending to eventually spreading spikelets; spikelets of 5 to 10 distichous scales, the axis with each internode thickened and concave (nched) on the fertile side and with 2 narrow vertical wings at the edges of the niche; perianth bristles 6 to 9, coarse, longer than the achene, retrorsely serrate; style branches 2; achene flattened, beaked with the long persistent style. Infrequent or rare in boggy

places, e. Tex. (Leon, Robertson and Wood cos.), fall; wet places and in shallow water over much of the lowlands of U.S., n. to Nfld., Que., Ont. and B.C., s. to the Gulf States and Calif.

2. SCIRPUS L. BULRUSH

Annual or perennial herbs, usually aquatic; leaves either well-developed or the blades much-reduced in some species; inflorescences very variable; scales of spikelets spirally imbricate; each flower with only a single subtending scale; bristles present or rarely absent; styles 2- or 3-branched; achenes plano-convex, biconvex or trigonous, usually apiculate but the apex of the same texture and color as the rest of the achene (not differentiated as a "tubercle"); style completely deciduous.

About 300 species, cosmopolitan.

- 1. Bracts leaflike, none appearing as a continuation of the culm (2)
- 1. The primary bract appearing as a continuation of the culm and similar to it in texture, color and usually in transectional outline (6)
- 2(1). Spikelets in dense spherical or prolate heads 1-2 cm. thick 13. *S. cubensis*.
- 2. Spikelets either solitary on their peduncles or in small fascicles or glomerules, never in dense heads (3)
- 3(2). Achene 3-4 mm. long 1. *S. maritimus*.
- 3. Achene about 1 mm. long (4)
- 4(3). Bristles very long and far-surpassing the scales ... 4. *S. cyperinus*.
- 4. Bristles mostly shorter than scales or if longer then never exerted from the spikelet (5)
- 5(4). Rhizomatous; bracts as long as or exceeding the inflorescence; each spikelet with 20 to 40 florets 2. *S. atrovirens*.
- 5. Not distinctly rhizomatous; bracts shorter than inflorescence; each spikelet with 70 to 200 florets 3. *S. georgianus*.
- 6(1). Achene 0.8-0.9 mm. long 6. *S. molestus*.
- 6. Achene 1.3-3 mm. long (7)
- 7(6). Achene 1.3-1.5 mm. long; culms 0.3-1.8 mm. thick; tufted annuals (8)
- 7. Achene 1.5-3 mm. long; culms usually thicker; rhizomatous perennials (9)
- 8(7). Achene with vertical rows of minute pits 5. *S. koilolepis*.
- 8. Achene with horizontal ridges 7. *S. supinus*.
- 9(7). Culms 3-20 dm. long, often sharply triquetrous, 2-8 mm. thick, often arcuate (10)
- 9. Culms 10-30 dm. long, either terete or only obscurely trigonous, 8-23 mm. thick near base, 2-4 mm. thick just beneath the inflorescence, usually rigidly erect (11)
- 10(9). Achene 2.5-3 mm. long; lower scales of the spikelets often much longer than the rest and with strong venation, bracteolelike; inflorescence a solitary spikelet or glomerule of 2 to 4 spikelets 8. *S. americanus*.
- 10. Achene 1.8-2.6 mm. long; lower scales of the spikelets not differentiated; inflorescence a dense glomerule of 5 to 15 spikelets 9. *S. Olneyi*.
- 11(9). Sheaths (near base of culm) at margins rather regularly retrorsely fimbriate-filiferous; achene bristles 2 to 4, each bristle on each side with 15 to 20 reddish-brown closely spaced spreading or somewhat retrorse projections (not barbellate) 12. *S. californicus*.
- 11. Sheaths smooth or merely lacerate; achene bristles usually 4 to 6, retrorsely barbed (each bristle on each side with 10 to 16 well-spaced barbs) (12)
- 12(11). Scales about 5 mm. long, thin-membranous, pale-brown and with conspicuous elongate reddish glutinous spots (seen under a lens), the distal margin lacerate; achene 1.8-2.9 mm. long 10. *S. acutus*.
- 12. Scales 3-4 mm. long, firm-membranous, dark-brown, nearly smooth (occasionally with a few reddish gummy spots near the midveins), the distal margin nearly smooth to slightly lacerate 11. *S. validus*.

1. *Scirpus maritimus* L. SALT-MARSH BULRUSH. Rhizomatous perennial; rhizome several mm. thick, extensive; culms tufted along the rhizome, often with tuberlike enlargements basally, 5-20 mm. thick above the tuber, 35-100 cm. long, erect, triquetrous; leaves several, well-developed; bracts several, flat, leaflike, ascending or usually spreading; inflorescence of 3 to 15 ovoid to ovoid-cylindric erect or ascending spikelets either all sessile or some variously sessile and others peduncled, quite variable; scales 6-10 mm. long, almost as broad, apically mostly retuse and the midnerve prolonged into a point 1-3 mm. long; achenes obovate-apiculate, 3-4 mm. long, about 2 mm. broad, in transection biconvex or one of the sides more convex or bifaceted than the other, ripening to a dark-brown. The species is nearly world-wide.

We have 2 varieties:

Var. *macrostachyus* Michx. Scales firm, maturing to a dark-brown; styles usually 3-branched. S. *robustus* Pursh. Coastal marshes, s.e. Tex. and Rio Grande Plains, spring-summer-fall.

Var. *paludosus* (A. Nels.) Koyama. Scales thin, translucent, whitish to pallid-buff; styles uniformly 2-branched. S. *paludosus* A. Nels. Marshes, n.-cen. and Trans-Pecos Tex., the Plains Country, Edwards Plateau and Rio Grande Plains.

2. *Scirpus atrovirens* Willd. Rhizomatous perennial; rhizome 2-6 mm. thick; culms 5-8 mm. thick basally, 8-15 dm. long, erect, somewhat trigonous in the upper portion, leafy; bracts several, well-developed, leaflike, ascending or spreading, as long as or exceeding the inflorescence; inflorescence complicatedly decompound, of 100 to 250 (to 500) spikelets in glomerules which in turn are disposed in dense compound panicles, some of the primary branches that bear the panicles 5-14 cm. long; spikelets ovoid to narrowly ovoid, dark-brown to fuscous, of 20 to 40 flowers; bristles almost as long as the achene; scales 1.5-3 mm. long, ovate, acute, with a strong midrib; achene oblong, about 1 mm. long, in transection flattened-trigonous (the abaxial angle blunt, the others sharp). Most of U.S. (except Pac. States).

We have 2 varieties:

Var. *atrovirens*. Scales with a minute mucro only. Rare in moist loam, e. Tex. (Angelina Co.), summer; otherwise in e. U.S. and e. Can., one station in Ariz.

Var. *pallidus* Britt. Scales with a strong mucro or very short awn. S. *pallidus* (Britt.) Fern. Rare in Plains Country (Panhandle), summer; otherwise in cen. and w. U.S.

3. *Scirpus georgianus* Harper. Tufted perennial from thick ascending ligneous caudexes but not distinctly rhizomatous; culms 5-15 dm. long, erect (some very shortly decumbent basally), 3-6 mm. thick just above the caudex, obscurely trigonous above, leafy; bracts several, leaflike but reduced in size, ascending, shorter than the inflorescence; inflorescence a decompound often droopy panicle, some of the longer branches 3-7 cm. long, the 50 to 120 spikelets not in glomerules but most of them on pedicels 2-8 mm. long; spikelets ovoid to usually cylindric, of 70 to 150 (to 200) flowers at maturity; scales ovate, about 2 mm. long, acute, brown with very strongly pronounced green or buffy midnerve; bristles several, about twice as long as the achenes or as long as the scales but mostly crumpled and entangled and never exerted from the spikelet; achene oblong, about 1 mm. long, in transection flattened-trigonous (the abaxial angle blunt, the others sharp). S. *atrovirens* var. *georgianus* (Harper) Fern. Infrequent in n.-cen. Tex., rare in e. Tex., spring; P.E.I. s. to Ga. and w. to Neb. and Tex.

4. *Scirpus cyperinus* (L.) Kunth var. *rubricosus* (Fern.) Cilly. Perennial probably from short thick rhizomes; culms 8-20 dm. long, 6-13 mm. thick basally, 3-4 mm. thick apically where obscurely trigonous; leaves numerous; bracts several, leaflike, basally brownish or reddish-brown, ascending, the lowest one about as long as or slightly surpassing the inflorescence, the rest much shorter; inflorescence a dense decompound panicle (some of the longer primary branches 5-11 cm. long), somewhat droopy, of 200 to 500 spikelets, most of them on slender peduncles 4-10 mm. long, not in glomerules; spikelets ovoid to ellipsoid, brown, 3-5 mm. long, of 40 to 100 flowers; scales elliptic, 1.5-2 mm. long, brown, acute; bristles several, very long, brown, far-surpassing the scales; achenes about 1 mm. long, oblong-apiculate, whitish, flattened-triangular (the abaxial angle blunt, the inner 2 sharp). S. *rubricosus* Fern. Wet or boggy places, e. Tex., summer; the var. *cyperinus* is widespread in e. U.S. and Can.; the var. *rubricosus* is found mostly in s.e. U.S. but occurs n. to Mich. and N.E.

5. *Scirpus koilolepis* (Stued.) Cl. Tufted annual; culms 4-22 cm. long, dark-grayish-green, compressed, 0.3-0.35 mm. thick, minutely striate, ascending, often somewhat flexuous or arcuate; blades 2-5 cm. long, arcuate-setaceous; bract solitary, appearing as a continuation of (and as thick as) the culm, (13-) 17-33 mm. long; inflorescence of 1 or less commonly 2 spikelets; spikelets 3-7 mm. long, narrowly ovoid, acute, of (7 to) 10 to 14 flowers; scales never purplish or reddish, tardily serially deciduous; lowest scale larger than the rest; second or third scale from the bottom 2-2.5 mm. long, ovate, acuminate, strongly gibbous, arcuate-convex, the midnerve forming a broad grayish-green keel and mucro or apiculus, the sides translucent, membranous, cellular, with 1 to 3 acrodrome veins near the keel on each side; perianth bristles absent; style 3-branched; achene globose to globose-oblong, trigonous, basally rounded or shortly stipitate, apically rounded or usually minutely apiculate, 1.3-1.5 mm. long, the 3 angles about equally prominent, the sides flat or slightly convex, superficially brownish, with numerous vertical rows of very minute pits and a thin whitish-waxy bloom. Frequent in moist sandy loam, e., s.e., and n.-cen. Tex., rare in Edwards Plateau (Burnet Co.), spring; Ga., Tenn. and Ala. to Okla. and Tex.; Calif.

6. *Scirpus molestus* M. C. Johnst. Tufted annual; culms 5-16 cm. long, grayish-green, compressed, 0.2-0.25 mm. thick, minutely striate, ascending, often somewhat flexuous or arcuate; sheaths short, slightly loose, quite smooth at the hyaline apical-ventral orifice, grayish-green, eventually turning brownish-stramineous, never red or purple; blades 2-3 cm. long, tightly involute, arcuate-setaceous, about as thick as the culms; bract solitary, appearing as a continuation of (and as thick as) the culm, 5-10 (-23) mm. long; inflorescence a glomerule of 2 or 3 spikelets, less commonly a solitary spikelet; spikelet 2-7 mm. long, ovoid to lance-ovoid, of (10 to) 20 to 30 flowers; scales never purplish or reddish, promptly and serially deciduous after anthesis, beginning at the bottom of the spikelet, the lowest scale larger than the rest; the second or third scale from the bottom 1-1.3 mm. long, gibbous, strongly arcuate-convex, broadly ovate, acute, the midnerve forming a broad grayish-green keel and mucro, the sides translucent, thin-membranous, unpigmented, cellular, with 1 or 2 acrodrome veins near the keel on each side; perianth bristles absent; stamens 2; filaments about as long as the achenes; anthers minute; style 3-branched; achene globose-trigonous, basally rounded or minutely stipitate, apically rounded or extremely minutely apiculate, 0.8-0.9 mm. long, the 3 angles about equally prominent, the sides flat or slightly concave, superficially pinkish-brownish with numerous vertical rows of very minute pits, this pattern and color obscured by a more or less thick whitish-waxy coat. Frequent in moist sand, often associated with *S. koilolepis*, e. and s.e. Tex., spring; Ark., La. and Tex.

7. *Scirpus supinus* L. Tufted annual; culms 3-35 cm. long, 0.6-1.8 mm. thick, essentially terete (ridged on drying), not or only obscurely and bluntly trigonous; sheaths somewhat loose, apically oblique and acute, essentially bladeless; lower bract appearing as a continuation of the culm, (1-) 3-10 (-15) cm. long; other bracts much-reduced, very inconspicuous; inflorescence a glomerule of 2 to 8 spikelets or occasionally some of these extended on peduncles 1-3 cm. long; spikelets lance-ovate, 4-11 mm. long, of 15 to 36 flowers; scales somewhat convex basally, ovate, acuminate, acute, with a very strong keel (green turning stramineous) and sides which are green-membranous turning firm and buffy to purple; style 2-branched [var. *Hallii* (Gray) Gray] or 3-branched [var. *saximontanus* (Fern.) Koyama]; bristles variable; achenes 1.3-1.5 mm. long, glabrous, to broadly elliptic, in transection either plano-convex (var. *Hallii*) or strongly trigonous (var. *saximontanus*) and superficially with horizontal ridges or wrinkles. Frequent in moist areas near the coast, s.e. Tex. and Rio Grande Plains (both varieties), rare in n.-cen. Tex. and Plains Country (var. *saximontanus*), spring-summer; var. *supinus* is widespread in temp. parts of the world; var. *Hallii* in e. U.S. mainly on Coastal Plain; var. *saximontanus* in Great Plains, N.D. to Tex.

Scirpus "supinus," in the present broad sense, has only recently been treated as several narrowly defined species, of which three are attributed to our area and are characterized as follows:

S. Wilkensis Schuyler. Styles mostly 2-parted and achenes 2-angled; scales mostly 1.9-2.3 mm. wide, the cells at the upper margin of the ventral surface 2 to 5 times as long as wide; spikelet achenes mostly 1-1.2 mm. wide, with narrow acute transverse ridges.

Ditches, swales and pond margins, s. Tex. (Aransas, Atascosa, Kleberg, Nueces and Wil-lacy cos.), spr.-fall; also Tam.

S. saximontanus Fern. Styles mostly 3-parted and achenes 3-angled; scales usually longer than wide; spikelet achenes with more than 15 narrow transverse ridges. Local in ditches, sink-lakes, ponds and wet prairies, e. (Austin Co.) and s. (Aransas, Bexar, Cameron, Hidalgo, Nueces and San Patricio cos.) Tex., Plains Country (Tom Green Co.) and Pan-handle (Hale and Lynn cos.), spr.-fall; Kan., Mo., Neb., O., Okla., S.D., Tex., Wyo., S.L.P. and Tam.

S. Bergsonii Schuyler. Styles mostly 3-parted and achenes 3-angled; scales broadly ovate, mostly 2.1-2.9 mm. long and 2.2-3 mm. wide; spikelet achenes with fewer than 15 firm undulating transverse ridges. Local in ditches and on pond margins in s. Tex. (Kenedy, Kleberg and Nueces cos.), summer-fall; endemic. Said to hybridize with *S. Wilkensis* in Kenedy and Nueces counties.

8. *Scirpus americanus* Pers. var. *longispicatus* Britt. SWORD-GRASS, THREE-SQUARE BULRUSH. Rhizomatous perennial; rhizomes extensively creeping, reddish-brown, 2-3 mm. thick; culms rising at short intervals, (1-) 3-15 dm. long, 2-6 mm. thick, ascending, in the distal half sharply triquetrous and often somewhat nodding; leaves 2 to 4, usually 2, with involute blades several cm. long; principal bract solitary, appearing as a continuation of the stem, (15-) 30-50 (-155) mm. long; (lower scales of the spikelets often much longer than the rest and with strong venation, bractlike); inflorescence a solitary spikelet or a glomerule of 2 to 4 spikelets; spikelets sessile, 7-17 mm. long, 4-5 mm. thick, narrowly ovoid or lance-ovoid, of 28 to 50 flowers; scales (except lowest) obovoid, brown, 4-5 mm. long, lower ones emarginate, with a well-marked buffy midnerve (prolonged into a short awn) and firm to membranous deep-brown sides; bristles about 4, about equaling the achene, retrorsely barbellate; style 3-branched, less commonly 2-branched; achene 2.5-3 mm. long, 1.8-2.5 mm. broad, broadly obovate, apiculate, plano-convex, smooth, dark-brown when mature. Some of our plants have been known incorrectly as var. *polyphyllus* (Boeck.) Beetle. Essentially throughout the state in low often moist ground, spring-summer; nearly throughout temp. parts of the world.

9. *Scirpus Olneyi* E. & G. Rhizomatous perennial; rhizomes extensive, 2-4 mm., thick; culms rising at intervals, 6-20 dm. long, 4-8 mm. thick, sharply triquetrous most of the length (the sides often concave); leaves crowded at the base, usually 2 or 3, the lowest ones with loose membranous sheaths and reduced or obsolete, the upper one (which still appears basal) with a slightly longer blade; principal bract solitary, appearing as a continuation of the stem, 1-4 (-15) cm. long; (lower scales of the spikelets not differentiated from the rest); inflorescence a dense glomerule of 5 to 15 spikelets; spikelets sessile, 5-8 (-12) mm. long, 3-5 mm. thick, mostly ovoid, of 24 to 30 (to 40) flowers; scales 3-4 mm. long, the lower ones emarginate, brown, the midrib paler, prolonged as a mucro; bristles about 4, about equaling the achene, retrorsely barbellate; style usually 2-branched, less commonly 3-branched; achene 1.8-2.6 mm. long, 1.5-1.8 mm. broad, obovate, apiculate, plano-convex or unequally biconvex. Our plants have been known incorrectly as *S. chilensis* Nees. Rare and scattered, marshy soil, s.e. and e. Tex., Trans-Pecos, Plains Country and probably elsewhere, spring-summer; temp. N.A.; also Br. Hond., Venez. and Chile.

10. *Scirpus acutus* Muhl. HARD-STEM BULRUSH. Rhizomatous perennial forming extensive colonies; culms 1-3 m. long, rising at close intervals from the rhizomes, 8-23 mm. thick near the base, long-tapered, 2-4 mm. thick just under the inflorescence, essentially terete to very obscurely trigonous; leaves 1 or 2 per culm, confined to the very base, consisting of short mostly open sheaths with nearly smooth to lacerate margins; blades obsolescent; bract appearing as a continuation of the culm, (5-) 10-30 (-55) mm. long, shorter than the inflorescence; inflorescence 3-10 cm. long, decom-pound, with several drooping primary branches and 10 to 35 spikelets; spikelets lance-ovoid, at maturity 8-15 mm. long, of 20 to 50 flowers; scales about 5 mm. long (the lower ones emarginate), thin-membranous, pale-brown and with conspicuous elongate reddish glutinous spots (seen under a lens), the distal margin lacerate, the midnerve scabrous and projected as a mucro or short awn; bristles 4 to 6, about equaling the achene, retrorsely barbed, on each side of the bristle 10 to 16 well-spaced barbs; styles mostly 2-branched; achene obovate, apiculate, plano-convex or very unequally biconvex, (1.8-) 2.1-2.4 (-2.9) mm. long. *S. lacustris* L. subsp. *glaucus* (Sm.) Hartm., *S. Tabernaemontani* Gmel., *S. lacustris*

var. *occidentalis* Wats. Alkaline or calcareous mud, usually in water, Plains Country and Trans-Pecos, rare e. to n.-cen. Tex., spring-fall; Eur.; much of temp. N. A. s. to Gulf States, Chih., Coah. and Calif.

This is perhaps only a variety of *S. lacustris*. Some specimens from the lower Rio Grande Plains seem to be intermediate between *S. acutus* and *S. validus*.

11. *Scirpus validus* Vahl. GREAT or SOFT-STEM BULRUSH. Rhizomatous perennial forming extensive colonies; culms 1-3 m. long, rising at close intervals from the rhizomes, 8-23 mm. thick near the base, long-tapered, 2-4 mm. thick just under the inflorescence, essentially terete or very obscurely trigonous; leaves 1 or 2 per culm, confined to the very base, consisting of short mostly open sheaths with nearly smooth to lacerate margins; blades obsolescent; bract appearing as a continuation of the culm, (5-) 10-30 (-55) mm. long, shorter than the inflorescence; inflorescence 3-10 cm. long, decompound, with several drooping primary branches and 20 to 120 spikelets; spikelets ovoid, 5-10 mm. long, of 20 to 50 flowers; scales obovate, 3-4 mm. long, firm-membranous, dark-brown, nearly smooth (occasionally with a few reddish gummy spots near the midnerve), the distal margin nearly smooth to slightly lacerate, the midnerve projected as a mucro or short awn; bristles 4 to 6, mostly slightly surpassing the achene, retrorsely barbed (on each side of each bristle 10 to 16 well-spaced barbs); styles mostly 2-branched; achenes obovate, apiculate, plano-convex or very unequally biconvex, (1.5-) 1.9-2.1 (-2.2) mm. long. *S. lacustris* var. *condensatus* Peck. In mud and usually in shallow water, infrequent in scattered parts of e., s.e. and n.-cen. Tex. and Rio Grande Plains, spring-fall; temp. N.A. s. to S.A. Perhaps only a variety of *S. lacustris*.

12. *Scirpus californicus* (C. A. Mey.) Steud. GIANT BULRUSH, TULE. Perennial from tight subrhizomatous knots; culms closely tufted, 1-2 m. long, 8-22 mm. thick near the base, 2-4 mm. thick near the inflorescence, bluntly trigonous; leaves few, basal, consisting only of mostly open brownish sheaths whose margins are rather regularly retrorsely fimbriate-filiferous; primary bract appearing as a continuation of the culm, 18-70 mm. long (other bracts reduced, scalelike), shorter than the inflorescence; inflorescence 4-12 cm. long, decompound with a number of usually drooping branches, altogether with 50 to 150 spikelets; spikelets lance-ovoid, 6-11 mm. long, of 30 to 50 flowers; scales about 3 mm. long, ovate to obovate, dark-brown, some of them emarginate, mucronate, the distal margins essentially entire; bristles 2 to 4, subligulate, reddish-brown, each one on each side with 15 to 20 reddish-brown closely spaced spreading or often somewhat retrorse projections (not barbellate); styles mostly bifid; achene obovate, apiculate, about 2 mm. long, brown, plano-convex or biconvex. Scattered in mud and shallow water throughout Tex. except the Plains Country, spring-summer; warmer parts of Am., n. to Gulf States, s. Ariz. and s. Calif.

13. *Scirpus cubensis* Poepp. & Kunth. Rhizomatous perennial; rhizome 1-5 mm. thick; aerial culms solitary at the nodes of the rhizome, to 1 m. tall, sharply trigonous, smooth; leaves all basal with blades to 15 mm. broad; inflorescence involucrate, umbel-like; bracts 2 to 5, leaflike, spreading, unequal, often much-elongate, far-surpassing the umbel; branches of umbel very unequal (1 head usually quite sessile), usually 1-3 cm. long; each branch terminated by a dense spherical or somewhat prolate head 1-2 cm. thick; each head of many spikelets; scales about 3 mm. long, reddish, spreading, tapered to the acute reflexed tip; bristles absent; style bifid; achene about 3 mm. long, lenticular, apiculate. Very rare, known only from Eagle Nest Lake, Brazoria Co. where collected once in 1958, summer-fall; warmer parts of Am., n. to Gulf States; also Afr.

3. FUIRENA ROTTB. — UMBRELLA-GRASS

Perennials, usually rhizomatous, the lowest leaves often with reduced blades, the upper 1, 2 or 3 leaves functioning as bracts with each subtending a very much condensed often glomerulelike inflorescence of 1 to 10 spikelets; spikelets globose to oblong-cylindric; scales numerous, spirally imbricate, usually pubescent, all fertile, usually obovate and awn-tipped (awn short in one species); perianth of 3 stalked scalelike or paddlelike structures often thickened at maturity, often additionally three perianth bristles alternating with these stalked structures; style branches 3; achene plumply trigonous, shiny, apically tapering into a more or less persistent indurate linear style base often nearly as long as the achenial body itself.

The genus is related to, and should be included within, *Scirpus*, according to some authors. A small genus of 40 species in warmer regions of the world.

1. All or nearly all blades reduced; awns of spikelet scales only about 1 mm. long, ascending1. *F. scirpoidea*.
1. Nearly all blades well-developed, only the lowest reduced; awns of spikelet scales usually 2-4 mm. long, often spreading apically (2)
- 2(1). Each of the 3 prominent perianth parts with an acuminate apex which often arches toward the style2. *F. squarrosa*.
2. Each of the 3 prominent perianth parts with an acute, blunt or even emarginate apex and often subapically on the dorsal side with a mucro or a minute awn3. *F. simplex*.

1. *Fuirena scirpoidea* Michx. Strongly rhizomatous; only the middle sheaths with small blades; inflorescences often only at the uppermost node and reduced to 1 to 3 spikelets; scales of spikelets with very short straight awns; the 3 expanded perianth parts tapering to their acumens. Rare in wet sand, s.e. Tex. (Aransas and San Patricio cos.), summer; coastwise, Ga. to Tex.; Cuba.

2. *Fuirena squarrosa* Michx. Scales of spikelet with long often decurved awns; expanded perianth parts tapering to the nonmucronate acumen which is often incurved to the style. *F. hispida* Ell., *F. breviseta* Cov. Frequent in moist usually acid soils of marshes and bogs, e. and s.e. Tex. s. to Aransas Co., summer; parts of e. U.S. w. to e. Okla. and Tex.; Cuba; P.R.

3. *Fuirena simplex* Vahl. Scales of spikelet with long awns; expanded perianth parts variable but usually apically blunt or retuse and dorsally just below the tip with a mucro or minute awn. Frequent in wet areas, usually in calcareous mud, w. part of Tex., e. to n.-cen. Tex. and Rio Grande Plains, late summer-fall; Guat. and Br. Hond. n.w. to Mo., Neb., N.M., Son. and Baja Calif.

4. ELEOCHARIS R. BR.* SPIKERUSH

Annual or perennial broomlike sedges usually in aquatic environments; leaves reduced to mere bladeless sheaths; inflorescence solitary, terminal, spiciform (the bract reduced to a mere basal scale or usually absent), bearing few to many perfect flowers crowded in 3 to many ranks; scales spirally imbricate or rarely distichous (as in *E. Baldwinii* and perhaps *E. minima*), usually closely crowded, remaining so even when the achenes mature in some species (in others serially deciduous starting at the base of the spike), of various textures but always glabrous; perianth bristles 6 to 9 (or in some species reduced or absent); stamens usually 3, in some species often reduced to 2 or 1; styles 2- or 3-branched, basally enlarged into a persistent base (called the "tubercle") capping the achene, with a postanthetic zone of abscission between this base and the more slender portion, variously shaped and textured, either well-demarcated from the body of the achene or appearing to merge with it (as in *E. parvula* and *E. Engelmannii*, etc.); achene body plano-convex or isolaterally or isosceleslike trigonous (the trigony often obscure) to nearly tercte, of various shapes, textures, colors and surficial sculpturing.

A cosmopolitan genus said to comprise about 200 species.

1. Tubercle 1.2-1.7 mm. long, about as broad as the achenial body30. *E. tuberculosa*.
1. Tubercle less than 1.1 mm. long (2)
- 2(1). Achenes with about 6 longitudinal panels or rows of numerous horizontally elongate cells (trabeculae) visible under a strong lens (3)
2. Achenes various but not trabeculate (6)
- 3(2). Tufted annual; horizontally elongate cells about 15 in each longitudinal series12. *E. brachycarpa*.
3. Perennials; trabeculae more numerous (4)
- 4(3). Culms strongly compressed, 2-edged, often C-shaped in transection, 0.6-1.3 mm. broad11. *E. Wolfii*.
4. Culms neither strongly compressed nor 2-edged (5)

* We wish to acknowledge the assistance of Henry K. Svenson, especially with field work.

- 5(4). Culms 0.2-0.4 mm. thick; anthers 0.5-1 mm. long . . . 9. *S. acicularis*.
 5. Culms 0.6-1 mm. thick; anthers 0.3-0.4 mm. long . . . 10. *E. radicans*.
- 6(2). Culms sharply triquetrous or quadrangular in transection, 2.5-4 mm. broad across each side, 5-8 dm. long (7)
 6. Culms not as above, if triquetrous or quadrangular then much less coarse (8)
- 7(6). Culms quadrangular; achenial body 1.7-2.3 mm. long; tubercle 1-1.5 mm. long . . .
 3. *E. quadrangulata*.
 7. Culms triquetrous; achenial body 1.4-1.7 mm. long; tubercle 0.7-1 mm. long
 4. *E. fistulosa*.
- 8(6). Tubercle coronalike, 0.3-0.5 mm. high, 0.8-1 mm. broad, capping and often broader than the trigonous-obpyramidal body 8. *E. melanocarpa*.
 8. Tubercle not as above, if coronalike then the body not trigonous (9)
- 9(8). Achene biconvex, lustrous, brown when mature; style branches 2; tubercle forming a narrow lamelliform cap on and in outline confluent with the body (10)
 9. Achene trigonous or biconvex, if biconvex then the style branches 3 and/or the tubercle not lamelliform (11)
- 10(9). Spikelets lanceolate, acuminate; scales acute 14. *E. lanceolata*.
 10. Spikelets broadly ovoid to ovoid-cylindric, obtuse; scales obtuse
 13. *E. obtusa*.
- 11(9). Culms 1.5-9 mm. thick; spikelets of 40 to 350 flowers; achenes biconvex (12)
 11. Culms 0.1-1.4 mm. thick; spikelets of 5 to 80 flowers; achenes either biconvex or trigonous (16)
- 12(11). Culms with complete septa (as revealed by dissection) (13)
 12. Culms not septate or irregularly and incompletely septate (15)
- 13(12). Culms 1.5-3.5 mm. thick; septa 2-5 mm. apart; tubercle depressed, 0.1-0.2 mm. high, in outline confluent with the body; body of achene 0.9-1.1 mm. long
 26. *E. montana*.
13. Culms 4-9 mm. thick; septa mostly farther apart; tubercle conic, 1-1.2 mm. long; body of achene 1.8-2.2 mm. long (14)
- 14(13). Septa very crowded just below the spikelet 1. *E. interstincta*.
 14. Septa not very crowded just below the spikelet 2. *E. equisetoides*.
- 15(12). Body of achene about 2 mm. long, the surface cellular, appearing as if embedded in plastic; scales obtuse; spikelet 19-36 mm. long, cylindric
 5. *E. cellulosa*.
15. Body of achene 1.2-1.8 mm. long, surface smooth or micropunctate; scales usually acute; spikelets 8-25 mm. long 18. *E. macrostachya*.
- 16(11). Achenes biconvex, lustrous, black when mature, the bodies 0.5-1 mm. long; tubercles 0.05-0.2 mm. long; style branches 2 (17)
 16. Achenes trigonous or if obscurely so then not black when mature (19)
- 17(16). Perennial usually with slender rhizomes; flowers 15 to 25 per spikelet; scales obviously keeled 15. *E. flavescens*.
 17. Annuals, densely tufted; flowers 28 to 80 per spikelet; scales not or inconspicuously keeled (18)
- 18(17). Achenial body 0.7-1 mm. long; tubercle (0.05-) 0.1-0.2 mm. long; culms 0.4-1 mm. thick 16. *E. caribaea*.
 18. Achenial body 0.5-0.6 (-0.7) mm. long; tubercle 0.05 mm. long; culms 0.2-0.3 mm. thick 17. *E. atropurpurea*.
- 19(16). Achenial body rather sharply trigonous, broadest near the middle, apically confluent in outline with the tubercle which is pyramidal and 0.1-0.2 mm. long; rhizomatous mat-formers; culms 2-12 cm. long, 0.1-0.4 mm. thick
 6. *E. parvula*.
19. Achenial body either not sharply trigonous or (if so) not confluent with the tubercle, or else plants otherwise habitally (20)

- 20(19). Tubercle columnar or slightly tapered, blunt, 0.7-1 mm. long, 0.3-0.4 mm. thick basally, not constricted basally but confluent with the body of the achene; culms wiry, compressed, 1-1.4 mm. thick in the larger dimension 7. *E. rostellata*.
20. Tubercle shorter or if as much as 0.7-1 mm. long then constricted basally, not confluent (21)
- 21(20). Tubercle 0.6-1 mm. long, high-pyramidal, basally truncate; body of achene 1.2-1.7 mm. long, surficially cellular (the cells with prominent margins) and olivaceous brown to olivaceous gray when mature ..31. *E. tortilis*.
21. Tubercle 0.05-0.7 mm. long, mostly pyramidal, low to depressed-pyramidal or globose; body of achene 0.5-1.8 mm. long, surficially smooth to warty or punctate but not cancellate, variously colored (22)
- 22(21). Spikelets 5- to 20-flowered; culms 0.1-0.3 mm. thick; achenes rather sharply trigonous, mostly whitish or maturing to shades of olive, surficially smooth; sheaths long-oblique apically (23)
22. Spikelets 20- to 110-flowered; culms 0.2-1.4 mm. thick; achenes mostly not so sharply trigonous (except in *E. tenuis*, *E. cylindrica* and *E. austrotexana*), maturing (except in *E. tenuis*) through shades of yellow to golden-brown or brown; sheaths truncate or only very slightly oblique apically (25)
- 23(22). Spikelets narrowly elliptic, 4-7 mm. long; scales appearing distichous, lance-elliptic, 3-4.5 mm. long, buffy to ferruginous-buff ..28. *E. Baldwinii*.
23. Spikelets ovoid, 2-5 mm. long; scales rarely appearing distichous (except in *E. minima*?), ovate, shorter, usually whitish to purplish (24)
- 24(23). Culms about 0.1 mm. thick, strongly recurved, 3-7 (-10) cm. long; spikelets 5- to 10-flowered; achenial body 0.7-0.8 mm. long, maturing through whitish or olive to olive-gray; tubercle pyramidal, 0.15-0.3 mm. long 27. *E. minima*.
24. Culms (0.1-) 0.15-0.3 mm. thick, mostly erect, 4-28 cm. long; spikelets 8- to 15-flowered; achenial body 0.5-0.6 mm. long, pearly-white; tubercle depressed-pyramidal, 0.05-0.1 (-0.15) mm. high 29. *E. microcarpa*.
- 25(22). Scales broadly ovate, subcartilaginous medially, firm-membranous marginally, stramineous in color; somewhat lustrous; achenial body ripening through shades of olive-whitish to brownish-olive and finally to a rich dark-chocolate-brown; bristles conspicuous, reddish-brown at maturity ...32. *E. albida*.
25. Scales mostly thinner, membranous and usually with some dark pigmentation; achenial body (except in *E. tenuis*) ripening through shades of yellow to golden-brown; bristles various (26)
- 26(25). Achenial body minutely but pronouncedly warty or pitted in vertical lines, 0.6-0.8 mm. long, ripening through shades of ivory to greenish-olive; tubercle pronouncedly depressed, 0.1-0.2 mm. high, not much-constricted basally; culms 0.2-0.3 mm. thick20. *E. tenuis*.
26. Achenial body minutely punctate-reticulate to smooth but not warty, 0.6-1.8 mm. long, ripening through shades of yellow to brown; tubercle usually conic-globular, usually constricted basally; culms 0.4-1.4 mm. thick (27)
- 27(26). Scales of spikelet apically rounded, hyaline only in a very narrow rounded border at the apex (28)
27. Scales of spikelet deltoid or ovate-acute to lance-acuminate, with a more or less acute more or less extensive hyaline apex (29)
- 28(27). Spikelets very variable, from globular to broadly cylindrical or ovoid to elliptic, apically usually blunt; achenial body obscurely trigonous, punctulate-reticulate surficially23. *E. montevidensis*.
28. Spikelet linear-cylindrical, acute; achenial body distinctly trigonous, smooth and satiny24. *E. cylindrica*.
- 29(27). Achenial body 1.2-1.8 mm. long; tubercle 0.2-0.7 mm. long; styles mostly 2-branched, rarely 3-branched (30)
29. Achenial body 0.7-1.2 mm. long; tubercle 0.1-0.2 mm. long; styles 3-branched (31)

- 30(29). Styles always 2-branched; achenial bodies very faintly reticulate-punctulate to essentially smooth; common18. *E. macrostachya*.
30. Styles 2- or 3-branched; achenial bodies distinctly reticulate-punctulate; exceedingly rare19. *E. fallax*.
- 31(29). Culms 30-45 cm. long, with complete septa at regular short intervals (as revealed by dissection); achenial bodies with at least 2 distinct angles, the third sometimes also fairly sharp, the surface essentially smooth; scales merely acute, about 2 mm. long25. *E. austrotexana*.
31. Culms 8-28 cm. long, not septate; achenial bodies obscurely trigonous, the surface somewhat punctulate-reticulate; scales with long-acuminate scarious or hyaline apexes which often become split (bifid) during elongation (32)
- 32(31). Culms strongly compressed, 0.6-1 mm. thick in the flat dimension; deep east Texas21. *E. compressa*.
32. Culms variable, somewhat to not at all compressed, 0.3-0.8 mm. thick; Edwards Plateau, Plains County, north-central and southeast Texas
.....22. *E. acutisquamata*.

1. *Eleocharis interstincta* (Vahl) R. & S. Tufted perennial; culms 5-10 dm. long, 4-9 mm. thick, erect, essentially terete, septate, the septa closer together as the spikelet is approached; sheaths often tinged dark-red, apically firm, oblique; spikelets cylindrical, 22-42 mm. long, 5-7 mm. thick, with 80 to 140 flowers; scales (sub)cartilaginous, 3.5-5 mm. long and broad, obtuse, rounded, stramineous to buffy-stramineous, marginally darker and thinner, medially flat with a faint narrow midvein which is more heavily pigmented distally; bristles 6, exceeding the achene, brownish, stout, subcartilaginous, flattened, with (usually retrorse) serrulations; styles 2- or 3-branched; achene body biconvex, 1.8-2.2 mm. long, brown (yellow when immature), shiny; tubercle high-conic, 1-1.2 mm. long, 0.8 mm. broad, dark, slightly constricted basally. Infrequent to rare in mud in e. Tex., Rio Grande Plains and Edwards Plateau, probably elsewhere, summer-fall; Fla.; Tex.; Berm.; W.I. s. to Bol. and Braz.

2. *Eleocharis equisetoides* (Ell.) Torr. Tufted perennial, exceedingly similar to *E. interstincta* but the septa not as crowded just below the spikelet and the bristles slightly shorter and thinner on the average. Rare in e. and s.e. Tex., summer-fall; Coastal States, Mass. to Tex.; also Ind., Mich., Wisc. and Mo.

3. *Eleocharis quadrangulata* (Michx.) R. & S. Tufted perennial; culms 5-8 dm. long, 2.5-4 mm. thick, erect, sharply 4-angled, not septate; sheaths membranous, brownish or less commonly reddish, apically oblique; spikelets cylindrical, 20-42 mm. long, 3.5-4.5 mm. thick, with 40 to 90 flowers; scales rotundly-obovate to ovate, 5.5-6 mm. long, 3-5 mm. broad, medially nearly flat, stramineous and subcartilaginous, laterally broadly chartaceous to hyaline, the distal margin with slightly darker coloration; bristles about 6, slender, unequal, some equaling the body, others surpassing the tubercle, with minute retrorse serrulations; style 2- or 3-branched; achene body biconvex to turgidly biconvex, 1.7-2.3 mm. long, brown (yellow when immature), shiny; tubercle high-conic to deltoid or oblong, 1-1.5 mm. long, 0.8-1 mm. broad, basally constricted, dark. Infrequent in mud in e. and s.e. Tex., rare in n. part of Rio Grande Plains, late spring-fall; most of e. U.S., w. to Wisc., Mo., Okla. and Tex.; also Jal.

4. *Eleocharis fistulosa* (Poir.) Schult. Tufted perennial, apparently rather similar to *E. quadrangulata* but the culms sharply triangular and the spikelets and scales averaging slightly smaller; achene body 1.4-1.7 mm. long; tubercle 0.7-1 mm. long. Rare in Rio Grande Plains, summer-fall (?); widely distributed in the warmer parts of the world, in Am. n. to Cuba and Tex.

5. *Eleocharis cellulosa* Torr. Tufted perennial; culms 5-8 dm. long, 2-5 mm. thick, erect, essentially terete or irregularly compressed and striate; sheaths usually reddish, apically oblique, membranous; spikelets cylindrical, 19-36 cm. long, 3.5-5 mm. thick, with 50 to 90 flowers; scales broadly ovate to obovate, 5-6 mm. long, 3-3.5 mm. broad, medially with a prominent midrib and subcartilaginous and stramineous, striate and brown-penicillate, in texture passing laterally to chartaceous and finally to hyaline, in color to pallid-buff, the distal margin finely white-hyaline, submarginally with a thin brown line; bristles about 6, slender, mostly exceeding the achene and not serrulate; style 3-branched; achene body biconvex, about 2 mm. long, brownish, surficially dis-

tinctly cellular (the cells quadrangular, appearing as if embedded in clear plastic), apically umbonate (forming a buttonlike base which is the podium for and merges into the tubercle); tubercle conic-deltoid, 0.6-1 mm. long, 0.4-0.6 mm. broad, dark, not at all constricted basally but appearing as a continuation of the umbo of the body although differing texturally (being noncellular). Infrequent in fresh-water mud in Edwards Plateau, rare in Rio Grande Plains, exceedingly rare in e. Tex., spring-fall; Coastal States, N.C. to Tex.; Mex.; W.I.; Berm.

6. *Eleocharis parvula* (R. & S.) Link. Tufted annual (?) spreading by short stolons or rhizomes 0.2-0.5 mm. thick, forming mats in mud; culms 2-7 (-12) cm. long, 0.1-0.4 mm. thick, usually sulcate or irregularly flattened; sheaths extremely short and inconspicuous, hyaline, often slightly reddish; spikelets ovoid to cylindrical, 2-9 mm. long, about 2 mm. thick, with (3 to) 5 to 8 (to 20) flowers; scales ovate, about 2 mm. long, stramineous, medially chartaceous, laterally membranous and marginally hyaline; bristles usually reduced and essentially obsolete [in our plants, most of which are of the var. *anachaeta* (Torr.) Svens.]; stamens 3; style 3-branched; achenial body ovoid to ob-ovoid, trigonous, 0.8-1 mm. long, passing through shades of gray to fuscous or black at maturity, smooth, usually somewhat shiny; tubercle conic-trigonous, much narrower than the body of the achene and confluent with it, scarcely differentiable except under high magnification, 0.1-0.2 mm. long. *Scirpus nanus* Spreng. (non Poir.), *E. membranacea* (Buckl.) Gilly. Infrequent to locally abundant, essentially throughout Tex., in mud, spring-fall; var. *parvula* is widespread in Eur., N. Afr., the Near East and N.A.; var. *anachaeta* is scattered in w. N.A.

7. *Eleocharis rostellata* (Torr.) Torr. Tufted perennial with short often erect rhizomes to 5 mm. thick; culms 25-80 (-150) cm. long, flattened (1-1.4 mm. thick in the broader dimension), on each side usually 3- or 4-costate, wiry, tough, erect or the more elongate ones arching and taking root as the spikelet touches the ground, thus stoloniform; sheaths firm, apically slightly oblique; spikelets lanceolate, acute, 8-17 mm. long, 2.5-4.5 mm. thick, with 12 to 30 flowers; scales ovate, 3-3.5 mm. long, the upper ones more acute than the lower, medially rigid and with a strong stramineous midrib, passing laterally through chartaceous to a membranous texture and in color through shades of brown to pale-brown or stramineous marginally; bristles firm, regularly serrulate, pale-brown, about equaling the tubercle; style 3-branched; achene body obscurely trigonous or turgidly plano-convex, obovoid, brownish, shiny, 1.5-1.7 mm. long, apically narrowed and merging with the tubercle; tubercle oblong or steeplike, 0.7-1 mm. long, 0.3-0.4 mm. thick basally (at attachment but narrower most of the length). Mud in upland areas, frequent in Plains Country, infrequent on Edwards Plateau, summer-fall; N. S. and Me. to Fla., inland in Ont. to N.J., Mich., Wisc., Ill., Kan., Okla., Tex., Coah., B.C. to Wyo., Ut., Calif., N.M.; Berm.; Cuba; Hisp.; n. Mex.; mts. of Ecu. and Arg.

8. *Eleocharis melanocarpa* Torr. Densely tufted perennial; culms 2-6 dm. long, flattened, about 1 mm. thick in the larger dimension, on each side paucicostate and paucisulcate; sheaths apically firm and thickened, mucronate; spikelets narrowly ovoid, obtuse, 6-12 mm. long, 4-5 mm. thick, with 20 to 40 flowers; scales ovate, 3-3.5 mm. long, with a pale buffy very firm midrib, passing laterally through firm-brown to membranous-stramineous marginally; bristles dark-brown, shorter than the achene tubercle, retrorsely toothed or much-reduced; style 3-branched; achenial body obpyramidal-trigonous, 0.8-1 mm. long, apically truncate, ripening through fuscous to black, glossy; tubercle paler, caplike, 0.3-0.5 mm. long, 0.8-1 mm. broad, often broader than the body and overhanging its truncate apex, depressed centrally with a slight pointed umbo. Rare in moist sandy often boggy loam, e. Tex. (Leon and Upshur cos.), summer-fall (?); Coastal States, Mass. to Tex.; also Ind. and Mich.

Plants of this species appear to combine some characters of *E. rostellata* and some of *E. obtusa*.

9. *Eleocharis acicularis* (L.) R. & S. Rhizomatous perennial forming mats; roots not fleshy; rhizomes 0.3-0.6 mm. thick, extensively creeping; aerial culms 2-23 cm. long, 0.2-0.4 mm. thick, about 8-costate and -sulcate, often somewhat flattened or angulate; sheaths thin, reddish below, pallid and membranous or hyaline terminally, oblique; spikelets narrowly ovoid to ovoid-elliptic, 2-5 mm. long, 5- to 15-flowered; scales membranous, whitish to usually dark-purplish-red (or marginally pallid), ovate, 1.5-2 mm. long, rather truncate to acute; bristles 3 or 4 or usually (in Texas material) reduced or

absent; styles 3-branched; achenial body obovoid, obscurely trigonous to usually nearly terete because of the turgid sides, 0.5-0.7 mm. long, pearly-white, with a number of longitudinal ribs and between each 2 ribs 25 to 40 close horizontally elongate facets or cells; tubercle conic, 0.075-0.15 mm. long, constricted basally, much narrower than the achenial body. *E. Reverchonii* Svens. Mud, nearly throughout the state except Trans-Pecos and e. Tex., infrequent or locally abundant, Feb.-summer; most n.-temp. areas of the world, in Am. s. to Calif., Chih., N.M. and the Gulf States.

10. *Eleocharis radicans* (A. Dietr.) Kunth. Densely matted perennial, the rhizomes very short; culms succulent (pressed flat in specimens), only 3-8 cm. long, 0.6-1 mm. thick, erect; sheaths membranous, tight; spikelets ovoid, 3-4 mm. long, 6- to 12-flowered; scales ovate-lanceolate, greenish-stramineous; bristles usually 4, slender, white, retrorsely toothed, variable in length, in some specimens reduced or absent; style 3-branched; achenial bodies narrowly obovoid, 0.7-0.9 mm. long, pearly, obscurely trigonous or usually essentially terete, with several longitudinal ridges and (between them) many (30 to 40) close horizontally elongate cells (trabeculae) in each longitudinal series; tubercle conic, 0.1-0.2 long, much narrower than the body. *Scirpus radicans* Poir. (an illegit. name), *Eleogiton radicans* A. Dietr., *Eleocharis Lindheimeri* (Clarke) Svens. Rare in marshy areas, e. and s.e. Tex., spring (-summer?); Va., Mich., Tex., Okla., Calif., Son., Gr. Ant., S.A.; H.I.

11. *Eleocharis Wolfii* (Gray) Patt. Perennial (?); rhizomes slender, creeping, fragile; culms tufted, 2-edged, somewhat concavo-convex or C-shaped in transection, 12-30 cm. long, 0.6-1.3 mm. broad, erect; sheaths apically scarious, oblique; spikelets ovoid-lanceolate, acute, 5-10 mm. long, 18- to 34-flowered; scales narrowly ovate, acute, usually with 2 purple longitudinal stripes and the rest stramineous, firm or marginally scarious; bristles absent; style 3-branched; achenial bodies narrowly obovoid, 0.8-0.9 mm. long, pearly, obscurely trigonous to terete, with about 9 longitudinal ridges and between each 2 ridges about 40 close horizontally elongate cells (trabeculae); tubercle depressed-conic, about 0.1 mm. long, much narrower than the body. Rare in wet sand, Plains Country and s.e. Tex., probably scattered elsewhere, spring-summer; Sask., Ind., Ill., Mo., Kan., Colo., Okla., Tenn., La. and Tex.

12. *Eleocharis brachycarpa* Svens. Slightly tufted annual; culms flexuous, "capillary," 1-7 cm. long; spikelets 2-4 mm. long, several-flowered; scales lanceolate, striate, apically scarious, green or streaked with brown; bristles absent; styles 3-branched; achenial body obovoid, nearly terete, with several longitudinal series, each of about 15 horizontally elongate cells (trabeculae); tubercle conic, much narrower than the body, basally constricted; body of achene plus tubercle totalling 0.4-0.5 mm. long. Rare in Rio Grande Plains (last collected in April, 1834), spring; also Tam.

13. *Eleocharis obtusa* (Willd.) Schult. Densely tufted annual (rarely persisting more than 1 season); culms 3-50 cm. long, 0.3-1.6 mm. thick (fleshy and sometimes seemingly broader when pressed flat), erect, striate; sheaths often slightly purplish basally, apically firm and oblique; spikelets broadly ovoid to nearly cylindrical, of 50 to 100 flowers (50 to 80 in var. *obtusa*, 60 to 100 in var. *detonsa*), obtuse; scales oblong to suborbicular, firm, drab-stramineous with a narrow scarious margin, obtuse, falling promptly in series from bottom to top of spikelet; bristles several, varying from surpassing the tubercle to essentially absent; style 2- or 3-branched; achenial body biconvex, pyriform, 0.8-1.2 mm. long, 0.7-1 mm. broad, smooth and shiny, ripening through shades of yellow-green to brown; tubercle forming a dark broad low-deltoid crown on the body and in outline merging with it, not constricted basally, 0.1-0.4 mm. long, 0.5-1 mm. broad (in var. *obtusa* the tubercle 1.7 to 3 times broader than long; in var. *detonsa* 2.8 to 4.5 times broader than long). *E. Engelmannii* Steud. Locally abundant in moist sandy soils; the var. *obtusa* in e. and s.e. Tex. passing into var. *detonsa* (Gray) Drapalik & Mohlenbrock in n.-cen. Tex. and Edwards Plateau (Enchanted Rock area only), spring-summer; over much of temp. N.A. [and perhaps including the Euras. *E. ovata* (Roth) R. & S. as var. *ovata* (Roth) Drapalik & Mohlenbrock].

14. *Eleocharis lanceolata* Fern. Densely tufted annual; culms 1-2 dm. long, 0.3-0.9 mm. thick, erect; sheaths apically firm and oblique; spikelets lanceolate to lance-ovoid, of 30 to 80 flowers, acute; scales ovate, firm, brownish-stramineous, with a narrow scarious margin, acute, falling promptly in series from bottom to top of spikelet; bristles 6 or 7, usually surpassing the tubercle; style 2- or 3-branched; achenial body 0.9-1.1 mm. long,

0.7-0.8 mm. broad, biconvex, pyriform in outline, smooth, shiny, ripening to a brownish color; tubercle forming a dark broad low-deltoid crown on the body and in outline merging with it, not constricted basally, about 0.4 mm. long, 0.5-0.6 mm. broad. *E. obtusa* var. *lanceolata* (Fern.) Gilly. Rare in n.-cen. and n.e. Tex. (Grayson and Bowie cos.), in moist loam, summer-fall(?); Mo., Kan., Ark., Okla. and Tex.

15. *Eleocharis flavescens* (Poir.) Urban. Perennial, often with elongate fleshy rhizomes 0.5-1 mm. thick; culms either densely tufted or rising singly from the nodes of the rhizome, 4-35 cm. long, 0.3-1 mm. thick, ascending, firm to flaccid, often sulcate when dried; sheaths apically oblique, hyaline, fragile, promptly becoming loose and withered on drying; spikelets 3-6 mm. long, ovoid, acute or blunt, with 15 to 25 flowers at maturity (the numerous more apically situated primordia never maturing); scales ovate to ovate-oblong, firm to membranous, somewhat striate, with a strong greenish keel-like midrib and brown-stramineous sides; bristles about 7, pallid to pure white, quite variable in length but usually about equaling the tubercle; style 2-branched; achenial body obovate to pyriform, 0.8-0.9 (-1) mm. long, biconvex, shining, microscopically pitted, ripening through shades of chartreuse and olive-brown to purplish-brown or even purplish-black; tubercle conic, yellow to greenish-white, acute, 0.1-0.2 mm. long, about 0.1 mm. broad, basally very slightly constricted. *E. olivacea* Torr., *E. ocreata* (Nees) Steud. Rare in moist soil, e. and s.e. Tex. and Edwards Plateau, probably elsewhere, spring-fall; e. N.A. w. to Minn. and Tex.; W.I., Mex., S.A. Easily confused with *E. caribaea*.

16. *Eleocharis caribaea* (Rottb.) Blake. Densely tufted annual (when plants are covered slowly with shifting sand the bases elongating upward somewhat like rhizomes) or perhaps rarely perennial; culms 4-30 cm. long, 0.4-1 mm. thick, terete (or striate and sulcate on drying); sheaths apically oblique, firm; spikelet 3-6 mm. long, ovoid to broadly ovoid, obtuse, of 28 to 50 flowers; scales broadly ovate, 1.5-2 mm. long, firm, when mature stramineous to pallid-buffy and with inconspicuous midrib, obtuse, eventually serially deciduous from lowest to highest; bristles about 7, dark-colored, usually about equaling the tubercle; style 2-branched; achenial body (0.7-) 0.8-1 mm. long, obovate to pyriform in outline, biconvex, ripening through shades of pale-green to purplish-black, shiny; tubercle conic (depressed or acute), (0.05-) 0.1-0.2 mm. long, pallid-greenish or whitish, slightly constricted basally. Locally abundant in moist calcareous soil in most parts of the state (absent from Plains Country and e. Tex.), summer-fall; widespread in warmer parts of the world; in Am. n. to Gulf States, casual elsewhere.

Has been known incorrectly as *E. geniculata* (L.) R. Br.; the latter is a species of coarse, tropical perennials not occurring in Texas.

17. *Eleocharis atropurpurea* (Retz.) J. & C. Presl. Densely tufted annual; culms 3-12 cm. long, 0.2-0.3 mm. thick, arcuate-erect, terete (sulcate or striate on drying); sheaths apically oblique, firm; spikelet narrowly ovoid, 2-4 mm. long, of 40 to 80 flowers; scales ovate to narrowly so, about 1 mm. long, obtuse to abruptly acute, firm-membranous, with a green midrib, brown to purplish laterally; bristles several, usually colorless, translucent, about equaling the achenial body or much-reduced; style 2-branched; achenial body 0.5-0.6 (-0.7) mm. long, obovate to pyriform in outline, biconvex, when mature quite jet black, shiny; tubercle conic, about 0.05 mm. long, whitish, constricted basally. Rare and local in moist sandy soil, e. Tex. (Bastrop Co.), Edwards Plateau (Burnet Co.), Plains Country (Hale Co.) and Rio Grande Plains (Hidalgo Co.), scattered, summer; scattered in warmer parts of both hemispheres, in Am. n. to Ia., Neb., Colo. and Wash.

18. *Eleocharis macrostachya* Britt. Rhizomatous perennial; rhizomes 1-2.5 mm. thick, often reddish; culms in tufts along the rhizome, 18-50 cm. long, 0.9-3 mm. thick, erect, often appearing slightly spongy and irregularly sulcate on drying, occasionally compressed; sheaths tight, apically truncate or very slightly oblique, very firm, in many specimens mucronate, basally dark-reddish-brown; spikelets 8-25 mm. long, about 3 mm. thick, lanceolate or linear-lanceolate, acute, of 40 to 100 flowers; lowest 1 to 3 scales sterile, firm, obtuse, the lowest one sometimes completely encircling the base of the spikelet; fertile scales lanceolate to broadly lanceolate, more or less acute, about 3 mm. long, with a green or stramineous midrib (which does not reach the apex), a firm buffy to castaneous lateral and subapical zone and a hyaline margin and apex; bristles 7 or 8, brownish, unequal, the longest usually as long as the tubercle; style 2-branched, the upper part promptly deciduous from the base; achenial body obovate to pyriform, 1.2-1.8 mm. long, usually more turgidly convex on one (abaxial) side than on the other,

surficially nearly smooth or very faintly reticulate-punctate in an open pattern, lustrous, ripening through shades of yellow to golden-brown; tubercle 0.3-0.7 mm. long, conic to depressed or even subglobular, grayish, texturally like pumice or rotted bone, usually about half as broad as the body, basally constricted. Some workers refer these plants to the Old World complex known by the name *E. palustris* (L.) R. & S. *E. xyridiformis* Fern. & Brack. Most of Tex. (except extreme e. and s.e.), usually in slightly alkaline mud, spring-summer; Minn. to Ill., Mo., Kan., Okla. and Tex., w. to s. Alas., Calif. and s. to cen. Mex.; Col.

19. *Eleocharis fallax* Weath. Perennial much like *E. macrostachya* but styles 2- or 3-branched, the achenes averaging smaller (body 1.2-1.7 mm. long and tubercle 0.2-0.5 mm. long) and the body more distinctly and regularly punctate (much as in *E. montevidensis*). Rare in (brackish?) mud, s.e. Tex. (collected once in Matagorda Co.), summer (?); coastwise, Mass. to Tex.; Cuba.

20. *Eleocharis tenuis* (Willd.) Schult. var. *verrucosa* (Svens.) Svens. Rhizomatous perennial; rhizomes 1-2 mm. thick, scaly-fibrous, castaneous-fuscous; culms tufted at intervals along the rhizomes, 15-50 cm. long, 0.2-0.3 mm. thick, weakly ascending, 4- or 5-sulcate or simply angled; sheaths basally purplish-red, apically firm, truncate to very slightly oblique, usually with a minute mucro; spikelets oblong or narrowly ovoid to lance-ovoid, 3-9 mm. long, of 20 to 40 flowers; scales ovate to obovate, obtuse, about 2 mm. long, with a greenish or stramineous midrib and firm castaneous to purplish-black sides, marginally very narrowly scarious; bristles 2 or 3, promptly deciduous, very short; styles 3-branched; achenial body broadly obovoid to suborbicular, distinctly trigonous, 0.6-0.8 mm. long, ripening through shades of ivory to greenish-olive, surficially minutely but pronouncedly warty or pitted in vertical lines; tubercle strongly depressed-pyramidal, 0.1-0.2 mm. long, slightly constricted basally. Infrequent in moist sand, forested areas, e. Tex., rare in s.e. Tex., spring; temp. e. N.A., w. to Ill., Mo., Okla. and Tex. (the var. *verrucosa* in the w. part of that distributional area).

21. *Eleocharis compressa* Sulliv. Rhizomatous perennial; rhizomes 2-4 (-6) mm. thick, usually short and forking, forming dense thick mats; culms tufted along the rhizome, 9-20 cm. long, erect, strongly compressed, 0.6-1 mm. broad in the flat dimension, several-striate on each side; sheaths usually reddish basally, apically firm and truncate or only very slightly oblique, with a mucro; spikelets ovoid to narrowly ovoid, 5-12 mm. long, with 20 to 40 flowers; scales broadly lanceolate, the lower medial portion chestnut-brown or chestnut-fuscous (the mid-nerve somewhat paler), the margins and the long-attenuate sometimes bifid (split) apex translucent-scarious; bristles 1 to 5, promptly deciduous, very short; style 3-branched; achenial body broadly obovoid, turgid, obscurely trigonous, about 1 mm. long, ripening through yellow to a golden-brown, surficially granular-roughened or reticulate (rougher than in the following species but not as rough as in *E. tenuis*); tubercle 0.1-0.2 mm. long, depressed- to globose-conic, usually slightly constricted basally. *E. elliptica* Kunth var. *compressa* (Sulliv.) Drapalik & Mohlenbrock. Rare in loamy usually moist soil in e. Tex. (San Augustine Co.), spring; most of n.e. U.S.; also Ont., Sask., Ga., Okla. and Tex.

22. *Eleocharis acutisquamata* Buckl. Rhizomatous perennial; rhizomes 2-4 (-6) mm. thick, usually short and forking, forming dense thick mats; culms tufted along the rhizome, 8-20 (-28) cm. long, 0.3-0.8 mm. thick, slightly compressed or usually merely irregularly several-angled; sheaths usually slightly pinkish basally, apically firm and truncate or only very slightly oblique, not mucronate; spikelets narrowly oblong or cylindrical to narrowly elliptic, usually with a blunt point, 3-11 mm. long, of 24 to 44 flowers; scales broadly lanceolate, the lower medial portion brown (the midnerve slightly paler), the margin and the long-attenuate sometimes bifid (split) apex translucent-scarious; bristles several, extremely short and promptly deciduous; style 3-branched; achenial body broadly obovoid to obovoid-pyriform, turgid, obscurely trigonous, 0.9-1.2 mm. long, ripening through yellow to a golden-brown, surficially very minutely granular-roughened and obscurely reticulate; tubercle conic to essentially globular, 0.1 mm. long (rarely to 0.2 mm.), basally constricted. Probably conspecific with *E. compressa*. Abundant in calcareous loamy (usually slightly moist) soil, Edwards Plateau and n.-cen. Tex., infrequent s. to s.e. Tex. (Refugio Co.) and in e. Plains Country, spring; also Okla.

23. *Eleocharis montevidensis* Kunth. Rhizomatous perennial; rhizomes extensive, 1-2 (-2.5) mm. thick, usually dark-reddish; culms 1-5 dm. long, 0.4-1 mm. thick, erect,

rather soft, sometimes slightly compressed, in pressed specimens often irregularly sulcate and showing incomplete and weak septa; sheaths basally dark-reddish, apically quite firm, truncate or only very slightly oblique and weakly mucronate; spikelets very variable in shape, from globular to cylindrical or ovoid to elliptic, apically blunt, 3-14 mm. long, with 24 to 70 (to 110) flowers; scales mostly oblong to oblong-ovate, 2-3 mm. long, obtuse to slightly emarginate, the median portion membranous and brownish to atrocastaneous (with or without a paler midnerve), marginally scarious, often somewhat convex abaxially, concave adaxially (this true even before the achenes mature, so the spikelets appear filled out soon after anthesis); bristles 4 to 6, some of them usually equaling the tubercle; style 3-branched; achenial body obovoid to pyriform-obovoid, (0.8-) 0.9-1.1(-1.2) mm. long, turgid, obscurely trigonous, ripening through shades of yellow to golden-brown or even dark-brown, punctuate-reticulate surficially (varying from as rough as in *E. compressa* to nearly smooth as in the plant called *E. Palmeri*), lustrous; tubercle precisely to irregularly conic, (0.1-) 0.2-0.3 (-0.4) mm. long. *E. arenicola* Torr., *E. Palmeri* Svens. Perhaps our commonest species, occurring in moist soil essentially throughout Tex. (rare in extreme e. and extreme w.), spring (-summer); cen. Mex. n. to Ore., Ida., N.M., Okla., the Gulf States and S.C.; also s. Braz., Urug. and Arg.

24. *Eleocharis cylindrica* Buckl. Rhizomatous perennial; rhizomes slender (1-2 mm. thick); culms 15-30 cm. long, 0.4-0.5 mm. thick, about 4-sulcate and -angled, erect; sheaths faintly reddish-brown basally, apically firm, truncate or very slightly oblique, mucronate; spikelets linear-cylindric, 8-17 mm. long, 2-2.5 mm. thick, acute, of 50 to 60 flowers; scales about 2 mm. long, ovate, acute, medially thin-membranous, brown (the midnerve pale), marginally white-hyaline, slightly convex abaxially; bristles pale-brown, 0.05-0.1 mm. long, extremely inconspicuous; style 3-branched; achenial body 0.6-0.8 (-1) mm. long, obovoid, strongly and obviously trigonous (the sides slightly concave, the angles prominent but not sharp), ripening through canary-yellow to golden-brown or dark-brown, essentially smooth and satiny, apically conspicuously and abruptly narrowed to a short cylindrical pedestal; tubercle depressed-pyramidal, about 0.1 mm. long and about as wide or pyramidal and about 0.3 mm. long. Rare, probably in shallow water or calcareous mud, Plains Country (Lubbock Co.) and Trans-Pecos (Presidio Co.), June-July; endemic, to be sought in N.M. and Chih.

25. *Eleocharis austrotexana* M. C. Johnst. Densely tufted perennial (probably with short slender matted reddish rhizomes); culms 30-45 cm. long, erect, 0.8-1.1 mm. thick, essentially terete, with 12 to 15 minute striae in dried specimens and very weak but complete transverse septa 2-3 mm. apart (otherwise hollow); sheaths 2-5 cm. long, tight, mostly reddish, apically quite firm, truncate or only very slightly oblique and with a seta or mucro to 1 mm. long; spikelets lanceolate, acuminate, acute, 8-13 mm. long, of about 50 to 70 flowers; scales ovate and acute to broadly lanceolate, about 2 mm. long, medially buffy-brown (midnerve paler) and membranous, marginally hyaline, whitish; bristles about 6 to 8, pale-brown, translucent, inconspicuous, persistent, unequal, the longer ones about equaling the achenial body; style 3-branched; achenial body obovoid-pyriform, 0.7-0.9 mm. long, obscurely trigonous (the 2 inner angles definite, though not sharp, the abaxial one obscure), ripening through shades of yellow to golden-brown, surficially nearly smooth, slightly lustrous (under very high magnification punctulate-reticulate); tubercle depressed-pyramidal, about 0.2 mm. long and broad, slightly constricted basally. Rare in Rio Grande Plains and s.e. Tex., Apr.; endemic.

26. *Eleocharis montana* (H.B.K.) R. & S. Perennial, basally subrhizomatous but not extensive; culms densely tufted, 3-8 dm. long, 1.5-3.5 mm. thick, erect, terete, with complete septa 2-3 mm. apart; sheaths basally reddish, apically lineolate, very firm, only very slightly oblique, mucronate; spikelets lanceolate, 8-24 mm. long, acute, with 110 to 240 (to 350) flowers; scales ovate and acute to broadly lanceolate, about 2 mm. long, medially buffy-brown and membranous, marginally hyaline and paler; bristles 6 to 8, brownish, unequal, the longer ones about equaling the achenial body; style 2-branched (in Texas material); achenial body 0.9-1.1 mm. long, obovate, biconvex (not turgidly so), with 2 definite angles (in Texas material), ripening through shades of pallid chartreuse and yellow to olive-brown, surficially punctulate-reticulate; tubercle 0.1-0.2 mm. long, depressed-deltoid, about half as broad as the body and scarcely restricted basally, almost merging with the body. Scarce in wet places, s.e. Tex. and s. as far as Nueces Co., summer; widespread in S.A. and C.A., W.I., n. to Ariz., Tex., La. and Fla.

27. *Eleocharis minima* Kunth. Tufted annual; culms 3-7 (-10) cm. long, about 0.1 mm. thick, extremely weak, often flexuous and recurved, quadrangulate-sulcate; sheaths dark-reddish, apically long-oblique, blunt, hyaline; reduced (cleistogamous?) spikelets often present at the base of the plant among the culms; ordinary spikelets 2-4 mm. long, ovoid, 5- to 10-flowered, usually blunt; scales ovate to narrowly ovate, blunt or shortly acute, 1.5-2 mm. long, brown and membranous (midrib paler), marginally hyaline; bristles about 5 to 7, whitish, about as long as the body of the achene; style 3-branched; achenial body obovoid, 0.7-0.8 mm. long, sharply trigonous (the 3 sides slightly convex), ripening through olive-whitish to pale-olive or even dark-olive-gray, often somewhat mottled, darker near the angles and the ends, essentially smooth; tubercle sharply pyramidal-trigonous, 0.15-0.3 mm. long and broad, slightly constricted basally. Rare in mud in s.e. Tex. (Aransas and Jackson cos.), spring and fall; trop. Am. s. to s. Braz. and n. to Ga., Tex. and Calif.

28. *Eleocharis Baldwinii* (Torr.) Chapm. Tufted annual; culms 6-20 cm. long, 0.1-0.25 mm. thick, ascending or often strongly recurved and stoloniform; sheaths mostly reddish, long-oblique, blunt, hyaline; cleistogamous few-flowered spikelets usually abundant at base of plant among the sheaths; ordinary spikelets mostly narrowly elliptic, 4-7 mm. long, of 5 to 10 flowers, frequently proliferating when the recurved culm (stolon) touches the ground; scales pseudodistichous, the lowest linear and with a strong green midnerve, the others progressively broader toward the top of the spikelet, lance-elliptic, 3-4.5 mm. long, buffy to ferruginous-buff, membranous, strictly appressed, acute; bristles several, pallid, about equaling the achenial body or reduced; style 3-branched; achenial body obovate, 0.7-0.8 mm. long, whitish-buffy to olive or brownish-olive, trigonous (angles distinct and sides nearly flat), smooth; tubercle pyramidal-trigonous, 0.2-0.3 mm. long, acute, constricted basally. Near Caddo Lake, La. (part of this lake extends into e. Tex.), summer-fall; N.C., Ga., Fla., La., (Tex.?).

29. *Eleocharis microcarpa* Torr. Tufted annual; culms 4-28 cm. long, (0.1-) 0.15-0.3 mm. thick, mostly erect or ascending (less commonly weak and somewhat flexuous), often quadrangulate-sulcate (at least when dry); sheaths short, stramineous or slightly tinged with pink basally, apically long-oblique, blunt and hyaline; spikelets never at the base of the plant, always terminal on elongate culms, ovoid, 2-5 mm. long, 8- to 15-flowered, often proliferous (sending out culms instead of flowers, usually from the axil of the lowest scale), the spikelet then slightly inclined; lowest scale differentiated, bract-like, sterile, lanceolate to linear, often a third to three fourths the entire length of the spikelet, consisting mostly of a prominent green midnerve with reduced membranous sides; other scales ovate, about 1.5 mm. long, blunt, the median distal portion purplish (midrib paler) and membranous, the median proximal portion whitish, the margins white-hyaline; bristles somewhat variable, in our specimens much reduced or usually absent; styles 3-branched; achenial body 0.5-0.6 mm. long, obovoid, trigonous (angles not very prominent, sides convex), pearly-white, lustrous, smooth; tubercle 0.05-0.1 (-0.15) mm. long, depressed-pyramidal, buffy-white, slightly constricted basally. *E. Brittonii* Small, *E. Lundellii* Svens. Frequent in sandy loams, s.e. Tex., infrequent in e. Tex., spring-fall; coastal areas, Conn. and N.J. to Tex.; also Tenn. and Ind.

30. *Eleocharis tuberculosa* (Michx.) R. & S. Tufted perennial, often with ascending rhizomes 3-6 mm. thick; culms 15-80 cm. long, compressed, 0.5-1 mm. thick in the longer dimension, erect, wiry, sulcate, grayish-yellow; sheaths grayish-yellow, shortly oblique and acute; spikelets ovoid to lance-ovoid, 5-15 mm. long, blunt to acute, with 25 to 40 flowers; scales ovate to nearly orbicular, about 3 mm. long, blunt, grayish-yellow to stramineous, firm (chartaceous to subcartilaginous), not keeled, marginally slightly thinner than medially; bristles several, brownish, usually surpassing the achenial body; style 3-branched; achenial body broadly obovoid, 1.2-1.7 mm. long, obscurely trigonous, stramineous to olivaceous, surficially with pronounced large cells (the cell-walls prominent), lustrous; tubercle 1.2-1.7 mm. long, irregularly stele-shaped-conic, apically rounded, toward the base flared out mushroomlike and as broad as the body, very strongly truncate, the connection to the body very thin. Frequent in moist sand, s.e. and e. Tex., May-Nov.; coastal provinces and states, N.S. and N.H. to Tex.; also Tenn. and Ark.

31. *Eleocharis tortilis* (Link) Schult. Tufted perennial; rhizomes ascending, 2-3 mm. thick; culms 15-50 cm. long, 0.5-1 mm. thick, usually flattened or irregularly 3-costate

and -sided, often twisted, wiry, grayish to yellowish; sheaths grayish or yellowish, shortly oblique and acute or blunt, firm; spikelets ovoid to lance-ovoid or cylindrical-ovoid, 6-14 mm. long, of 13 to 38 flowers; scales ovate to suborbicular, about 3 mm. long, blunt, firm (subcartilaginous medially to chartaceous marginally), yellowish or grayish-stramineous, sometimes with a subterminal purplish splotch especially when immature; bristles several, brownish, often surpassing the achenial body; style 3-branched; achenial body broadly obovoid, 1.2-1.7 mm. long, obscurely trigonous, the sides convex, superficially pronouncedly large-cellular (the cell walls prominent), lustrous, olivaceous-brown or gray; tubercle pyramidal, 0.6-1 mm. long, usually acute, basally narrower than the body, truncately constricted to the very narrow attachment. Infrequent in moist sandy soil, e. Tex., May-Nov.; coastal areas, N.Y. to Tex.

32. *Eleocharis albida* Torr. Rhizomatous perennial; rhizomes extensive, 1-2 mm. thick, orangish-brown; culms tufted at intervals along the rhizome, 5-30 cm. long, about 1 mm. thick, erect, essentially terete, stramineous or basally slightly pinkish; sheaths apically truncate or shortly oblique and firm but membranous, basally often pinkish to red; spikelets ovoid to ovoid-cylindric, 5-16 mm. long, of 30 to 90 flowers, rarely proliferating; scales broadly ovate, subcartilaginous medially, firm-membranous marginally, stramineous, shiny; bristles 5 to 8, when mature reddish-brown, some often surpassing the achenial body, others half as long; style 3-branched; achenial body broadly obovoid, 0.8-1 mm. long, trigonous (the 2 inner angles sharper and more definite than the abaxial one, the faces only slightly convex), maturing through shades of olive-whitish to brownish-olive and finally to a rich dark-chocolate-brown, lustrous; tubercle varying from conic to globular, 0.15-0.3 mm. long, paler than the body at maturity, constricted basally. Frequent in moist perhaps brackish sand in coastal parts of Rio Grande Plains and s.e. Tex., spring-summer; coastal areas, Md. to Mex.; Berm.

5. BULBOSTYLIS KUNTH

Essentially glabrous perennial forming tight swards of limited extent or less commonly annual herbs; culms closely tufted, 4-30 cm. long, 0.2-0.6 mm. thick, wiry, erect; leaves setaceous, about half as high as and even thinner than the culm; primary bract setaceous, often appearing as a continuation of the culm or spreading, 3-22 mm. long; other bracts setaceous, much-reduced; inflorescence umbelliform or cymose, simple or compound, 5-40 mm. long or occasionally reduced to a glomerule or even rarely a single spikelet; spikelets lance-cylindric, dark-brown, of 7 to 25 perfect flowers; scales spirally imbricate, ovate, obtuse to acute or rarely retuse, dark-brown, 1-2 mm. long, strongly keeled (the keel paler), occasionally slightly gibbous, glabrous to strigose or puberulent, marginally smooth to slightly fimbriate; perianth bristles absent; style 3-branched, the base enlarged and persistent as a tubercle 0.5-1 mm. long, differentiated in texture and color from the achenial body; achenial body obovoid or usually obpyramidal, strongly triquetrous, 0.7-0.9 mm. long, maturing through shades of white to pale-buffy-white or grayish, with papillae or transverse ridges. *Stenophyllus* Raf. (a rejected name). Many authors, with much justification, include *Bulbostylis* in *Fimbristylis*.

About 100 species in warm regions.

1. Achenes papillose, maturing yellowish or grayish; cyme typically compound 1. *B. ciliatifolia*.
1. Achenes transversely ridged or rugose; cyme simple (2)
- 2(1). Annual or perennial; achenes with about 10 indistinct transverse ridges on each face, maturing to a buffy-white 2. *B. capillaris*.
2. Strong perennial; achene with about 20 minute but (under a lens!) conspicuous and pronounced transverse rugae on each face, maturing to a grayish color 3. *B. juncooides*.

1. *Bulbostylis ciliatifolia* (Ell.) Fern. Characters given in the generic description and the key. Uncommon in periodically wet sandy soil of open woods and hillsides in e. and s.e. Tex., summer-fall; from Va. s. to Fla., w. to Tex.

2. *Bulbostylis capillaris* (L.) Clarke. Characters given in the generic description and the key. *Fimbristylis capillaris* (L.) Gray. Infrequent in sandy soil and in crevices of

granitelike rocks which decompose to sandy soil, e., s.e. and n.-cen. Tex. and Edwards Plateau (Central Mineral Region), rare in Trans-Pecos, spring-summer; widespread in warm-temp. N.A., s. to Calif., Ariz., N.M. and the Gulf States; Tam.; Cuba; reported in Chih.

3. *Bulbostylis juncoides* (Vahl) Kükenth. Characters given in the generic description and the key. Locally frequent in rock crevices in Chisos and Davis Mts. in the Trans-Pecos, rare in granite area of Edwards Plateau, summer; Tex. and Ariz. s.e. to Guat.; Hisp.; Bol. to Urug. and Arg.

Our plants are referable to the var. *ampliceps* Kükenth. (which name is probably not the earliest applicable one in the varietal rank).

6. FIMBRISTYLIS VAHL¹⁷

Perennial or annual, the culms solitary or in tufts, or variously rhizomatous, rigid or lax, leafy toward the base; leaves filiform to narrowly or broadly linear, glabrous to pubescent, flat or involute, ligulate or eligulate, the sheaths closed or partly open at maturity of the leaf; spikelets lanceolate or oblong to ovoid or round in outline, terete or somewhat flattened or angled, either solitary and terminal on the scapes or in simple or compound umbelliform systems involving pedunculate and sessile spikelets of cymules, the whole inflorescence as well as the cymules composing it often subtended by a leafy involucre; fertile scales glabrous or variously pubescent, subdistichous to more often spirally arranged, deciduous, all but the lowermost fertile; florets perfect; perianth absent (the flower produced on a short pedicel joint which usually disarticulates with the achene); stamens one to three; anthers oblong, basifixed, sometimes apiculate, the two thecae at maturity longitudinally and laterally dehiscent; style 2- or 3-branched, the unbranched portion flattened and fimbriate for at least a portion of its length or (more rarely) subterete or angled, the style base either flattened or swollen but in any event not persistent at the summit of the achene; achene lenticular or trigonous; surface of achene smoothish, cancellate or warty, usually made up of isodiametric or horizontally arranged rectangular cells, these either concave or protuberant.

Over 200 described species, in a variety of habitats in warm temperate to tropical regions of the world.

1. Style 3-branched (2)

1. Style 2-branched (3)

2(1). Achene trigonous, the surfaces smooth or warty; ligule of short hairs present 1. *F. autumnalis*.

2. Achene not trigonous or only obscurely so, obovoid, the surfaces usually warty; ligule absent 2. *F. miliacea*.

3(1). Ligule of short hairs present (this characteristic is most noticeable in those entities that have broadly linear flattened leaf blades but is difficult to detect in those extremes that have very involute narrow leaf blades (4)

3. Ligule absent (8)

4(3). A system of slender pale or reddish rhizomes present; robust perennials with tall wandlike culms (5)

4. Rhizomes absent or (if present) thickened and composed of stout contiguous culm-bases; perennial or annual species (6)

5(4). Fertile scales puberulent toward the tip; scapes usually flattened, often scabrous-edged distally; edges of leaves (especially toward the tip) scabrid; achene finely but definitely reticulate; in upper edges of salt marshes, dune swales or fresh marshes on the Coastal Plain 3. *F. caroliniana*.

5. Fertile scales usually smooth; scapes more slender, terete or broadly oval in cross section and smooth distally; edges of leaves usually not scabrid; achene smoothish or with longitudinal rows of shallow isodiametric pits; moist or wet prairies, river sloughs, marshes and springy places in west Texas 10. *F. puberula* var. *interior*.

¹⁷ Adapted from Robert Kral in *Sida* 4, No. 2, 1970,

- 6(4). Face (one side) of achene smoothish or with many (15 or more) longitudinal rows of shallow pits or cells (thus finely striate) . . . 4. *F. tomentosa*.
6. Face (one side) of achene more closely reticulate, usually with 12 or less longitudinal rows of horizontally oriented rectangular cells (7)
- 7(6). Sheaths densely spreading-hairy; margins of leaf blades spreading-hairy (at least toward the base); leaves broadly linear, spreading, subdistichous; primary rays of umbel stiffly spreading, the inflorescence often as wide as long or wider; edges of achene with at least low warts; weed of Gulf Coastal Plain 5. *F. decipiens*.
7. Sheaths and leaves variable in pubescence; leaves narrowly linear, usually ascending; primary rays of umbel spreading or ascending but inflorescence usually longer than broad; achene lacking warts or copiously warty; widespread 6. *F. annua*.
- 8(3). Low often densely tufted weedy annual; leaf blades linear-filiform 7. *F. Vahl.*
8. Taller more robust wider-leaved perennials (9)
- 9(8). Plants densely caespitose; bases of leaves hard, leathery, usually very dark-brown or castaneous, often quite lustrous, deeply set in substrate; common to brackish coastal habitats 8. *F. castanea*.
9. Plants in small tufts or culms solitary; bases of leaves thickened and hard or culm bases bulbous but in any case more shallow-set in substrate; either with stout contracted rhizomes or with fasciculate clusters of narrow orange-brown rhizomes; from sandy acid pineland savannahs or oak barrens to heavy prairie soils but not in brackish coastal habitats (10)
- 10(9). Base of culms bulbous, often joined together into a stout knotty rhizome; old leaf bases often persisting as shreddy remnants; outer surface of fertile scales usually with some puberulence 9. *F. puberula*.
10. Base of culms rarely bulbous, usually producing fascicles of slender orangish rhizomes; old leaf bases not persisting as shreddy remnants; outer surface of fertile scales seldom with any puberulence 10. *F. puberula* var. *interior*.

1. *Fimbristylis autumnalis* (L.) R. & S. Caespitose annual, usually 5-20 cm. tall; leaves glabrous, spreading, subdistichous, from half as long as the culms to equaling the culms; blades linear (to 4 mm. broad), flat, the backs with numerous raised veins, the margin a pale cartilaginous ciliate-scabrid border; sheaths broader, keeled, with a broad scarious tan entire margin, joining the blade at an acute angle or truncate; ligule present as a line of short pale hairs; scapes flat, similar to the leaf blades, the edges often harsh; longest involucre bract with blade similar to that of the leaves, seemingly a continuation of the scape, shorter to longer than the inflorescence; spikelets linear-oblong to lanceolate, usually 3-7 mm. long, pale- to dark-brown, in an open to densely closed paniculate system of cymes, the primary rays usually ascending; fertile scales ovate-lanceolate, usually keeled, entire, the midrib excurrent as a mucro; stamens usually 2, rarely 1, 0.2-0.3 mm. long; style 3-branched, much longer than the achene, trigonous at the base, subterete above toward the branches, entirely smooth; achene trigonous-obovoid, apiculate, about 1 mm. long, pale-brown, the surface smooth to quite verrucose. Moist to wet sands, peats, silts or clays, primarily of disturbed sunny ground, various provinces of e. N.A.; Carib. I., Mex. and C.A.; also Old and New World trop.

2. *Fimbristylis miliacea* (L.) Vahl. Caespitose annual to 5 dm. tall (rarely to 1 m.); leaves equitant, distichous, from one half the length of the plant to nearly as long, rigid, smooth, flabellately spreading, tapering evenly from broad clasping sheaths into the blade, thence continuing to taper into a slender tip, the numerous veins raised and evenly spaced; margin of the blade narrow, pale, cartilaginous, antorsely ciliate-scabrid, the margin of the sheath somewhat broader, scarious and entire; sheaths keeled, often bladeless; ligule not evident; scapes slender but rigid, flattened or somewhat angled in cross section toward the base, more flattened distally but often with a double margin along each edge; spikelets subglobose to ovoid or short-cylindrical, 2-4 mm. long, on flattened scabrous pedicels in a compound loose to congested system of cymes; longest involucre bract usually shorter than the inflorescence; fertile scales ovate, pale-

(usually) dark-brown, smooth, the apex obtuse to rounded or emarginate, the margin entire, the midrib paler by contrast or greenish and rarely excurrent; stamens 1 or 2, the anthers less than 1 mm. long; style 3-branched, the unbranched portion not much longer than the achene, subterete below, more flattened and fimbriate above toward the branches; achene obovoid (usually narrowly so), apiculate, about 1 mm. long, pale-brown, reticulate, the cells narrowly rectangular and horizontally oriented in 4 to 6 rows on a face, the longitudinal ribs usually more prominent and usually verrucose. Sandy peat, peat-muck and silt of open areas such as savannahs, pond, lake or river shores, cult. areas (particularly rice fields), in the U.S. from N.C. s. in the Coastal Plain into peninsular Fla., w. along the Gulf Coast into Tex.; throughout the Carib. I., Mex. and C.A.

3. *Fimbristylis caroliniana* (Lam.) Fern. Rhizomatous perennial, to 1.5 (-2) m. tall; culms solitary or in small tufts, the bases rather shallowly set in the substrate; leaves subdistichous, usually spreading, about half as long as the scapes; blades firm, linear, 2.5 (-7) mm. wide, the surfaces smooth or in some cases pubescent near the ligule or the upper face, the backs with several raised nerves, the pale margin hyaline and scabrid; leaf-sheath broader, clasping, firm, pale- to dark-brown, glabrous to sparsely pubescent, with a wide stramineous to tan or reddish-brown scarious margin (this gradually or abruptly passing into the blade and often ciliate at this point); ligule of appressed hairs, usually complete; scapes about the width of the leaf blade, glabrous, many-ribbed, subterete toward the base, usually flattened toward the apex (in which case the edges scabrid); longest bract of the involucre much shorter than the inflorescence to but slightly exceeding it, the back glabrous to puberulent, the margin harsh; spikelets ellipsoidal to lance-ovoid or oblong, 5-15 mm. long, blunt to acute, pale-dull-brown to reddish-brown, few to many in a compound umbellate system of cymes, the edges of the peduncles scabrid; fertile bracts ovate, glabrous or puberulent on the backs toward the apex, the margin entire, the surface marked by a thick usually paler area of midrib (this sometimes excurrent as a short mucro); stamens 3, the apex of the flattened filaments narrowed, the anthers about 3 mm. long; style 2-branched, flat, fimbriate from near the base to slightly beyond the point of branching; achene lenticular-obovoid, about 1 mm. long, pale- to deep-brown, often lustrous, finely reticulate with the reticule composed of several fine rows of foveae or horizontally oriented rectangular cells; pedicel joint very short, usually persistent. Brackish, alkaline or mildly acid sands or sandy peats of beaches, dune swales, lake shores, roadside ditches, more rarely savannahs or flatwoods, Coastal Plain from N.J. s. into the Fla. Keys and w. along the Gulf Coast to Tab.; Cuba.

4. *Fimbristylis tomentosa* Vahl. Cespitose annual to 7.5 dm. tall; leaves from half as long to nearly the length of the mature culms; blades linear, 2-4 (-5) mm. broad, usually flat but sometimes slightly involute, spreading to ascending, the surfaces pubescent, the backs with several prominent raised nerves, the margin evident as a pale cartilaginous narrow border which is ciliate-scabrid; leaf sheath broad, usually tomentose, with a wide brownish subscarious margin (this long-ciliate and truncate above at juncture with blade); ligule present as horizontal line of short pale hairs; scapes rather rigid, subterete basally, usually flattened or oval in cross section just below inflorescence, smooth or variously pubescent; spikelets at maturity a rich-reddish-brown, lance-ovoid, 4-6 mm. long, acute, usually many in a rather dense paniculate system of cymes the primary branches of which are usually ascending, pubescent (spikelets solitary in depauperate specimens); longest involucral bract exceeding inflorescence, leaflike in its vestiture, always with a prominently hairy sheath; fertile bracts ovate, at maturity glabrous, reddish-brown except for a paler often greenish area of midrib (this usually exerted as a short cusp (backs of the midrib of lowermost scales often with some hairs)); anthers 2, 0.7-1 mm. long; style 2-branched, flattened, the edges fimbriate from near the base to the base of the branches; achene obovoid, slightly apiculate, including the pedicel 1.7-2 mm. long, lenticular, finely foveate (pitted) with the pits arranged in many vertical rows, sometimes slightly umbonate, at maturity a dark- to pale-brown except for the pale margin; pedicel joint persistent, to 0.5 mm. long. Moist to wet sands, silts or clays of disturbed habitats such as pond or river banks, roadside ditches, canals or agricultural grounds, Coastal Plain from N.C. s. to n. Fla. and w. into Tex.

5. *Fimbristylis decipiens* Kral. Cespitose decumbent annual to about 3 dm. tall, the scapes spreading or ascending; leaves about one half as long as the mature culms; blades linear, pale-green, averaging about 2 mm. wide, the upper and lower surfaces smoothish

or with erect long trichomes along the veins beneath, the backs with several prominent raised nerves; leaf margins thickened, pale-cartilaginous, with approximate to scattered long horizontal trichomes toward the blade base (these grading into a scabrid margin distally); sheaths closed, with a broad scarious tan margin that is spreading-pilose and also ciliate apically; ligule present as a line of short pale appressed hairs; scapes fairly rigid, multicostate, terete below, sometimes slightly flattened distally, the ridges sometimes with scattered horizontally spreading hairs; longest involucrel bract longer than the inflorescence, similar to leaves in width and indument of blade, the expanded sheath spreading-pilose; spikelets ellipsoidal to lance-ovoid, 5-6 mm. long, acute, stramineous to brownish, few to several in an open system of spreading usually 1- to 3-spikeletted cymules, the inflorescence usually about as broad as or broader than long; fertile bracts broadly oblong to ovate, the apex acute to acuminate or obtuse, the margin entire and scarious, paler, the surface smooth, tan or tinted with brown, the midveins inconspicuous and pale or the midnerve itself green; midvein usually excurrent as a short mucro; anthers 1 or 2, about 0.8 mm. long; style 2-branched, flattened, the edges usually fimbriate only from about the midpoint to the base of the style branches; achene broadly lenticular-obovoid, about 1 mm. long, pale-brown or greenish-brown, the 2 edges somewhat thickened and paler, the surface ridged-reticulate, the cells rectangular and horizontally oriented in 8 to 11 vertical lines to a side, with the longitudinal edges more prominent than the transverse; edges of the achene usually with a few isolated papillae toward the distal end. A weed of moist sandy roadbanks, fields and disturbed open usually piney woods, in the Coastal Plain from e. N.C. s. to n. Fla. and w. to e. Tex.

6. *Fimbristylis annua* (All.) R. & S. Cespitose, decumbent to ascending or erect annual, to 5 dm. tall (usually much lower); leaves from half as long to nearly the length of the mature culms; blades usually narrowly linear, glabrous to tomentose, 1-2 (-4) mm. wide, the backs with several prominent raised nerves, the often pale margin cartilaginous and usually ciliate-scabrid; sheaths broad, smooth or pubescent, with a wide subscarious margin that is smooth or pubescent, pale brown, toward its apex ciliate and truncate or acute; ligule present as a horizontal line of short hairs; scapes lax to rigid, ascending or erect, subterete basally, flattened or subterete above at juncture with inflorescence; longest involucrel bract similar to leaves in its width and indument, shorter or longer than the inflorescence, the sheathing base smooth or hirsute; spikelets lance-ovoid or oblong, 3-8 mm. long, acute, greenish to tan or brown to a dark-reddish-brown, in a few- to many-spikeletted simple or compound umbellate system of cymes (spikelets solitary in depauperate specimens); fertile bracts broadly oblong to ovate, the apex acute to obtuse, the margin entire, the surface smooth, the paler midrib seldom excurrent; anthers 1 or rarely 2, about 1 mm. long; style 2-branched, flattened, the edges fimbriate from the base to the branches or entire basally; achene lenticular, ovoid or obovoid and quite tumid, about 1 mm. long, apiculate, white to brownish, often iridescent, striate-reticulate, the rectangular cells shallowly concave and horizontally arranged in from 5 to 12 longitudinal rows per side, the longitudinal ribs more conspicuous than the horizontal; surface of achene often verrucose, the warts forming either along the longitudinal ribs or over entire cells. On a variety of moist sunny substrates such as savannahs, roadsides, grasslands and disturbed or cultivated areas, in temp. to trop. climates of both hemispheres.

7. *Fimbristylis VahlII* (Lam.) Link. Cespitose low annual, the culms to 1.5 dm. tall (usually much lower); leaves one third as long as the scape to equaling or exceeding it; blades linear-filiform, spreading-recurved, less than 1 mm. broad, somewhat involute, the backs with several prominent raised veins, often with small stiff ascending hairs, the margin somewhat thickened and similarly hairy; leaf sheath broad, stramineous or pale-brown, usually smooth or with a scattering of small hairs, the margin scarious, entire, passing gradually into the blade; ligule absent; scapes stiffly ascending, wiry, slightly broader than the leaves, glabrous, many-ribbed, subterete; spikelets lance-ovoid to linear-ellipsoidal or oblong, 5-10 mm. long, usually acute, pale-greenish-brown, 3 to 8 in a dense terminal cluster that are subtended by several leaflike involucrel bracts (these always exceeding the inflorescence and usually at least the length of the basal leaves); fertile bracts ovate-lanceolate or oblong-lanceolate, glabrous, stramineous or pale-green, the midrib conspicuous, dark-green and pointed beyond the scale as a short erect or slightly recurved mucro; stamen 1, the anther less than 0.5 mm. long; style 2-branched, much longer than the achene, subterete, the base swollen, the surface smooth or papillate

from about the midpoint to the point of branching; achene obovoid, tumid, 0.5-0.7 mm. long, pale, sometimes slightly iridescent, reticulate, the individual rectangular cells arranged horizontally in 5 to 7 vertical rows on a side. Fine sands, silts or clays, usually alluvial or shoreline situations, often on areas of disturbed bottomland, S.C. s. to n. Fla., w. to Tex.; scattered localities in inland states; in w. U.S., Calif. and Ariz.; Mex. and C.A.

8. *Fimbristylis castanea* (Michx.) Vahl. Densely caespitose perennial to 1.5 (-2) m. tall, the bases of the plants castaneous, deep-set in substratum, the outer leaves of a tuft and the older leaves persistent as imbricated scales; leaves from one third the length of the culms to nearly as long; blades usually very narrowly linear (rarely to 2 or 3 mm. broad), ascending, thick (often semicircular in cross section), most frequently involute, smooth (particularly toward the base), the nerves on the back numerous and indistinct but the marginal nerve or nerves ciliate-scabrid with ascending stout-based hairs; sheathing portion of the leaf broad (broadening gradually toward the base), pale-brown to dark-brown or very deep-lustrous-reddish-brown, thick and rigid, the broad margin thin or even scarious, entire except for the truncate or rounded ciliate apex; ligule of hairs either absent or incomplete but a color change evident on the upper surface of the leaf at the collar; scapes slender, wandlike, as wide as the blades or somewhat wider, many-ribbed, terete toward the base of the plant, subterete to oval or elliptical in cross section upwardly; longest bract of the involucre usually shorter than the inflorescence or about the length of the inflorescence (rarely longer), the blade somewhat flattened, ciliate-scabrid; spikelets usually ovoid or lance-ovoid, very rarely cylindrical, 5-10 mm. long, rarely longer, the mature ones usually pale- to dark-brown, dull, in a dense to open ascending or spreading umbellate compound system of cymes; fertile bracts broadly ovate, smooth, brown, usually dull, the margin entire or becoming erose with age, the apex rounded; veins of the mid-portion of the scale obscure or visible as faint pale lines that converge apically to form a short mucro; stamens 2 or 3, the anthers about 2 mm. long; style 2-branched, flattened, fimbriate from the base to the point of branching; achene lenticular-obovoid or obpyriform, 1.5-2 mm. long, reddish-brown or dark-brown, often lustrous, scalariform-foveate or reticulate, the individual cells almost isodiametric or horizontally rectangular and usually arranged in numerous fine vertical rows. Moist sands or muck of coastal marshes, dune swales or estuary banks (rarely alkaline situations inland), L.I. s. along the Atl. Coast into the Fla. Keys, along the Gulf Coast s. and w. into Tam. and the Yuc. Peninsula; Bah. I., Cuba.

9. *Fimbristylis puberula* (Michx.) Vahl. Perennial to 1 m. tall; culms solitary or in small tufts, the bases often hard, knotty and jointed together into short thick rhizomes on which the old leaf bases often persist as shreddy remnants; leaves from one third as long to nearly equaling the culms; blades narrowly linear, usually involute at least toward the base, about 1 mm. wide, the backs with several raised nerves, smooth to variously pubescent, the upper surface smooth or variously pubescent, the pale margin cartilaginous and ciliate-scabrid (this most noticeable toward the blade-base and -apex); sheaths hard, thick, fibrous, pale- to dark-brown, the broad margin scarious and entire except for long cilia at apex; ligule inconspicuous, incomplete or absent; longest bract of inflorescence erect, the blade flattened, usually much-surpassed by the inflorescence; spikelets lance-ovoid to ovoid or ellipsoidal, 5-10 mm. long, reddish-brown, in a usually few-flowered compact to open system of pedunculate cymules or a simple umbel-like cyme; fertile scales ovate to obovate or even reniform, reddish-brown to dull-brown or flavescent, the backs rounded, the scarious rounded margin entire and ciliate or somewhat lacerate, the inconspicuous nerves flavescent to pale-brown or sometimes the central ones slightly raised, greenish and slightly excurrent as a short mucro; outer surface of at least the lower scales puberulent at least toward the apex; stamens 3, the anthers 2-2.5 mm. long; style 2-branched, flattened, the edges usually fimbriate from about the mid-point to the base of the style branches; achene lenticular-obovoid, about 1 mm. long, rather flat to somewhat tumid, sometimes umbonate, flavescent to dark-brown, the surface distinctly to faintly reticulate, the rectangular cells usually arranged in several longitudinal lines (11 to 20 on a face) in a few cases with very many longitudinal lines with the cells isodiametric, the longitudinal lines prominently to slightly raised. Sands, sandy peats or clays of savannahs, open pinelands, upper edges of grass-sedge bogs, meadows and prairies, throughout the Atl. and Gulf Coastal Plain from L.I. s. into peninsular Fla. and w. to Tex. nearly to the Mex. border; scattered from the cen. Piedmont to its southwest.

edge; scattered in the interior highlands and of frequent occurrence in the moist meadows and prairies of the cen. lowlands, particularly along the Great Lakes on the Pleistocene shores and w. into the tall and mid-grass prairies of Tex., Okla., Kan. and Neb.; Can.

10. *Fimbristylis puberula* var. *interior* (Britt.) Kral. As the species but plant base less bulbous and producing dense clusters of short slender twisted pale-reddish-brown rhizomes; foliage pale-green, sometimes appearing glaucous; blade margins distantly to approximately ciliate-scabrid; ligule inconspicuous or present as a narrow line of short ascending hairs; longest involucral bract usually longer than the inflorescence; spikelets ovoid to cylindrical or ellipsoidal, 5-10 mm. long, stramineous to reddish-brown, the backs of the scales usually smooth, the central nerve of at least the lower scales excurrent as a definite terete mucro; achene with several prominent to rather obscure longitudinal ridges that are interconnected with finer horizontal lines, hence the surface composed of longitudinal rows of roughly isodiametric shallowly concave cells. Sandy sloughs in prairie provinces, particularly in w. Kan. and Neb. but extending s. into w. Tex. and southw. Ariz.

7. HEMICARPHA NEES & ARN.

A genus of a few species (perhaps as many as 6) of warm regions. *Hemicarpha* is closely related to *Cyperus* subgenus *Kyllinga* but the inflorescence and flowers are much-reduced. Some authors include *Hemicarpha* in *Scirpus* but this has very little merit.

1. *Hemicarpha micrantha* (Vahl) Britt. Essentially glabrous densely tufted annuals; culms 1-22 cm. long, 0.2-0.6 mm. thick, essentially leafless; leaves usually 2 per culm at its base; upper sheath purplish or brownish, its blade linear to setaceous; lower sheath much-reduced, its blade absent; lower bract often appearing as a continuation of the culm, 7-37 mm. long; 1 or 2 other much-reduced bracts present; inflorescence a glomerule of 2 (rarely 3) sessile heads or head solitary; heads broadly ovoid, 2-8 mm. long, of 60 to 140 uniflorous spikelets arranged in tight spirals; scale solitary per spikelet, abaxial, ovate to lanceolate, 0.8-2.3 mm. long, the midrib conspicuous often as a keel in the lower part and a mucro or awn apically, the sides membranous, convex; "perianth" (actually the wings of the reduced spikelet axis) of a single hyaline adaxial scale, often split and torn by or adhering to the achene, very inconspicuous; stamens 1 or 2; styles 2-branched; achene oblong, nearly terete or elliptic in transection, 0.5-0.8 mm. long, very minutely apiculate, superficially microscopically papillate. *Scirpus micranthus* Vahl. The species is widespread in warm temp. and trop. areas of Am. We have 3 varieties as follows.

Var. *micrantha*. "Perianth" scale much shorter than the achene, often bifid or reduced or absent. Infrequent or rare in moist soil, s. part of e. Tex., Rio Grande Plains and Trans-Pecos; widespread in trop. Am., Calif., Wash., Gulf States and n.e. U.S.

Var. *aristulata* Cov. "Perianth" scale equaling or surpassing the achene and often cupped around it distally and adaxially, with no definite vascular tissue (use magnification of 40 diameters); awn of floral scale two thirds as long as to a little longer than the body of the scale. Infrequent in moist soil, e., s.e., n.-cen. and Trans-Pecos Tex., Edwards Plateau and Rio Grande Plains; Neb. and Wyo. s. to Tex., N.M. and Ariz.

Var. *Drummondii* (Nees) Friedl. "Perianth" scale equaling or surpassing the achene and often cupped around it distally and adaxially, with 3 to 5 vascular strands; mucro of floral scale less than two thirds as long as the body of the scale. Frequent in e. and n.-cen. Tex.; from Mo. and Neb. s. and s.w. to Tex., N.M. and Ariz.; intergrading with the last variety.

8. CYPERUS L. FLATSEDGE

Herbs, usually with culms leafy near the base, often subscapose; inflorescence terminal, an umbel-like aggregation of primary peduncles (each subtended by a bract, usually) bearing spikes or heads of spikelets or the longer of the peduncles each bearing smaller umbel-like aggregations of secondary peduncles (with or without bractlets) each bearing spikes or head of spikelets or the whole inflorescence contracted into a dense flowering mass with the true form obliterated; spikelets usually borne in several rows on the spike or head axis, with a minute bract basally and either with several to many fertile scales

distichously arranged or else reduced to a single fertile scale plus one or more sterile scales above, when several scales present the spikelet usually discernibly laterally compressed (i.e., as if the 2 margins of the folded scale were pushed toward each other and the scale creased at the usually keel-like median portion, the breadth of the spikelet then measured from keel to keel of alternating scales and the thickness from side to side of the same folded scale), the spikelet axis either disarticulating at the top of each internode or only at its base or often completely persistent, each internode of the spikelet axis often with 2 thin "wings" on each side of the flower (the decurrent lower margins of the next superjacent scale); scales usually folded, either persistent or deciduous; perianth absent; stamens 1 to 3; styles 2- or 3-branched; achenes lenticular or trigonous, often stipitate and/or apiculate, jointed with the style usually at the very top of the achene, the achenial body there with or without a minute apiculus but the latter (if present) of the same color and texture as the main part of the achene.

With upwards of 900 species in warm regions, *Cyperus*, a vast, difficult genus, is often made more confusing by a very unsatisfactory and arbitrary segregation of smaller "genera," such as *Mariscus* Vahl, *Pycreus* Beauv., *Kyllinga* Rottb.

1. Achene lenticular, biconvex or concavo-convex (2)
1. Achene trigonous or vaguely so, occasionally appearing nearly terete but definitely not biconvex or concavo-convex (10)
- 2(1). Achene dorsiventrally compressed, i.e., with one of the sides appressed to the spikelet axis, the other appressed to the inner surface of the scale (the latter not keeled)38. *C. laevigatus*.
2. Achene laterally compressed, i.e., with one angle next to the spikelet axis and the 2 slightly convex sides parallel with the 2 sides of the scale, the scale being folded and creased at the keel-like median (3)
- 3(2). Each spikelet with only 2 scales and only one achene (4)
3. Each spikelet with 6 to 60 scales, usually several of them fertile (6)
- 4(3). Stamen solitary; plants rhizomatous, the culms rising at intervals of 3-10 mm. ...
.....46. *C. brevifolius*.
4. Stamens paired; culms densely tufted or plants mat-forming (5)
- 5(4). Densely tufted with a culm density of 4 to 20 per square cm. in the tufts; culms about 0.7 mm. thick basally; inflorescence 3-8 mm. long; bracts with translucent corners at the very base; spikelets 2-2.5 mm. long, 0.7-0.8 mm. broad, sordid-whitish or very pale-brownish; lower (fertile) scale 1.7-2.4 mm. long; achene elliptic, 0.9-1.1 mm. long (not including the apiculus), 0.5-0.6 mm. broad, ripening to a very dark-brown45. *C. tenuifolius*.
5. Culm density in the mat 1 to 4 per square cm.; culms 0.8-1.8 mm. thick basally; inflorescence 7-14 mm. long; bracts without translucent corners; spikelets 2.3-3 mm. long, 1.2-1.3 mm. broad, buffy-white to white; lower (fertile) scale 2.2-2.9 mm. long; achene obovate, 1-1.4 mm. long (not including the apiculus), 0.75-0.9 mm. broad, ripening black44. *C. sesquiflorus*.
- 6(3). Spikelets borne in lax spikes 12-40 mm. long, 12-23 mm. thick; scales with broad white-hyaline margins markedly contrasting with the brownish sides; achenes 1.2-1.5 mm. long39. *C. albomarginatus*.
6. Spikelets borne in heads or glomerules; scales with thin but not hyaline nor white margins; achenes mostly less than 1.2 mm. long (7)
- 7(6). The lower part of the edges of the internodal niches of the spikelet axis with minute persistent wings which become narrowed and join abaxially forming a minute cup at the base of the achene40. *C. polystachyos*.
7. The edges of the internodal niches essentially wingless (8)
- 8(7). Achenial surface with rectangular-linear cells oriented vertically in horizontal rows, these rows marked off by horizontal wavy usually discolored sutures
.....43. *C. flavescens*.
8. Achenial surface with vertical rows of minute essentially isodiametric usually somewhat hexagonal cells (9)

- 9(8). Spikelets 7-12 mm. long; each scale in the center of each side having a splotch of a brownish or fuscous color darker than the marginal zone; scales about 2 mm. long41. *C. niger*.
9. Spikelets 3-7 mm. long; each scale nearly uniformly stramineous or olive-stramineous, 1.5-1.8 mm. long42. *C. lanceolatus*.
- 10(1). The spikelet axis at maturity disarticulating at the base of each internode (just above each node), thus breaking into units consisting of a scale, the next lowest internode and the attached wings and clasped achene; internodes postantheically on the sterile side becoming thickened and assuming a white cartilaginous texture (11)
10. The spikelet axis either persistent as a unit or else deciduous as a unit, not disarticulating spontaneously at maturity (12)
- 11(10). Inflorescence ample, relatively lax, to 45 cm. long35. *C. odoratus*.
11. Inflorescence congested into a single large headlike mass36. *C. macrocephalus*.
- 12(10). Culms stiffly erect with complete septa at intervals of 5-50 mm. 4. *C. articulatus*.
12. Culms nonseptate (13)
- 13(12). Each of the 5 to 8 extremely unequal primary peduncles with an irregular panicle of several spikes each with a number of ascending spikelets; the total inflorescence with 100 to 600 spikelets; scales when spread out nearly orbicular, about 1.5 mm. long; spikelet axes wingless 8. *C. Iria*.
13. Each primary peduncle either reduced or bearing a head or spike or a glomerule or bearing several short secondary peduncles but never an irregular panicle; scales usually considerably longer than broad or if nearly as long as broad then longer than 1.5 mm. (14)
- 14(13). Stamen 1; spikelet axis wingless or essentially so (15)
14. Stamens 3; spikelet axis winged or wingless (22)
- 15(14). Achenes nearly as thick as long, with concave sides; matted perennials of Chisos Mountains22. *C. seslerioides*.
15. Achenes (1.5 to) 2 to 3 times as long as broad; sides of achenes not concave (16)
- 16(15). Tufted annual with culms 1-20 cm. long and a peculiar persistent odor; scales with 7 or 9 strong evenly distributed nerves and a wholly keel-like median portion, the tip usually strongly acuminate and excurved37. *C. aristatus*.
16. Tufted or rhizomatous perennials (some flowering the first year) with culms 10-110 cm. long, odorless (except in some specimens of *C. acuminatus*); scales with 3 or 5 nerves and these usually obscure and concentrated in the median portion which has a flat portion or groove at the base dorsally, the tip either incurved or straight (slightly excurved in *C. acuminatus*) (17)
- 17(16). Achenes only 0.7-0.8 mm. long; culms with scattered microscopic retrorse projections like shark's teeth17. *C. surinamensis*.
17. Achenes 0.9-1.5 mm. long; culms either smooth or with antrorse or horizontal projections (18)
- 18(17). Culms 5-12 mm. thick basally, apically 3-8 mm. thick and with microscopic antrorse projections like shark's teeth; scales 2-2.4 mm. long, when spread out 1.2-1.5 mm. broad at the broadest point (just below the middle)13. *C. virens*.
18. Culms 0.7-5 mm. thick basally, apically 0.4-2.7 mm. thick, either smooth or with microscopic knobs (very rarely with antrorse projections in *C. pseudovegetus*); scales 1.3-1.9 mm. long (19)

- 19(18). Scales with the dorsal basal flat portion or groove continuing a third to half the total length of the scale and 0.3-0.5 mm. broad; scales when spread out 1.5-1.9 mm. broad near the base and tapering all the way to the apex; achene 1.3-1.5 mm. long, 0.5-0.6 mm. thick, maturing to a nearly black color 12. *C. ochraceus*.
19. Scales with the dorsal basal flat portion or groove continuing only a fifth to a third the total length and only 0.1-0.2 (-0.3) mm. broad; scales when spread out 0.6-1.2 mm. broad at the broadest (near the middle or shortly below); achene 0.9-1.3 mm. long, 0.2-0.45 mm. thick, maturing to a brownish color (20)
- 20(19). Scales essentially linear for most of the length, only 0.6-0.7 mm. broad and (as folded in place) the whole scale incurved-falcate; achene linear, 0.2-0.3 mm. thick 14. *C. pseudovegetus*.
20. Scales ovate, 0.8-1.1 mm. broad at the broadest point, as folded in place the lower part of the keel, incurved but the upper part either straight or slightly excurved; achene elliptic to oblong, 0.3-0.45 mm. thick (21)
- 21(20). Spikelets with 8 to 12 scales, these in 3- to 30-lobed compound glomerules each with 25 to 100 spikelets; scales reddish with greenish keels; plants basally often with short scaly creeping rhizomes 1-1.5 mm. thick, the culms basally 1-2.5 mm. thick 15. *C. reflexus*.
21. Spikelets with 12 to 44 scales, these in nearly hemispherical to spherical heads each with 13 to 44 spikelets; scales brownish-stramineous to rarely tawny stramineous; plants tufted, the culms basally 0.7-1.2 mm. thick .. 16. *C. acuminatus*.
- 22(14). Most leaves reduced to mere bladeless sheaths or occasionally the uppermost sheaths with short blades very rarely to 10 cm. long (23)
22. Even the lower leaves with well-developed blades (26)
- 23(22). Inflorescence (not including bracts) 1-2 cm. long .20. *C. phaeolepis*.
23. Inflorescence (not including bracts) 3-35 cm. long (24)
- 24(23). Bracts usually 2, 1 of them 0.3 to 1 (to 2) times as long as the inflorescence 21. *C. Haspan*.
24. Bracts 10 to 25, often much-surpassing the inflorescence (25)
- 25(24). Internodes of spikelet axes with deciduous wings about 1 mm. long and 0.2-0.3 mm. broad 1. *C. giganteus*.
25. Spikelet axes wingless 19. *C. alternifolius*.
- 26(22). Achene 0.4-0.7 mm. long, 0.4-0.5 mm. thick, subglobose, white; bracts usually only 2 in number 21. *C. Haspan*.
26. Achene 0.7-3 mm. long, usually considerably longer than thick; bracts 3 to 13 (27)
- 27(26). Scales 1.3-2 mm. long; achenes 0.8-1 mm. long, 0.3-0.6 mm. thick, unequally trigonous; spikelet axis with readily deciduous wings 0.2-0.3 mm. broad; spikelets only 1 mm. broad, much-compressed, borne 15 to 70 together in spikes (28)
27. Scales (at least the fertile ones) 2.3-5.5 mm. long; spikelet axis either wingless or with more or less persistent wings; spikelets variously borne but if only 1 mm. broad then not much-compressed (29)
- 28(27). Internodes of spikes 0.0-0.5 mm. long; scales 1.3-1.5 mm. long 2. *C. erythrorhizos*.
28. Internodes of spikes 0.6-2 mm. long; scales 1.5-2 mm. long 3. *C. digitatus*.
- 29(27). Achene 0.25-0.3 mm. thick 18. *C. onerosus*.
29. Achene 0.4-1.2 mm. thick (30)
- 30(29). Achene 1-1.3 mm. long, nearly as thick (0.9-1 mm.) as long; spikelets much-compressed, 2-3 mm. broad, grayish-white with a pale whitish broad stripe running down each side (this formed from the pale margins of the scales) 9. *C. compressus*.
30. Achene 1.3-3 mm. long, much longer than thick (31)
- 31(30). Spikelet axis internodes essentially wingless, occasionally with wings up to 0.2 mm. broad (32)
31. Spikelet axis internodes with wings 0.3-1.2 mm. broad (37)

- 32(31). Viscid tufted perennials with culms 3-7 mm. thick, the longer peduncles in most inflorescences with secondary peduncles each bearing a head similar to those of the shorter primary peduncles; leaves spongy at base, when dried their incomplete septa visible, the leaf apexes involute (33)
32. Nonviscid perennials, tufted and usually with extensive knotty subrhizomatous bases; secondary peduncles absent; leaves neither spongy nor septate basally (34)
- 33(32). Spikelets grayish-ochraceous turning grayish-brown; achene thickest (0.7-0.8 mm.) near the apex, long-tapered to the base, 1.4-1.8 mm. long, only slightly apiculate 10. *C. elegans*.
33. Spikelets grayish-yellow becoming rich-golden-brown; achene nearly cylindrical or very slightly thickened in the upper part, long-tapered below, the main part 1.5 mm. long and 0.5 mm. thick but also with the persistent style base (or very large apiculus) adding almost 1 mm. to the length 11. *C. oxylepis*.
- 34(32). Inflorescence a single dense sessile head 1-3 cm. thick with 15 to 55 spikelets ..
..... 31. *C. filiculmis*.
34. Inflorescence a short or long relatively lax spike with 3 to 30 spikelets (35)
- 35(34). Spikes 20-50 mm. long, 20-30 mm. thick, with 9 to 30 divaricately spreading spikelets; scales 1.5-2 mm. broad when unfolded, deciduous from the spikelet axis, usually chestnut-brown or less commonly a tawny grayish-brown
..... 34. *C. spectabilis*.
35. Spikes 10-25 (-30) mm. long, 6-14 mm. thick, with 3 to 18 spikelets; scales 2-3 mm. broad when unfolded, usually relatively persistent, brown to brownish-gray to dark-olive-brown (36)
- 36(35). Inflorescence with 4 to 8 erect or ascending unequal primary peduncles 2-80 mm. long, each bearing a spike 9-14 mm. thick of erect or ascending spikelets 3-4 mm. broad; scales 3-3.8 mm. long; achenes 2-2.8 mm. long
..... 32. *C. Schweinitzii*.
36. Inflorescence with (1 to) 3 to 5 (or 6) spikes, either all of them sessile or a very few of them elevated on peduncles; spikes 6-11 mm. thick, of spreading spikelets 2-3 mm. broad; scales 2.3-3.3 mm. long; achenes 1.6-2.1 mm. long
..... 33. *C. Fendlerianus*.
- 37(31). Rhizomatous perennials; spikelets with 6 to 40 eventually deciduous scales; spikelet axes persistent on the axis of the cluster or spike (38)
37. Tufted perennials (occasionally with knotty subrhizomatous bases in *C. huarmensis*); spikelets with 2 to 8 scales (up to 20 in *C. strigosus*) and these persistent (deciduous in some specimens of *C. strigosus*); spikelet axis deciduous (more or less so in *C. strigosus*) (40)
- 38(37). Bracts 3 or 4, about equaling the inflorescence; inflorescence with 20 to 65 spikelets altogether, usually even the longer primary peduncles bearing a simple cluster or spike of spikelets just as do the shorter peduncles; each cluster or spike with 3 to 9 spikelets; wings of spikelet axis 2-3 mm. long; achenes 0.9-1 mm. thick 5. *C. rotundus*.
38. Bracts 5 to 13, usually much-surpassing the inflorescence; inflorescence with 70 to 350 spikelets altogether; the longer primary peduncles usually with several nearly sessile clusters or spikes of spikelets; each cluster or spike with 10 to 50 spikelets; wings of spikelet axis 1-1.5 mm. long; achenes 0.4-0.8 mm. thick (39)
- 39(38). Culms (60-) 75-110 cm. tall; bracts 9 to 13; primary peduncles 9 to 13; spikelets reddish-brown; achenes 0.4-0.5 mm. thick . 6. *C. setigerus*.
39. Culms 15-50 (-65) cm. tall; bracts 5 to 10; primary peduncles 5 to 10; spikelets brown, buffy-brown or golden-brown; achenes 0.6-0.8 mm. thick
..... 7. *C. esculentus*.
- 40(37). Achenes mostly 0.3 to 0.5 times as long as the scales; spikelets 10-29 mm. long, 1-2 mm. broad, usually less than half as thick as broad (41)
40. Achenes mostly 0.6 to 0.8 times as long as the scales; spikelets 3.5-11 mm. long, 0.5-1 (-1.3) mm. broad, usually more than half as thick as broad (42)

- 41(40). Blades 2-8 mm. broad; most inflorescences with the longer peduncles bearing a few short secondary ones; spikes 13-35 mm. long, 20-45 mm. thick, thus usually thicker than long, with 20 to 70 spikelets 1-2 mm. broad, golden- or tawny-brown, with 5 to 20 scales23. *C. strigosus*.
41. Blades 1.5-5 mm. broad; secondary peduncle formation rare; spikes 20-40 mm. long, 15-27 mm. thick, thus usually longer than thick, with 14 to 45 spikelets 0.7-1.3 mm. broad, grayish-brown, with 3 to 6 scales24. *C. tenuis*.
- 42(40). Head obovoid, 8-15 mm. long, 9-17 mm. thick, with 60 to 80 spikelets in each head, the higher spikelets very short, the middle ones spreading and very crowded, the lower ones less closely crowded on the axis but retrorsely appressed to the stiff peduncle; scales of middle spikelets 5-5.5 mm. long; wings about 3 mm. long, clasping the linear achene which is about 3 mm. long28. *C. retrofractus*.
42. Heads or spikes various but not as described above; scales 2.5-4.5 mm. long; wings 0.8-2.2 mm. long; achenes 1.3-2.5 mm. long (43)
- 43(42). Each wing of the spikelet axis thickened in a narrow longitudinal stripe near where it clasps one of the adaxial angles of the achene, the thickened part chartaceous and usually slightly discolored brownish in contrast to the white-hyaline remainder27. *C. uniflorus*.
43. Wings not thickened and often not noticeably clasped around the achene (44)
- 44(43). Perennial from black knotty subrhizomatous bases; inflorescence only 2-3 (-4) cm. long, of 3 to 6 essentially sessile spikes 10-25 mm. long and 7-10 mm. thick, with 40 to 80 three-scaled spikelets; only the lowest scale of each spikelet fertile and it enclosing the achene (1.5-2.1 mm. long, 0.8-1 mm. thick)26. *C. huarmensis*.
44. Tufted perennials; inflorescence (1-) 2-15 cm. long, of 1 to 14 usually peduncled heads or spikes 7-30 mm. long and 7-20 mm. thick, with 8 to 240 2- to 8-scaled spikelets in which only the terminal scale is sterile, the rest all fertile; achenes 0.5-0.8 mm. thick (45)
- 45(44). Spikes lax, 10-30 mm. long, with 8 to 30 spikelets25. *C. hermaphroditus*.
45. Heads or spikes dense (the spikelets touching), 7-15 mm. long, with 25 to 240 spikelets (46)
- 46(45). Achenes 1.8-2.2 mm. long; wings 1-2 mm. long; scales 1.2-2 mm. broad; spikelets 50 to 240 per head or spike, 0.5-1 mm. broad, with 2 to 4 scales, straw-brown to dark-brown (to tawny ochraceous)29. *C. ovularis*.
46. Achenes 1.3-1.7 mm. long; wings 0.8-1.4 mm. long; scales 1-1.3 mm. broad; spikelets 25 to 70 per head, with 3 to 8 scales, greenish-brown to ochraceous-brown or olive30. *C. globulosus*.

1. *Cyperus giganteus* Vahl. Perennial, densely tufted; culms 4-15 dm. long; leaves reduced to mere long brown sheaths at the base of the culm; inflorescence an umbel-like aggregation of 10 to 25 primary peduncles (the longest only about twice as long as the shortest), each bearing an umbellule of 4 to 8 peduncled lax spikes with elongate axes and 10 to 20 (reportedly up to 50) spreading spikelets; spikelets about 1 mm. broad or narrower, laterally much-compressed, 4-10 mm. long, with 8 to 18 flowers; bracts of umbel about as many as the primary peduncles and surpassing the umbel; bracts of umbellules as many as the spikes and mostly exceeding them; spikelet axis persistent as a unit after the achenes and scales fall; lower margins of scales decurrent on the spikelet axis as hyaline readily deciduous wings 0.2-0.3 mm. broad and more than 1 mm. long; stamens 3; anthers with 2 cells, the connective between the cells prolonged 0.2-0.5 mm. beyond the end of the anthers; achene unequally trigonous, the 2 adaxial angles much smaller (sharper) than the abaxial one. Rare in extreme s.e. Tex. (Orange Co.) in marshes, probably not a persistent member of our flora; Parag., Urug. and Col. n. to Hond. and Gr. Ant.

2. *Cyperus erythrorhizos* Muhl. Tufted annual or becoming a definite perennial in s. Tex.; culms 5-14 dm. long; inflorescence an umbel-like aggregation of 4 to 10 long

markedly unequal peduncles each bearing an irregular cluster of several nearly sessile spikes with elongate axes (with internodes 0-0.5 mm. long) and 15 to 70 spreading spikelets; spikelets about 1 mm. broad or narrower, laterally much-compressed, very thin, 3-10 (-15) mm. long with 6 to 34 or more flowers; bracts of umbel about as many as primary peduncles and some about as long as the inflorescence; bracts of the spike clusters considerably reduced, inconspicuous; spikelet axes persistent as a unit after the achenes and scales have fallen; scales keeled, the lower margins decurrent on the spikelet axis as readily deciduous hyaline wings about 0.8 mm. long and 0.2-0.3 mm. broad; stamens 3; connective of anthers not surpassing the anther cells themselves or else projected as a red point only 0.05-0.1 mm. long; achene unequally trigonous. Abundant in marshy places, s.e. Tex., infrequent in Rio Grande Plains, n.-cen. and e. Tex., probably elsewhere, July-Dec.; Ont. and e. U.S. w. to N.D., S.D., Neb., Kan., Okla. and N.M.; also Wash., Ore., Calif., Ariz. and Ut.; presumably also Tam.

Probably not sufficiently distinct from *C. digitatus*.

3. *Cyperus digitatus* Roxb. Tufted perennial; culms 5-15 dm. long; inflorescence an umbel-like aggregation of 5 to 13 long markedly unequal peduncles each bearing an irregular cluster of several nearly sessile spikes with elongate axes (internodes of spike axis 0.6-2 mm. long) and 15 to 35 spreading spikelets; spikelets about 1 mm. broad, laterally compressed, 7-15 mm. long, with 8 to 35 flowers; bracts of umbel about as many as peduncles and some as long as or longer than the inflorescence; bracts of spike clusters considerably reduced, inconspicuous; spikelet axes persistent as units after the achenes and scales have fallen; scales keeled, the lower sides decurrent down the spikelet axis as readily deciduous hyaline wings 0.2-0.3 mm. broad and about 0.8 mm. long; stamens 3; connective of anther not surpassing the anther cells themselves or else merely a red point 0.05-0.1 mm. long; achene unequally trigonous. Local in marshy places near Brownsville, Laredo and Corpus Christi in Rio Grande Plains, July-Dec.; Braz., Col., Mex., W.I. and Tex.

4. *Cyperus articulatus* L. CHINTUL. Perennial forming colonies with creeping scaly rhizomes 1.5-6 mm. thick; culms rising at intervals 7-50 mm. apart on the rhizomes, erect, 5-14 dm. long, 2-8 mm. thick, nearly terete or only vaguely triangular, septate at intervals of 5-50 mm.; leaves only few, toward the base, reduced to small essentially bladeless sheaths; bracts few, 3-11 mm. long; inflorescence comprising 4 to 12 glomerules of spikelets, some glomerules nearly sessile and some on slender nodding peduncles to 12 cm. long; glomerules with up to 20 spikelets, essentially bractless; spikelets 6-25 mm. long, about 2 mm. broad, laterally compressed, the axis remaining intact after the scales and achenes fall; scales keeled, the lower sides decurrent on the spikelet axis as readily deciduous wings 0.2-0.4 mm. wide and about 1 mm. long; stamens 3; connective very minutely prolonged beyond the end of the anther; achene unequally trigonous. Abundant in moist clay meadows, s.e. Tex. and Rio Grande Plains, rare n. to s. part of n.-cen. Tex. (Comal, Travis and McLennan cos.), May-Oct.; Braz. and Col. n. to Gulf States.

5. *Cyperus rotundus* L. NUT-CRASS, TULLILLO. Perennial forming colonies with creeping rhizomes about 1 mm. thick, at intervals with tuberlike thickenings to 1 cm. thick; culms 8-30 (-75) cm. long, just beneath the inflorescence 0.8-1.8 mm. thick; leaves crowded in the basal few cm., much shorter than the culm and usually spreading; inflorescence 3-11 cm. long, of 3 to 8 extremely unequal peduncles each bearing a (rarely compound) cluster or short spike of divaricate spikelets, each cluster or spike with 3 to 9 spikelets, the total inflorescence with 20 to 65 spikelets; bracts usually about 3 or 4 and about as long as the inflorescence; spikelets 4-30 mm. long, 1-2 mm. broad, laterally much-compressed, with 12 to 36 flowers; scales keeled, straight, dark-reddish, dark-purplish or dark-purplish-brown, 3-3.5 mm. long, with about 7 paler nerves crowded near the median so that each of the halves is nerveless in the marginal half to five eighths the width, the sides decurrent basally as hyaline persistent wings on the spikelet axis which remains intact even after the scales and achenes have fallen; stamens 3; the prominent long-exserted anthers with the connective slightly prolonged into a minute reddish knob; achenes trigonous. Abundant in loamy soils, s.e., n.-cen. Tex. and Rio Grande Plains, rare in Plains Country and Trans-Pecos, a pernicious lawn-weed, adv. with us, July-Dec., less commonly Jan.-Apr.; widespread in the warmer parts of the world, nat. to Euras.

6. *Cyperus setigerus* T. & H. Perennial forming small colonies with creeping rhizomes (1-) 1.5-5 mm. thick or slightly thicker at the culm bases; culms (60-) 75-110 cm. long, just beneath the inflorescence (1.5-) 2.3-3.3 mm. thick; leaves few, attached in

the basal third of the culm, shorter than the culm, ascending; inflorescence (not including bracts) (7-) 10-16 (-20) cm. long, of 9 to 13 extremely unequal peduncles each bearing a compound cluster or short spike of divaricate spikelets, each cluster or spike with 10 to 30 spikelets, the total inflorescence with 120 to 350 spikelets; bracts about as many as the primary peduncles, the longer ones far-surpassing the inflorescence; spikelets 6-40 mm. long, 1.5-2 mm. broad, laterally much-compressed, with 6 to 40 flowers; scales keeled, reddish-brown, straight, 3-4 mm. long, with 5 to 7 nerves either crowded medially or somewhat spread out so that each of the halves is nerveless in the marginal fifth to three eighths the width, the sides decurrent basally as hyaline persistent wings on the spikelet axis which remains intact even after the scales and achenes have fallen; stamens 3; anther connective sometimes minutely prolonged; achenes trigonous. Scattered and local in moist clay meadows and ditches, n.-cen. Tex., Rio Grande Plains, Edwards Plateau (Mason Co.) and Plains Country, summer; Kan., Mo., Okla. and Tex.

7. *Cyperus esculentus* L. **YELLOW NUT-GRASS**. Perennial forming colonies with creeping rhizomes 1-1.5 (-2) mm. thick (some forms have tuberlike thickenings on the rhizomes; these forms rarely flower); culms 15-50 (-65) cm. long, just below the inflorescence 1.5-3 (-3.8) mm. thick; leaves several, attached in the basal half of the culm, the upper ones ascending, almost equaling or surpassing the inflorescence; inflorescence (not including bracts) 4-14 (-24) cm. long, of 5 to 10 extremely unequal peduncles each bearing a short spike (or the longer peduncles a cluster of short spikes) of divaricate spikelets, each spike or cluster with 12 to 50 spikelets, the total inflorescence with 70 to 350 spikelets; bracts about as many as the primary peduncles, the longer ones far-surpassing the inflorescence; spikelets 6-30 mm. long, 1-2 mm. broad, somewhat laterally compressed, with 8 to 40 flowers; scales keeled, straight, brown, buffy-brown or golden-brown, 2.6-4 mm. long, hyaline, with 7 to 9 nerves which are about equidistant and so spaced out that only about the marginal third of each side of the scale is nerveless, the sides decurrent basally as hyaline persistent wings on the spikelet axis which remains intact even after the scales and achenes have fallen; stamens 3; anther connective prolonged into a red dot 0.05-0.1 mm. long; achenes trigonous. Locally abundant and weedy in occasionally moistened sandy usually disturbed or unstable or loamy soil, scattered all over Tex. but rare in Edwards Plateau and higher parts of the Plains Country, summer-fall (through Dec. in extreme s.); scattered in the warmer parts of the world, in Am. n. to Que., Ont., Minn., Ore. and Alas.; probably adv. in Tex.

8. *Cyperus Iria* L. Tufted annual; culms 8-60 cm. long, erect; leaves crowded near the base, shorter than the culm; inflorescence 4-12 cm. long (not including the bracts), an umbel-like aggregation of 5 to 8 extremely unequal peduncles each bearing an irregular panicle of several spikes each with a number of ascending spikelets, the total inflorescence with 100 to 600 spikelets; bracts about 4, much longer than the inflorescence; spikelets 3-10 mm. long, 1.3-1.8 mm. broad, with 2 to 22 flowers, the axis persisting and remaining intact even after the achenes and scales fall; scales nearly orbicular or as seen laterally and folded appearing obovate, about 1.5 mm. long, rounded to emarginate, mucronulate, with about 4 nerves in the incurved weakly keel-like median, brownish or golden-brown, the hyaline margins tending to fold in and meet on the adaxial side of the achene, decurrent below as thin striations but not as wings; stamens 2 or 3; achene trigonous, 1.2-1.3 mm. long. Wet clay in coastal rice-growing areas, s.e. Tex. (Colorado, Harris, Jackson and Matagorda cos.), locally common, July-Sept.; s.e. Asia (n. to Korea and Mongolia), N. Austral., Malaysia, India, Afr., Madag., Iran, Afghan., adv. in scattered parts of Am., especially in the Gulf and s. Atl. States; W.I.

9. *Cyperus compressus* L. Tufted annual (or occasionally appearing as a short-lived perennial); leaves few, clustered near the base, little shorter than the culms; inflorescence (not including bracts) 1-7 cm. long, either of a single nearly sessile head or an umbel-like aggregation of 2 to 6 very unequal peduncles each bearing a head of more or less spreading spikelets, the total inflorescence with 5 to 38 spikelets; bracts 3 to 5, the longer ones far-surpassing the inflorescence; spikelets 10-24 mm. long, 2-3 mm. broad, laterally compressed, with 12 to 24 flowers, the axis persistent and remaining intact even after the achenes and scales have fallen; scales 3-3.5 mm. long, acuminate, the keel-like median somewhat excurved in the distal half and with 9 to 13 nerves, grayish-white with very pale broad hyaline margins (so the entire spikelet appears to have a white mid-stripe), decurrent below as definite wings but these persistent until the scale

next below falls; stamens 3; achene trigonous, 1-1.3 mm. long, almost as thick as long. In moist sand, infrequent in s.e. Tex., rare in e. Tex., July-Sept.; Afr., Madag., s.e. Asia, Malaysia, N. Austral., Micronesia; in Am. from Ecu., Bol. and Braz. n. to N.Y., Pa., O., Ark. and Tex.

10. *Cyperus elegans* L. Tufted perennial; culms 3-7 dm. long, erect; leaves viscid, crowded near the base, basally stramineous and somewhat spongy when fresh and upon drying the incomplete septa becoming conspicuous, the upper part involute; inflorescence (excluding bracts) 5-15 (-22) cm. long, of 3 to 10 extremely unequal primary peduncles, the shorter ones each bearing a head of spikelets, the longer ones often with several short secondary peduncles each bearing a head; each head with 5 to 13 spikelets; bracts 3 to 5, the longer ones much-exceeding the inflorescence; spikelets 3-15 mm. long, 2.5-4 mm. broad, with 6 to 20 flowers, viscid, grayish-ochraceous turning grayish-brown at maturity, the axis persistent and remaining intact even after the scales and achenes have fallen, wingless; scales firm, 3-4.2 mm. long, with 3 strong nerves close together on the weakly keel-like median and farther apart on each side 2 or 3 less conspicuous ones (7 to 9 altogether), the very sharp tip slightly excurved, the lower sides not decurrent (the scale measured as folded in the spikelet is 1-1.2 mm. broad); stamens 3; achene 1.4-1.8 mm. long, black at maturity, trigonous, widest near the apex and long-tapered to the base. In moist calcareous soil, frequent in s.e. Tex. and Rio Grande Plains, infrequent to rare in Edwards Plateau and Trans-Pecos, Aug.-Nov., rarely in spring or early summer; W.I., Trin., C.A., Mex., Fla., La. and Tex.; a var. *major* Kükenth. in Peru.

11. *Cyperus oxylepis* Steud. Tufted perennial; culms 3-7 dm. long, erect; leaves viscid, crowded near the base, basally stramineous spotted with red, somewhat spongy when fresh and upon drying the incomplete septa becoming conspicuous, the upper part involute; inflorescence (excluding bracts) 5-15 cm. long, of 3 to 10 extremely unequal primary peduncles, the shorter ones each bearing a head of spikelets, the longer ones often with several short secondary peduncles each bearing a head, each head with 6 to 18 spikelets; bracts 3 to 5, the longer ones much-exceeding the inflorescence; spikelets 8-22 mm. long, 2.5-3.5 mm. broad, with 10 to 24 flowers, viscid, grayish-yellow becoming at maturity a rich golden-brown, the axis persistent and remaining intact even after the scales and achenes fall, wingless; scales firm-membranous, 3.3-3.7 mm. long, with 3 strong nerves together on the weakly keel-like median and farther apart on each side 2 less conspicuous ones (7 altogether), the sharp point very slightly excurved, the lower sides not decurrent on the axis (the half-scale measured as it is folded in the spikelet is 0.8 mm. broad); stamens 3; achene 1.4-2 mm. long, dark-brown at maturity, trigonous, nearly cylindrical or very slightly thickened in the upper part and long-tapered below, capped by the beaklike persistent style base about 1 mm. long. Infrequent in coastal s.e. Tex. (Harris, Nueces, Refugio and San Patricio cos.), in clay ditches and ponds, May-Aug.; Arg., Parag., Ecu., Col., Br. Gui., Jam., Virg. I., Oax., Sin., Son., Tex. and La.

12. *Cyperus ochraceus* Vahl. Perennial, tufted; culms 11-80 cm. long, basally 2-5 mm. thick, apically bluntly trigonous, 1-2.7 mm. thick, erect, smooth; leaves several, basally aggregated, the longer ones about as long as the culm, not septate-nodulose; inflorescence (excluding bracts) 25-185 mm. long, of 6 to 12 very unequal primary peduncles, the shorter of which bear nearly spherical lax heads of 4 to 15 spikelets, the longer ones bearing some short unequal secondary peduncles each with a head of 4 to 24 spikelets; bracts 5 to 8, the longer ones far-surpassing the inflorescence; spikelets 5-20 mm. long, 2-2.5 (-3) mm. broad, linear, acute, with 10 to 30 (to 40) flowers, olive-stramineous (young) to olive-yellow or yellowish-brown (mature), laterally compressed, the axis flat, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally membranous and with visible cells, medially chartaceous (eventually subcartilaginous), 1.5-2 mm. long, in the proximal half to two thirds definitely bicarinate with a flat area or shallow groove (0.3-0.5 mm. broad) dorsally (abaxially), the 2 lateral parts 0.6-0.7 mm. broad (therefore the scale when spread out 1.5-1.9 mm. broad at the very base, tapering all the way to the blunt apex), with 5 nerves (the midvein in the channel between the keels inconspicuous) including a nerve at each keel and one on each lateral face about a third the distance from the keel to the margin, the whole scale as folded in position in the spikelet incurved slightly in the distal half; stamen solitary; achene ovoid, 1.3-1.5 mm. long, 0.5-0.6 mm. thick, nearly terete or obscurely triangular, slightly stipitate, apically acuminate and passing imperceptibly into the

style, black when mature but appearing dark-iridescent-gray because of outer 1-cell-thick covering of translucent cells; stigmas 3. Abundant in shallow water and mud, Rio Grande Plains (n. to Bexar Co.) and s.e. Tex., throughout year, most profuse Sept.-Nov.; C.A., W.I., Mex., n. to Cuba and La.

A robust flatsedge related to *C. ochraceus* was collected near Blewett, Uvalde Co., among boulders at edge of water along stream below dam in Oct.; its very ample inflorescence has numerous drooping spikelets up to 38 mm. long, each with 60 to 88 flowers. It probably represents an undescribed variety.

13. *Cyperus virens* Michx. Tufted perennial; culms 5-11 dm. long, erect, basally leafy and 5-12 mm. thick, just beneath the inflorescence 3-8 mm. thick, sharply triquetrous and often with microscopic rigid antrorse projections like shark's teeth especially on the angles; leaves several, the longer ones almost as long as the culm, basally usually with numerous short incomplete transverse septa visible after pressing and drying; inflorescence (excluding bracts) 3-13 cm. long, of 6 to 14 very unequal primary peduncles, the shorter of which bear nearly spherical heads of 12 to 30 spikelets, the longer ones bearing some shorter unequal secondary peduncles each with a head of 16 to 40 spikelets; bracts 5 to 9, the longer ones far-surpassing the inflorescence; spikelets 6-13 mm. long, 2.5-3.3 mm. broad, linear, acute, with 10 to 36 flowers, stramineous (young) to olive-brown or grayish-brown (mature), laterally compressed, the axis flat, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally firm-membranous and with visible cells, medially chartaceous (to eventually subcartilaginous), 2-2.4 mm. long, in the proximal third to five eighths the length definitely bicarinate with a flat area or shallow groove 0.25-0.4 mm. broad dorsally (abaxially), the 2 lateral parts 0.5-0.6 mm. broad (therefore the scale spread out 1.2-1.5 mm. broad just below the middle), in the lower half linear, gently tapering distally, with 5 nerves (1 of these being the inconspicuous midvein between the keels), including 1 nerve at each keel and 1 on each lateral face about a fourth to a third the distance from the keel to the margin, the whole scale (as folded in the spikelet) incurved slightly in the distal half; stamen 1; achene linear, triquetrous, basally stipitate, apically acuminate, 1-1.5 mm. long, 0.3-0.5 mm. thick, brownish with a very thin translucent surficial layer of cells. Abundant in moist places, s.e. Tex., frequent in e. Tex. and coastal parts of Rio Grande Plains, May-Oct.; Urug. and Ecu. n. to N.C. and the Gulf States, adv. in Calif.

Through error, the name *C. virens* has been widely misapplied to *C. pseudovegetus* (next below). The 2 taxa are extremely closely related and occasionally hybridize. Young specimens of *C. virens* greatly resemble *C. pseudovegetus*.

14. *Cyperus pseudovegetus* Steud. Tufted perennial, often slightly more loosely tufted than in *C. virens* by elongation of rhizomes 2-5 mm. between culms; culms 3-8 dm. long, erect basally with a few leaves and 2-5 mm. thick, just beneath the inflorescence 1-2.2 mm. thick, roundly triquetrous, smooth or rarely with microscopic antrorse scabrousness; leaves few to several, the larger ones almost as long as the culms, basally often with minute transverse septa between the close veins; inflorescence (excluding bracts) 2-9 cm. long, of 3 to 10 very unequal primary peduncles, the shorter of which bear dense strongly 3- to 8-lobed glomerules or heads of 15 to 50 spikelets, the longer ones bearing some shorter unequal secondary peduncles each with such a head; bracts 3 to 6, the longer ones far-surpassing the inflorescence; spikelets 2.5-4 mm. long, 2.2-3 mm. broad, narrowly ovate, blunt or slightly acute, with 6 to 14 flowers, tawny stramineous to (very slightly reddish-) brown, laterally compressed, the axis flat, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally membranous with visible cells, medially firm to chartaceous, 1.8-2.5 mm. long, in the proximal fourth to third the length bicarinate with a flat or shallowly grovelike area 0.1-0.2 (-0.3) mm. broad dorsally (abaxially), the 2 lateral parts 0.2-0.4 mm. broad (therefore the scale spread out is 0.6-0.7 mm. broad near the middle, almost linear), tapering only at the very tip, with 5 inconspicuous nerves in the median portion, the whole scale (as folded in the spikelet) incurved-falcate; stamen 1; achene linear, 1-1.3 mm. long, 0.2-0.3 mm. thick, bluntly trigonous, basally short-stipitate, apically acuminate, often slightly falcate, brown with a very thin translucent-iridescent surficial layer of cells. *C. arenicola* Steud. Locally frequent in moist places, e. and s.e. Tex., infrequent in n.-cen. Tex., May-Sept.; Gulf States and n. to N.J., Ind., Ill., Mo. and Kan.

Through error this species, in some works, has been called *C. virens*.

15. *Cyperus reflexus* Vahl. Perennial with scaly creeping rhizomes 1-1.5 mm. thick; culms contiguous or several mm. apart along the rhizome, 3-7 dm. long, erect, basally with a slightly bulblike enlargement, with a few leaves and 1-2.5 mm. thick (just above the "bulb"), just beneath the inflorescence 0.5-1.3 mm. thick, roundly triquetrous, smooth; leaves few, the longer ones about as long as the culms or shorter, basally not septate; inflorescence (excluding bracts) 15-50 mm. long, of 3 to 8 very unequal primary peduncles the shorter of which bear very dense strongly 3- to 8-lobed glomerules of 25 to 50 spikelets, the longer ones (more than 15 mm. long) with dense strongly 15- to 30-lobed compound glomerules of up to 100 spikelets; bracts 3 to 5, the longer ones far-surpassing the inflorescence; spikelets 3-5 mm. long, 1.5-2.2 mm. broad, nearly linear in the lower part, distally tapered and apically crowded, with 8 to 12 flowers, red and green, laterally compressed, the axis flat, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally red, membranous, inconspicuously cellular, medially firm-membranous, 1.5-2 mm. long, in the proximal fourth the length with a narrow flat area about 0.2 mm. broad dorsally (abaxially), the 2 lateral parts red, 0.5-0.6 mm. broad (therefore the scale spread out is about 1.1 mm. broad, narrowly ovate), tapering distally to the slightly acute tip, with 5 inconspicuous nerves in the median portion, the median portion of the scale (as folded in position in the spikelet) with a distinct curve in the proximal part but distally nearly straight; stamen 1; achene oblong or elliptic-oblong, 0.9-1 (-1.2) mm. long, 0.3-0.4 mm. thick, sharply trigonous, basally short-stipitate, apically shortly acuminate or pyramidal, pale-brown (finally dark-fuscous beneath the outer cellular layer). *C. rufescens* Torr. Rare in e. and s.e. Tex. inland to Houston, Bastrop and DeWitt cos., in moist sand, spring-summer; otherwise scattered in S.A., Mex., La. and Okla.

The plants here called *C. reflexus* may actually be only a form of *C. pseudovegetus* and *C. acuminatus*; in several characters they appear intermediate between *C. pseudovegetus* and *C. acuminatus*; the young *C. acuminatus* inflorescence is extraordinarily similar to the mature *C. reflexus* inflorescence. Only mature material can be determined with confidence.

16. *Cyperus acuminatus* T. & H. Short-lived perennial, flowering the first year, tufted; culms 1-4 dm. long, erect, basally with a few leaves and 0.7-1.2 mm. thick, just beneath the inflorescence 0.4-0.8 mm. thick, roundly triquetrous, smooth or with more or less abundant microscopic knobs more or less at right angles to the culm; leaves few, 0.5-2 mm. broad, the longer ones sometimes equaling the culms, basally not septate; inflorescence (excluding bracts) 2-8 cm. long, of 2 to 5 very unequal primary peduncles, the shorter of which bear nearly hemispherical to spherical glomerules of 13 to 25 spikelets, the longer ones with such glomerules (rarely compound or with secondary peduncles) of up to 55 spikelets; bracts 3 or 4, the longer ones nearly erect and far-surpassing the inflorescence; spikelets 4-10 mm. long, 1.5-2.5 mm. broad, nearly linear, with 12 to 44 flowers, stramineous to brownish-stramineous or rarely tawny-stramineous, laterally compressed, the axis slightly flattened, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally membranous, inconspicuously cellular, medially firm-membranous, 1.3-1.9 mm. long, in the proximal fifth to fourth the length with a flattish area about 0.2 mm. broad dorsally (abaxially), the 2 lateral parts 0.4-0.6 mm. broad (the scale spread out 0.8-1.2 mm. broad, ovate or narrowly so), tapering distally to the acute apex, with 3 nerves (the inconspicuous midnerve plus on each side a conspicuous nerve about three eighths to two fifths the distance from the midnerve to the margin), the dorsal (median) portion of the scale (as the scale is folded in position in the spikelet) incurved in the lower part, in the distal part either straight or usually with a slight to marked excurvature so that the whole is weakly S-shaped; stamen 1; achene elliptic, 0.9-1.1 mm. long, 0.35-0.45 mm. thick, sharply trigonous, basally short-stipitate, apically prolonged-acuminate, pale-brown, occasionally maturing to brown. *C. cyrtolepis* T. & H. Abundant in moist places, e., s.e., n.-cen. Tex. and Rio Grande Plains, rare in Edwards Plateau (Central Mineral Region only) and the Trans-Pecos (Jeff Davis and Presidio cos.), almost all year; Mo. and N.C., s. to La., Tex. and Coah.; also Ga., Ariz., Nev., Calif. and Ore.

Young specimens strongly simulate dwarf specimens of *C. reflexus*.

17. *Cyperus surinamensis* Rottb. Short-lived tufted perennial, flowering the first year; culms 1-4 (-8) dm. long, with scattered microscopic retrorse projections like shark's

teeth, erect, basally with a few leaves and 0.8-3.5 (-4.5) mm. thick, just beneath the inflorescence 0.4-1.5 mm. thick and bluntly triquetrous; leaves few, the longer ones nearly as long as the culm, basally usually with scattered microscopic transverse septa between the nerves; inflorescence (excluding bracts) 1-8 cm. long, of (4 to) 7 to 12 very unequal primary peduncles the shorter of which bear nearly spherical glomerules of 8 to 25 spikelets, the longer usually with several very unequal secondary peduncles each with a nearly spherical head of 11 to 35 spikelets; bracts 5 to 7, the longer ones far-surpassing the inflorescence; spikelets 3-6 (-14) mm. long, 1.8-2.5 mm. broad, nearly linear, with 10 to 20 (to 30) flowers, stramineous to chartreuse or ochraceous, laterally compressed, the axis slightly flattened, wingless and persistent as a unit after the scales and achenes have fallen; scales laterally membranous, inconspicuously cellular, medially slightly firmer, 1-1.5 mm. long, in the proximal third to three fifths the length with a flat abaxial (dorsal) area 0.15-0.2 mm. broad, the 2 lateral parts 0.4-0.6 mm. broad (the scale when spread out 0.9-1.2 mm. broad, ovate), rounded or slightly acute, with 3 nerves (the inconspicuous midnerve plus the 2 prominent laterals which form the proximal keels); dorsum of the scale as it is folded in position in the spikelet gently incurved in the proximal part, nearly straight distally; stamen 1; achene elliptic-oblong or oblong, 0.7-0.8 mm. long, 0.25-0.3 mm. thick, bluntly trigonous, dark-rosy-brown, basally minutely stipitate, apiculate or shortly acuminate. Infrequent in moist places, s.e. Tex. and coastal parts of Rio Grande Plains, rare in n.-cen. and e. Tex., July-Nov., rarely spring; Arg. and Bol. n. to Fla., La. and Tex.

18. *Cyperus onerosus* M. C. Johnst. Perennial with scaly rhizomes 5-80 mm. long and 1-2 mm. thick; culms 20-49 cm. long, erect, basally leafy and 2-4 mm. thick, just beneath the inflorescence smooth, sharply triquetrous and 1.5-2 mm. thick; leaves few, basally with no transverse septation, some of the longer ones usually surpassing the inflorescence; inflorescence (excluding bracts) 2-12 cm. long, with 7 to 15 very unequal primary peduncles, the shorter of these bearing nearly spherical heads of 8 to 25 spikelets, the longer ones bearing 3 to 12 unequal secondary peduncles each bearing a head of 20 to 35 spikelets; bracts about 4, the longer one nearly erect, exceeding the inflorescence; spikelets 7-13 mm. long, 2.5-3.5 mm. broad, linear, with (10 to) 16 to 26 (to 42) flowers, brownish to tawny-brown, laterally compressed; the axis wingless, thick, dorsiventrally slightly flattened, persistent as a unit after the scales and achenes have fallen, the internodes sculptured (with a niche for each achene); scales 2.3-2.9 mm. long, 1.2-1.4 mm. broad, ovate-elliptic when unfolded, basally slightly gibbous, laterally firm-membranous, medially chartaceous and with a midnerve and on each side 2 (rarely 3) nerves (the total number obscure except when the scale is young and translucent), the medial nerved keel-like zone (as seen in place in the spikelet) except for the curve at the gibbous base mostly straight or very slightly excurved to the very acute apex; stamens 3; achene elliptic to narrowly so, trigonous, acuminate at both ends, 0.7-0.8 mm. long, 0.25-0.3 mm. thick, whitish or eventually turning brownish. Locally frequent in moist loose sand and pools between sand dunes, s.w. part of Plains Country (Ward and Winkler cos.), June-Nov.; endemic.

19. *Cyperus alternifolius* L. UMBRELLA FLATSEDEGE, UMBRELLA PLANT. Tufted perennial; culm 3-15 dm. long, erect, basally 5-20 mm. thick, just below the apex 1-5 mm. thick, triangular; leaves few, basal, reduced to sheaths, apically with a diagonal orifice and a short flat triangular blade 5-50 (-100) mm. long; inflorescence (excluding bracts) 3-10 cm. long, of 15 to 25 slightly unequal primary peduncles each bearing a short headlike raceme of 8 to 15 short-peduncled spikelets; bracts 15 to 25, 15-40 cm. long, 1-15 mm. broad, spreading (forming an umbrella); spikelets 5-10 mm. long, 1.5-2 mm. broad, with 12 to 30 flowers, compressed, the axis wingless and remaining intact as a unit after the scales have fallen (achenes often more persistent); scales 1.6-2 mm. long, 1.4-1.6 mm. broad when unfolded, several-nerved; stamens 3; achene trigonous, 0.6-0.9 mm. long, 0.5-0.6 mm. thick, brown, elliptic-oblong. S.e. Tex., cult. in moist ground and rarely escaping, summer-fall; nat. of the Old World, probably Afr. or Madag., widely cult. and escaping in warm regions.

20. *Cyperus phaeolepis* Cherm. Densely tufted perennial; culm 3-5 (-9) dm. long, erect, basally 2-3 mm. thick, just beneath the inflorescence 1.7-2 mm. thick, irregularly striate; leaves few, basal, reduced to usually reddish-brown sheaths with diagonal orifices, the "blades" only a few mm. long; inflorescences (excluding bracts) 1-2 cm. long, of

8 to 12 unequal peduncles each bearing a headlike (occasionally compound) glomerule of 8 to 15 spikelets; bracts 9 to 13, spreading, 3-10 cm. long, (1-) 3-5 mm. broad, abruptly acute; spikelets 3-6 mm. long, 1.5-2 mm. broad, with 12 to 18 flowers, compressed slightly, the axis flat, wingless and remaining intact as a unit after the scales have fallen (achenes sometimes more persistent); scales 1.3-1.5 mm. long, about as broad, broadly ovate when unfolded, obtuse, laterally membranous, whitish or with a chestnut-tawny splotch, dorsally-proximally flat, the midnerve obscure and the 2 other nerves forming keels on each side of the flat area for about three eighths the total length; stamens 3; achenes 0.7-0.8 mm. long, ellipsoid, obscurely trigonous, pallid-brown turning brown. *C. albiflorus* Cherm. Rare in moist places, s.e. (Galveston) and Trans-Pecos (4 miles n. of Ft. Stockton) Tex., escaped, Apr.-June; Madag.; Tex.

21. *Cyperus Haspan* L. Short-lived tufted perennial, flowering the first year; culms 1-7 dm. long, erect, basally 2-5 mm. thick, just beneath the inflorescence 1.5-3 mm. thick, sharply trigonous but soft and easily pressed flat; leaves basal, the lowest ones bladeless, some of the upper ones consisting of sheaths with oblique orifices or even with soft blades 1-10 cm. long; inflorescence (excluding bracts) 4-12 cm. long, of 10 to 15 extremely unequal primary peduncles the shorter of which each bears a lax glomerule of 3 to 12 spikelets and the longer with several secondary peduncles each with a lax glomerule (or occasionally bearing unequal tertiary peduncles with glomerules); bracts usually 2, one of them 0.3 to 1 (to 2) times as long as the inflorescence, the other much shorter and inconspicuous; spikelets 4-10 mm. long, about 1 mm. broad, linear, compressed, brown, with 8 to 30 flowers, the axis persistent as a unit after the scales have fallen (the achenes and filaments often less readily caducous than the scales); scales 1.2-1.6 mm. long, 0.8-1 mm. broad, obtuse, fragile-membranous, 3-nerved (actually with 5 nerves but the ones nearest the margin extremely inconspicuous and in some specimens weakly developed); stamens 3; achene globose-obovate to subglobose, obscurely trigonous, 0.4-0.7 mm. long, 0.4-0.5 mm. thick, whitish, roughened. Incl. var. *americanus* Boeck., *C. juncooides* Lam. Infrequent in moist places, e. and s.e. Tex. and coastal parts of Rio Grande Plains, inland to Guadalupe Co., June-Oct.; widely distributed in warm regions.

22. *Cyperus seslerioides* H.B.K. Tufted perennial forming tough fibrous black mats (bulblike bases connected by extremely short branching rhizomes); culms 10-25 cm. long, erect, basally about 1 mm. thick, apically about 0.5 mm. thick; leaves 2 or 3 per culm, basal, 1-2 mm. broad; inflorescence (excluding bracts) 6-12 mm. long, contracted into a single densely flowered several-lobed subhemispheric whitish or pallid-brownish (*Dichromena*-like) head; bracts 3 or 4, linear, 2 to 10 times as long as the head, spreading or reflexed; spikelets 3-7 mm. long, 2-2.5 mm. broad, compressed, with 10 to 20 flowers, the axis wingless and persistent as a unit after the scales have fallen; scales 1.5-2.7 mm. long, 1.1-1.6 mm. broad, membranous, 3-nerved, acuminate, sharp; stamen 1; achene 0.7-1 mm. long and nearly as thick, suborbicular, strongly 3-angled with concave sides, maturing to a very dark-brown. Scarce in shaded ravines high in the Chisos Mts. in the Trans-Pecos, summer; Venez., Guat., Mex., Ariz. and Tex.

23. *Cyperus strigosus* L. Tufted perennial (occasionally flowering the first year); culms 4-10 dm. long, subbasally 3-9 mm. thick (at the extreme base swollen tuberlike), just below the inflorescence trigonous and 1.7-3 mm. thick; leaves 2-8 mm. broad, firm, the longer ones about equaling the culm; inflorescence 7-30 (-40) cm. long, of 4 to 11 very unequal primary peduncles the shorter of which bear spikes 13-25 mm. long and 2-4 cm. thick, each spike with 20 to 40 divaricately spreading spikelets in several ranks, the longer peduncles in turn bearing a few secondary peduncles (often very short) each with a spike 15-35 mm. long and 20-45 mm. thick, each spike with 25 to 70 spreading spikelets; bracts 3 to 10, the longer ones far-surpassing the inflorescence; spikelets linear, straight, (10-) 12-25 (-29) mm. long, 1-2 mm. broad, less than half as thick as broad, golden-brown or tawny-brown, with 5 to 20 scales (the terminal one sterile, tending to become involuted and forming a short point), the axis at maturity detaching as a unit from the spike axis, the internodes on the fertile side with 2 narrow hyaline wings 1.5-2 mm. long, about 0.4 mm. broad; scales 3.7-4.5 mm. long, 1.2-1.8 mm. broad, with 7 or 9 nerves, overlapping, usually persistent or less commonly belatedly deciduous either before or after the axis falls from the plant; stamens 3; achene 1.5-2 mm. long (usually about half as long as the scale), 0.5-0.6 mm. thick, trigonous, linear-oblong, brown,

basally substipitate, short-apiculate. Frequent in bogs and marshy areas, e. and s.e. Tex., less frequent in n.-cen. Tex. and rare in the Panhandle (genetically dilute plants rare elsewhere), summer-fall; e. U.S. n. to Que., Ont., Minn., w. to Neb., Kan., Okla. and Tex.; also Pac. States.

The description applies to the more or less typical plants; through various intermediate forms the species is linked to *C. tenuis* and *C. hermaphroditus* and through forms known as *C. "refractus"* and *C. dipsaciformis* to *C. retrofractus*. The forms in which the scales fall before the spikelet axis falls usually show evidence of contamination from one of the group of related species which includes *C. esculentus* and *C. setigerus*. The southern Louisiana plants called *C. cephalanthus* T. & H. (based on a supposedly Texan specimen but not found in Texas at least since 1835) probably are basically *C. strigosus* but contaminated by something like *C. virens*; they probably do not deserve specific rank.

24. *Cyperus tenuis* Sw. Tufted perennial; culms 3-8 dm. long, basally 2-7 mm. thick, just below the inflorescence 1.1-2.8 mm. thick; leaves 1.5-5 mm. broad, the longer ones about equaling the culms; inflorescence 6-20 cm. long, of 4 to 11 extremely unequal primary peduncles the shorter of which bear spikes 2-3 cm. long and 15-24 mm. thick, each spike with 14 to 30 divaricately spreading spikelets in 3 or 4 ranks, the longer peduncles each with a spike 25-40 mm. long and 18-27 mm. thick, each spike with 19 to 45 spikelets, the spikes occasionally compound with 1 or 2 smaller nearly sessile spikes basally; bracts 3 to 11, the longer ones far-surpassing the inflorescence; spikelets linear, straight, 10-15 mm. long, 0.7-1.3 mm. broad, about half as thick as broad, grayish-brown, with 3 to 6 scales (the terminal 1 sterile, tending to become involute and forming a short point), the axis at maturity detaching as a unit from the spike axis, the internodes on the fertile side with 2 narrow hyaline wings 1.5-2 mm. long and 0.3-0.5 mm. broad; scales 3.5-5 mm. long, 1-1.6 mm. broad, with 7 or 9 nerves, overlapping, persistent; stamens 3; achene 1.3-1.6 mm. long, less than half as long as the scale, 0.5-0.6 mm. thick, trigonous, ellipsoid to obovoid-ellipsoid, brown, very minutely stipitate, apiculate. Incl. var. *lentiginosus* (Millsp. & Chase) Kükenth., *C. strigosus* var. *gracilis* Britt., *C. lentiginosus* Millsp. & Chase. Infrequent in s. part of s.e. Tex. (San Patricio and Nueces cos.) and coastal parts of Rio Grande Plains (Duval, Karnes and Cameron cos.), in moist clayey loam, summer-fall; n. S.A. w. to C.A. and Mex., n. to Sin. and Tex.; also (?) Afr.

Plants intermediate to *C. strigosus* occur, as do also forms leading from *C. tenuis* through *C. hermaphroditus* (shorter redder scales, greater tendency for the terminal scale to become awnlike, broader wings, etc.) toward the *C. uniflorus* plexus.

25. *Cyperus hermaphroditus* (Jacq.) Standl. Tufted perennial; culms very slightly thickened, 15-80 cm. long, subbasally 1-3 mm. thick, just below the inflorescence 0.7-2 mm. thick; leaves 1-3 mm. broad, the longer ones about as long as the culm; inflorescences 3-15 cm. long, of 4 to 8 or more slender very unequal peduncles each with a lax spike 1-3 cm. long and 1-2 cm. thick, of 8 to 30 or more divaricately spreading spikelets in 3 or 4 ranks, secondary peduncles absent; bracts 3 to 8, the longer ones far-surpassing the inflorescence; spikelets linear, 5-11 mm. long, 0.5-1 mm. broad, more than half as thick as broad, dull-brown, with 3 to 7 scales (the terminal one sterile, tending to become involute and forming a short point), the axis at maturity detaching as a unit from the spike axis, the internodes on their fertile side with 2 narrow hyaline wings 1.3-2 mm. long and 0.3-0.5 mm. broad; scales 2.5-3.5 mm. long, 0.8-1.3 mm. broad, with about 9 nerves, overlapping, persistent; stamens 3; achene 1.6-1.8 (-2) mm. long, 0.6-0.8 mm. thick, trigonous, oblong to ellipsoid, yellowish brown to brown, substipitate, apiculate. Incl. var. *angustior* (Clarke) Kükenth., *C. thyrsiflorus* Schlecht. & Cham., *C. dissitiflorus* Torr. Rare in rich loam, shaded river woods, s.e. Tex. (Brazoria, Colorado, Harris and Jackson cos.), summer; widespread in warmer parts of Am., n. to Ala., La., Tex., Coah. and Ariz.

This "species," one of a group of exceedingly poorly marked ones, verges both toward the *C. "tenuis"* complex and toward the *C. uniflorus* complex. Those plants with somewhat larger achenes and broad clasping wings thickened near the adaxial angles of the achene are here arbitrarily referred to *C. uniflorus*. The plants from Louisiana and southeast Texas referred here differ from the more or less typical populations of tropical America in the narrow leaves; most populations elsewhere have blades 2-7 mm. broad. Some collections from the Chisos Mountains in Trans-Pecos Texas represent the "true"

broadleaved *C. hermaphroditus*, which comes northward from the mountains of Coahuila and Nuevo Leon.

26. *Cyperus huarmensis* (H.B.K.) M. C. Johnst. (Often loosely) tufted perennial from black knotty subrhizomatous bases; culms 1-4 dm. long, subbasally 1.5-3 mm. thick, just beneath the inflorescence 0.7-1.3 mm. thick; leaves 2-4 mm. broad, firm, shorter than the culms; inflorescence 2-3 (-4) cm. long, of 3 to 6 essentially sessile (or occasionally 1 or 2 of them on peduncles 1-2 cm. long) dense spikes 10-25 mm. long and 7-10 mm. thick, with 40 to 80 ascending spikelets; bracts 3 to 6, spreading, the longer ones 3 to 10 times as long as the inflorescence; spikelets 4-7 mm. long, about 1 mm. broad and almost as thick, ochraceous gray-brown to tawny-gray, with 3 scales (usually only the lowest one fertile and it slightly longer than the others), straight, the axis at maturity detaching as a unit from the spike axis, the internodes of the fertile side with 2 hyaline wings 1.5-2.2 mm. long and 0.6-0.8 mm. broad, clasping the achene; fertile scale 3-4 mm. long, about 2 mm. broad, with about 9 nerves, almost completely overlapping the higher scales; stamens 3; achene 1.5-2.1 mm. long, 0.8-1 mm. thick, oblong-obovoid, trigonous, very dark-brown, substipitate, apiculate. *C. cayennensis* (Lam.) Britt., non Link, *C. flavus* (Vahl) Nees, non J. & C. Presl, *Mariscus huarmensis* H.B.K., *C. obesus* Liebm. Rare in s.e. Tex. (Aransas and San Patricio cos.), spring-fall; widespread in the warmer parts of Am. s. to Arg. and n. to Ariz., N.M., Tex. and La.

27. *Cyperus uniflorus* T. & H. Tufted perennial; culms usually very slightly tuberous-thickened basally, 8-30 (-40) cm. long, subbasally 0.7-1.5 (-1.8) mm. thick, just beneath the inflorescence 0.5-1 (-1.3) mm. thick; leaves 1-3 mm. broad, the longer ones shorter than the culm; inflorescence 8-60 mm. long, of (1 to) 3 to 6 slender very unequal peduncles each bearing a lax or dense head or spike of 10 to 38 spreading spikelets in at least 4 ranks; secondary peduncles absent; bracts 3 to 6, the longer ones far-surpassing the inflorescence; spikelets linear, 4-8 (-11) mm. long, 0.5-1 mm. broad, more than half as thick as broad, stramineous to grayish-brown to brownish-red, with 2 to 5 scales (the terminal one sterile, becoming involute and forming an awnlike straight or curved point), mostly straight (or, when abortive and drying before maturing fruit, then often falcate, especially at the tip), the axis at maturity detaching as a unit from the spike axis, the internodes on the fertile side with 2 wings 1.7-2.7 mm. long and 0.5-0.8 mm. broad, conspicuously clasping the 2 adaxial angles of the achene and subchartaceous and discolored over these angles (wings otherwise membranous and translucent); fertile scales 3-4.5 mm. long, 1.3-2 mm. broad, with 9 or 11 nerves aggregated in a median strip about half as wide as the whole scale, overlapping, persistent; stamens 3; achene oblong, 1.7-2.5 mm. long (more than half as long as the scale), 0.6-0.9 mm. thick, trigonous, dark-brown to dark-chestnut, substipitate, subapiculate. Abundant or scattered in dry to somewhat moist sandy or loamy prairies, brush and open woodland, nearly throughout except rare in Trans-Pecos and extreme e. Tex., infrequent in the Panhandle, spring-fall, occasionally winter; Ark., Okla., N.M. and Ariz., s. to n. Mex.

On soil derived from limestone and granite in the Edwards Plateau and elsewhere, especially in shaded ravines, occur plants (*C. uniflorus* var. *pseudothyrsiflorus* Kükenth.) technically referred here because of the broad, achene-clasping, thickened wings of the spikelet-axis, but otherwise with the characters of *C. hermaphroditus*, s. *amplo*. They probably would be better referred to *C. hermaphroditus*, but the specific lines become blurred, probably through introgression, and the characters thoroughly scrambled. Likewise, *C. uniflorus* grades through a perplexing series to *C. globulosus* (through *C. "subuniflorus"* Britt.) to the *C. "retrorsus"* form of *C. ovularis* (through *C. uniflorus* var. *floribundus* Kükenth.) to *C. ovularis*; and to *C. retrofractus*.

28. *Cyperus retrofractus* (L.) T. & G. Loosely tufted perennial with conspicuous tuberous enlargements; culms 3-9 dm. long, subbasally 2-3 mm. thick, just beneath the inflorescence 1-2 mm. thick; leaves 2-6 mm. broad, even the longer ones much shorter than the culms; inflorescence 6-20 cm. long, of 6 to 10 rather unequal stiffly ascending peduncles each bearing a dense obovoid head 9-17 mm. long and 8-15 mm. thick, with 60 to 180 spikelets borne in a spiral arrangement, densest apically and with a progressively laxer pattern downward; secondary peduncles absent; bracts 4 to 7, only the very longest ones equaling or slightly exceeding the inflorescence; apical spikelets very short and spreading, the middle ones longer and markedly reflexed or the lowest retrorsely appressed to the head axis; middle spikelets of head linear, 6-10 mm. long, 0.5-0.7 mm.

broad, almost as thick, straw-brown to brown, with 2 or 3 scales (the terminal one sterile, becoming involute and forming a point), straight, the axis at maturity detaching as a unit from the head-axis, the internodes on the fertile side with 2 wings about 3 mm. long and 0.5 mm. broad, usually clasping the 2 adaxial angles of the achene, thin and translucent; fertile scales 5-5.5 mm. long, 1.2-1.5 mm. broad, with 11 or 13 nerves, overlapping, persistent; stamens 3; achene linear, about 3 mm. long, 0.5-0.8 mm. thick, trigonous, dark-brown, substipitate, subapiculate. *C. Plukenetii* Fern. Infrequent in woods on moist or dry sandy soil, e. and s.e. Tex., July-Oct.; s.e. U.S. n. to N.J., O., Mo. and Okla.

The typical form is described above. It passes through intermediate forms (some incorrectly called *C. hystricinus*) to *C. uniflorus*; through forms known as *C. dipsaciformis* Fern. and *C. "refractus"* Steud. emend. Boeck. to *C. strigosus*; through *C. hystricinus* Fern. (sometimes incorrectly called *C. retrofractus*) to the *C. retrorsus* form of *C. ovularis*; and through forms known as *C. lancastriensis* Porter to true *C. ovularis*.

29. *Cyperus ovularis* (Michx.) Torr. Tufted perennial; culms, basally with tuberos enlargements, 25-80 cm. long, subbasally 1-3 mm. thick, just beneath the inflorescence 0.6-2 mm. thick; leaves 1.5-5 mm. broad, the longer ones about equaling the culms; inflorescence (1-) 3-12 cm. long, of (1 to) 3 to 8 very unequal peduncles each with a dense spherical or prolate-spherical head 7-19 mm. long and 7-18 mm. thick, with (70 to) 100 to 240 spikelets borne spirally or in many ranks, about equally dense at top and bottom, the upper spikelets ascending, middle ones spreading and lower ones retrorsely appressed; secondary peduncles absent; bracts (2 or) 3 to 7, the longer ones far-exceeding the inflorescence; spikelets 3.5-9 mm. long, 0.5-1 mm. broad, about half to three fourths as thick as broad, straw-brown to dark-brown, with 2 to 4 scales (the terminal one or two sterile and forming a blunt point, not an awn), straight, the axis at maturity detaching as a unit from the head axis, the internodes on the fertile side with 2 hyaline wings 1-2 mm. long and 0.3-0.7 mm. broad, usually not clasping the achene; fertile scales 2.5-4 mm. long, 1.2-2 mm. broad, obtuse, with about 9 nerves well-distributed over the width, overlapping, persistent; stamens 3; achene narrowly oblong, 1.8-2.2 mm. long, 0.5-0.7 mm. thick, trigonous, brown, substipitate, apiculate. Incl. var. *sphaericus* Boeck. and var. *robustus* Britt., *C. Wolfi* Wood. Infrequent in moist sand, e., s.e. and n.-cen. Tex., spring-fall; e. U.S. n. to N.Y., Pa., O., Ind., Ill. and Mo., w. to Kan., Okla. and Tex.

The description above applies to the typical form. A more common form is the var. *cylindricus* (Ell.) Torr. (*C. retrorsus* Chapm.) with narrower and proportionally more elongate heads (actually short spikes), paler and with a slightly more tawny-ochraceous tinge, with fewer spikelets on the average (50 to 100), only 2 or 3 scales per spikelet, the wings averaging slightly narrower, the wings, scales and achene averaging shorter. These characters, except for the spikelike heads, are mostly intermediate between the true *C. ovularis* and *C. globulosus*, into which the former freely grades (the var. *cylindricus* could equally well be treated as a variety of *C. globulosus*). Both the var. *ovularis* and the var. *cylindricus* grade freely into *C. uniflorus* as well as into *C. retrofractus*.

30. *Cyperus globulosus* Aubl. Tufted perennial; culms slightly tuberos-enlarged basally, 1-8 dm. long, subbasally 1.5-2.5 mm. thick, just beneath the inflorescence 1-1.7 mm. thick; leaves 1.5-3 mm. broad, the longer ones about equaling the culms; inflorescences 2-8 cm. long, of 3 to 14 very unequal peduncles each with a dense head 7-15 mm. long and 8-17 mm. thick, with 25 to 70 spikelets borne spirally or in a number of ranks, about equally dense throughout, the upper spikelets ascending, the middle ones spreading, the lower spreading or slightly descending but never retrorsely appressed; secondary peduncles absent; bracts 4 to 11, the longer ones far-exceeding the inflorescences; spikelets 5-10 mm. long, 0.7-1.3 mm. broad, almost as thick as broad, greenish-brown to ochraceous-brown or olive, with 3 to 8 scales (the terminal one sterile or staminate and forming a short point, or blunt), straight, the axis at maturity detaching as a unit from the head axis, the internodes with hyaline wings 0.8-1.4 mm. long and 0.25-0.6 mm. broad and not clasping the achene; scales 2.5-3 mm. long, 1-1.3 mm. broad, obtuse, with usually 9 well-distributed nerves, overlapping, persistent; stamens 3; achene narrowly oblong, 1.3-1.6 mm. long, about 0.6 mm. thick, trigonous, brown, substipitate, subapiculate. Frequent in moist or dry sandy soil, e. and s.e. Tex., rare and in genetically dilute form inland to n.-cen. Tex., summer-fall; n. S.A., n. reputedly to Va., Mo. and Okla.

This "species" grades freely into the various forms of *C. ovularis* (especially the

C. "retrorsus"); into some forms of *C. uniflorus* (especially the *C. "subuniflorus"*); and less commonly through *C. "Martindalei"* into *C. filiculmis* next below.

31. *Cyperus filiculmis* Vahl. Tufted or very loosely tufted perennial; culms basally tuberous-thickened or with short thick rhizomes, 10-35 (-50) cm. long, subbasally 1-2 (-2.3) mm. thick, just beneath the inflorescence 0.5-1 mm. thick; leaves 1-2 mm. broad, even the longer ones mostly shorter than the culms; inflorescence 1-3 cm. long, of a single nearly spherical head of 15 to 55 spikelets or (usually in contaminated plants) the inflorescences with such a head plus a few peduncles 1-5 cm. long each with a head or glomerule of 8 to 20 spikelets; bracts 3 or 4, 0.5-1 mm. broad, much-exceeding the inflorescence, usually spreading or reflexed; spikelets 6-16 mm. long, 2.5-4 mm. broad, about 1 mm. thick, grayish-brown to dark-tawny-grayish-brown, with 7 to 20 scales (the terminal one sterile or staminate and slightly reduced), straight, the axis noticeably dorsiventrally flattened, at maturity either persistent or commonly tardily deciduous as a unit from the head axis, the flat sculptured internodes commonly wingless or with wings only to 0.2 mm. broad; scales spreading at a 45° angle (the spikelet axis thus exposed), most much-overlapping, 2.5-3.5 mm. long, 2-2.5 mm. broad, broadly ovate, with 9 to 11 nerves; stamens 3; achene 1.5-2.2 mm. long, 0.8-1.1 mm. thick, broadly oblong, trigonous, dark-brown. *C. Houghtonii* Torr. var. *Bushii* (Britt.) Kükenth. Infrequent, scattered in seasonally moist sandy loam in open-wooded areas, n.-cen. Tex., Plains Country and Edwards Plateau, rare in the Trans-Pecos (i.e., genetically dilute plants in Glass Mts.), spring-fall; e. U.S. and s.e. Can. w. to the Rocky Mts.

On a broad scale this species has hybridized with *C. Schweinitzii* in the Great Plains and locally (in Glass Mts.) perhaps with *C. spectabilis*. In southeastern United States occurs *C. "Martindalei"* Britt. which is basically *C. filiculmis* contaminated by *C. globulosus*.

32. *Cyperus Schweinitzii* Torr. Fairly densely tufted perennial from hard knotty subrhizomatous bases; culms 15-45 cm. long, subbasally (1-) 2-3 mm. thick, just beneath the inflorescence 0.8-1.4 mm. thick; leaves 1-3 mm. broad, even the longer ones mostly shorter than the culm; inflorescence 3-10 cm. long, of 4 to 8 erect to ascending primary peduncles 2-80 mm. long each bearing a short lax spike 1-2 cm. long and 9-14 mm. thick, with 5 to 18 erect or ascending spikelets that are set 1-2 mm. apart on the axis; bracts 4 to 8, the longer ones far-exceeding the inflorescence; spikelets 4-10 mm. long, 3-4 mm. broad, 1-1.5 mm. thick, brown to dark-olive-brown, with 5 to 11 scales, straight, the axis noticeably dorsiventrally flattened, at maturity usually persistent, essentially wingless; scales spreading at 45° angle (the axis thus exposed), not much-overlapping, 3-3.8 mm. long, 2-3 mm. broad, broadly ovate, with 11 to 15 nerves, apically acute and usually acuminate with a fine sharp point, eventually deciduous from the axis; stamens 3; achene 2-2.8 mm. long, 1-1.2 mm. thick, broadly ellipsoid, trigonous, dark-brown. *C. Houghtonii* Torr. var. *uberius* Kükenth. Frequent in deep sands in higher (western) parts of the Plains Country and infrequent to the lower Plains Country, rare in n.-cen. Tex., probably also scattered in the Trans-Pecos, spring-summer; s.w. Que. to Sask. s. to N.Y., Pa., O., Ind., Ill., Mo., Okla. and Tex.; also extreme n. Chih. (Samalayuca dunes area).

This species passes into *C. Fendlerianus* of the Trans-Pecos mountains and toward the north has hybridized with *C. filiculmis*.

33. *Cyperus Fendlerianus* Boeck. Loosely tufted or forming stools from knotty or tuberlike bases; culms 1-4 (-5) dm. long, subbasally 0.7-2.2 mm. thick, just beneath the inflorescence 0.5-1.2 mm. thick; leaves 1-3 (-5) mm. broad, the longer ones shorter than or equaling the culms; inflorescence (15-) 30-80 (-150) mm. long, of (1 to) 3 to 5 (or 6) spikes, several or all of them nearly sessile and crowded into a dense mass at the culm summit and the rest elevated on erect peduncles; spikes lax, 12-25 (-30) mm. long, 6-11 mm. thick, of 3 to 13 erect or ascending spikelets; bracts 3 to 5, the longest usually erect and far-exceeding the inflorescence; spikelets 7-12 mm. long, 2-3 mm. broad, about 1 mm. thick, brownish-gray to pale-brown, with 3 to 16 scales, straight, the noticeably dorsiventrally flattened axis at maturity usually persistent, essentially wingless; scales (including mucro) 2.3-3.3 mm. long, 2-2.6 mm. broad, broadly ovate, with 9 or 11 nerves, acute, usually mucronate, slightly overlapping, spreading at almost a 40° angle, at least the lower ones eventually deciduous from the axis; stamens 3; achene 1.6-2.1 mm. long, 0.9-1.2 mm. thick, broadly ellipsoid, trigonous, dark-brown. *C. Schweinitzii*

var. *debilis* Britt. Frequent locally in Trans-Pecos mts. (Chisos and Davis) mostly above 5,000 ft. alt., summer; highlands of Mex. and s.w. U.S.

We have mostly the var. *debilis* (Britt.) Kükenth.; the var. *Fendlerianus* in which none of the peduncles is elongated and the bracts are usually reflexed is rare in the Davis Mts. The species is extremely closely related to, and often confused with, *C. Schweinitzii* and *C. manimae* H.B.K. These "species" need re-evaluation.

34. *Cyperus spectabilis* Link. Loosely tufted or matted perennial from short knotty branched fibrous blackish rhizomes; culms 3-8 dm. long, subbasally 2-3.5 mm. thick, just beneath the inflorescence 0.7-1.2 mm. thick; leaves 2-4 mm. broad, even the longer ones shorter than the culm; inflorescence 5-13 cm. long, of 4 to 9 very unequal peduncles each bearing a lax spike 2-5 cm. long and 2-3 cm. thick, of 9 to 30 well-spaced spikelets (mostly divaricately spreading or the lower ones slightly reflexed); bracts 3 to 5, ascending or spreading, the longer ones about twice as long as the inflorescence; spikelets 8-15 mm. long, 2-3 mm. broad, about 0.7 mm. thick, chestnut-brown or less commonly a tawny grayish-brown, with 9 to 15 scales, straight, the axis dorsiventrally flattened, at maturity usually persistent, essentially wingless; scales 2.5-3 mm. long, 1.5-2 mm. broad, ovate, obtuse, with 7 to 11 nerves, slightly overlapping, spreading at about a 40° angle, at maturity deciduous; stamens 3; achene 1.7-2 mm. long, 0.6-1 mm. thick, trigonous, oblong or ellipsoid, dark-brown, substipitate, subapiculate. *C. Buckleyi* Britt. Rare in the Trans-Pecos (Davis and Glass mts.), summer; highlands of Mex. n. to Ariz. and Tex.; Arg.; Peru.

In the Glass Mts. (Green Valley, Split Tank) occur plants with characteristics somewhat intermediate between this species and *C. filiculmis*.

35. *Cyperus odoratus* L. Tufted perennial, rarely rhizomatous or often flowering the first year and behaving annual; culms often slightly tuberous-thickened basally, 1-90 cm. long, subbasally 1-6 mm. thick, just beneath the inflorescence 0.3-3 mm. thick; inflorescence 1-45 cm. long, of numerous very unequal spreading or ascending primary peduncles the longer of which usually bear several unequal secondary peduncles, all eventually bearing lax to subdense spikes of rather numerous spreading spikelets; bracts 3 to 10, the longer far-surpassing the inflorescence; spikelets quite variable in size (about 1 mm. broad and thick) and number of scales (4 to 30), each internode of the axis unilaterally (on the sterile side) postantheically bulbous with white cartilaginous thickening and on the fertile side with 2 hyaline wings (eventually becoming papery) clasping the achene and at the base of each internode (above each node) abscising so that the whole spikelet breaks up into joints each comprising a scale, the next lower internode and the attached wings and achene; scales small, brownish, with a number of nerves, each persistent on its joint; stamens 3; achenes brownish, unequally trigonous, the 2 smaller (sharper) angles adaxial, clasped by the wings. *C. ferax* Rich., *C. speciosus* Vahl, *C. ferruginescens* Buckl. Abundant in all parts of Tex., perhaps our most abundant flatsedge and one of the most variable, but it is impossible to distinguish segregate taxa, spring-fall, occasionally winter; semicosmopolitan in temp. and trop. regions. Passing through the form called *C. Eggersii* Boeck. to *C. macrocephalus*.

36. *Cyperus macrocephalus* Liebm. Like *C. odoratus* but the peduncles absent so the extremely dense spikes are confined to a single large headlike mass. *C. oxycarioides* Britt. Common in resacas and ditches, Brownsville region of extreme s. Tex., nearly all year; otherwise Yuc., Ver. and Tam. Probably a mere form of *C. odoratus* (many species of flatsedges have parallel forms), but geographically rather well-localized.

37. *Cyperus aristatus* Rottb. Tufted annual with persistent coffee-and-chicory or curry powder odor (like *Ulmus rubra*, *Phyllanthus ericoides*, *Gnaphalium obtusifolium*, flowers of Bombacaceae, etc.); culms 1-20 cm. long, the longer leaves often equaling or surpassing them; inflorescence of 1 to 3 heads, essentially sessile at the summit, often with 1 to 6 additional shortly peduncled ones; bracts 2 to 4, the longer ones far-surpassing the inflorescence, often ascending; heads 5-20 mm. thick, often slightly prolate, with 2 to 50 spikelets; spikelets 4-14 mm. long, 2-3 mm. broad, about 0.5 mm. thick, laterally compressed, straight, with 5 to 30 scales, brown to yellow-brown to tawny-brown, the axis essentially wingless, at maturity eventually deciduous as a unit from the head axis; scales deciduous either before or after fall of the spikelet axis, 2-2.5 mm. long, about in the distal third the length being a very slender sharp acuminate-subulate prominently

recurved tip, with 7 or 9 evenly distributed nerves; stamen 1; achene 0.7-1 mm. long, 0.2-0.5 mm. broad, from nearly linear-oblong to obovoid, dark-brown. *C. inflexus* Muhl. Throughout Tex. (except Plains Country), scattered, spring-early winter; nearly cosmopolitan in temp. and trop. areas.

In extreme south coastal Texas occurs the var. *Runyonii* O'Neill with the achenes at the extremes of greatest length and narrowness allowed here.

38. *Cyperus laevigatus* L. Densely tufted or mat-forming perennial; culms soft, 5-25 cm. long, 1-1.5 mm. thick; leaves reduced to basal sheaths with subulate or setaceous blades 3-30 mm. long; inflorescence 5-10 mm. long, of a single head of 4 to 8 spikelets; bracts 2, the longer one 2-8 cm. long, appearing as a continuation of the culm; spikelet straw-white or often white with atropurpureous blotches medially, 4-7 mm. long, 2-3 mm. broad, 0.7-1 mm. thick, with 8 to 30 scales, the axis persistent, essentially wingless, somewhat flattened; achene lenticular (often concavo-convex) with one of the flat sides against the flattened spikelet axis. Infrequent in fresh or subsaline or gypseous mud in the Trans-Pecos, Feb.-Oct.; widely distributed in warm-temp. and trop. regions.

39. *Cyperus albomarginatus* Mart. & Schrad. Tufted annual; culms 2-9 dm. long, basally leafy and 2-8 mm. thick, apically 0.7-4 mm. thick; inflorescences 2-13 cm. long, of 3 to 12 very unequal peduncles each bearing a lax spike 12-40 mm. long and 12-23 mm. thick, of 10 to 60 spreading spikelets or the longer peduncles bearing secondary peduncles with such spikes; bracts 3 to 7, far-surpassing the inflorescence; spikelets 5-12 mm. long, 1.7-3 mm. broad, about 0.7 mm. thick, with 6 to 18 scales, straw-brown to dark-chocolate-brown, straight, the axis somewhat 4-angled, at maturity persistent, each internode on the fertile side with a niche for an edge of the achene and on the edges (at the sides of the achene) with minute winglike margins; scales 1.4-1.7 mm. long, 1.4-2 mm. broad, obovate, membranous, with 5 nerves at the keel-like median and marginally with a broad hyaline zone (albomargin) markedly contrasting with the brownish sides, deciduous, not much overlapping, clasping the achene; stamens 2 or 3; achenes lenticular, with an angle fitting into the niche of the internode, nearly as long as the scale, broadly obovate, apiculate, 1.2-1.5 mm. long, 0.6-1 mm. broad, maturing to black. Infrequent or rare, scattered in s.e. and Trans-Pecos Tex., summer; Afr., Madag., India, Burma, Austral.; in Am. from Arg. and Bol. n. to Va., N.C., S.C., Ala., La., Tex. and Ariz.

40. *Cyperus polystachyos* Rottb. var. *texensis* (Torr.) Fern. Tufted perennial (flowering the first year); culms 3-35 cm. long, basally 0.8-3 mm. thick, apically 0.5-1.5 mm. thick, wiry; leaves basal, mostly shorter than the culms; inflorescence 12-60 mm. long, of several unequal peduncles (these, especially in coastal populations, suppressed so the inflorescence is congested) with glomerules or short lax spikes, or rarely the longer ones with secondary peduncles 1-3 mm. long each with a glomerule or lax spike; glomerules or lax spikes with 5 to 10 mostly spreading spikelets; bracts 1 to 6, the longer ones usually about twice as long as the inflorescence; spikelets 4-25 (-43) mm. long, 0.7-2 mm. broad, about 0.5 mm. thick, with 10 to 40 (to 60) scales, brownish-buff to tawny-stramineous, straight, the axis slightly 4-angled, at maturity persistent, each internode on its fertile side with a niche for one edge of the achene, near the base of the niche with minute hyaline wings that narrow and join abaxially forming a minute cup at the base of the achene (use a strong lens!); scales 1.4-2 mm. long, about 1 mm. broad, ovate, appressed, much-overlapping, with 3 obscure nerves at the keel-like median, deciduous; stamens 2; achene lenticular, with an angle fitting the niche of the internode, about 1 mm. long, oblong to narrowly oblong, ripening through brown to black. Incl. var. *leptostachyus* Boeck. Locally abundant in seasonally moist sand, e. and s.e. Tex. and coastal part of Rio Grande Plains, spring-fall; widespread in Am. n. to Mass., Pa., Mo., Ark. and Okla.; the var. *polystachyos* (*C. filicinus* Vahl) occurs in coastal areas, Mass. to Va.; the var. *paniculatus* (*C. vulgaris* var. *teretifructus* (Steud.) Miq.) occurs widely in trop. of both hemispheres.

41. *Cyperus niger* R. & P. Annual or usually weak perennial occasionally forming mats by rooting of very shortly decumbent culms; aerial parts 1-4 (-6) dm. long, mostly erect, subbasally 1-2 mm. thick, apically 0.4-1.4 mm. thick; leaves few, mostly much shorter than the culms; inflorescence commonly of a single sessile irregular head 1-2 cm. thick of 3 to 30 spikelets, rarely more elaborate with a sessile head plus 2 or 3 peduncles to 4 cm. long each with a lax irregular head or glomerule of up to 20 spikelets; bracts 1 to 3, the longest far-surpassing the inflorescence and (when young) commonly erect

(like a continuation of the culm), later spreading; spikelets 7-12 mm. long, 1.7-2.2 mm. broad, about 0.7 mm. thick, with 10 to 22 scales, straight, pale-chestnut-brown or often with darker blotches of chestnut on each scale, rarely almost totally dark-brown, the axis persistent, somewhat 4-angled but essentially wingless, each internode on the fertile side with a niche into which fits an angle of the achene; scales about 2 mm. long, much-overlapping, with about 3 nerves crowded in the arcuate keel-like median, otherwise smooth and shiny, deciduous; stamens 2; achene lenticular (biconvex) about 1 mm. long, elliptic, apiculate, surficially nearly featureless, ripening through shades of brown to nearly black, oriented so an angle fits into the internodal niche. *C. melanostachys* H.B.K. We have two varieties.

Var. *castaneus* (Pursh) Kükenth. With usually lax elaborate inflorescences. *C. bipartitus* Torr., *C. rivularis* Kunth. Rare in moist sandy loam in e. Tex. (Austin and Washington cos.); from Que. w. to Minn. and Neb., s. to Ga., Ala., Miss. and Tex.; also Calif. and Ore.

Var. *capitatus* (Britt.) O'Neill. With relatively light-colored (chestnut-brown) glumes and strongly apiculate achenes. Local in creeks in igneous Trans-Pecos mts. at elev. of more than 4,000 ft., summer-fall; from Cuba and C.A. n.w. to Calif., Ariz. and Colo.

Reports of *C. diandrus* Torr. from Texas are erroneous and based largely on specimens of *C. niger*. The var. *niger* occurs from Arg. and Bol. n. to Coah.

42. *Cyperus lanceolatus* Poir. var. *compositus* C. & J. Presl. Loosely tufted perennial or mat-forming by decumbence and rooting of bases of culms; aerial parts of culms 5-50 cm. long, 2-3 mm. thick basally, 1-1.5 mm. thick apically; inflorescence congested into a sessile head plus 1 to 5 very short peduncles each with a head of 6 to 30 spikelets; bracts 2 or 3, the longer ones far-surpassing the inflorescence; spikelets 3-7 mm. long, 1.5-2 mm. broad, stramineous, sometimes with an olivaceous tinge (but not having a darker splotch on each scale), the axis straight, persistent, somewhat flattened but essentially wingless, each internode with a niche into which fits an angle of the achene; scales 1.5-1.8 mm. long, blunt, much-overlapping, with 3 or 5 nerves crowded into the keel-like median, otherwise smooth and shiny, deciduous; stamens 2; achene lenticular (biconvex), about 1 mm. long, obovate, short-apiculate, short-stipitate, surficially featureless or with regular hexagonal cells arranged in vertical rows, ripening to purplish-brown. Exceedingly rare in Llanó Co. in the Central Mineral Region on the Edwards Plateau, Sept. The nominate variety occurs in Arg., Bol., Urug., Parag., Braz., Col., Pan., Nic., Guat., s. Mex. and has been reported casual in La. and Fla. The var. *compositus* occurs in Braz., Col., Gr. Ant., C.A., Mex. (n.w. to Son. and Chih.) and (?) Tex. The species is closely related to *C. niger*.

43. *Cyperus flavescens* L. Tufted annual; culms 10-25 cm. long, basally 0.8-1.9 mm. thick, apically 0.7-1.1 mm. thick; inflorescence a congested (compound) sessile head of 10 to 35 spikelets plus occasionally 1 to 3 peduncles 1-3 cm. long each with a head of 4 to 10 spikelets; bracts 1 to 4, the longer ones usually surpassing the inflorescence; spikelets 6-20 mm. long, 1.8-3 mm. broad, about 0.8 mm. thick, with 22 to 40 scales, mostly straight, uniformly stramineous to ochre-stramineous, the axis persistent, straightish, flattened, essentially wingless, each internode with a niche into which fits an angle of the achene; scales deciduous, 1.5-2 mm. long, 1.2-1.6 mm. broad, ovate, with 3 nerves in the keel-like median; stamens normally 3; achene lenticular (biconvex), about 0.9 mm. long and 0.6 mm. broad, obovate, substipitate, short-apiculate, ripening to black, surficially shiny and with rectangular linear (vertical) cells (the rows of these cells marked off by horizontal wavy usually discolored sutures). Infrequent or rare in moist sand, e., s.e. and n.-cen. Tex., July-Nov.; widespread (in several varieties) in warm regions; in Am. n. to N.Y., Pa., Mich., Mo. and Kan.

44. *Cyperus sesquiflorus* (Torr.) Mattf. & Kükenth. Annual (?) or usually perennial mat-formers, emitting a strong citronellalike odor when bruised, with a culm density of 1 to 4 flowering culms per square cm. in the mat; culms 5-30 cm. long, basally 0.8-1.8 mm. thick, apically 0.5-1 mm. thick; leaves essentially basal, with sheaths 1-2 (-3) cm. long and firm-membranous, ascending blades 3-12 cm. long and 2-3.5 (-5) mm. broad, mostly much shorter than the scapelike culms; inflorescence a single prolate few-lobed compound congested headlike mass 7-14 mm. long and 6-8 mm. broad in the upper cylindrical lobe, with 50 to 200 spikelets altogether; bracts 3 (or 4), ultimately slightly to strongly reflexed, firm-membranous, 2-8 cm. long, 1-3 mm. broad, at the very base

discolored whitish-green but not hyaline at corners; spikelets each deciduous as a unit, 2.3-3 mm. long, 1.2-1.3 mm. broad, about 0.4 mm. thick, with 2 scales, buffy-white to white laterally, the lower scale enclosing a fertile floret, the upper one empty, the single short internode with very broad hyaline wings clasping the achene and continuous with the lower part of the higher scale; scales persistent (the lower one 2.2-2.9 mm. long) with green keels and buffy-white to white sides, each side with a couple of inconspicuous well-distributed longitudinal nerves; stamens uniformly 2 at the abaxial angle of the achene; stigmas 2; achene lenticular with the adaxial angle against the internode, the abaxial one at the keel of the lower scale, obovate, 1-1.4 mm. long, plus an apicule 0.05-0.15 mm. long, 0.75-0.9 mm. broad, ripening to jet-black. *Kyllinga odorata* Vahl. Frequent in moist sandy loam, e. Tex. (Angelina, Austin, Gonzales, Hardin, Lavaca and Newton cos.), June-Oct.; widespread in warm regions.

45. *Cyperus tenuifolius* (Steud.) Dandy. Densely tufted fragrant annual (or short-lived perennial?) with density of about 4 to 20 culms per square cm.; culms 1-21 cm. long, 0.5-0.7 mm. thick throughout; leaves with sheaths 8-45 mm. long and membranous; flaccid blades 2-11 cm. long, 1-1.8 mm. broad, often more than two thirds as long as the culms; inflorescence a single roundish 3-lobed compound headlike mass 3-8 mm. long and 5-6 mm. broad in the upper obtuse lobe, with 40 to 170 spikelets altogether; bracts 3 (or 4), ultimately spreading or slightly reflexed, flaccid, 2-10 cm. long, 1-2 mm. broad, at the very base with broad translucent membranous corners; spikelets each deciduous as a unit, 2-2.5 mm. long, 0.7-0.8 mm. broad, about 0.3 mm. thick, sordid-whitish or very pale-brownish, with 2 scales, the lower one enclosing a fertile floret, the upper empty, the single short internode with very broad hyaline wings clasping the achene and continuous with the lower part of the higher scale; scales persistent (the lower one 1.7-2.4 mm. long) with green keels and translucent sides, each side with a couple of inconspicuous well-distributed longitudinal nerves; stamens uniformly 2 at the abaxial angle of the achene; stigmas 2; achene lenticular, with the adaxial angle against the internode, the abaxial one at the keel of the lower scale, elliptic, 0.9-1.1 mm. long (plus an apicule 0.1 mm. long), 0.5-0.6 mm. broad, ripening to a very dark-brown. *Kyllinga pumila* Michx., *Cyperus densicaespitosus* Mattf. & Kükenth. Infrequent in moist loam, e. Tex. (Bowie, Cass, Hardin and Polk cos.), rare in n.-cen. Tex. (Grayson Co.), Sept.-Nov.; widespread in warmer moister parts of Am.; also Afr. and Madag.

The name is incorrectly said by some writers to be illegitimate.

46. *Cyperus brevifolius* (Rottb.) Hassk. Perennial with creeping branching reddish-brown rhizomes to 20 cm. long and 1-2 mm. thick; flowering culms rising from the rhizomes 3-10 mm. apart, 4-20 (-38) cm. long, 0.4-1 mm. thick; leaves with sheaths 5-30 mm. long and membranous; flaccid blades 1-3 (-10) cm. long, 1-3 mm. broad, mostly much shorter than the culms except when the latter are dwarfed; inflorescence a single roundish seemingly simple congested head 4-6 mm. long and broad, with 38 to 100 spikelets; bracts 3 (or 4), the longest one usually nearly vertical or ultimately reflexed, membranous, 15-120 mm. long, 1-2 mm. broad; spikelets each deciduous as a unit, 2-2.9 mm. long, 0.8-1.1 mm. broad, about 0.3 mm. thick, sordid- or buffy-whitish or very pale-brownish, with 2 scales, the lower one enclosing a fertile floret, the upper empty, the single short internode with very broad hyaline wings clasping the achene and continuous with the lower part of the higher scales; scales persistent (the lower one 1.9-2.4 mm. long), with green keels and translucent sides, each side with a couple of inconspicuous well-distributed nerves; stamens 1 (very rarely 2 in isolated spikelets, never many on the same head), at the abaxial angle of the achene; stigmas 2; achene lenticular with an adaxial angle against the internode and abaxial one at the keel of the lower scale, obovate or oblong-obovate, 1-1.2 mm. long (plus an apicule 0.05-0.1 mm. long), (0.6-) 0.7-0.8 mm. broad, ripening to a rich-brown. *Kyllinga brevifolia* Rottb. Common weeds in moist loam, s.e. Tex., less common in e. Tex., rare in Edwards Plateau and Brownsville region, Apr.-Nov.; widespread in warm regions.

9. CLADIUM P. BR.

About 55 species of tropical and temperate regions, especially Australia; our species almost cosmopolitan.

1. *Cladium jamaicense* Crantz. SAW-GRASS. Coarse erect reed 1-2.5 m. tall, with short rhizomes; leaves long, very tough, channeled ventrally, with dangerous saw-toothed cutting margins; inflorescences ample, 2-5 dm. long, much-branched, often droopy; spikelets ovoid, chestnut-brown, 3-5 mm. long, in fascicles of 2 to 6 at ends of the branchlets, each with a single fertile floret and below it 2 or 3 other spirally imbricate scales, all but the lowest enclosing stamens; perianth absent; achene obovoid, apiculate, somewhat lustrous, brownish, the obovoid body 2-2.5 mm. long, the apicule 0.6-1 mm. long. Locally abundant in fresh water on margins of streams, ponds and lakes, mostly in areas of calcareous soil, Rio Grande Plains, s.e. Tex., Edwards Plateau and Trans-Pecos, summer; widespread in Carib. region, n. to Gulf States and Va. The var. *chinense* (Nees) Koyama occurs in China and Japan.

Some of the plants of the Edwards Plateau and the Trans-Pecos have, on the average, slightly smaller, proportionately shorter and more numerous spikelets and denser inflorescences; these have been segregated as a separate species, *C. californicum* (Wats.) O'Neill, but this is at best weakly marked. Similar plants occur in Coahuila, New Mexico, Arizona, Nevada and California.

10. SCHOENUS L.

About 100 species, world-wide in distribution.

1. *Schoenus nigricans* L. Coarsely tufted perennial; culms slender, wiry, erect, simple, 2-6 dm. long, about 1 mm. thick; leaves basally crowded, the lower sheaths chestnut-black and shiny, the upper blades tough, thin, wiry, involute, shorter than the culms, apically spinose; bracts 1 or 2, the lower one far-surpassing the inflorescence, involute and wiry like the leaves; inflorescence a single sessile glomerule of about 10 sessile spikelets; spikelets laterally compressed, of about 5 to 10 distichous much-overlapping dark-chestnut to blackish scales of which only the upper few produce mature fruit; perianth bristles few, much shorter than the achene, minutely plumose at the very base; style 3-branched; achene shortly obovoid-trigonous with convex sides, pearly- or bony-white, shiny, jointed abruptly with the differently-textured style which thus does not leave a tubercle. Infrequent or rare in creek canyons, s. part of Edwards Plateau, spring; widespread in warm-temp. usually semiarid parts of the world.

11. DICHROMENA MICHX.

WHITE-TOP SEDGE

Tufted or rhizomatous perennials with stems leafy basally, the blades ascending; flowering culms terminating in an involucrate headlike agglomeration of spikelets, the bracts white basally but green distally; spikelets usually whitish; scales several, spirally imbricated or irregularly distichous, the terminal ones enclosing a fertile floret, the lower ones staminate or empty; perianth absent; achenes lenticular, transversely rugose, crowned with the broad persistent base of the style (tubercle) as in *Rhynchospora*. Some authors would include *Dichromena* within *Rhynchospora*.

One of the more easily recognizable of the sedges because of the white bases of the bracts; these apparently function to attract insects. Most sedges, on the contrary, are thought to be wind-pollinated. About 60 species in the Western Hemisphere.

1. Plants densely tufted; rhizomes absent; culms 1 mm. or less thick; blades 3-7 cm. long, 1 mm. broad basally, arcuate-filiform in the distal part; bracts 2 (rarely 3), the longer ones 17-37 mm. long, filiform most of the length 3. *D. nivea*.
1. Plants with extensively creeping orangish or whitish rhizomes; culms 1.5-3 mm. thick basally; blades 6-25 cm. long, 1.2-4 mm. broad basally and at least 1 mm. broad even in the distal part; bracts several, the longer ones (20-) 40-130 mm. long, not filiform except perhaps at the extreme apex (2)
 - 2(1). The white spot at the base of the longer bracts 5-20 (-25) mm. long, a (third to a) fifth to a tenth as long as the bract; bracts 3 to 6 (or 7) 1. *D. colorata*.
 2. The white spot at the base of the longer bracts 25-50 mm. long, about half as long as the bract; bracts 6 to 10 2. *D. latifolia*.

1. *Dichromena colorata* (L.) Hitchc. WHITE-TOPPED UMBRELLA GRASS. Rhizomes usually orangish, 2-3 mm. thick, extensively creeping, scaly; culms, 12-56 cm. long, erect or often decumbent at the very base; leaves crowded basally, mostly rather stiffly ascending, 2-6 mm. broad, linear-involute at the tip; bracts 3 to 6 (or 7), mostly basally ascending but for most of the length spreading or slightly reflexed, lanceolate, very unequal, the longer ones (3-) 5-15 cm. long, (1.5-) 2.5-5 mm. broad basally, with a white spot 5-20 (-25) mm. long. Locally frequent in swales, ditches and wet places generally, s.e. Tex., Rio Grande Plains and Edwards Plateau, rare in s. part of e. Tex., w. to Terrell Co. in the Trans-Pecos, (spring-) summer; widespread in Carib. region, n. to Va. and the Gulf States; e. Mex.

2. *Dichromena latifolia* Ell. Perennial with rhizomes 2-3 mm. thick; culms rather stiffly erect the full length, 4-8 (-10) dm. long, 2-4 mm. thick basally; leaves crowded basally, ascending, 4-6 mm. broad basally, tapered upward and involute in the distal third, apically pointed; bracts 6 to 10, mostly basally ascending but for most of the length spreading or slightly reflexed, lanceolate, very unequal, the longer ones 5-10 cm. long, 4-10 mm. broad in the lower half, with a white spot 25-50 mm. long (about half as long as the bract). Locally frequent in poorly drained pine savannahs, s.e. Tex. (Hardin and Jefferson cos. only), summer; Gulf States and n. to N.C.

3. *Dichromena nivea* (Boeck.) Britt. Densely tufted; rhizomes absent; culms weak, ascending, 1-3 (-4) dm. long, about 1 mm. thick or less; leaves in the lower part, flaccid, 3-7 cm. long, about 1 mm. broad basally, arcuate-filiform; bracts 2 (rarely 3), weak, the longer ones 17-37 mm. long, filiform most of the length, with a white spot only at the very base. *D. Reverchonii* S. H. Wright, *Rhynchospora nivea* Boeck. Locally frequent in creek beds through limestone on Edwards Plateau, rare in n.-cen. Tex., summer; also Ark. and Okla.

12. RHYNCHOSPORA VAHL (CORT. WILLD.)

BEAK-RUSHES

Perennials (rarely annuals); culms leafy; inflorescence of each culm usually divided into several discontinuous parts (branches of the culm), the largest part (appearing terminal) usually subumbelliform (occasionally much-reduced) with several unequal primary branches (each subtended by a bracteal leaf) and these in turn bearing spikelets or glomerules or corymbs of spikelets; the several axillary parts of the inflorescence below usually reduced as compared to the terminal part, occasionally reduced to virtual absence; spikelets with several spirally-disposed scales, the axils of the lowest 1 (or 2) scales empty, the 1 to 10 axils above with perfect flowers, and usually above that 1 or 2 scales enclosing staminate or rudimentary flowers; scales usually broad, membranous, usually brownish with very indistinct midnerves and no other nervation; bristles usually about 6 or 8 (or up to 20) or reduced to virtual absence; stamens usually 1 or 2 or 3; style bifurcate either at the very tip or usually much farther down, its base becoming indurate and persisting on the achenial body as a tubercle of distinctly different texture; achenial body usually distinctly biconvex, varying to nearly flat or nearly turgid, the cells of the face usually variously sculptured and elongated, the walls often prominent.

About 200 species, cosmopolitan in distribution, especially tropical. The name has been misspelled as *Rynchospora* and *Rhynchospora* in various works.

- 1. Style nearly simple or very shortly 2-branched at the summit; achenial bodies 3.5-6 mm. long; tubercle 3.5-18 mm. long (2)
- 1. Style with 2 long branches; achenial bodies and tubercles mostly shorter (4)
- 2(1). Mature spikelet 7-10 mm. long; achenial body 3.5-4 mm. long; tubercle 3.5-4 mm. long 3. *R. indianolensis*.
- 2. Mature spikelet 15-23 mm. long; achenial body 4-5 mm. long; tubercle 13-18 mm. long (3)
- 3(2). Bristles (at least most of them) much-exceeding the achenial body 1. *R. macrostachya*.
- 3. Bristles shorter than the achenial body, stout and closely appressed 2. *R. corniculata*.

- 4(1). Achenial bodies pearly-white, 0.7-0.8 mm. long; tubercles 0.1-0.2 mm. long, 0.15-0.2 mm. broad; spikelets with 5 to 8 fertile flowers; perianth bristles absent (5)
4. Achenial bodies and/or tubercles considerably larger and often brownish in color; spikelets with fewer fertile flowers; perianth bristles usually present (6)
- 5(4). Achenial body smooth under low magnification or faintly cellular-reticulate under high magnification, the 2 faces strongly convex 4. *R. divergens*.
5. Achenial body with transverse ridges, the 2 faces only slightly convex 5. *R. pusilla*.
- 6(4). Bristles conspicuously retrorsely barbed (7)
6. Bristles antrorsely barbed or plumose or absent or smooth (9)
- 7(6). Bristles 10 to 20 per achene; spikelets with only 1 fertile flower and this appearing terminal (no rudimentary flower above it); inflorescence usually merely a dense terminal fascicle 8. *R. macra*.
7. Bristles fewer; spikelets usually with 2 fertile flowers or one fertile flower and a reduced one above it; each culm with several fascicles, one terminal and several axillary (8)
- 8(7). Central portions of the 2 sides of the achenial body abruptly raised in a hump and polished-buffy, contrasting with the dark chestnut-brown submarginal flat portions, the margins themselves pale and wirelike; leaves basally 5-6 mm. broad; culms basally 2-3.5 mm. thick 6. *R. glomerata*.
8. The 2 sides of the achenial body rather evenly convex all over, grading from buffy centrally to darker brownish marginally, the margins themselves slightly paler and wirelike; leaves basally 2-3 mm. broad; culms basally 1-2 mm. thick 7. *R. capitellata*.
- 9(6). Bristles heavily plumose basally (10)
9. Bristles antrorsely serrulate or barbed, smooth or these absent (11)
- 10(9). Spikelets 4-7 mm. long, 1 to 5 present per culm, remote on slender pedicels; achene 2.3-2.6 mm. long (excluding tubercle) 9. *R. oligantha*.
10. Spikelets 3-4 mm. long, more numerous, congested in spike-like fascicles; achene 1.4-1.8 mm. long (excluding tubercle) 10. *R. plumosa*.
- 11(9). Achenial body smooth (12)
11. Achenial body with transverse wrinkles or transverse rows of cells with sculptured walls (14)
- 12(11). Achenial body 0.9-1 mm. long; tubercle 0.4-0.6 mm. long 11. *R. filifolia*.
12. Achenial body 1.3-1.8 mm. long; tubercle 0.4-2 mm. long (13)
- 13(12). Tubercle 0.4-0.7 mm. long 12. *R. fascicularis*.
13. Tubercle 1-2 mm. long 13. *R. gracilentia*.
- 14(11). Terminal part of inflorescence of each culm very lax, with only 6 to 12 (to 20) spikelets each on a capillary pedicel 3-12 mm. long; culms only 0.6-1 mm. thick 16. *R. rariflora*.
14. Terminal fascicle denser with more spikelets or if as few as 12 then either denser or else the culm thicker than 1 mm. basally (15)
- 15(14). Horizontal rows of cell counted in vertical series near the middle of one face of the achenial body numbering (14 to) 16 to 30 and all the cells nearly isodiametric, the horizontal cell walls only slightly if at all raised more than the vertical walls; achenes turgid, 1 mm. or more thick from the middle of one face to the middle of the other (16)
15. Horizontal rows of cells usually 11 to 15; (except in *R. mixta*) those cells near the middle of the face greatly vertically elongated and their horizontal walls very prominent and forming horizontal wrinkles on the achene, but those cells near the base and top of the body nearly isodiametric; achenes less turgid, less than 1 mm. thick from face to face (17)

- 16(15). Achenial body 2-2.4 mm. long, 1.5-1.8 mm. thick from face to face; horizontal rows of cells 25 to 30 or more; spikelets 4-5.5 mm. long 14. *R. Grayi*.
16. Achenial body 1.5-1.8 mm. long, 1-1.5 mm. thick from face to face; horizontal rows of cells (14 to) 16 to 20; spikelets 2.5-3 mm. long .. 15. *R. Harveyi*.
- 17(15). Achenial body twice as long as broad 17. *R. inexpansa*.
17. Achenial body less than twice as long as broad (18)
- 18(17). Bristles (most of them) surpassing the tubercle (19)
18. Bristles not surpassing the tubercle (21)
- 19(18). Achenial body 1.2-1.3 mm. long, the 2 faces nearly flat; plants never rhizomatous; tubercle 0.3-0.4 mm. long 19. *R. Elliottii*.
19. Achenial body 1.3-1.7 mm. long, the 2 faces distinctly convex at least in the upper part; plants rhizomatous (this often obscure in exsiccatae); tubercle 0.4-0.9 mm. long (20)
- 20(19). Achenial body only 0.8-0.9 mm. broad, with numerous indistinct transverse lines 18. *R. mixta*.
20. Achenial body 1.2-1.6 mm. broad, with strong transverse wrinkles 22. *R. caduca*.
- 21(18). Primary branches of the terminal part of the inflorescence straight, stiffly ascending; faces of the achenial body definitely convex at least in the upper half 23. *R. globularis*.
21. Primary branches of the terminal part of the inflorescence arcuate, often slightly droopy; faces of the achenial body nearly flat or only very slightly convex (22)
- 22(21). Bristles half as long as to nearly as long as the achenial body; blades usually flat basally 20. *R. microcarpa*.
22. Bristles less than half as long as the achenial body; blades usually nearly all strongly involute 21. *R. perplexa*.

1. *Rhynchospora macrostachya* Torr. HORNED-RUSH. Tufted perennial; culms 5-10 dm. long, erect, 3-7 mm. thick basally, triquetrous, leafy; basal sheaths becoming markedly fibrous; inflorescence (at maturity) clavate, 3-6 cm. thick, the branches numerous but rather short, erect; spikelets subulate, rich-brown, 15-23 mm. long, the distal third consisting merely of the protruding distal part of the tubercle; bristles several (4 to 7), about 1.5 to 2.5 times as long as the achenial body, stiff, brownish, antrorsely barbed; achenial body 4-5 mm. long, obovate, nearly flat on the 2 faces, dark-brown; tubercle subulate, consisting of the indurated entire portion of the style, 13-18 mm. long, pale-brownish to buffy. *R. corniculata* var. *macrostachya* (Torr.) Britt. Infrequent in s.e. Tex., rare in e. Tex., in mud, summer; s.e. U.S. n. to N.E., N.Y. and Mo., w. to Kan., Okla. and Tex.

2. *Rhynchospora corniculata* (Lam.) Gray. HORNED-RUSH. Perennial, either tufted or usually with thick scaly rhizomes (these often broken off in specimens); culms 6-11 dm. long, erect, 3-9 mm. thick basally, triquetrous, very leafy; basal sheaths becoming only slightly fibrous; inflorescence at maturity loose-obovoid, ample, 7-15 cm. thick, the numerous branches ascending to spreading; spikelets subulate, rich-brown, 15-23 mm. long, the distal third to half consisting merely of the protruding distal part of the tubercle; bristles 2 to 4 (or 5), about a third to two thirds as long as the achenial body, stiff, brownish, closely appressed; achenial body 4-5 mm. long, obovate, nearly flat on the 2 faces, dark-brown; tubercle subulate, consisting of the indurated entire portion of the style, 13-18 mm. long, pale buffy. Frequent in mud., e. and s.e. Tex., spring-summer (fruiting into fall); s.e. U.S., n. to Del., Ky., Ind. and Mo., w. to Okla. and Tex.; W.I.

Ours are nearly all of the var. *interior* Fern. in which the achenial body is only about 1.5 times as broad as the base of the tubercle; a few are of the var. *corniculata* in which the body is about twice as broad as the tubercle.

3. *Rhynchospora indianolensis* Small. Tufted perennial; culms 5-9 dm. long, erect, 3-6 mm. thick basally, triquetrous, leafy (especially in the basal part); terminal part of the inflorescence somewhat umbelliform, *Cyperus*-like, 4-9 cm. long, with several ascending rays each bearing a dense roundish glomerule or capitulum of nearly sessile spikelets,

usually a reduced axillary part of the inflorescence present; spikelets 7-10 mm. long, lanceolate, brown, acute, the tubercle only slightly if at all exerted; bristles 3 to 5, about equaling the achenial body, stiff, appressed; achenial body 3.5-4 mm. long, obovate, nearly flat on the 2 faces, dark brown; tubercle 3.5-4 mm. long, brown, elongate-deltoid, acute or slightly acuminate. Locally frequent in mud, s.e. Tex., summer; endemic.

4. *Rhynchospora divergens* M. A. Curtis. Tufted short-lived perennial (or annual?); culms 18-42 cm. long, 0.3-0.9 mm. thick, erect; leaves numerous, 5-10 cm. long, setaceous-involute; terminal part of the inflorescence umbel-like, 1-2 cm. long, about 1 cm. broad, occasionally 1 or 2 reduced axillary parts of the inflorescence present below; spikelets linear, 3- to 10-flowered, about 1 mm. thick, the fruits very quickly maturing in succession acropetally as the spikelet elongates, the scales and achenes falling as the achenes mature, eventually as many as 5 to 8 fruits maturing from a single spikelet but only 1 or 2 visible at any one time; scales brownish, about 1.5 mm. long; bristles absent; achenial body 0.7 mm. long, obovate, white, the 2 faces convex and under low magnification appearing smooth, under higher magnification faintly cellular-reticulate; tubercle about 0.15 mm. long and 2 mm. broad, whitish, blunt. Rare in moist sand, s.e. Tex. (Aransas and Montgomery cos.), summer; S.C., Ga., Fla., Bah. I. and Tex.

5. *Rhynchospora pusilla* M. A. Curtis. Tufted short-lived *Bulbostylis*-like perennial; culms 15-30 cm. long, 0.2-0.7 mm. thick, erect; leaves numerous, 5-10 cm. long, setaceous-involute; terminal part of the inflorescence reduced, somewhat umbel-like or corymbose, 6-20 mm. long, 5-10 mm. broad, often reduced parts of the inflorescence also present from the penultimate axils; spikelets linear, 3- to 10-flowered, about 1 mm. thick, the fruits very quickly maturing in acropetal succession and falling with the scales, as many as 5 to 8 fruits maturing from a single spikelet but only 1 or 2 visible at any one time; scales brownish, about 1.5 mm. long; bristles absent; achenial body 0.7-0.8 mm. long, obovate, whitish, the 2 faces nearly flat, with transverse rugae; tubercle 0.1-0.15 mm. long, 0.15-0.2 mm. broad, whitish, blunt. Rare in moist sand, s. part of e. Tex. (Hardin Co.), summer; Fla. to Tex.; W.I. Some authors have referred these plants to *R. intermixta* Wright.

6. *Rhynchospora glomerata* (L.) Vahl. Tufted perennial; culms 6-11 dm. long, erect, 2-3.5 mm. thick basally, triquetrous, leafy; larger leaves 5-6 mm. broad near the base of the plant; inflorescence variable, either of a number of subcapitate glomerules scattered along the upper half of the culm ("var. *glomerata*") or of a few more discretely grouped glomerules ("var. *angusta* Gale"); spikelets lanceolate, 4.5-6 mm. long, rich-dark-brown, with usually 2 fruits (less commonly 3 or 1, if with 1 then with a terminal rudimentary flower); bristles about 6, exceeding the achene and often about equaling the tubercle, somewhat dorsiventrally compressed, conspicuously retrorsely barbed; achenial body pyriform, 1.5-1.7 mm. long, the 2 sides with an abruptly raised central hump which is polished and buffy, contrasting with the dark-chestnut-brown submarginal flat portion, the margins themselves pale like the umbo; tubercle 1.3-1.8 mm. long, elongate-deltoid, much-compressed, grayish. In moist sand, frequent in e. Tex., infrequent in s.e. Tex., summer; Gulf States, n. to Del., Va., Tenn. and Ark., w. to Okla. and Tex.

7. *Rhynchospora capitellata* (Michx.) Vahl. Tufted perennial; culms 2-9 dm. long, erect, 1-2 mm. thick basally, bluntly 3-angled, leafy; larger leaves 2-3 mm. broad near the base of the plant; inflorescence of a few turbinate fascicles scattered along the upper half of the culm; spikelets lanceolate, 3.5-5 mm. long, usually with 2 fruits (less commonly 3 or 1, if with 1 then also with a terminal rudimentary flower); bristles about 6, exceeding the achene, usually about equaling the tubercle, somewhat dorsiventrally compressed, conspicuously retrorsely barbed; achenial body pyriform or obovate, basally cuneate, 1.3-1.6 mm. long, the 2 sides merely convex (the central portions paler, grading off into the darker brown submarginal zones, the margins themselves pale like the center); tubercle elongate-deltoid, 0.9-1.6 mm. long, grayish, much-compressed. Infrequent or rare in e. Tex. (Austin, Guadalupe, Henderson and Leon cos.), apparently always in acid boggy ground, summer; e. U.S. n.e. to N.S., w. to Wisc., Mo., Okla. and Tex.

8. *Rhynchospora macra* (Clarke) Small. Tufted (?) or with rhizomes about 1 mm. thick; culms 3-7 dm. long, erect, triquetrous, 1.5-2 mm. thick near the base; leaves several, the blades 2-3.5 mm. broad near the base of the plant; inflorescence primarily a large terminal turbinate-corymbose fascicle 1-3 cm. broad, 1 or 2 extremely reduced axillary fascicles also present; spikelets linear-lanceolate, 4-5 mm. long, pale brown, each with a

single fertile flower and never a higher rudimentary one; bristles 10 to 20 per achene, much-surpassing the body, conspicuously retrorsely barbed; achenial body pyriform, 1.8-2 mm. long, brown (the raised central portions of the 2 sides paler, buffy), the submarginal surfaces with very faint transverse wrinkles; tubercle elongate-deltoid, much-compressed, about 1 mm. long. Very rare in bogs in e. Tex. (Houston and Robertson cos.), summer; Ga., Fla., Miss. and Tex.

9. *Rhynchospora oligantha* Gray. Tufted perennial; culms 15-45 cm. long, erect or ascending, 0.3-0.6 mm. thick; leaves filiform-setaceous, resembling the stems; inflorescence of a lax terminal fascicle and usually a remote reduced axillary one, each fascicle with only 1 to 3 spikelets; spikelets on slender individual pedicels 3-10 mm. long, narrowly ovoid, pale-brown, 4-7 mm. long, usually with 2 fruits (1 to 3); bristles 6, in the lower half densely plumose, slightly shorter than the body; achenial body 2.3-2.6 mm. long, broadly ovate, dark-brown when mature, very turgidly biconvex, transversely wrinkled, apically pronouncedly narrowed into a definite hour-glass-shaped tubercle base; tubercle very short-conic, 0.3-0.6 mm. long. Rare in bogs in e. Tex. (Austin, Henderson, Smith and Waller cos.), spring (May-early June); N.J., Del., N.C., Ga. and Gulf States; Gr. Ant.; C.A.

10. *Rhynchospora plumosa* Ell. Tufted perennial; culms wiry, 2-4 dm. long, erect, 0.6-1.1 mm. thick basally, stramineous; leaves setaceous-filiform, wiry, numerous, often curling toward the ends; lower bracts of the fascicles elongate, wiry, like the leaves, far-surpassing the inflorescence; inflorescence compact, congested, terminal, 1-3 cm. long, about 1 cm. thick, often spikelike; spikelets pale- to dark-brown, lance-elliptic, 3-4 mm. long, usually with 1 or 2 fruits; bristles 6, densely plumose in the lower part; achenial body broadly obovate, 1.4-1.8 mm. long, brown, turgid, transversely wrinkled, not narrowed apically; tubercle short-conic, about 0.5 mm. long, brown. *R. semiplumosa* Gray. Infrequent in s.e. Tex. (Hardin, Tyler and Newton cos.), Apr.-May; coastal flats, N.C. to Tex.; Cuba.

11. *Rhynchospora filifolia* Gray. Tufted perennial; culms 3-6 dm. long, about 1 mm. thick near the base, erect, wiry; leaves mostly involute, resembling the culms; inflorescence a terminal very dense round-topped fascicle 10-15 mm. broad, plus usually one reduced fascicle in the next lowest axil; spikelets cinnamon-brown, lanceolate, 3-5 mm. long, with 3 to 10 flowers, the 2 to 6 achenes and their scales quickly falling in acropetal succession, upon maturation only 1 or 2 mature achenes present at any one time and these usually exposed by the rapid shedding of the scales; bristles 6, usually surpassing the tubercle, minutely antrorsely barbed; achenial bodies obovate, 0.9-1 mm. long, biconvex, the 2 polished smooth faces brown or the central portions paler, buffy; tubercle deltoid, grayish, compressed, acute, 0.4-0.6 mm. long. Rare in moist loam, e. Tex. (Hardin and Waller cos.), summer; coastal areas, N.J. to Tex.; Cuba.

12. *Rhynchospora fascicularis* (Michx.) Vahl. Tufted perennial; culms 5-13 dm. long, 1.5-2.5 mm. thick basally, subterete or obtusely 3-angled, leafy; leaves 1-4 mm. broad; inflorescence a crowded terminal group of 1 to 3 fascicles (about 1 cm. broad and over-topped by the setaceous bracts) plus usually 1 (rarely 2) remote similar axillary fascicles below; spikelets 3.5-5 mm. long, lanceolate, cinnamon-brown, several-flowered and -fruited, the scales caducous in acropetal succession, each falling just before maturation of its achene; bristles about 6, minutely antrorsely serrulate or barbed; achenial body nearly orbicular, biconvex, very dark-brown or fuscous except for a buffy spot in the center of each of the 2 smooth faces, 1.4-1.5 mm. long; tubercle deltoid, 0.4-0.7 mm. long, much-compressed, grayish. Infrequent in moist sand, s.e. Tex. (Aransas, Chambers and Jefferson cos.), summer; low coastal areas, Va. to Tex.; Berm.; Gr. Ant.

13. *Rhynchospora gracilentia* Gray. Tufted perennial; culms 5-9 dm. long, erect, 1-1.5 mm. thick basally, essentially terete; leaves mostly confined to the base of the plant, the blades proximally only 1-2.5 mm. broad, distally involute; inflorescence a terminal fascicle about 1 cm. broad and usually a remote slightly smaller axillary one a few cm. below; spikelets broadly lanceolate, 3-4 mm. long, cinnamon-brown, with 2 or 3 flowers, when 3 flowers present usually only the middle one or the upper 2 bearing fruit; bristles about 6, about equaling the body or tubercle, minutely antrorsely serrulate or barbed; achenial body broadly obovate or nearly orbicular, turgidly biconvex, 1.3-1.8 mm. long, smooth, dark-brown (or a central spot on each of the 2 faces slightly paler); tubercle much-compressed, whitish, 1-2 mm. long including the straplike prolongation. Infrequent in

boggy ground, e. and s.e. Tex., summer (-fall?); s.e. U.S. mainly near the coast, N.J. to Tex., less frequent inland to Tenn. and Ark.

14. *Rhynchospora Grayi* Kunth. Tufted perennial; culms 4-7 dm. long, 1.5-2 mm. thick basally, erect; leaves mostly crowded toward the base, curly, 2-4 mm. broad; inflorescence a dense terminal fascicle about 1 cm. broad and long, of essentially sessile spikelets, plus sometimes a reduced fascicle lower down; spikelets cinnamon-brown, 4-5.5 mm. long, narrowly ovoid to broadly lanceolate, of 2 to 3 flowers, but usually maturing only 1 fruit; bristles 6, minutely antrorsely serrulate; achenial body broadly obovate, 2-2.4 mm. long, 1.8-2.2 mm. broad, 1.5-1.8 mm. thick from face to face, turgid, at maturity dark-brown, each face with 25 to 30 or more horizontal rows of minute nearly isodiametric cells whose horizontal walls are only slightly more prominent than the vertical walls; tubercle conic, 0.4-0.6 mm. high, basally not wider than (but often appearing embedded in) the top of the body. Rare in moist sand, e. Tex. (Jasper and Liberty cos.), Mar.-May (earlier-flowering than most beak-rushes); lowlands near the coast, Va. to Tex.; Cuba.

15. *Rhynchospora Harveyi* W. Boott. Tufted perennial; culms 15-60 cm. long, 1-2 mm. thick near the base, erect, obtusely triquetrous, leafy; leaves 1.5-3 mm. broad; inflorescence a dense terminal fascicle about 5 mm. high and 5-10 mm. broad, of essentially sessile spikelets plus usually 1 or 2 reduced similarly dense glomerules lower down; spikelets cinnamon-brown, ovoid, 2.5-3 mm. long, usually with 2 flowers and setting 1 fruit; bristles 6, minutely antrorsely serrulate; achenial body broadly obovate, 1.5-1.8 mm. long, 1.3-1.6 mm. broad, 1-1.5 mm. thick from face to face, turgid, at maturity rich-dark-brown, each face with (14 to) 16 to 20 horizontal rows of minute nearly isodiametric cells with prominent walls; tubercle conic, 0.4-0.5 mm. long, basally no wider than (but often appearing embedded in) the top of the body. *R. Plankii* Small. Frequent to abundant in low places in open woods and prairies, e., s.e. and n.-cen. Tex., Apr.-Sept.; s.e. U.S. n. to Va., Tenn. and Mo., w. to Okla. and Tex.

16. *Rhynchospora rariflora* (Michx.) Ell. Tufted perennial; culms 3-6 dm. long, 0.6-0.9 mm. thick near the base, ascending but often flexuous, essentially terete; leaves in lower half of plant, capillary-setaceous; inflorescence of a terminal 6- to 12- (to 20-) spikeletted lax subumbelliform unit 1-3 cm. broad, the individual capillary pedicels 3-12 mm. long; spikelets narrowly ovoid, subacute, pale-cinnamon-brown, 3-4 mm. long, with 2 to 4 flowers and maturing 1 to 3 fruits; bristles 6, shorter than the achenial body, minutely antrorsely serrulate; achenial body broadly obovate, 1.1-1.4 mm. long, biconvex, pale-brown, the 2 faces with strong transverse ridges; tubercle deltoid, compressed, 0.3-0.6 mm. long. Rare in bogs or piny crayfish-land, e. and s.e. Tex. (Austin, Harris, Henderson, Orange and Waller cos.), May-June; coastal areas, N.J. to Tex.; also Tenn., Gr. Ant. and C.A.

17. *Rhynchospora inexpansa* (Michx.) Vahl. Tufted perennial; culms 5-8 dm. long, erect (or terminally drooping), wiry, 1.5-2 mm. thick near the base; leaves mostly basal, with long tough somewhat curly blades; inflorescence fairly narrow, elongate and drooping; spikelets lanceolate, brown, 4.5-6 mm. long, with 2 to 5 flowers, setting 1 to 4 fruits; bristles about 6, surpassing the tubercle, minutely antrorsely serrulate; achenial body elliptic-obovate, 2-2.2 mm. long, 0.8-1 mm. broad, much-compressed, the 2 flat faces transversely ridged; tubercle deltoid, 0.9-1.2 mm. long. Locally frequent in open pine-lands, e. and s.e. Tex. (Angelina, Hardin, Jasper, Jefferson and Liberty cos.), summer; Coastal States, Va. to Tex.; also Ark. and Okla.

18. *Rhynchospora mixta* Small. Rhizomatous perennial; culms about 1 m. long, about 2 mm. or more thick basally, leafy, erect or ascending (flexuous in the distal floriferous portion); blades 3-4 mm. broad; inflorescence decomposed, open, the terminal portion 3-4 cm. broad, very lax, of about 25 spikelets, some of the ultimate glomerules on long spreading arcuate-erect peduncles 10-15 mm. long; spikelets narrowly ovoid, 4-6 mm. long, brown, with 2 or more (rarely as many as 10) flowers, 1 (rarely as many as 10) fruit produced; bristles about 6, surpassing the tubercle, upwardly minutely barbed; achenial body narrowly obovate, 1.3-1.4 mm. long, 0.8-0.9 mm. broad, turgidly biconvex, with very numerous faint transverse lines; tubercle deltoid-attenuate, 0.4-0.9 mm. long, compressed. Rare in sandy forested areas near streams, e. Tex. (Nacogdoches Co.), summer; near the coast, N.C. to s.e. La.; Tex.

19. *Rhynchospora Elliottii* A. Dietr. Tufted perennial; culms 8-15 dm. long, 2.5-5 mm. thick basally, erect except slightly nodding distally; leaf blades 4-5 mm. wide basally,

mostly long-tapered, strictly erect and appressed; inflorescence of 2 to 5 dense compound separate portions, the terminal portion irregularly corymbiform, 2-6 cm. broad, of 150 to 300 spikelets; spikelets ovoid, rich-dark-brown, 2.5-3.2 mm. long, with 3 to 6 flowers and setting 2 to 4 fruits; bristles 6, surpassing the tubercle, minutely antrorsely serrulate, not closely appressed to the achene but slightly spreading basally and arcuate-erect; achenial body obovate, tawny-brown, 1.2-1.3 mm. long, 0.9-1.1 mm. broad, with very pronounced transverse ridges on the 2 nearly flat faces; tubercle deltoid, 0.3-0.4 mm. long. *R. schoenoides* (Ell.) Wood, an illegit. name. Frequent in moist sand in e. and s.e. Tex., summer; near the coast, N.C. to Tex. (except Fla.).

20. *Rhynchospora microcarpa* Gray. Tufted perennial; culms 5-8 dm. long, 2-3 mm. thick basally, erect; leaves mostly appressed or curly, 2-3 mm. broad basally; inflorescence in (1 or) 2 to 4 parts per culm, the terminal part irregularly corymbiform, dense, nearly erect, 2-6 cm. broad, of 100 to 200 spikelets or less commonly fewer; spikelets ovoid to narrowly ovoid, 2.5-3 mm. long, dark-rich-brown, with 3 or 4 flowers and setting 2 or 3 fruits; bristles about 6, from half as long as to as long as the body or rarely nearly equaling the tubercle, stiffly erect and mostly appressed to the body, minutely antrorsely serrulate; achenial body obovate, 1-1.2 mm. long, 0.8-1.2 mm. broad, the 2 nearly flat or very slightly convex faces with strong transverse wrinkles; tubercle deltoid, 0.2-0.5 mm. long. Rare in moist sand, s.e. Tex. (Aransas Co.), summer; near the coast, Fla. and Ga. to Tex.; Bah. I., Hisp. and Cuba.

21. *Rhynchospora perplexa* Small. Tufted perennial; culms 5-11 dm. long, 1.5-2 mm. thick basally, wiry, erect or very slightly flexuous in the floriferous region; leaf blades 1-2 mm. broad basally, mostly strongly involute; inflorescence in 1 to 3 parts per culm, the terminal part very irregularly corymbiform, 1-4 mm. broad, usually dense and with upwards of 100 to 200 spikelets; spikelets ovoid, rich-dark-brown, 2.5-3 mm. long; bristles about 6 or fewer, less than half as long as the body to which they are appressed or reduced to virtual absence; achenial body obovate, 1-1.3 mm. long, 0.9-1.2 mm. broad, tawny, the 2 nearly flat or very slightly convex faces with strong transverse wrinkles; tubercle deltoid, 0.2-0.3 mm. long. Rare in moist sand in e. and s.e. Tex. (Aransas, Hardin, Tyler and Waller cos.), late spring-summer; Coastal States, s.e. Va. to Tex.; Tenn.; Gr. Ant. Probably not specifically distinct from *R. microcarpa*.

22. *Rhynchospora caduca* Ell. Rhizomatous perennial; culms 7-13 dm. long, 2-4 mm. thick near the base, ascending but quite flexuous in the upper part; leaves 4-7 mm. broad below the middle, tapering in both directions; inflorescence of 3 to 5 parts per culm, the terminal part obovoid, irregularly corymbiform, 2-4 cm. broad, with 60 to 125 spikelets, some of the primary branches commonly elongate, erect and 1-2 cm. long; spikelets rich-dark-brown, ovoid, 4-4.5 mm. long, with 3 to 6 flowers and setting 2 to 5 fruits; bristles about 6, surpassing the tubercle and somewhat stiffly spreading away from the body basally, minutely antrorsely serrulate; achenial body obovate, 1.4-1.7 mm. long, 1.2-1.6 mm. broad, the 2 faces with strong transverse wrinkles and at least in the upper part pronouncedly convex; tubercle deltoid, 0.6-0.8 mm. long. Frequent in moist sand, s.e. Tex., less frequent in e. Tex. and very local in Burnet and Llano cos. on the Edwards Plateau, summer; Coastal States, Va. to Tex.; also Ark. and Okla.

23. *Rhynchospora globularis* (Chapm.) Small. Tufted perennial; culms (15-) 30-75 (-90) cm. long, 1-1.8 (-2.5) mm. thick near the base, basally often shortly reclining, mostly erect, leafy with the old sheaths basally becoming somewhat fibrous; blades 1.5-4 mm. broad; inflorescence in 1 to 4 parts per culm, the terminal part usually strictly erect, of several straight stiffly ascending unequal branches each topped by a corymbiform glomerule 8-15 mm. broad (broader than high) and often with stiffly erect setaceous protruding bracts; spikelets ovoid, 2.5-4 mm. long, cinnamon-brown, with 1 to 4 flowers and setting 1 to 3 fruits; bristles about 6, shorter than the body of the achene, minutely antrorsely serrulate; achenial body obovate, 1.2-1.6 mm. long, 1-1.5 mm. broad, castaneous, with 2 faces which are convex at least in the upper part and have strong transverse wrinkles; tubercle deltoid, 0.3-0.6 mm. long. *R. cymosa* of many auth., not (Willd.) Ell., *R. globularis* var. *recognita* Gale, *R. obliterated* Gale. Moist sandy soil, frequent in e. Tex., infrequent in s.e. Tex. and rare inland to n.-cen. Tex., late spring-summer; widespread in s.e. U.S., n. to N.J., Tenn. and Mo., w. to Okla. and Tex.; also Calif., W.I. and C.A.

13. PSILOCARYA TORR. BALD RUSH

An American and Australian genus of about 6 species, included by several workers in *Rhynchospora*.

1. *Psilocarya nitens* (Vahl) Wood. Said to be annual but occasionally with weak short rhizomes and often rooting from the lower nodes; culms few, erect, soft, 3-8 dm. long, 1-4 mm. thick, usually with 1 to 3 weakly exerted ascending branches in the middle part; leaves crowded in lower half of culm, with long acute ascending blades; main panicle lax, terminal on main stem, smaller panicles terminating the branches; bracts several, attached at close intervals along the panicle axis, shorter than the inflorescence; inflorescence axis about 1 cm. long, with several unequal divergent mostly naked branches bearing racemes of spikelets; spikelets 5-9 mm. long, narrowly ovoid, acute; scales numerous, spirally attached, strongly imbricate, brown, ovate, acute, all fertile; perianth absent; style branches 2; base of style becoming indurated and persistent on the achene as a low grayish tubercle almost as broad as the achene itself (but not as thick) achene plumply biconvex, *Rhynchospora*-like, strongly transversely wrinkled. Infrequent or rare in s.e. Tex. (Hardin to Aransas cos.), usually in marshy places; coastwise, Mass. to Tex.; local in n.w. Ind.

14. SCLERIA BERG.¹⁸ STONE-RUSH. NUT-RUSH

Rhizomatous perennial or rarely tufted annual monoecious herbs; upper portion of sheaths often broadly 3-winged; leaf blades well-developed; ligule usually triangular or reduced to absent; flowers unisexual, the 2 kinds usually in separate spikelets; inflorescence congested but much-reduced, of a few spikelets in a fascicle or several or a number of these borne at intervals along the upper half of the culm; 1-flowered pistillate spikelet occasionally borne apparently from the lowest (sterile) scale of the staminate spikelet; perianth absent (perhaps partially represented by the "hypogynium," see below); stamens 1 to 3; style 2- or 3-branched, basally slender to thickened, totally deciduous; achene usually borne on an indurated base (hypogynium) which usually adheres to the base of the mature achene and bears 3 to 9 tubercles or a rough crust or is extended into 3 prominent lobes; achenial body (minus hypogynium) globose or ovoid to obovoid, in texture crustaceous or bony, smooth or rough, usually whitish.

About 200 species, mostly tropical and subtropical.

1. Hypogynium obscure or absent (2)
1. Hypogynium present, well-developed (5)
 - 2(1). Achene reticulate or verrucose 4. *S. verticillata*.
 2. Achene essentially smooth (3)
 - 3(2). Inflorescence an interrupted spiciform arrangement of glomerules 1. *S. nutans*.
3. Inflorescence a single cluster at the summit of the culm (4)
 - 4(3). Achene 2 mm. long, its base 6-pored 2. *S. georgiana*.
 4. Achene 3-4 mm. long, pores absent 3. *S. Baldwinii*.
- 5(1). Hypogynium covered with a rough white crust (6)
 5. Hypogynium not so covered (7)
 - 6(5). Leaves 5-8 mm. broad; achenes 2-2.5 mm. long ... 5. *S. triglomerata*.
 6. Leaves 1-2.5 mm. broad; achenes 1-1.8 mm. long 6. *S. minor*.
 - 7(5). Achene smooth 10. *S. oligantha*.
 7. Achene rugose or reticulate (8)
 - 8(7). Hypogynium not bearing tubercles but deeply 3-lobed 11. *S. Muhlenbergii*.
8. Hypogynium bearing 3 or 6 tubercles (9)

¹⁸ Largely adapted from Earl L. Core in C. L. Lundell, Flora of Texas I: 383-392. 1967.

- 9(8). Hypogynium bearing 6 tubercles9. *S. pauciflora*.
 9. Hypogynium bearing 3 tubercles (10)
 10(9). Plants pubescent7. *S. ciliata*.
 10. Plants glabrous8. *S. Brittonii*.

1. *Scleria nutans* Kunth. Perennial; rhizome elongate, odorous; culms 15-65 cm. long, erect, 1-2 mm. thick, acutely trigonous; sheaths hirsute; blades 4-20 cm. long, 2-5 mm. broad; inflorescence interrupted, glomerate-spicate, simple, terminal, 4-12 cm. long, of 3 to 9 sessile often nutant more or less remote glomerules; spikelets 4-5 mm. long; hypogynium absent; achene 1-2 mm. long, obovoid to subglobose, obscurely trigonous, whitish, smooth, shining, basally tapered, the basal pores 9 to 12, shallow or virtually absent. *S. hirtella* of most auth., not Sw. Moist soil, e. Tex., rare (collected once in Waller Co.), spring-early summer(?); Coastal States, Ga. to Tex.; W.I., Mex. and s. to Urug. and Parag.; also trop. Afr.

2. *Scleria georgiana* Core. SLENDER NUT-RUSH. Perennial; rhizomes 2.5-5 mm. thick; culms 3-5 dm. tall, about 1 mm. thick, wiry, trigonous, glabrous; sheaths glabrous, the lower ones bladeless; blades 12-16 cm. long or more, 1-2 mm. broad, few, glabrous, linear or filiform, simulating but shorter than the stem, involute; inflorescence a single terminal fascicle of 2 to 5 spikelets; lower bract 1-8 cm. long, 1-2 mm. broad, appearing as a continuation of the culm; spikelet about 5 mm. long; bractlets glabrous, lanceolate; hypogynium absent; achene about 2 mm. long, white, smooth, usually longitudinally ridged, dull, basally triangular and 6-pored, ovoid, shorter than the scales. Moist loam, e. and s.e. Tex., spring-early summer; Coastal States, N.C. to Tex.; Cuba; Jam.; Br. Hond.; s.e. Braz.

3. *Scleria Baldwinii* (Torr.) Steud. Perennial; rhizomes horizontal, nodose, thick; culms 3-9 dm. long, about 1 mm. thick, erect, sharply trigonous, lightly channelled, smooth or slightly scabrous distally on the angles; sheaths tight, glabrous; blades 10-45 cm. long, 1-5 mm. broad, glabrous or slightly scabrous at the margins, linear, rigid, keeled (i.e., midnerve prominent), few, the lower ones reduced or absent; lower bract of the inflorescence 4-15 cm. long, 1-4 mm. broad; inflorescence a single capitate cluster 1.5-2 cm. high; bractlets ovate; spikelets 8-10 mm. long, oblong, obtuse, of many flowers; hypogynium absent; achene ovoid, dull, whitish, smooth or often longitudinally ribbed, conspicuously apiculate, 3-4 mm. long, obscurely trigonous, basally triangular and pointed, pitless, concave laterally. Incl. var. *costata* Britt. Moist soil, s.e. Tex. (Harris Co.); Coastal States, Ga. to Tex.; Cuba.

4. *Scleria verticillata* Muhl. LOW NUT-RUSH. Annual; roots capillary, fibrous, odorous; culms 1-6 dm. long, about 1 mm. thick, simple, erect, trigonous; sheaths usually pilose; blades 5-30 cm. long, 0.5-2 mm. broad, flat; inflorescence interrupted-spiciform, simple, of 2 to 8 erect glomerules, 4-15 cm. long; spikelets 2-3 mm. long, of 2 or 3 flowers, sessile; bracts 6-7 mm. long, often caudate; hypogynium absent; achenes about 1 mm. long, reticulate or verrucose, globose, obscurely trigonous, whitish, fragile, mucronate, with about 5 pores just above the attenuate trigonous base. Moist sandy soil, often along river bars, extreme n. Rio Grande Plains (Guadalupe Co.) and n.-cen. Tex., probably elsewhere, rare, July-Sept.; Ont.; much of e. U.S.; Mex.; Cuba; Venez.; Surinam; Braz.

5. *Scleria triglomerata* Michx. WHIP-GRASS. Perennial; rhizomes clustered, hard, 3-5 mm. thick; culms 4-10 dm. long, 2-4 mm. thick basally, sharply trigonous, glabrous or nearly so, somewhat roughened distally; sheaths scarcely winged, scabrous on the angles; blades 15-30 cm. long, 5-9 mm. broad, rigid, scabrous marginally, scarcely narrowed up to the abrupt apex; inflorescence of 3 to 12 spikelets, terminal or axillary, in about 3 fascicles, the lateral ones often on erect peduncles; bracts foliaceous; staminate spikelets 5-6 mm. long, of 2 to 3 flowers; hypogynium low, obscurely trigonous, covered with a white papillose crust; achene 2-3 mm. long, ovoid-subglobose, smooth, shiny, bright white, obtuse. Moist soil, e., s.e. and n.-cen. Tex., locally abundant, June-Sept.; Ont. to Mass., s. to Ia. and the Gulf States.

6. *Scleria minor* (Britt.) Stone. Perennial; rhizomes 7 mm. thick, hard, clustered; culms 3.5-6 dm. long, 1-3 mm. thick basally, erect, sharply trigonous, glabrous or nearly so, somewhat roughened toward the apex; sheaths scarcely winged, slightly scabrous

on the angles; blades 1-2.5 mm. broad, long-tapered; inflorescence few-spikeletted, terminal or axillary in about 3 fascicles, the lateral ones on long filiform peduncles; male spikelets 5-6 mm. long; hypogynium low, obscurely trigonous, covered by a white papillose crust; achenes 1-1.8 mm. long, subglobose to ovoid, smooth, shiny, whitish, obtuse. *S. triglomerata* var. *gracilis* Britt. Moist soil, e. and s.e. Tex., rare (Matagorda and Newton cos.); Coastal States, N.J. to S.C.; Tex.

7. *Scleria ciliata* Michx. Perennial; rhizomes clustered, 2-3 (-5) mm. thick; culms 2-6 dm. long, 1.2-2.5 (-4) mm. thick, sharply triangular; sheaths pubescent, especially on the angles; blades 20-45 cm. long, 2-6 mm. broad, keeled, linear, obtuse, ciliate on the margins and midrib beneath, often much-surpassing the culm; inflorescence terminal and axillary, few-spikeletted, the cluster sometimes arising on short peduncles from the lower axils; male spikelets with 3 or 4 flowers; hypogynium a narrow obtusely trigonous flange supporting 3 globose brownish entire or 2-lobed tubercles; achene 2-3 mm. long, tuberculate or verrucose-scabrous, whitish, globose, fragile, usually mucronate-apiculate. *S. Elliottii* Chapm. E., s.e. and n.-cen. Tex., frequent, Apr.-Oct.; Va. to Mo. and s. to Gulf States; W.I., Br. Hond.

8. *Scleria Brittonii* Core. Perennial; rhizomes elongate, 4-6 mm. thick; culms 2-6 dm. or more long, 1-1.5 mm. thick, rigidly erect, trigonous, glabrous or sometimes scabrous distally; sheaths glabrous; blades to 2 dm. long and 2 mm. broad, few, glabrous; lower bract foliaceous, erect, often appearing as a continuation of the culm; inflorescence terminal or often with a remote axillary cluster on a long slender ancipital peduncle, the clusters small; spikelets of 2 or 3 flowers, 5 mm. long; hypogynium with 3 entire or 2-lobed tubercles; achene 2-3 mm. long, papillose-verrucose, globose or globose-ovoid, apiculate, whitish. Moist soil in s.e. Tex., rare (collected once in Jefferson Co.), summer; Coastal States, N.C. to Tex.

9. *Scleria pauciflora* Muhl. CAROLINA WHEAT-GRASS. Rhizomatous perennial; rhizomes 3-5 mm. thick, hard, clustered; culms mostly rising singly at short intervals from the rhizome, 2-5 dm. long, 2-3 mm. thick, basally stiffly erect; blades 15-20 cm. long, 3-4 mm. broad basally, few, rigid, scabrous marginally, often folded and/or pleated; inflorescence of a few spikelets in a terminal cluster or sometimes 1 or 2 in axillary clusters, the lateral ones remote on long filiform peduncles; bracts surpassing the culm; spikelets few-flowered; hypogynium a narrow trigonous border bearing 6 globose tubercles (disposed in pairs in the var. *kansana* Fern.); achene globose, 1-2 mm. long, whitish, apiculate, transversely verrucose-papillate, the lower papillae pointed down and elongate. *S. ciliata* var. *pauciflora* (Muhl.) Kükenth. Moist sandy soil, infrequent in e. and s.e. Tex., rare in n. part of Rio Grande Plains (Wilson Co.), summer; much of e. U.S., w. to Kan., Okla. and Tex.; Cuba; Br. Hond.

10. *Scleria oligantha* Michx. Perennial; rhizome 2-5 mm. thick; culms 3-6 dm. long, 2-3 mm. thick, erect, sharply trigonous, rising adjacently along the rhizome; sheaths narrowly winged; blades 12-25 cm. long, 2-6 mm. broad, scabrous on the nerves and margins, linear, somewhat revolute on drying; inflorescence of 2 to 5 dense clusters, terminal and axillary, the lateral on long filiform peduncles, few-spikeletted, the peduncles scabrous on the angles, dilated toward the apex; hypogynium borderlike, narrow, obtusely trigonous, with 8 or 9 small hemispheric white-pulverulent tubercles; achene ovoid, 3-4 mm. long, whitish, shiny, shorter than the scales, obtusely pointed. Moist sand, e., s.e. and n.-cen. Tex., frequent, Apr.-July; D.C. to Ind. and Mo., s. to the Gulf States.

11. *Scleria Muhlenbergii* Steud. Annual with fibrous roots or perennial with very short rhizomes; culms 15-80 cm. long, 1-1.6 mm. thick, trigonous or somewhat compressed, tufted, weak and diffuse; sheaths sometimes somewhat winged; blades 15-25 cm. long, 1-4 (-8) mm. broad, flat, often with cartilaginous margins, sometimes scabrous marginally and on the nerves beneath; inflorescence terminal and axillary (the lateral ones very remote, on long setaceous-filiform compressed often recurved or drooping peduncles), loosely flowered, the clusters 1-3 cm. long; spikelets 2-4 mm. long; hypogynium deeply 3-lobed, the lobes ovate-lanceolate, subacute, appressed; achene 2 mm. long, more or less reticulate, the transverse ridges pilose, sordid-white, globose-elliptic, umbonate, the ridges somewhat spirally disposed. *S. setacea* of many auth., non Poir. Moist sand, e. Tex., infrequent, rare in n. part of Rio Grande Plains (Guadalupe Co.); N.Y. to Ind. and s. to Gulf States; W.I.; Mex.; C.A., s. to Braz. and Bol.

15. CAREX L.

SEDGE. CARIC-SEDGE

Perennials with well-developed leaves, monoecious; inflorescence of several to many more or less spikelike spikelets emerging singly from the axils of the upper leaves (herein called bracts) (in *C. leptalea* the spikelet solitary), in some species the spikelets so numerous and crowded and the bracts so reduced that the inflorescence appears headlike or spikelike; spikelets of few to many unisexual flowers arranged spirally around the axis (rarely in definite rows) either wholly staminate or pistillate or androgynous (with staminate flowers at top, pistillate below) or gynecandrous (reverse order); *staminate flowers* comprising merely 3 stamens (rarely 2) subtended by a scale; *pistillate flowers* merely a scale subtending a "perigynium" that encloses an achene; perigynium an indehiscent bag or envelope completely enclosing the achene (but not adherent to it) except at the minute apical orifice through which the stigmas protrude at anthesis, falling with the mature achene and thus a spurious outer portion of the fruit which is unique to this genus.

An enormous, technical genus occurring in moist temperate and moist cool tropical regions. *Carex* is in dire need of critical taxonomic study bolstered by cytology and by field and garden studies which might elucidate many of the problems arising from hybridization or introgression. The keys and descriptions can be used only when the material to be determined is complete with underground parts and has fully mature achenes, the latter to be examined carefully at a magnification of at least 15 diameters.

Presumably caric-sedges provide some forage for stock.

1. Lower part of style (at least a segment half as long as the achene itself) hard, texturally similar to the achene, persistent (2)
1. Lower part of style (except in most species a minute apiculus of the achene) of a different texture from the achene, soft and soon after anthesis withering and usually becoming detached (11)
- 2(1). Spikelets solitary (rarely paired), gynecandrous .. 9. *C. typhina*.
2. Spikelets 2 to 8 per culm, never gynecandrous (3)
- 3(2). Lowest spikelet with 8 to 20 perigynia (4)
3. Lowest spikelet with 25 to 130 perigynia (5)
- 4(3). Perigynia lance-subulate; leaf blades 5-10 mm. broad 1. *C. folliculata*.
4. Perigynia ovoid or narrowly ovoid; leaf blades 2-5 mm. broad 2. *C. intumescens*.
- 5(3). Perigynia with obovoid bodies 2-4 mm. long which are apically truncate or very abruptly short-conic and with sharply defined subulate beaks about 1.5 mm. long 8. *C. Frankii*.
5. Perigynia with ovoid to obovoid or lance-acuminate usually longer bodies either long-tapered or long-conic apically and not sharply differentiated from the beak (6)
- 6(5). Perigynia with 8 to 11 slender longitudinal nerves clearly visible under a lens .. 5. *C. lurida*.
6. Perigynia with 13 to 21 slender longitudinal nerves or 20 to 25 vanishingly faint ones (7)
- 7(6). Perigynia only slightly if at all acuminate, tough-membranous to tough-chartaceous, with 20 to 25 vanishingly faint nerves, ascending, the lowest spikelet with 70 to 100 of these perigynia 10. *C. hyalinolepis*.
7. Perigynia acuminate, membranous, thin but often brittle, spreading at least at maturity, with 13 to 21 slender longitudinal nerves clearly visible under a lens (8)
- 8(7). Perigynia 11-20 mm. long (9)
8. Perigynia 4-7 mm. long (10)
- 9(8). Achene about as broad as (or usually broader than) long, with very knobby angles 3. *C. gigantea*.
9. Achene longer than broad, the angles from slightly prominent to moderately knobbed 4. *C. lupulina*.

- 10(8). Lowest spikelet 15-35 mm. long, 8-12 mm. thick, with 35 to 70 perigynia; beak of perigynium about half as long as the inflated body 6. *C. hystericina*.
10. Lowest spikelet 35-50 mm. long, 12-15 mm. thick, with 65 to 130 perigynia; beak of perigynium almost as long as the very slightly inflated body 7. *C. comosa*.
- 11(1). Spikelets solitary per culm 45. *C. leptalea*.
11. Spikelets 2 to numerous per culm (12)
- 12(11). Spikelets numerous (more than 15) per culm (13)
12. Spikelets 2 to 15 per culm (15)
- 13(12). Perigynial body 1-1.5 mm. long, the beak 0.3-0.5 mm. long 48. *C. decomposita*.
13. Perigynial body 2-3 mm. long, the beak 2-4 mm. long (14)
- 14(13). Perigynial body triangular in transection, inflated in the lower part, the beak 3-4 mm. long; each of the numerous spikelets with fewer than 8 perigynia 46. *C. crus-corvi*.
14. Perigynial body plano-convex, scarcely inflated, the beak 2-3 mm. long; each spikelet with 8 to 15 perigynia 47. *C. stipata*.
- 15(12). Terminal spikelet gynecandrous (i.e., the upper part bearing pistillate flowers, the lower part staminate ones) (see also *C. debilis*) (16)
15. Terminal spikelet staminate or less commonly androgynous (28)
- 16(15). Stigmas 3 and achenes triangular; perigynia only slightly if at all flattened and lacking winglike margins (17)
16. Stigmas 2 and achenes lenticular; perigynia flattened and often with winglike margins (21)
- 17(16). Terminal spikelet 20-50 mm. long; apiculus of the achene straight (18)
17. Terminal spikelet only 7-13 mm. long; apiculus of the achene bent (19)
- 18(17). Lowest spikelet with 12 to 20 ovoid perigynia each 4-6 mm. long and with 9 to 12 slender longitudinal nerves 26. *C. Davisii*.
18. Lowest spikelet with 20 to 44 fusiform-ellipsoid perigynia each 3.5-4 mm. long and with 6 to 8 slender longitudinal nerves 27. *C. oxylepis*.
- 19(17). Spikelet usually 2 per culm, the lower ones 7-10 mm. thick; scales of the lower part of the ovoid pistillate portion of the terminal spikelet strongly cuspidate, 4-5 mm. long, longer than the perigynia even at their maturity; perigynia 3-5 mm. long 28. *C. Bushii*.
19. Spikelets usually 3, less commonly 4 per culm, the lower ones 4-6 mm. thick; scales of lower part of the ovoid-cylindric to cylindric pistillate portion of the terminal spikelet 1.5-3 mm. long, shorter than to about as long as the mature perigynia; perigynia 1.8-2.8 mm. long (20)
- 20(19). Perigynia in transection flattened-triangular to unequally biconvex, 2.3-2.8 mm. long, ascending 29. *C. complanata*.
20. Perigynia in transection nearly round, 1.8-2.3 mm. long, spreading 30. *C. caroliniana*.
- 21(16). Perigynia sharp-edged but not wing-margined (almost as broad as long); usually only the terminal spikelet gynecandrous, the rest wholly pistillate 53. *C. atlantica*.
21. Perigynia wing-margined (variously shaped but if the wings narrow then the perigynia much narrower than long); usually the subterminal as well as the terminal spikelets gynecandrous (22)
- 22(21). Perigynia including wings 1-1.5 mm. broad 60. *C. tribuloides*.
22. Perigynia including wings 1.6-4.5 mm. broad (23)
- 23(22). Larger perigynia including beaks 5.5-8.5 mm. long (24)
23. Larger perigynia including beaks 2.8-5.5 mm. long (25)

- 24(23). Larger perigynia including wings 2.5-3.2 mm. broad 54. *C. hyalina*.
24. Larger perigynia including wings 3.7-6 mm. broad ... 55. *C. Brittoniana*.
- 25(23). Perigynial beak 1-1.7 mm. long, the venter (adaxial surface) of the perigynium (at maturity!) subcoriaceous, shiny and nearly veinless; spikelets nearly globose 56. *C. reniformis*.
25. Perigynial beak usually about 1 mm. long or shorter, if longer then the perigynium venter (at maturity) membranous and/or more or less veiny; spikelets ovoid to narrowly ovoid (26)
- 26(25). Perigynial body including wings 3.1-3.5 mm. broad 57. *C. alata*.
26. Perigynial body including wings 1.6-2.5 mm. broad (27)
- 27(26). Inflorescence 6-10 mm. thick; spikelets ovoid, each with 30 to 50 perigynia which are 2.8-3.2 (-3.5) mm. long and 1.6-2.2 mm. broad 58. *C. albolutescens*.
27. Inflorescence 12-15 mm. thick; spikelets narrowly ovoid, each with 55 to 80 perigynia which are (3-) 3.5-4.2 (-4.5) mm. long and 1.7-2.5 mm. broad 59. *C. Longii*.
- 28(15). Stigmas 2; achenes lenticular (29)
28. Stigmas 3; achenes triangular or vaguely so (37)
- 29(28). Terminal spikelet strictly staminate and lowest spikelet strictly pistillate, often with androgynous spikelets at intermediate levels (30)
29. Spikelets all about equally androgynous (33)
- 30(29). Lower pistillate spikelets about 1 cm. long 36. *C. aurea*.
30. Lower pistillate spikelets 2-10 cm. long (31)
- 31(30). Pistillate scales with oblong bodies and long spreading cusps surpassing the perigynia; most of the spikelets nodding 35. *C. crinita*.
31. Pistillate scales oblong, shorter than the perigynia; most of the spikelets ascending or erect (32)
- 32(31). Juncture of sheath and blade flat or slightly arcuate 33. *C. Emoryi*.
32. Juncture of sheath and blade inverted V-shaped 34. *C. stricta*.
- 33(29). Bodies of mature perigynia (not including beaks) 3-4 mm. long, thin-coriaceous; mountains of Trans-Pecos Texas 61. *C. praegracilis*.
33. Bodies of mature perigynia 1.5-3 mm. long, firm-membranous (sometimes spongy-coriaceous and discolored in the proximal part); not in Trans-Pecos Texas (34)
- 34(33). Inflorescence interrupted-spiciform, 35-80 mm. long, with 10 to 15 spikelets; sheath venters transversely wrinkled 49. *C. vulpinoidea*.
34. Inflorescence headlike to interrupted-spiciform, 10-40 mm. long, with 3 to 10 spikelets; sheath venters not transversely wrinkled except in genetically contaminated plants (35)
- 35(34). Perigynia spreading or at full maturity even slightly reflexed, brown and taking on a spongy-coriaceous texture in the proximal half .52. *C. retroflexa*.
35. Perigynia mostly ascending even at maturity and either not discolored and spongy or else becoming so only in the basal fifth to third the length (36)
- 36(35). Inflorescence an ovoid essentially bractless head 10-15 (-17) mm. long and 4-9 mm. thick 51. *C. cephalophora*.
36. Inflorescence elongate-ovoid to ovoid-oblong or linear-oblong, 20-40 mm. long, 10-15 mm. thick, with bracts 1-3 (-20) cm. long 50. *C. Muhlenbergii*.
- 37(28). Culms only 0.2-0.3 mm. thick even toward the base, wiry; Guadalupe Mountains in Trans-Pecos Texas 40. *C. eburnea*.
37. Culms 0.5-4 mm. thick OR if as thin as 0.3 mm. then not occurring in Trans-Pecos Texas (38)

- 38(37). Nerves of perigynia bearing a series of fuzzy warts (Trans-Pecos Texas)
 37. *C. muriculata*.
38. Perigynia not warty (39)
- 39(38). Achenes apically blunt, not apiculate but jointed with the style which is slightly enlarged at the base 44. *C. Willdenovii*.
39. Achenes either apiculate or if the apiculus is extremely small then the sides of the achene convex (40)
- 40(39). The 3 sides of the achene strongly convex; culms 1-30 cm. long, 0.3-0.6 mm. thick (41)
40. The sides of the achene nearly flat or concave; culms 4-120 cm. long, 0.5-4 mm. thick (43)
- 41(40). Perigynia about 3.3 mm. long 42. *C. nigromarginata*.
41. Perigynia 2.5-3 mm. long (42)
- 42(41). Culms 1-17 cm. long, usually much-surpassed by basally clustered bracts from which the lower pistillate spikelets emerge on capillary-flexuous peduncles 6-32 mm. long 41. *C. microrhyncha*.
42. Culms 15-30 cm. long, usually surpassing the leaves and bracts; lower pistillate spikes nearly sessile and borne high, only 3-10 mm. apart on the culm
 43. *C. physorhyncha*.
- 43(40). Bracts of lowest spikelet sheathless or with sheath only 1 mm. long or less (44)
43. Bracts of lowest spikelets with definite sheaths (48)
- 44(43). Lowest spikelet only 4-18 mm. long (45)
44. Lowest spikelet 20-50 mm. long (46)
- 45(44). Perigynia 3-4 mm. long, 3 to 14 per spikelet; flowering culms almost all with the lower pistillate spikelet(s) widely separated from the staminate spikelet, appearing to emerge severally on long peduncles from the basal clusters of leaves and bracts 38. *C. planostachys*.
45. Perigynia about 4.5 mm. long, 15 to 20 per spikelet; pistillate spikelets all sessile and subterminal 39. *C. tenax*.
- 46(44). Perigynia densely hirsutulous 12. *C. lanuginosa*.
46. Perigynia glabrous (47)
- 47(46). Perigynia 4-5 mm. long, with 11 to 14 nerves (2 stronger than the rest), spreading 31. *C. Joorii*.
47. Perigynia 3-4 mm. long, with 4 or 5 weak nerves, ascending
 32. *C. glaucescens*.
- 48(43). Perigynia with 6 to 10 nerves, 5-7 mm. long 11. *C. cherokeensis*.
48. Perigynia with 12 to 67 nerves, 2-9 mm. long (49)
- 49(48). Perigynia 6-9 mm. long 25. *C. debilis*.
49. Perigynia 2-5.5 mm. long (50)
- 50(49). Perigynia with 42 to 67 nerves (51)
50. Perigynia with 12 to 40 nerves (53)
- 51(50). Cauline blades 4-10 mm. broad; lower spikelet 12-50 mm. long, with 8 to 32 perigynia 18. *C. flaccosperma*.
51. Cauline blades 1.5-3.5 (-4.5) mm. broad; lower spikelet 5-13 (-20) mm. long, with 3 to 8 (to 10) perigynia (52)
- 52(51). Lower spikelet 5-10 mm. long; perigynia obovoid-ellipsoid, obtusely triangular, slightly inflated basally, apically pyramidal with an apical angle of 65°-85°
 16. *C. oligocarpa*.
52. Lower spikelet 8-13 (-20) mm. long; perigynia turgidly to slenderly obovoid, in transection nearly round (when fresh!), inflated (when fresh!), apically broadly rounded, very obtuse 17. *C. amphibola*.

- 53(50). Lowest pistillate spikelet(s) widely separated from the staminate ones, peduncled and appearing to emerge severally from the basal clusters of leaves (and bracts)38. *C. planostachys*.
53. Lower pistillate spikelet emerging from sheaths of cauline bracts (54)
- 54(53). Perigynia 2-2.5 mm. long, with about 12 nerves ..14. *C. granularis*.
54. Perigynia 2.5-5.5 mm. long, with 14 to 40 nerves (55)
- 55(54). Perigynia 2 to 3 times as long as broad, 3.5-5 mm. long (56)
55. Perigynia 1 to 1.7 times as long as broad, 2.5-4 mm. long (58)
- 56(55). Upper 2 or 3 spikelets including the very inconspicuous staminate one sessile and closely set, mostly overlapping, usually exceeded by the bract at the base of the terminal inflorescence24. *C. crebriflora*.
56. The peduncled pistillate spikelets remote from the terminal staminate one (57)
- 57(56). Leaves firm, pale, those of the rosettelike sterile tufts 7-25 mm. broad, those of the fertile culms 2-7 mm. broad; basal leaves of fertile culms reduced
.....22. *C. striatula*.
57. Leaves flaccid, deep green, those of the elongate sterile shoots 2-15 mm. broad, those of the fertile culms 2.5-3.5 mm. broad; basal leaves of fertile culms well-developed, with blades 3-7 mm. broad23. *C. styloflexa*.
- 58(55). Plants with elongate creeping rhizomes; perigynia with 13 to 23 nerves (59)
58. Plants only tufted; perigynia with 22 to 37 nerves (60)
- 59(58). Perigynia basally rounded or short-tapered, reddish-brown (as are also the scales), apically with a short minutely bidentate beak
.....13. *C. microdonta*.
59. Perigynia basally tapering, stramineous to yellowish, apically with a minute more or less strongly bidentate beak with a nearly entire orifice; perigynial scales often with conspicuous dark-purple submedian stripes15. *C. Mearnsii*.
- 60(58). Perigynia rather sharply triangular, apically scarcely beaklike; orifice often excentric19. *C. digitalis*.
60. Perigynia obtusely triangular, apically with a minute but definite beak with a right-angle bend (61)
- 61(60). Culms 0.8-1.5 mm. thick; staminate spikelet 2-3 mm. thick; upper 1 or 2 pistillate spikelets usually close to each other and to the staminate spikelet, often overlapping and nearly sessile; lower pistillate spikelet 4-6 mm. thick
.....20. *C. blanda*.
61. Culms 0.7-1 mm. thick; staminate spikelet 1-1.5 mm. thick; upper 1 or 2 pistillate spikelets usually well-separated (rarely upper 1 overlapping the staminate spikelet); lower pistillate spikelet 2-3 mm. thick21. *C. gracilescens*.

1. *Carex folliculata* L. var. *australis* Bailey. Tufted perennial; culms 4-8 dm. long, 2-4 mm. thick basally, erect; basal sheaths whitish, nodulose; blades 5-10 mm. broad; spikelets 3 or 4 per culm, remote except for sometimes the 2 upper ones; the uppermost spikelet staminate, 2-4 cm. long, 2-3 mm. thick, stramineous; next lowest spikelet pistillate (or with a very short terminal staminate portion), nearly sessile; lower spikelets progressively longer-peduncled and all pistillate, erect; lowest spikelet 15-27 mm. long, 15-23 mm. broad, with 12 to 20 spreading perigynia (internodes of rachis about 1 mm. long), the lance-acuminate scales hyaline-stramineous and 5-7 mm. long; bracts leaflike, that of the lowest spikelet 15-25 cm. long including the sheath; higher bracts progressively reduced; perigynia lance-subulate, not at all acuminate, nearly round in transection, 11-14 mm. long, greenish (drying stramineous), membranous, with 15 to 25 strong nerves narrower than the internerve spaces, inflated; achene rounded-triangular with concave sides, continuous with the long persistent slender style which basally has much the same porcelaneous texture as the achene itself. *C. lonchocarpa* Willd. Infrequent or rare in e. Tex. (Hardin, Jasper, Newton and Tyler cos.), in moist sand or mud, Apr.-May, rarely as late as June, a few perigynia persistent into July; Coastal States, Va. to Tex.

2. *Carex intumescens* Rudge. Tufted perennial; culms 3-7 dm. long, basally 1.5-3 mm. thick, erect; basal sheaths reddish-brown; blades 2-5 mm. broad; spikelets 2 to 4 per culm, clustered or remote; terminal spikelet staminate, 2-5 cm. long, 2-3 mm. thick, brownish; the remaining spikelets pistillate, ascending, 13-22 mm. long, 14-25 mm. broad, with 8 to 15 close spreading perigynia, the narrowly ovate scales acute and only about half as long as their perigynia; bracts sheathing, foliaceous, surpassing the inflorescence; perigynia 11-16 mm. long, the body three-fourths to five-sixths the total length, ovoid to narrowly so, olivaceous, crusty-membranous, much-inflated, with 14 to 19 slender nerves, basally rounded, apically tapered and passing gradually into the proportionally short bidentate beak; achene longer than thick, triangular, the angles not prominent and totally knobless, passing into the slender often looped style (the lower persistent part of which texturally resembles the achene). Frequent in moist areas, e. and s.e. Tex., Apr.-June; s.e. Can. and e. U.S. w. to Minn., Ia., Mo., Ark. and Tex.

3. *Carex gigantea* Rudge. Loosely tufted perennial with creeping scaly rhizomes 1.5-3 mm. thick; culms 35-80 cm. long; basal sheaths brownish to stramineous; blades 4-12 mm. broad; spikelets 3 or 4 (rarely 5) per culm, usually all but the lowermost overlapping; terminal spikelet staminate, 3-6 cm. long, 2-4 mm. thick; the remaining spikelets pistillate, cylindrical, the lowest 3-5 cm. long, 14-22 mm. thick (including beaks), with 30 to 65 close spreading perigynia, the lanceolate scales acute or acuminate and about half to three fourths as long as the perigynia; bracts sheathing, foliaceous, that of the lowest spikelet far-exceeding the inflorescence; perigynia 12-15 mm. long, the body about three-eighths the total length, ovoid, crusty-membranous, inflated, olive-stramineous, with 14 to 17 slender nerves, basally rounded, apically acuminate and passing into the long subulate bidentate beak; achene about as broad as or usually broader than long, rhombic-triangular with very prominent angles each with a pronounced knob near the middle, apically continuous with the violently looped style whose persistent lower part texturally resembles the achene. Rare in moist places, e. and s.e. Tex. (Harris and Polk cos.), May-July; lowlands of s.e. U.S. n. to Del., Ky., Ind., Mo. and Okla.

4. *Carex lupulina* Muhl. Perennial, usually very loosely tufted and with creeping rhizomes 1-3 mm. thick; culms 3-10 dm. long, erect, basally 1.5-10 mm. thick, the lower sheaths brownish, occasionally with a slight rosy hue; blades 3-12 mm. broad; spikelets 3 to 6 per culm, either clustered and overlapping or the lower remote, occasionally all rather remote and the lower ones long-peduncled; upper spikelet (rarely upper 2) staminate, 3-8 cm. long, 2-4 mm. thick, brownish; lower spikelets pistillate, usually cylindrical, less commonly oblong or ellipsoid-oblong, often slightly nodding terminally, 2-5 cm. long, 15-24 mm. thick, the lowest with 25 to 80 close ascending or somewhat spreading perigynia; scales mostly hyaline-translucent, broadly lanceolate, acute, often mucronate, less commonly with an awn about 2 mm. long, the whole only about half to two thirds as long as the perigynia; bracts sheathing, foliaceous, that of the lowest spikelet commonly far-surpassing the inflorescence; perigynia 11-20 mm. long, the body about half to five-eighths the total length, broadly ovoid, stramineous to olivaceous, crusty-membranous, with 14 to 21 slender nerves, inflated, basally rounded, apically acuminate and passing gradually into the long slender bidentate beak; achene longer than broad, triangular with more or less pronounced angles (making the sides seem concave) and with more or less of a process or knob on each angle (very indistinct in some plants), apically continuous with the violently looped style whose lower persistent part texturally resembles the achene. *C. lupuliformis* Sartw., *C. louisianica* Bailey. Frequent in moist soil, e. and s.e. Tex., Apr.-May, occasionally into early summer; N.S., Que. and Ont., e. U.S. w. to Minn., Ia., Mo., Okla. and Tex.

The form called *C. louisianica* has few, spreading perigynia per spikelet and these are proportionately short-beaked (i.e., the inflated body is proportionally longer) and the achenes are scarcely knobby; these seem to show introgressive influence on *C. lupulina* by *C. intumescens*. The form called *C. lupuliformis* has proportionately longer-beaked, more spreading perigynia, with blunter scales and very knobby achenes; these plants seem to show the introgressive influence on *C. lupulina* by *C. gigantea*. Plants are also found which show relatively short, narrow perigynia, and long-aristate pistillate scales; these seem to be hybrids of *C. lupulina* and *C. lurida*.

5. *Carex lurida* Wahl. Tufted perennial with very short rhizomes; culms 3-10 dm. long, 1.5-6.5 mm. thick, erect, leafy; basal sheaths brown (occasionally faintly reddish); blades

4-10 mm. broad; spikelets 3 to 5, mostly overlapping or occasionally the lower 1 or 2 slightly removed; terminal spikelet staminate, erect, 3-6 cm. long, 1-2 mm. thick; rest of spikelets pistillate, nearly sessile (or the lower occasionally on flexuous peduncles to 19 cm. long), often arcuate-nodding, the lowest 25-40 (-60) mm. long, 14-18 (-20) mm. thick including beaks, with 50 to 80 (to 110) close somewhat ascending perigynia, the scales about as long as the bodies of the perigynia and subulate or awnlike in their distal part; bracts foliaceous, sheathing, the blade of the lowest one much-surpassing the entire inflorescence; perigynia ampule-shaped, 7-11 mm. long, the bodies ovoid or obovoid, 2.3 mm. thick, 4-6 mm. long, inflated, membranous, olive-green, drying to olive-brown or olive-stramineous, with 8 to 11 nerves (2 slightly stronger than the rest) much narrower than the internerve spaces, basally tapered and shortly rounded, apically tapered or long-conic and passing gradually into the linear-subulate bidentate beak; achene triangular, continuous with the sinuous-flexuous persistent style the lower half of which is texturally similar to the achene. Frequent in moist sand and mud, e. Tex., May-June; e. temp. N.A. w. to Minn., Mo., Okla. and Tex.; also Ver.

6. *Carex hystericina* Muhl. PORCUPINE CARIC-SEDGE, BOTTLE-BRUSH CARIC-SEDGE. Perennial with rhizomes 1.5-2.5 mm. thick and several cm. long; culms tufted at intervals along the rhizome, 2-8 dm. long, 1-3.5 mm. thick, erect; lower sheaths stramineous, rarely with a reddish-tinge; blades 2.5-9 mm. broad; spikelets 3 to 4 (to 6) per culm, mostly overlapping or the lower one or 2 somewhat remote; uppermost spikelet staminate (rarely androgynous), 15-35 mm. long, 3-4 mm. thick, stramineous; lower spikelets pistillate (some upper ones infrequently androgynous), bristly, the lowest one erect or nodding slightly, 15-35 mm. long, 8-12 mm. thick, with 35 to 70 close spreading (at maturity) perigynia, the stramineous scales almost as long as the perigynia and with ovate hyaline bodies and long subulate cusps or awns; bracts sheathless, the blades of the lowest one often surpassing the terminal spikelets, the higher ones progressively much-reduced; perigynia lance-acuminate, in transection nearly round or (when immature or pressed) dorsiventrally flattened, 4-7 mm. long, stramineous-membranous, with 2 nerves or weak ribs and 11 to 14 fine nerves much narrower than the spaces between them, basally narrowly rounded, acuminate into a slender strongly bidentate beak about half as long as the inflated body; achene triangular, the sides concave in lower part, continuous with the long persistent slender style which basally has much the same porcelaneous texture as the achene itself. Locally abundant in calcareous mud of stream-beds in the mts. of the Trans-Pecos, rare e. to the Plains Country and Edwards Plateau, summer; s. Can. and n. U.S. s. to Va., Ky., Okla., Coah., Ariz. and Calif.

Sometimes incorrectly spelled "hystericina."

7. *Carex comosa* Boott. Mat-forming perennial with short branching rhizomes; culms 5-13 dm. long, erect, 3-10 mm. thick basally; lower sheaths brownish-stramineous; blades 6-12 mm. broad; spikelets 4 or 5 per culm, overlapping for most of their lengths; uppermost spikelet staminate, 25-50 mm. long, 3-5 mm. thick, brownish-stramineous; lower spikelets pistillate, nearly horizontal by virtue of a sharp bend at the top of each peduncle, bristly, the lowest one 35-50 mm. long, 12-15 mm. thick, with 65 to 130 spreading or even slightly deflexed close perigynia; bracts sheathless, the lowest one with a blade far-surpassing the inflorescence, the rest progressively reduced; perigynia lance-acuminate, in transection vaguely triangular or somewhat dorsiventrally flattened, 4-7 mm. long, stramineous, firm-membranous, with 2 ribs and 14 or 15 prominent nerves slightly narrower than the spaces between, basally narrowly rounded, acuminate into a slender beak almost as long as the very slightly inflated body and with 2 terminal arcuate-divaricate teeth; achene triangular, apically continuous with the long slender persistent style which proximally has much the same porcelaneous texture as the achene itself. Rare in lakes in e. Tex. (Wood Co.), Apr.-June; otherwise s.e. Can. and e. U.S. w. to Minn., Neb., Mo. and Tex.; also Ida., Wash., Ore. and Calif.

8. *Carex Frankii* Kunth. Perennial with extensively creeping rhizomes 1-2 mm. thick; culms 2-7 dm. long, 1.5-5 mm. thick basally; basal sheaths brownish, rarely rosy; blades 4-11 mm. broad; inflorescence of 4 to 6 ascending spikelets; terminal (often exceedingly inconspicuous) spikelet staminate, 3-50 mm. long, 1.5-5 mm. thick, stramineous or brown; the remaining spikelets pistillate, the upper ones overlapping and short-peduncled but the lowest commonly remote with a peduncle to 15 cm. long, 1-4 cm. long, 8-15 mm. thick, bristly, with 25 to 130 very close spreading perigynia and scales as long as or longer than

the perigynia with the distal part being a wiry awn or bristle; bracts sheathing, foliaceous, the blade of the lowest one commonly far-exceeding the inflorescence, the higher ones progressively reduced; perigynia 3.5-5.5 mm. long, with obovoid bodies 2-4 mm. long, olivaceous, inflated, membranous, with 10 to 15 nerves much more slender than the internerve spaces, basally tapered and narrowly rounded, apically abruptly short-conic and well-differentiated from the subulate beak (about 1.5 mm. long) and with a strongly bidentate orifice; achenes triangular, 1.5-2.2 mm. long, continuous with the persistent very slender usually straight style which in its lower half has much the same texture as the achene. Frequent in moist sand in e. and s.e. Tex., infrequent in n.-cen. Tex., rare in the Trans-Pecos (Franklin and Davis Mts.), in seeps and springs, Apr.-June (to July in Trans-Pecos); s.e. U.S. n. to N.Y., Ill. and Kan.; also Coah. and parts of s. S.A.

The Trans-Pecos and Coahuilan specimens differ from the others in being more robust, with very broad blades and very large spikelets with prominent staminate spikelets, in all measurement near the maxima given above.

9. *Carex typhina* Michx. Perennial; rhizomes black, scaly, 2-5 mm. thick, 1-4 cm. long between culm-tufts; culms 3-8 dm. long, 1.5-4 mm. thick basally; lower sheaths brown; blades 3-7 mm. broad; spikelets solitary (rarely geminate), terminal, gynecandrous, 3-4 cm. long, 12-15 mm. thick including the beaks, with a cylindric (slightly ovoid) terminal pistillate portion of 60 to 110 closely packed spreading perigynia, basally abruptly acuminate to the inconspicuous staminate portion; pistillate scales narrowly obovate to oblanceolate, apically acute but not mucronate, laterally hyaline; bract sheathless, the blade surpassing the spikelet; perigynia about 6 mm. long, the obovoid bodies 4-5 mm. long, inflated, brownish, brittle-membranous, shiny, with 2 faint nerves distally, basally narrowed and shortly rounded, apically abruptly short-conic to the subulate or linear bidentate spreading or usually very slightly ascending beak; achene triangular, occupying only a small portion of the perigynium, apically acute, continuous with the persistent slender abruptly sinuous style whose proximal part is texturally like the achene. *C. squarrosa* L. var. *typhina* (Michx.) Nutt. Rare in wet sandy loam, forests of e. Tex. (Harrison and Shelby cos.), July-Sept.; Que. and n.e. U.S. s. to S.C., Ky. and La., w. to Wisc., Ia., Mo. and Tex. May not be specifically distinct from *C. squarrosa*.

10. *Carex hyalinolepis* Steud. Perennial with extensively creeping rhizomes 2-5 mm. thick; culms single at the nodes of the rhizome, 4-8 dm. long, 5-8 mm. thick basally; leaves mostly crowded toward the base; basal sheaths yellowish-stramineous; blades 4-13 mm. broad, tough, with noxious serrulate edges; spikelets 4 to 6 (to 8) per culm, the upper 1 to 3 staminate and sessile, the lower 1 to 4 short-peduncled, erect and pistillate, often with an androgynous spikelet at an intermediate level; terminal spikelet 3-6 cm. long, 3-6 mm. thick; lowest pistillate spikelet 3-8 cm. long, 11-15 mm. thick, with 70 to 100 ascending perigynia (overlapping closely except occasionally the lowest 2 or 3), the scales much shorter than their perigynia; bracts foliaceous, short-sheathing, that of the lowest commonly surpassing the entire inflorescence, the higher ones progressively reduced; perigynia 6-9 mm. long, ampulelike or very narrowly ovate, in transection elliptic, stramineous-brown to olive-brown, tough-membranous, eventually becoming tough-chartaceous, with 20 to 25 very faint (vanishing in some specimens) nerves much narrower than the spaces between them, slightly inflated, basally rounded, in the upper half slightly acuminate to a scarcely beaklike firm bidentate apex; achene triangular, continuous with the basally curved style which basally has the same porcelaneous texture as the achene. Infrequent to rare in wet black clay in s.e. (Brazoria and Colorado cos.), e. (Bowie and Gonzales cos.) and n.-cen. (Dallas and Tarrant cos.) Tex., Apr.-May; Ont. and e. U.S. w. to Mich., Neb., Kan., Okla. and Tex.

11. *Carex cherokeensis* Schwein. Perennial forming dense auxoclones to 1 m. across, the short tough rooty black rhizomes 3-12 mm. thick (thickest of any of our caric-sedges); culms 30-75 cm. long, 1-2 mm. thick, ascending; leaves mostly crowded at the base, 2-6 mm. broad, chartaceous, pale-green, sometimes folded and often medially keeled abaxially, the sheaths dark castaneous-buffy; spikelets usually 4 to 7 per culm (but when subterminal ones are whorled, up to 12 spikelets per culm); terminal spikelet (less commonly two) staminate (occasionally compound basally), the subterminal ones either androgynous or pistillate and nearly sessile or on flexuous peduncles to 3 cm. long, the lowest ones usually all pistillate and nodding on flexuous peduncles to 1 dm. long; staminate portions 2-3 mm. thick, with stramineous-hyaline scales; lower pistillate spike-

lets 2-4 cm. long, 6-10 mm. thick, with 30 to 60 spreading-ascending crowded perigynia, the stramineous-hyaline scales lance-ovate and shorter than the perigynia; lower bract foliaceous, long-sheathing, the blade 1.5-5 mm. broad and 15-30 cm. long (but never attaining the pistillate spikelet), the higher ones progressively reduced; perigynia lance-ovoid, in transection from unequally biconvex to obscurely triangular, 5-7 mm. long, stramineous, membranous (eventually thin-chartaceous), inflated, with 2 strong nerves and 4 to 8 weaker ones, basally narrowly rounded, apically tapered and passing into the tubular beak (about 1 mm. long) and with a very strongly bidentate hyaline orifice; achene triangular with concave sides, apiculate, jointed with the style which entirely withers after anthesis. Abundant in sandy loam in woodlands, e., s.e. and n.-cen. Tex., spring; Gulf States plus Ga., Okla., Ark. and Mo.

12. *Carex lanuginosa* Michx. Perennial with branching rhizomes about 1.5 mm. thick and several cm. long (often broken off in prepared specimens); culms 3-6 dm. long, strictly erect, simple, in slender clumps, 2-4 mm. thick basally; blades 3-4 mm. broad, the sheath-orifices U-shaped, brownish-discolored and thickened; sheaths ventrally pale-brownish, basally with transverse septation between the nerves; spikelets about 3 or 4, sessile or on very short peduncles, the upper 2 usually overlapping slightly, the upper one or 2 completely or almost completely staminate or with a few female flowers at the very base; female spikelet 25-30 mm. long, 5-7 mm. thick, with 30 to 60 spreading-ascending spikelets; scales lanceolate, hyaline with green midrib, the body 1.5-2 mm. long and with a subulate mucro about 1 mm. long; bract of lowest spikelet not sheathing, its blade about 2 mm. broad and equaling or exceeding the staminate spikelet; perigynial body broadly ellipsoid, brown, firm-membranous, slightly inflated, about 2.5 mm. long, densely hirsutulous as seen under a lens (the nervature obscured), the beak about 1 mm. long and strongly bidentate apically; achene triangular with concave sides, 1.7-2 mm. long, sessile, short-apiculate, jointed with the very short straight style which entirely withers after anthesis. Sloughs of river bottoms, Panhandle of Plains Country (Hemphill Co.), rare, late spring-early summer; most of temp. N.A.

13. *Carex microdonta* T. & H. Perennial; rhizomes 2-15 cm. long, 1 mm. thick, brown; culms rising singly or in small tufts from the rhizomes, 9-50 cm. long, 0.7-1.1 mm. thick; leaves mostly crowded at the base, the basal sheaths brown; blades 2-7 mm. broad, shorter than the culm, shortly tapered apically; spikelets 3 to 5 per culm, the terminal one staminate (rarely androgynous), usually with the sessile staminate or androgynous second spikelet attached near its base and overlapping it; rest of spikelets usually more remote, erect, on pedicels 2-10 cm. long and nearly all pistillate (the upper one occasionally with a few terminal staminate flowers); staminate spikelets prominent, 2-5 cm. long, 4-8 mm. thick, often with prominent subsistent anthers, greenish or brownish, the narrowly obovate scales 3-8 mm. long and brownish to reddish-brown and hyaline with 3 prominent green midnerves; pistillate spikelets 1-5 cm. long, 5-6 mm. thick, with 20 to 40 close spreading perigynia, the ovate scales acuminate and half as long as the perigynia, reddish-brown with hyaline margins and prominent 3-nerved median; perigynia ovoid to narrowly ovoid, 2.6-3.6 mm. long (including beak), reddish-brown, firm-membranous, with 2 ribs and 12 to 15 less prominent nerves, rather closely investing the achene except at the rounded or very shortly tapered base and the conical apex which abruptly passes into the tubular beak (0.5-0.7 mm. long with a minutely 2-toothed apex); achene triangular with concave sides, bent-apiculate, jointed with the style which entirely withers after anthesis. Frequent in moist open places, usually calcareous areas, n.-cen. and s.e. Tex., Edwards Plateau, infrequent in e. Tex., rare in the Trans-Pecos, Mar.-May (June-Aug. in Trans-Pecos); Miss., La., Tex., Okla. and Mo.

14. *Carex granularis* Muhl. Tufted perennial; culms 18-55 cm. long, 0.5-1.1 mm. thick, erect, leafy; basal sheaths brown; cauline blades 2-4 mm. broad, olive-green, membranous, erect, long-tapered; spikelets 4 or 5 per culm, the upper 2 or 3 usually essentially sessile and approximate, the rest remote and on slender peduncles; terminal spikelet staminate, 15-25 (-35) mm. long, about 1 mm. thick, the ovate scales awned to cuspidate or acuminate, closely appressed and brownish; rest of spikelets pistillate, 5-20 mm. long, 3.5-5 mm. thick, with 10 to 40 close widely spreading perigynia, the ovate scales little over half as long as the perigynia; bracts foliaceous, with definite sheaths, the lower bracts (of fourth or fifth spikelet) often equaling or exceeding the staminate spikelet; perigynia broadly ovoid to broadly obovoid, round in transection, 2-2.5 mm. long, about

1.3 mm. thick, membranous, brownish, with 2 ribs and about 10 nerves (these much more slender than the internerve spaces), inflated, not closely investing the achene at any point, basally obtuse (either rounded or very shortly tapered), apically abruptly contracted into a minute entire straight (though often distorted in prepared specimens) tubular beak with a nearly entire orifice; achenes triangular with concave sides, bent-apiculate, jointed with the style which entirely withers after anthesis. Rare in extreme n.e. Tex. (Bowie Co.), in ditch, May; e. U.S. and Que. and Ont., w. to Minn., Kan., Okla. and Tex.

15. *Carex Meadii* Dew. Perennial; rhizomes 1.5-2 mm. thick, several cm. long; culms 3-5 dm. long, 1-2 mm. thick, triangular, erect, rising singly or few in bunches at intervals along the rhizomes; leaves few; blades firm-membranous, 3-5 mm. broad, not attaining the inflorescence; inflorescence 7-15 cm. long, 5-7 mm. broad, of usually 3 erect spikelets, the lowest on a peduncle 4-6 cm. long, the middle peduncle much shorter; terminal spikelet staminate, 2-3 cm. long, 3-4 mm. thick, the subtorninal one commonly androgynous or wholly pistillate, the lower one (often subcompound basally) pistillate and 1-2 cm. long and 5-6 mm. broad; lowest spikelet with a conspicuous leaflike bract about as long as the inflorescence, the higher bracts progressively smaller, all the bracts with noticeable sheaths; scales of pistillate spikelets very variable, half as long to as long as their perigynia, often with conspicuous dark-purple submedian stripes; perigynia 15 to 30 on the lowest spikelet, obovoid, fruitful distally, obtusely triangular in transection, only slightly inflated in distal part but not noticeably inflated basally, basally tapering, 3-4 mm. long, with 17 to 23 slender nerves (2 stronger than the rest), stramineous to yellowish, membranous, sessile, apically narrowed to a minute more or less strongly bent beak whose orifice is nearly entire; achenes triangular, the sides very slightly concave, shortly apiculate, jointed with the style which wholly withers after anthesis, only slightly shorter than the perigynia. *C. tetanica* var. *Meadii* (Dew.) Bailey. Infrequent in low clay prairies, s.e. and n.-cen. Tex., Apr.-May; Sask., N.D., S.D., Neb., Kan., Okla. and Tex., e. to Pa., N.J., N.C. and Tenn.

Reports of *C. tetanica* Schkuhr in Texas are based in part on specimens of *C. Meadii* and in part on specimens of *C. microdonta*.

16. *Carex oligocarpa* Schkuhr. Tufted perennial; culms 25-35 cm. long, about 1 mm. thick, erect, leafy (but not at the base); lower bracts purplish-tinged; blades 2-3 mm. broad, erect, long-tapered, green, membranous; spikelets usually 3 or 4 per culm, the terminal one staminate, the second one pistillate and either sessile and borne near the base of the staminate spikelet or short-peduncled and slightly remote, the lower ones pistillate and remote on peduncles; staminate spikelet 15-30 mm. long, about 2 mm. thick, brownish-stramineous; scales oblanceolate, acute, about 7 mm. long, with broad green midnerve and brownish-hyaline lateral portion; pistillate spikelet 5-10 mm. long, about 5 mm. thick, with 3 to 8 close ascending perigynia; scales ovate, acuminate (or the lower ones cuspidate), shorter than their perigynia, brownish-hyaline with green median; bracts foliaceous, definitely sheathed, the blades of the second one and sometimes the third one exceeding the staminate spikelet; perigynia obovoid-ellipsoid, obtusely triangular, often with concave sides, about 4 mm. long, firm-membranous, olive-brown, with 2 fairly prominent nerves and 42 to 65 less prominent ones (these minutely undulating and so closely set as to be about as broad as the internerve spaces), basally slightly inflated, shortly tapered and narrowly rounded, laterally closely investing the achene, apically pyramidal (apical angle about 65°-85°) and then capped by a very minute straight bidentate beak; achene triangular, apiculate, jointed with the straight thickish style which entirely withers after anthesis. Rare on wooded calcareous slopes, Edwards Plateau (Travis and Kendall cos.), Apr. 18-May 3; from Ont. and n.e. U.S. w. to Mich., Ia., Mo. and Okla., s. to Ala., Ky., Ark. and Tex.

Our specimens differ from those in the main part of the distributional area and perhaps should not be referred to this species, which ordinarily has staminate spikelets only 1-2 mm. thick with distinctly reddish scales only 5-6 mm. long, and perigynia with the apical conelike portion shorter, thus more abruptly leading to the longer, snoutlike beak that is about 0.5 mm. long.

17. *Carex amphibola* Steud. Tufted perennial; culms 15-30 (-40) cm. long, erect; basal sheaths purplish-brown with reduced blades; cauline leaves few, 1.5-3.5 (-4.5) mm. broad, membranous, green; spikelets usually 4, less commonly 3; terminal spikelets in-

conspicuous and staminate, nearly sessile, 6-20 mm. long, 1.5-2.5 mm. thick, stramineous, the scales broadly hyaline; rest of spikelets pistillate (the highest one subterminal and sessile at the base of the staminate spikelet, the others on slender short peduncles and more or less remote), 8-13 (-20) mm. long, about 5 mm. thick, with 3 to 6 (to 10) ascending perigynia which are close enough to overlap (except occasionally the lowermost), the scales with the hyaline broadly ovate main portion about a third to half as long as the perigynia but the abrupt subulate cusp almost equaling it; bracts narrowly foliaceous with definite sheaths, the blades greatly surpassing the spikelets; perigynia turgidly to slenderly obovoid, in transection nearly round when fresh but less so after drying, often obtusely triangular, 4-5 mm. long, inflated, brown-membranous, in the lower half with about 50 or 60 nerves which are so close they are only a little narrower than the internerve spaces (some of these ending so the upper part with fewer nerves than the lower), basally slightly tapered and narrowly rounded, apically broadly rounded or very obtuse, essentially beakless with a nearly entire orifice (after drying the apex often somewhat conical instead of rounded but still essentially beakless); achene triangular, apiculate, jointed with the style which entirely withers after anthesis. Incl. var. *globosa* (Bailey) Bailey, var. *rigida* Fern. and var. *turgida* Fern. "*C. grisea*" of many authors, not Wahl., *C. bulbostylis* Mack. Frequent in moist soil and woodlands, e., s.e. and n.-cen. Tex., infrequent to rare in moist areas of e. part of Edwards Plateau, spring; from Fla. to Tex., n. to Del., Pa., Tenn. and Ark. Seeming to grade somewhat into *C. flaccosperma* and our *C. "oligosperma"*.

18. *Carex flaccosperma* Dew. Tufted perennial; culms (14-) 25-40 (-60) cm. long, erect; basal sheaths usually glaucous to pale-brownish with reduced blades; cauline leaves few, 4-10 mm. broad, membranous, pale-green or glaucous-green; spikelets usually 5, less commonly 4; terminal spikelet very inconspicuous, staminate, nearly sessile or short-peduncled, 7-35 mm. long, 1-3 mm. thick, stramineous, the scales broadly hyaline; other spikelets pistillate (the highest one subterminal and nearly sessile or short-peduncled and attached near the base of the staminate spikelet, the others more or less remote on slender peduncles 1-15 cm. long), 12-50 mm. long, about 7 mm. thick, with 8 to 32 ascending perigynia which are close enough to overlap (except occasionally the lowermost); scales brownish-hyaline, ovate, less than half as long as the perigynia, acute to very short-cuspidate; bracts foliaceous, with definite sheaths, the blades greatly surpassing the spikelets; perigynia slenderly obovoid to ovoid-fusiform, in transection nearly round when fresh (but after drying often obtusely triangular), 4-5 mm. long, inflated, brown-membranous, in the lower half with 47 to 60 nerves which are so close they are only a little (if at all) narrower than the internerve spaces (some of them ending so the upper part has fewer than the lower), basally slightly tapered and narrowly rounded, apically tapered and narrowly rounded or acute, essentially beakless, with a nearly entire orifice; achene triangular, apiculate, jointed with the style which entirely withers after anthesis. Frequent in moist sandy soil in wooded areas, e. and s.e. Tex., infrequent in n.-cen. Tex., spring; s.e. U.S. n. to Va., Tenn. and Mo., w. to Okla. and Tex.

19. *Carex digitalis* Willd. Perennial in dense tufts (rhizomes very short); culms 1-5 dm. long, 0.5-1 mm. thick, weak but ascending, the basal sheaths brownish; leaves dark-green, membranous, the blades 2.5-5 mm. broad; spikelets usually not overlapping; terminal spikelet staminate, 1-1.5 mm. thick, on a filiform culm apex 1-5 cm. long, the scales white-hyaline and acute; lower (1 or) 2 spikelets pistillate (or often the very tip of the next-to-highest spikelet with some staminate flowers), 1-2 cm. long, about 3 mm. thick, with 8 to 20 overlapping perigynia, on filiform (often slightly arcuate) peduncles 3-10 cm. long; scales about 1 mm. long, ovate, acute to cuspidate, white-hyaline with green midnerve; bracts with definite sheaths, foliaceous, the upper one occasionally equaling or surpassing the staminate spikelet; perigynia obovoid, rather sharply triangular through most of the length, 2.5-3.5 mm. long, more than half as thick as long, 2-ribbed and with 25 to 35 slender nerves (much narrower than the internerve spaces), membranous, basally tapered to a short stipelike base, laterally closely enveloping the achene, abruptly tapered to the essentially straight pyramidal scarcely beaklike apex with an entire orifice; achene triangular, apiculate, jointed with the style which wholly withers after anthesis. Incl. the var. *asymmetrica* Fern. and var. *macropoda* Fern. Rare in forested areas, e. Tex. (Newton and Polk cos.), Apr.; Ont. and e. U.S. w. to Wis., Mo., Okla. and Tex.

20. *Carex blanda* Dew. Tufted perennial (rhizomes very short); culms 15-55 cm. long, ascending, 0.8-1.5 mm. thick; basal sheaths brownish at base and rather loose; basal blades 4-11 mm. broad, the cauline ones 3-5 mm. broad, thin-membranous; upper 2 or 3 spikelets usually close or even overlapping, nearly sessile, the lowest (usually fourth and/or fifth) spikelet usually widely separate and exerted on an erect filiform peduncle 2-8 cm. long; terminal spikelet staminate, 1-2 cm. long, 2-3 mm. thick, stramineous, the scales acute to acuminate or cuspidate; remainder of spikelets pistillate, 5-20 mm. long, 4-6 mm. thick, with 4 to 20 closely set overlapping perigynia, the ovate or obovate scales either mucronate (and shorter than their perigynia) or with a long subulate projection (this often equaling or exceeding the perigynium) and white-hyaline; bracts foliaceous, with definite sheaths (the edges of which are minutely fimbriate), the blades of the bract of the third or fourth spikelet from the apex often equaling or surpassing the staminate spikelet; perigynia turgidly obovoid, vaguely triangular, 3-4 mm. long, closely investing the achene not only laterally but in much of the apex as well, membranous, with 2 ribs and 23 to 30 nerves (much more slender than the internerve spaces), basally tapering and substipitate, apically rounded, abruptly very short-beaked, the beak about 0.5 mm. long and bent or recurved nearly at right angles to the axis of the perigynium, the orifice hyaline and entire; achenes triangular, bent-apiculate, jointed with the style which wholly withers after anthesis. Frequent in moist woods, e. and n.-cen. Tex., rare w. to Edwards Plateau (San Saba Co.), Apr.-May; e. temp. N.A. w. to the Dakotas, Neb., Kan., Okla. and Tex.

21. *Carex gracilescens* Steud. Tufted perennial (rhizomes very short); culms 15-60 cm. long, ascending, 0.7-1 mm. thick; basal sheaths brownish (said to be purplish-tinged), not loose; basal blades reduced, cauline blades 1-4 mm. broad, thin-membranous; spikelets 3 or 4 per culm, separated, rarely the 2 upper ones overlapping, the upper nearly sessile, the lower on erect peduncles 2-5 cm. long; terminal spikelets staminate, 8-19 mm. long, 1-1.5 mm. thick, stramineous, the obtuse scales hyaline; lower spikelets pistillate, 5-18 mm. long, 2-3 mm. thick, with 7 to 20 closely set mostly overlapping perigynia; scales ovate or obovate, cuspidate even with the subulate medial prolongation, not equaling the perigynium; bracts foliaceous, the edges of the definite sheaths minutely erose, the blade of the bract of the lowest spikelet 4-12 cm. long, occasionally surpassing the terminal spikelet; perigynia turgidly obovoid, vaguely triangular, 2.5-3.5 mm. long, closely investing the achene not only laterally but for a portion of the apex as well, membranous, with 2 ribs and 20 to 30 nerves (much more slender than the internerve spaces), basally tapering and substipitate, apically rounded, abruptly short-beaked, the beak about 0.7 mm. long, and recurved so the apex is at right angles to the perigynium, the orifice entire; achene triangular, bent-apiculate, jointed with the style which entirely withers after anthesis. Rare in s.e. Tex. (Jefferson Co.), Apr. (-May); e. temp. N.A. w. to Wisc., Mo., Ark. and Tex.

22. *Carex striatula* Michx. Loosely tufted perennial (rhizomes very short); fertile culms 2-6 dm. long, ascending, lateral, not leafy at the base, erose or obscurely erose-granulose on the sharp angles; sterile shoots at fruiting time not stemmy but mere rosetted tufts; leaves pale, scabrous, quite firm, with prominent ribs, those of the sterile tufts 7-25 mm. broad, those of the culms 2-7 mm. broad; basal sheaths brown, never with any purplish-tinge; terminal spikelet staminate, long- or short-peduncled, prominent, pale, stout (2-3.5 mm. thick), the broad scales white and with nonexcurrent midribs; the lower 2 or 3 spikelets pistillate, remote, scattered (the lowest on a peduncle a few times its own length, the higher peduncles shorter), interruptedly linear or oblong-cylindric, the longer one 15-35 mm. long and 4-8 mm. thick, with a smooth sharply angled rachis, often loose (but perigynia overlapping), 6- to 20-flowered, the cuspidate or acuminate scales white-hyaline and shorter than the perigynia; bracts foliaceous but shorter than or scarcely exceeding the staminate spike, their definite sheaths smooth on the edges; perigynia elliptic-obovoid to slenderly fusiform-obovoid, 4-5.5 mm. long, less than half as thick as long, outward-curving, 2-ribbed and 21- to 33-nerved (the nerves much narrower than the internerve spaces), very firm, basally obtusely triangular, stipelike, tapered (the stipelike portion 1.3-2 mm. long), laterally closely enveloping the achene (but not elsewhere), apically obtusely triangular, conical, gradually acute, long-tapered or somewhat abruptly narrowed into the straight or only slightly oblique (?) conspicuous beak with entire orifice; achene triangular, apiculate, jointed with the style which entirely

withers after anthesis. *C. ignota* Dew., *C. laxiflora* Lam. var. *Michauxii* Bailey. Forested areas, e. Tex., May; Gulf and Atl. states n. to N.Y. and Conn., inland to Ky. and Ind.

23. *Carex styloflexa* Buckl. Tufted perennial (rhizomes very short); fertile culms 2-8 dm. long, ascending, mostly lateral, few-leaved, more or less granulose-scabrous on the angles; sterile leafy basal shoots at fruiting time with culms elongating to 5-15 cm.; basal leaves of fertile shoots 3-7 mm. broad; upper blades of sterile shoots 2-15 mm. broad, the broadest ones with 13 to 35 nerves; culm blades of fertile shoots 2.5-3.5 mm. broad; all leaves membranous, deep-green, slightly roughened; basal sheaths brown, never with any purplish-tinge; terminal spikelet staminate, on a peduncle to 8 cm. long, conspicuous, prominent but slender, 2.5 mm. thick, the white-hyaline scale less firm than those of *C. striatula*; the lower 2 or 3 spikelets pistillate, scattered, remote, oblong-cylindrical to oblong or linear-oblong, 4- to 15-flowered, 5-30 mm. long, 4.5-10 mm. thick, closely flowered, all but the lowermost perigynia overlapping; scales acute to short-awned, not cuspidate, more or less strongly reddish-tinged, shorter than their perigynia, the rachis not sharply angled; bracts foliaceous but not surpassing the staminate spikelet, their definite sheaths minutely roughened on the edges; perigynia fusiform-obovoid, 3.5-5 mm. long, 2-3 mm. thick, 2 to 3 times as long as broad, nearly straight, barely curved or outwardly arching, 2-ribbed and with 18 to 33 slender nerves (much narrower than the internerve spaces), basally long-tapered, stipelike, obtusely triangular, laterally closely enveloping the achene (but not elsewhere), above tapered to a beak as long as the stipe, oblique but more or less straight, rather sharply triangular, with an entire orifice; achene triangular, apiculate, jointed with the style which entirely withers after anthesis. *C. laxiflora* Lam. var. *styloflexa* (Buckl.) Boott. Infrequent in moist rich hardwood forests, less common still in mixed pine-oak woods, e. Tex., Mar.-May; Gulf and Atl. states n. to N.Y. and Conn. Perhaps not sufficiently distinct from *C. striatula*.

24. *Carex crebriflora* Wieg. Perennial in large tufts (rhizomes very short); fertile culms 2-6 dm. long, ascending, usually retrorsely scabrous; broadest basal leaves 3-5 mm. broad; broadest cauline leaves 3-4 mm. broad; upper 2 to 3 spikelets nearly sessile, overlapping; terminal spikelet staminate, 1-3 cm. long, 1-2 mm. thick, inconspicuous, the white-hyaline scales usually acute but not cuspidate; lower spikelets pistillate, 5-20 mm. long, about 3 mm. thick, with 8 to 18 close overlapping perigynia, with smooth rachis; scales white-hyaline-membranous, acute but not cuspidate, with strong greenish midvein, more than half as long as their perigynia (often 1-2 dm. below the headlike aggregation of the upper spikelets occurs a third or fourth pistillate spikelet on a peduncle 15-40 mm. long and exceeded by its bract); bracts foliaceous with definite sheaths that are minutely rough on the edges, the bract of the lowest spikelet of the terminal aggregation usually exceeding the staminate spikelet; perigynia elliptic-obovoid to fusiform, 3.5-4.5 mm. long, about half as thick as long, essentially straight, with 2 ribs and 27 to 38 nerves (the nerves much narrower than the internerve spaces), firm-membranous, basally long-tapered and stipelike, laterally closely enveloping the achene and rather sharply triangular, above somewhat triangular and long-pyramidal, acute, tapered to an essentially straight beak as long as the stipe and with an entire orifice; achene triangular, apiculate, jointed with the style which entirely withers after anthesis. Infrequent to rare in e. and s.e. Tex. (Polk, Hardin and Harris cos.), Apr.; S.C., Ala., Fla., Miss., La. and Tex.

The characters of this plant suggest the products of hybridization of *C. blanda* and *C. styloflexa*.

25. *Carex debilis* Michx. Loosely tufted perennial; culms 15-60 cm. long, 0.6-1 mm. thick, basally with reduced blades and purplish red sheaths; cauline leaves 2-4 mm. broad, ascending, pale-green, membranous; spikelets 4 or 5 per culm, the terminal one (rarely the terminal 2) staminate in Texas material (some non-Texan specimens have gynecandrous terminal spikelets), 2-5 cm. long, about 1 mm. thick, erect or often nodding on a peduncle 2-5 cm. long, the scales stramineous-hyaline; the remaining spikelets pistillate, nodding on slender flexuous peduncles 2-5 cm. long, crowded or the lower ones usually remote, 3-6 cm. long, 4-6 mm. thick, with 12 to 25 ascending perigynia which are usually close enough to overlap a little (except the lowermost); scales subulate, hyaline, inconspicuous, about half as long as the perigynia and deciduous with them; lower bract long-sheathing, foliaceous, the blade 1-2 mm. broad and often equaling or surpassing the pistillate spikelet; perigynia narrowly fusiform, in transection nearly round when fresh, 6-9 mm. long, 1.2-1.7 mm. thick, stramineous-brown, membranous, inflated, with 2 strong

nerves and 10 to 18 weak slender ones, long-tapered basally and apically and passing into a beak about 1 mm. long and very deeply bidentate; achene triangular with concave sides and thickened angles, stipitate, apiculate, jointed with the style which entirely withers after anthesis. Infrequent near brooks and in low poorly drained pinewoods, e. and s.e. Tex. (Cass, Cherokee, Hardin, Nacogdoches, Panola and Polk cos.), Apr.-May; e. temp. N.A., w. to Wisc., Mo. and Tex.

26. *Carex Davisii* Schwein. & Torr. Loosely tufted perennial or with reddish-black scaly rhizomes 2.5-4 mm. thick; culms 2-6 dm. long, 1.5-3 mm. thick, erect, basally with reduced blades and reddish-black sheaths; cauline leaves 4-8 mm. broad, pale green, erect; spikelets 3 or 4 per culm; terminal spikelet gynecandrous, 2-3 cm. long, with a terminal pistillate section and a staminate portion about 2 mm. thick, on an ascending or only slightly nodding peduncle 1-3 cm. long, the stramineous-hyaline scales oblanceolate and long-cuspidate; the remaining spikelets pistillate, on ascending peduncles (that of the lowest spikelet 2-10 cm. long), either crowded terminally and overlapping or the lower ones remote, 2-5 cm. long, about 6 mm. thick, with 12 to 20 ascending perigynia which are close enough to overlap (except occasionally the lowermost); scales hyaline, elliptic, long-cuspidate, half to three fourths as long as the perigynia; lower bract very long-sheathing and foliaceous, the blade 2-6 mm. broad, usually equaling or surpassing the staminate spikelet; perigynia ovoid, in transection nearly round when fresh, 4-6 mm. long, brownish, membranous, strongly inflated, with 9 to 12 slender nerves (2 stronger than the others), basally rounded, apically obtuse and abruptly giving way to the beak (0.3-0.4 mm. long) with a strongly bidentate orifice; achene triangular with concave sides, apiculate, jointed with the style which entirely withers after anthesis. Infrequent in rich calcareous woods, n.-cen. Tex. (Dallas, Denton, Kaufman and Tarrant cos.), Apr.; Que. and n.e. U.S. w. to Minn. and Kan.; also Okla. and Tex.

27. *Carex oxylepis* T. & H. Loosely tufted perennial or with short purplish-black scaly rhizomes 2-3 mm. thick; culms 4-7 dm. long, 1-2 mm. thick, erect, basally with reduced blades and purplish-black sheaths; cauline leaves 2.5-6 mm. broad, pale-green, erect; spikelets usually 4 per culm; terminal spikelet gynecandrous, on a slender nodding peduncle 2-4 cm. long, 2-5 cm. long, with a short terminal pistillate portion and a long staminate portion about 2 mm. thick, with lanceolate hyaline stramineous scales; other spikelets pistillate, with slender nodding or flexuous peduncles usually only 2-4 cm. long, 18-35 mm. long, 4-5 mm. thick, with 20 to 44 ascending perigynia which are close enough to overlap (except occasionally the lowermost); scales hyaline, ovate, long-subulate-cuspidate, about three fourths as long as the perigynia; lower bract with definite sheath and a long blade 1-3 mm. broad, almost equaling the uppermost spikelet, the higher bracts progressively much-reduced; perigynia fusiform-ellipsoid, in transection nearly round when fresh or obtusely triangular after drying, 3.5-4 mm. long, green, membranous, inflated, with 6 to 8 slender nerves (2 stronger than the rest), basally and apically tapered, with a beak 0.2-0.3 mm. long and a nearly entire orifice; achene triangular with concave sides, apiculate, jointed with the style which entirely withers after anthesis. Infrequent in low moist rich woods near streams, e. and s.e. Tex., Mar.-Apr.; Fla., Ga., S.C., N.C., Ala., Tenn., Miss., La., Tex., Ark. and Mo.

28. *Carex Bushii* Mack. Tufted perennial; culms 3-9 dm. long, basally 1.5-2.5 mm. thick, erect, the basal sheaths rich-brown and quickly fading; foliage usually shortly pilose or hirsute at least on the sheaths; blades 2.5-5 mm. broad at the broadest point, the uppermost one usually surpassing the spikelets; spikelets usually 2, less commonly 3, overlapping; terminal spikelet gynecandrous, with an ovoid distal pistillate portion 7-10 mm. long and 7-9 mm. thick (including the scales), with ovate scales in the widest part pale-hyaline, strongly cuspidate and 4-5 mm. long (longer than the perigynia even at maturity), with an obconic basal staminate portion with elliptic acuminate whitish hyaline scales about 4 mm. long; the lower spikelet(s) all pistillate, ovoid, 9-14 mm. long, 7-10 mm. thick (including scales), with 12 to 25 ascending perigynia; lowest bract not sheathing, about 1 mm. broad, usually about equaling the terminal spikelet, the higher bracts greatly reduced; perigynia obovoid, in transection usually very slightly unequally triangular, 3-5 mm. long, brown, firm-membranous, with 2 strong nerves and 7 to 13 weaker slender ones (scarcely visible at maturity), basally obconical and shortly rounded, apically short-pyramidal and abruptly passing into the very short beak (some specimens essentially beakless) with essentially entire orifice; achenes triangular, bent-apiculate,

jointed with the style which entirely withers after anthesis. *C. caroliniana* var. *cuspidata* (Dew.) Shinners. Frequent in moist sandy soil in e. Tex., infrequent in n.-cen. Tex., spring; N.E. s. to D.C. and s.w. to Kan., Okla. and Tex.

Grades into or hybridizes with *C. caroliniana* and *C. complanata*.

29. *Carex complanata* T. & H. Tufted perennial; culms 3-8 dm. long, basally 1-2 mm. thick, erect, the basal sheaths dark-purplish; foliage often shortly pilose to hirsute on the sheaths and often also on the lower parts or all of the blade; blades 1.5-3 mm. broad at the broadest point, usually the uppermost one surpassing the spikelets; spikelets usually 3, less often 4, overlapping; terminal spikelet gynecandrous, with an ovoid-cylindrical distal pistillate portion 8-11 mm. long and 5-6 mm. broad (with brownish-white hyaline ovate scales, the lower ones more strongly acuminate than the upper, slightly longer than the immature perigynia but about equaling the mature ones), with a short obconic staminate portion with ovate acuminate brownish-white hyaline scales 3-4 mm. long; lower spikelets pistillate, ovoid to cylindrical, 5-12 mm. long, 5-6 mm. thick, with 11 to 25 close ascending perigynia; bracts not sheathing, that of the lowest spikelet 0.5-1.5 mm. broad and usually exceeding the terminal spikelets, that of the middle spikelet much-reduced, that of the terminal spikelet essentially absent; perigynia obovoid, in transection flattened-triangular to unequally biconvex, 2.3-2.8 mm. long, ascending, olive-brown, firm-membranous, with 2 strong and 7 to 14 weak (at full maturity scarcely visible) nerves, scarcely inflated, basally rounded, apically shortly acute to a nearly entire orifice; achene triangular, bent-apiculate, jointed with the style which entirely withers after anthesis. *C. hirsutella* Mack. Frequent in moist sandy woods, e. and s.e. Tex., spring; Ont. and e. U.S. w. to Mich., Mo., Okla. and Tex.

Apparently grading into *C. caroliniana* and *C. Bushii*. These three taxa probably should be treated as varieties of a single species (*C. caroliniana*).

30. *Carex caroliniana* Schwein. Tufted perennial; culms 3-6 dm. long, basally about 1 mm. thick, erect, the basal sheaths dark-purplish-black quickly fading to brown; foliage essentially glabrous; blades 1.5-3 mm. broad at the broadest point, usually the uppermost one surpassing the spikelets; spikelets usually 3, overlapping; terminal spikelet gynecandrous with a cylindrical distal pistillate portion 8-13 mm. long and 4-4.5 mm. thick (with scales ovate, brownish-white, hyaline, 1.5-2 mm. long, shorter than the perigynia) and a long-attenuate basal staminate portion 2-3 mm. thick with ellipsoid acute brownish-white-hyaline scales 2-2.5 mm. long; the lower spikelets all pistillate, cylindrical, 6-20 mm. long, 4-4.5 mm. thick, with 16 to 40 closely packed spreading perigynia; bracts not sheathing, that of the lowest spikelet 1-2 mm. broad, usually exceeding the terminal spikelet, that of the middle spikelet much-reduced, that of the terminal one essentially absent; perigynia obovoid, nearly round in transection, 1.8-2.3 mm. long, spreading, fuscous or reddish-brown, membranous, with 8 to 15 nerves (2 stronger than the rest), inflated, basally rounded, apically short-conic and passing abruptly to the short tubular bidentate beak or in some specimens essentially beakless; achene triangular, bent-apiculate, jointed with the style which entirely withers after anthesis. Infrequent in rich open woods near streams in sandy soil, e., s.e. and n.-cen. Tex. (Jasper, Jefferson, Kaufman and Walker cos.), spring; Pa. to Ind. and s. to N.C., Tenn., Ark., Okla. and Tex. (probably also La.). Grades into or hybridizes with *C. complanata* and *C. Bushii*.

31. *Carex Joorii* Bailey. Loosely tufted glabrous perennial with short blackish scaly rhizomes 3-8 mm. thick; culms 6-10 dm. long, erect; blades 4-8 mm. broad at the broadest point; spikelets (5 or) 6 (rarely up to 8); the upper 1 (or 2) spikelets staminate and erect, the lower ones pistillate (or the 2nd and 3rd from the top androgynous with a very short staminate portion) and downward progressively longer-peduncled and more nodding (at maturity!); terminal staminate spikelet 3-6 cm. long, 4-6 mm. thick, with mucronate scales 5-6 mm. long; lowest pistillate spikelet 25-40 mm. long, 6-9 mm. thick, with 25 to 60 close spreading perigynia and obovate or ovate strongly cuspidate hyaline scales about as long as the perigynia; lowest bract sheathless, the blade 2-4 mm. broad, often surpassing the staminate spikelet, the bracts of the higher spikelets progressively very strongly reduced; perigynia rhomboid-ovoid to -obovoid, in transection nearly round (fresh) to obscurely triangular (dried), 4-5 mm. long, inflated, firm-membranous, dark brown, with 2 strong pale nerves (or ribs) and 9 to 12 slightly less strong ones, basally rounded, apically pyramidal-acuminate, passing into the definite slender beak (about 0.5

mm. long) with an entire orifice; achene triangular with concave sides, apiculate, jointed with the style which entirely withers after anthesis. Frequent in e. and s.e. Tex., July-Oct.; Coastal States, Md. to Tex.; also Ark., Tenn. and Mo.

32. *Carex glaucescens* Ell. Tufted glabrous perennial with short blackish rhizomes 2-3 mm. thick; culms 5-12 dm. long, erect, leafy; blades 4-8 mm. broad at the broadest point; spikelets 4 to 7, the upper one staminate and erect, the lower ones pistillate (or some of them androgynous with very short staminate portions) and downward progressively longer peduncled and more nodding (at maturity); at anthesis many of them ascending); terminal staminate spikelet 25-40 mm. long, 5-7 mm. thick, with mucronate scales 5-7 mm. long; lowest pistillate spikelet 2-5 cm. long, 7-9 mm. thick, with 60 to 100 very close ascending perigynia and obovate reddish-brown hyaline scales (with greenish midnerves subulately exerted from an emarginate apex) about equaling the perigynia; lowest bract sheathless, the blade 1-4.5 mm. broad and from very short to surpassing the staminate spikelet, the bracts of the higher spikelet progressively strongly reduced; perigynia elliptic to obovate in the larger plane, in transection elliptic or obscurely very unequally triangular, 3-4 mm. long, somewhat inflated, membranous, purplish-brown with a very pronounced whitish bloom, with 2 strong nerves and 2 or 3 extremely weak scarcely visible ones, basally tapered and rounded, apically tapered to a very short beak (0.2-0.3 mm. long) and a nearly entire orifice; achene triangular with concave sides, apiculate, jointed with the style which entirely withers after anthesis. *C. verrucosa* var. *glaucescens* (Ell.) Wood. Frequent in e. Tex., rare in s.e. Tex., late spring-summer; Coastal States, Va. to Tex.

Perhaps not specifically distinct from *C. verrucosa* Muhl., the typical form of which has erroneously been reported to occur in Texas.

33. *Carex Emoryi* Dew. Perennial in large tufts and in tufts with extensively creeping scaly rhizomes 2-3 mm. thick; culms 4-10 dm. long, 2-3 mm. thick basally, remainder of leaves mostly clustered basally; basal sheaths light chestnut to purplish; juncture of sheath and blade flat or slightly arcuate; spikelets 4 to 7 per culm, overlapping or rarely slightly remote; uppermost spikelet nearly erect and usually entirely or nearly entirely staminate, 2.5-7 cm. long, 2.5-4 mm. thick, brownish-stramineous; lower spikelets usually sessile, androgynous, slightly nodding (at maturity); lowest spikelets usually almost entirely pistillate, 3-10 cm. long, 3.5-5 mm. thick, with 65 to 165 overlapping ascending perigynia (borne in rows); scales brownish-hyaline, oblong, blunt, with paler broad midnerves, shorter than the perigynia to which they are closely appressed; bract sheathless, that of the lowest spikelet 1.5-4 mm. broad and (in length) often attaining the uppermost spikelet, the higher bracts progressively drastically reduced; perigynia ovate to obovate, flattened (biconvex), 2.3-3.3 mm. long, stramineous, with 2 strong (marginal) nerves and a few vanishingly obscure ones, firm-membranous, basally rounded, shortly tapered to an essentially beakless or minutely beaked apex, the orifice essentially entire; stigmas 2; achene lenticular, only about half filling the perigynium, apiculate, jointed with the style which entirely withers after anthesis. Frequent in calcareous mud, n.-cen. and Trans-Pecos Tex. and Edwards Plateau, Apr.-May; Man. and N.D. s. to Coah. and Tex., e. to N.Y., N.J., D.C. and Va. Perhaps only a variety of *C. stricta*.

34. *Carex stricta* Lam. Perennial in large tufts, with slender easily detached rhizomes; culms 3-8 dm. long, 1-2 mm. thick basally, the basal sheaths chestnut-black; juncture of sheath and blade inverted V-shaped; spikelets usually 4 per culm, overlapping or occasionally the lowermost slightly remote; uppermost spikelet erect and usually entirely staminate, 2-4 cm. long, 2.5-4 mm. thick, buffy-brown; subterminal spikelets usually sessile, androgynous and slightly nodding (at maturity); lower spikelets usually almost entirely pistillate, 2-4 cm. long, 3-4 mm. thick, with 45 to 65 overlapping ascending perigynia (borne in elegant rows) and brownish oblong blunt scales with paler midnerve and slightly shorter than their perigynia to which they are closely appressed; bracts sheathless, that of the lowest spikelet often attaining the uppermost spikelet in length, those of higher spikelets progressively drastically reduced; perigynia ovate, flattened (biconvex), 2.5-3 mm. long, olivaceous, with 2 strong (marginal) nerves and a few vanishingly obscure ones, firm-membranous, basally rounded, shortly tapered to an essentially beakless or minutely beaked apex, the orifice essentially entire; stigmas 2; achene lenticular, only about half filling the perigynium, apiculate, jointed with the style which

entirely withers after anthesis. Rare in moist sandy forests and bogs, e. Tex. (Freestone and Walker cos.), Apr.-May; N.E., N.Y. and Pa. s. to N.C.; also Ind., Mich., Wisc., Ill., Minn. and Tex.

Our plants have longer, fewer perigynia than plants from most of the range in north-eastern United States and perhaps should be given a different name.

35. *Carex crinita* Lam. Tufted essentially glabrous perennial with branching scaly brownish rhizomes 2-4 mm. thick; culms 6-12 dm. long, 2.5-5 mm. thick basally; basal sheaths dark brown, bladeless; blades of cauline leaves 5-11 mm. broad; spikelets 4 or 5 per culm, overlapping, mostly nodding; terminal spikelet staminate, 3-5 cm. long, 2-3 mm. thick; subterminal spikelets androgynous and progressively longer-peduncled downward; lowest spikelet essentially all pistillate or with only a very small terminal staminate portion, 4-9 cm. long, 5-10 mm. thick (including the scale cusps), with 75 to 130 close ascending perigynia, the scales with hyaline oblong bodies shorter than the perigynia but with the midnerve elongated into a spreading cusp surpassing the perigynium; bract of lowest spikelet sheathless, erect and usually much-surpassing the terminal spikelet, the higher bracts progressively reduced; perigynia obovate, 3-3.5 mm. long, biconvex, membranous, somewhat inflated, with 2 strong marginal nerves and a few vanishingly faint ones, stramineous to brownish, basally tapered, apically rounded or tapered and giving way abruptly to the minute tubular beak with entire orifice; achene biconvex, only half filling the perigynium, apiculate, jointed with the 2-branched style which entirely withers after anthesis. Incl. var. *Mitchelliana* (M. A. Curtis) Gl. and var. *brevicrinis* Fern. Infrequent in wet places, usually in water, e. Tex. (Cass, Gregg and Morris cos.), May-June; e. N.A. w. to Man., Minn., Mo. and Tex.

36. *Carex aurea* Nutt. Perennial with extensive rhizomes several cm. long and 1 mm. thick; culms often weak and reclining basally, distally ascending, 7-20 cm. long, 0.5-0.8 mm. thick; leaves few, clustered basally; blades 15-25 cm. long and about 2 mm. broad, often surpassing the inflorescence; inflorescence of a terminal staminate spikelet and 2 or 3 subterminal weakly ascending peduncled (peduncle of lowest filiform one 1-2 cm. long, of upper ones shorter) lax pistillate spikelets about 1 cm. long; scales hyaline, minute, much smaller than their perigynia; bract of lowest spikelet leaflike, 3-10 cm. long, those of the higher spikelets smaller; perigynia 5 to 8 per spikelet, broadly ovate, plano-convex or lenticular, 2-2.5 mm. long, basally slightly narrowed, apically rounded, quite beakless, with a number of faint veins (2 of them less faint than the rest), membranous (when fresh somewhat succulent or baccate and translucent but drying firm, opaque in specimens), orange (in dried specimens rich-dark-brown); achene not quite filling the top of the perigynium (at least in dried specimens) but laterally filling it, lenticular, ovate, minutely apiculate, dark-brown, jointed with the style. Rare in seepy areas on shaded hillsides, Plains Country (Randall Co., Ceta Canyon), June; temp. N.A., s. to Conn., Mich. and Neb. and at moderate elev. to Tex., N.M., Ut., Nev. and Calif.

37. *Carex muriculata* Herm. Densely tufted perennial; culms 15-50 cm. long, 1-2 mm. thick, erect; leaves clustered basally; blades 10-23 cm. long, 2-3 mm. broad, long-tapered to a setaceous tip, some of the longer ones about equaling or surpassing the culms; inflorescence of 3 to 6 sessile ascending-appressed androgynous spikelets about 10-15 mm. long and 3-6 mm. thick, the lowest 2 of them separated by an internode 1-2 cm. long, the higher internodes shorter; scales mostly hyaline, about as long as their perigynia and partly concealing them; bract of the lowest spikelets foliaceous, 5-15 cm. long (some reportedly as long as "27 cm."), ascending, those of the upper spikelets smaller; perigynia 14 to 23 per spikelet, 4-4.2 mm. long, fusiform, stramineous-brown, firm, with 2 prominent nerves (one on each of the adaxial faces) and a number of other less prominent nerves each marking a row of minute fuzzy warts, the body obovoid, almost completely filled by the achene, rather sharply trigonous, 3-3.2 mm. long, apically narrowed, the beak rather poorly defined and about 1 mm. long, slightly flattened and bidentate; achenes brownish, rather sharply trigonous, 2.3-2.5 mm. long, apiculate, jointed with the rest of the style which however tends to persist. Locally abundant in mts. of the Trans-Pecos (Brewster, Culberson and Pecos cos.), flowers late spring-early summer, fruits in summer to Aug.; endemic but doubtless also to be found in Coah. and N.M.

Perhaps not specifically distinct from the Mexican *C. stellata* Mack., the typical form of which has erroneously been reported to occur in Texas.

38. *Carex planostachys* Kunze. Densely tufted perennial, basally brownish-black, hard and knotty; culms 4-30 cm. long, 0.5-1 mm. thick, wiry; blades of leaves and bracts commonly surpassing the culms; inflorescence variable, often of a headlike group of 1 terminal (staminate) and 1 to 3 pistillate subterminal nearly sessile spikelets (or else the staminate spikelet solitary) and with 1 to 3 pistillate spikelets (4-15 mm. long) on long capillary-flexuous peduncles widely isolated lower on the culm (appearing basal and emanating severally from the tight cluster of bracts); scales about as long as their perigynia, often slightly longer and concealing most of the dorsal part; bract of lowest subterminal pistillate spikelet foliaceous, (1-) 2-4 (-10) cm. long, 1-2 mm. broad, the bracts of upper spikelets reduced; perigynia 3 or 4 per spikelet, narrowly rhomboid-ellipsoid or obovoid-ellipsoid, 3-4 mm. long, rather sharply triangular, not at all inflated, membranous, minutely pubescent, narrowed basally and apically (beak not differentiable), with about 6 prominent close-set veins or ribs on each of the 3 sides (the 2 ribs on the adaxial corners more prominent than the rest); achenes almost completely filling the perigynium, triangular, the sides slightly concave, minutely apiculate, jointed with the style which completely withers after anthesis. Abundant in dry scrub on limestone, Edwards Plateau and n.-cen. Tex. (n. to Taylor, Parker, Tarrant and Dallas cos.), infrequent in mts. of the Trans-Pecos (Brewster, Hudspeth and Pecos cos.) and cuestas of Rio Grande Plains (Karnes, Live Oak and San Patricio cos.), Mar.-May; Tex., S.L.P., Pue.; Guat.

39. *Carex tenax* Chapm. Tufted perennial with tough knotty bases, forming stools 1-2 dm. across; culms 25-35 cm. long, about 1 mm. thick, tough, wiry, sharply triangular, erect; leaves mostly basal, grayish-green, the blades about 2 mm. broad, tough, stiffly ascending, the longer ones equaling or surpassing the culm; inflorescence a close group of usually 3 spikelets, a terminal staminate one and 2 subterminal sessile oblong pistillate spikelets (5-18 mm. long); bract of lowest spikelets foliaceous, 5-10 cm. long, 1-2 mm. broad, much-exceeding the inflorescence, the bracts of the higher spikelets smaller; perigynia 15 to 20 per spikelet, ellipsoid, about 4.5 mm. long, triangular, not inflated, firm-membranous, covered with a short white pubescence (especially dense in the distal half), with about 20 strong veins or ribs (about 6 or 7 per side), narrowed to a stipelike base, apically tapered to a scarcely beaklike apex, with an essentially entire orifice; achene almost completely filling the perigynium, triangular, with prominent angles and concave sides, minutely apiculate, jointed with the style which completely withers after anthesis. *C. dasycarpa* Muhl. var. *tenax* (Chapm.) Kükenth. Rare in pine-oaks, s.e. Tex. (known only in e. Hardin Co.), Apr.; S.C., Ga., Fla., Miss. and Tex. (presumably also La., Ala.).

40. *Carex eburnea* Boott. Perennial; rhizomes extensively creeping, scaly, about 1 mm. thick; culms in small tufts at intervals along the rhizome, 20-35 cm. long, 0.2-0.3 mm. thick, wiry, grayish-green; leaves involute-filiform, 15-20 cm. long, 0.2-0.3 mm. thick, mostly shorter than the culms, grayish-green, basally clustered; inflorescence essentially bractless except for a minute nearly bladeless hyaline sheath at the node of the subterminal spikelets, composed of a terminal erect staminate spikelet and usually 2 subterminal erect peduncled (peduncles filiform, erect, 1-2 cm. long) pistillate spikelets about 8 mm. long and 2 mm. thick, the nodes of attachment of spikelets being separated by internodes 8-12 (upper ones) or 13-27 (lower ones) mm. long; scales hyaline, very slightly shorter than their perigynia; perigynia 5 to 8 per spikelet, fusiform, 2.5-2.7 mm. long, the bodies narrowly obovoid-triangular (the angles blunt, the sides flat), 2-2.1 mm. long, membranous or subhyaline, glabrous, with 2 prominent veins and a number of faint ones, apically narrowed; beak 0.5-0.6 mm. long, not well-defined, thick basally, oblique and the orifice oblique; achenes 1.6-1.8 mm. long, dark-brown, obovoid, rather sharply trigonous, essentially filling the bodies of the perigynia, apiculate, jointed with the style which wholly withers after anthesis. Rare in seepage areas of limestone cliffs at alt. of 5,000-6,000 ft. in the Trans-Pecos (Guadalupe Mts.), July; temp. N.A. s. to Va., Tenn., Mo., Neb., and in mts. to Tex.

Our plants may be variably distinct in that the perigynia and achenes average slightly larger than in more northern plants.

41. *Carex microrhyncha* Mack. Perennial in dense tufts to 1 dm. across; culms 1-10 (-17) cm. long, 0.3-0.4 mm. thick; leaves (some of these bracteal) clustered at the base; lowest sheaths of new shoots with blades; blades 10-35 cm. long, 1-2 mm. broad, far-exceeding the culms; inflorescences diverse, some with a terminal staminate spikelet and

1 (rarely 2) subterminal nearly sessile ascending pistillate spikelet but usually with a terminal staminate spikelet and 2 or 3 pistillate spikelets widely separated from the staminate spikelet and each other and borne on capillary-flexuous peduncles 6-32 mm. long, thus appearing solitary on casual examination as they appear to be borne severally in the tight leaf- (actually bract-) clusters; scales about as long as the perigynia and largely covering them; bracts of upper spikelets negligible; perigynia 3 to 10 per spikelet, ascending, 2.5-3 mm. long, the bodies narrowly obovate and about 2 mm. long, vaguely triangular in transection, long-tapered basally (at the extreme base discolored), apically narrowed, minutely pubescent, with 2 prominent nerves and no others, membranous; beak about 0.5 mm. long (rarely to 1 mm.), shallowly bidentate; achene completely filling the upper part of the body, triangular, the angles blunt and sides convex, apically truncate, jointed with the style which completely withers after anthesis. Frequent but very inconspicuous in gravelly sandy soil, e. Tex. (Bastrop, Brazos, Colorado, Fayette, Lavaca, Lee and Shelby cos.), also reported in Dallas Co., Mar.-Apr.; Mo., Okla. and Tex.

By some authors this plant is merged with *C. abdita* Bickn. which ranges from Nfld. and Sask., s. to Va., Tenn., Ill. and Mo.

42. *Carex nigromarginata* Schwein. var. *floridana* (Schwein). Kükenth. Tufted perennial, often with scaly slender rhizomes; culms 4-20 cm. long, 0.3-0.5 mm. thick; leaves largely clustered near the base; lowest sheaths of the new shoots bladeless; blades 8-30 cm. long, far-exceeding the culms, 2-2.5 mm. broad; inflorescence subcapitate, 9-12 mm. long, 3-7 mm. thick, composed of one terminal staminate spikelet and a few subterminal sessile ascending-appressed pistillate ones so closely placed that they overlap for most of their lengths; scales about as long as the perigynia and mostly concealing them, often with a faint purplish marginal zone, otherwise thin-membranous; bract of lowest spikelet 6-9 mm. long, foliaceous, those of rest of spikelets smaller; perigynia 5 to 12 per spikelet, ascending-appressed, about 3.3 mm. long, the bodies narrowly obovate and about 2.8 mm. long, vaguely triangular in transection (the inner "angle" blunt), long-tapered basally (at the extreme base discolored), apically narrowed, minutely pubescent, with 2 prominent veins; membranous; beak about 0.5 mm. long, oblique or minutely bidentate; achene completely filling the upper part of the body of the perigynium, in transection with 2 definitely small angles and one ventral indefinite blunt one, with convex sides, apiculate, jointed with the style which completely withers after anthesis. Rare in moist sandy forests, e. Tex. (Nacogdoches and Newton cos.), Feb.-Mar.; Ga., Fla., Miss., La. and Tex. (the var. *nigromarginata* from Gulf States except Tex., n. to N.E.).

43. *Carex physorhyncha* Liebm. Tufted perennial, with scaly reddish brown rhizomes about 2 mm. thick; culms 15-30 cm. long, 0.3-0.6 mm. thick; lowest sheaths of flowering culms with blades, those of sterile shoots bladeless; blades 2-3 mm. broad, shorter than the culms; inflorescence interrupted-spiciform, 15-25 mm. long, 4-7 mm. thick, composed of one terminal staminate spikelet and 2 to 3 subterminal sessile ascending-appressed pistillate ones, the 2 lowest pistillate spikelets only 3-10 mm. apart on the axis; scales nearly as long as the perigynia, 3-veined medially, marginally hyaline; bracts of lowest spikelet setaceous to subfoliaceous, 5-44 mm. long, ascending, those of the rest of the spikelets smaller; perigynia 6 to 12 per spikelet, ascending-appressed, 2.5-3 mm. long (the bodies narrowly obovoid, bluntly triangular, 1.8-2.3 mm. long, about 1 mm. thick), basally strongly stipitate-narrowed and at the very base discolored, with 2 prominent veins, minutely pubescent, membranous; beak 0.5-0.7 mm. long, thin-membranous, shallowly bidentate; achene completely filling the upper part of the perigynium, triangular, apiculate with convex sides, jointed with the style which completely withers after anthesis. Rare in e. (Smith and Walker cos.), s.e. (Jefferson Co.) and n.-cen. (Dallas Co.) Tex. in moist sandy soil, Mar.-May; S.C., Ala., Miss., La., Ark., Okla., Tex. and Hgo.

44. *Carex Willdenovii* Schkuhr. Densely tufted perennial; culms 8-25 cm. long, leafy, the leaves far-surpassing the inflorescences; spikelets 1, 2 or 3, androgynous, 5-10 mm. long, 2-4 mm. thick, widely separated, the lower one essentially basal and on a peduncle 2-5 cm. long and 0.3-0.5 mm. thick, the upper one on a peduncle 8-15 cm. long and 0.4-0.5 mm. thick; pistillate scales minute; staminate scales very inconspicuous, the margins united basally; bract of terminal spikelet leaflike, 1-5 cm. long, far-surpassing the spikelet, bracts of lower spikelets somewhat smaller; perigynia 3 to 6 per spikelet, nearly round in transection or faintly triangular, with 2 prominent veins and none others,

glabrous, ascending, about 5 mm. long and 1.5 mm. broad, the body obovoid, apically rounded, basally tapered, closely enveloping the achene; beak about 2 mm. long, sharply distinguished from the body, subulate-triangular, at the orifice oblique and entire; achenes triangular, apically blunt, jointed with the style which is 3-branched and which withers in its entire length after anthesis. Rare (if present at all) in extreme e. Tex., late spring?; Vt. and Ont. s. to Ga., Miss. and La.; said to occur also in Texas, but no material has been seen from the state.

45. *Carex leptalea* Wahl. Perennial with creeping scaly rhizomes 0.5-1 mm. thick; culms in tight tufts along the rhizome, 1-4 dm. long, 0.5-1 mm. thick, erect; sheath venters broadly hyaline, splitting lengthwise; blades narrower than their sheaths, 0.5-1 mm. broad, shorter than to occasionally equaling the culms; inflorescence a solitary androgynous spikelet 5-18 mm. long and 2-3 mm. thick; scales red-dotted, those of the staminate flowers with edges connate on lower part; bract absent; perigynia compressed-triangular in transection, almost flat (flat in prepared specimens, appearing 2-edged), oblong-elliptic, 3.9-5 mm. long, 1 to 10 per spikelet, appearing to be tristichous, the lower ones maturing first and falling early in succession (with their scales!), appressed-erect, membranous, many-nerved, the upper part empty, basally spongy, substipitate, beakless, apically rounded; achenes triangular with concave sides, apically truncate, jointed with the flexuous style which all withers away after anthesis. Incl. var. *Harperi* (Fern.) Stone. Frequent in sphagnum areas, e. and s.e. Tex. (Anderson, Angelina, Hardin, Jasper, Nacogdoches, Newton, Shelby and Tyler cos.), Apr.-early June; e. temp. N.A. s. and w. to n. Calif., Colo. and Tex.

46. *Carex crus-corvi* Kunze. Densely tufted perennial (the internodes of the rhizomes very short); culms 4-9 dm. long, 4-12 mm. thick basally, soft; sheaths soft, ventrally thin-papery and easily splitting, the orifice horizontal or shallowly U-shaped, not thickened; blades long, often surpassing the inflorescence; inflorescence a decompound panicle 6-15 (-19) cm. long and 15-40 mm. thick, with 7 to 13 ascending or erect short branches (the lower-middle branches the longest), each branch with 3 to 10 burlike sessile androgynous bractless spikelets each with only a few perigynia; scales lanceolate, about as long as or slightly exceeding the body; perigynial body triangular, largely plano-convex, 2-3 mm. long, firm, brownish, basally inflated, discolored whitish, truncately narrowed to the minute stipelike base, apically passing into the linear strongly bidentate beak (3-4 mm. long); achene lenticular. In mud, frequent in e. Tex., infrequent in s.e. and n.-cen. Tex., rare in the Plains Country (Wichita Co.), spring; Gulf States and n. in cen. U.S. to O., Mich., Minn. and Wisc.

47. *Carex stipata* Muhl. Densely tufted perennial, the internodes of the rootstocks very short; culms 3-10 dm. long, 3-7 (-12) mm. thick basally, rather soft, triangular above with concave sides; sheaths soft, ventrally not transversely wrinkled, easily splitting, orifice horizontal or slightly prolonged and rounded, not thickened; upper blades usually about equaling the inflorescence; inflorescence a dense decompound panicle 3-10 cm. long and 10-25 mm. thick, with several ascending branches (the lower branches longer), each branch with 2 to 10 sessile subglobose essentially bractless androgynous spikelets each with 8 to 15 perigynia; scales ovate, acuminate, about equaling the perigynia; perigynial bodies plano-convex, ovate, firm, 2-3 mm. long, basally more or less discolored brownish-stramineous, firmer, abruptly narrowed to a minute stipe, apically passing into the linear beak which is strongly bidentate and 2-3 mm. long; achene lenticular. Incl. var. *maxima* Chapm., *C. uberior* (Mohr) Mack. Rare in mud, e. Tex. (Austin and Leon cos.), spring; most of temp. N.A. (except extreme s.w. U.S. and Mex.).

C. stipata and *C. Muhlenbergii* (especially the form "*C. Lunelliana*") have apparently hybridized in the past; some of the products have been called *C. oklahomensis* Mack. or *C. stipata* var. *oklahomensis* (Mack.) Gl. These plants show intermediate characters; plants of this kind have been found in Gray County (Panhandle, Plains Country). *C. stipata* itself is intermediate between *C. Muhlenbergii* and *C. crus-corvi* and may represent merely selected populations derived from ancient hybridization.

48. *Carex decomposita* Muhl. Perennial, the branching fibrous blackish rhizomes with internodes several mm. to several cm. long; culms weakly arcuately ascending, soft, 5-15 dm. long, 3-7 mm. thick, nearly terete; lower sheaths brownish or reddish-brown, 1-2 cm. long; sheath venters papery, tending to split at maturity, not at all wrinkled, orifice weakly rounded; upper leaves long, much-surpassing the inflorescences; inflorescence a

decompound panicle of 5 to 10 spiciform erect branches (the lower branches longer than the upper ones), each branch bearing 5 to 20 short ovoid sessile androgynous brownish essentially bractless spikelets each with 8 to 13 perigynia; scales narrower and shorter than the perigynia, perigynial bodies obovate, plano-convex, firm, 1-1.5 mm. long, 0.7-1 mm. broad, sharp-edged laterally; beak abrupt, 0.3-0.5 mm. long, bidentate; achene lenticular. Rare in wet areas, usually on rotten logs at lake-margins, n.e. Tex. (Marion and Wood cos.), spring; e. U.S. n. to N.Y. and Mich., w. to Mo. and Tex.

49. *Carex vulpinoidea* Michx. Densely matted rhizomatous perennial; rhizomes 2-4 mm. thick, dark-brown or black, fibrous, internodes only 1-2 mm. long; culms 35-70 (-90) cm. long, 1.5-3.5 mm. thick, erect; sheaths tight, ventrally papery, strongly and closely transversely wrinkled, at the orifice firm and rounded; leaf blades diverse, the lower ones only 5-10 cm. long, the upper very long and equaling or surpassing the heads, tapered to a setaceous tip; inflorescence interrupted-spiciform, 35-80 mm. long, 7-13 mm. thick, of 10 to 15 short sessile androgynous spikelets (each with 15 to 30 perigynia), all except the lowermost bractless (in var. *platycarpa* Hall) or with setaceous bracts 10-30 (-80) mm. long (in var. *vulpinoidea*); scales papery, lanceolate, acute, about equaling or usually a little shorter than their perigynia; perigynial bodies ovate to suborbicular, 2.5-3 mm. long, 2-3 mm. broad, strongly compressed, mostly flat ventrally, very slightly convex dorsally, smooth or usually serrulate marginally, ventrally usually with a few veins and often on both faces at maturity becoming brownish and firm-membranous; beak of perigynium either abruptly differentiated from and only about a third as long as the body (var. *platycarpa*) or less abrupt and about half as long to as long as the body (var. *vulpinoidea*), bidentate, serrulate or entire-margined; achene lenticular. *C. triangularis* Boeck., *C. annectans* Bickn. The var. *platycarpa* Hall is frequent in mud in e. and s.e. Tex., rare in n.-cen. Tex. (Denton Co.); var. *vulpinoidea* is rare in the Plains Country (Dallam and Hemphill cos.), spring (var. *platycarpa*) or summer (var. *vulpinoidea*); e. temp. N.A. w. to the Rocky Mts.; also B.C., Wash. and Ore.

50. *Carex Muhlenbergii* Schkuhr. Rhizomatous perennial, the rhizomes blackish and fibrous with extremely short internodes, the plants thus appearing tufted; culms 2-6 dm. long, mostly erect, 1.2-2.5 mm. thick basally; sheaths whitish or green-mottled, tight or loose, dorsally with or without transverse septate venation, ventrally smooth (wrinkled in genetically contaminated plants), the orifice shallowly U-shaped; blades 3-5 mm. broad, long-tapered to a setaceous tip, the upper ones about equaling the inflorescence; inflorescences elongate-ovoid to ovoid-oblong or linear-oblong, 2-4 cm. long, 10-15 mm. thick, of 5 to 10 sessile androgynous spikelets (each with 10 to 20 perigynia), the lower 1 to 8 spikes with ascending narrow bracts 1-3 cm. long (or in the form known as *C. arkansana* the bracts strongly elongated to 2 dm. long); scales acuminate, with strong green midribs, often nearly equaling (or the lower ones in each spike exceeding) the perigynia; perigynia ascending, plano-convex, with bodies 2.5-3 mm. long and broad, often slightly discolored brownish at the very base, marginally green (usually strongly contrasting with the membranous whitish or brown center), ventrally and dorsally smooth or somewhat veiny, narrowed to a bidentate serrulate beak a third to half as long as the body; achene lenticular. Incl. var. *enervis* Boott, var. *australis* Bailey and var. *austrina* Small (a superfluous and illegit. name), *C. arkansana* Bailey, *C. austrina* (Small) Mack., *C. onusta* Mack., *C. Lunelliana* Mack., *C. plana* Mack., *C. gravida* var. *Lunelliana* (Mack.) Herm. Frequent in e., s.e. and n.-cen. Tex., rare in Edwards Plateau and e. part of Plains Country, usually in sandy forested soil, spring; e. N.A., w. to Minn., Neb., Kan., Okla. and Tex.

C. Muhlenbergii grades freely into *C. cephalophora* and into the nexus of populations here called *C. vulpinoidea* and *C. stipata*.

51. *Carex cephalophora* Muhl. (Sub-) rhizomatous perennial; rhizomes 2-10 cm. long, much-branched, about 2 mm. thick, with very short internodes; culms 15-30 (-45) cm. long, 1-2 mm. thick, ascending; leaves 2 to 4 per culm, mostly basal; blades about 15 cm. long and 2 mm. broad, the sheaths ventrally smooth, rather tight-fitting, stramineous, the orifice broadly U-shaped; spikelets 5 to 10, each with about 10 perigynia, very short, sessile, androgynous, aggregated in a narrow more or less ovoid nearly or usually quite bractless head 10-15 (-17) mm. long and 4-9 mm. broad; scales inconspicuous, shorter than the perigynia; perigynia ascending, much-flattened, broadly ovate, the body 1.5-2.5

mm. long and 1-1.5 mm. broad, plano-convex, ventrally quite smooth and with raised margins, basally not differentiated or else discoloring brown in the basal third to fourth the length, firm-membranous, with inconspicuous only slightly tougher margins and with a very short triangular beak less than half as long as the body; achene lenticular. Incl. var. *angustifolia* Boott and some plants referred to *C. "mesochorea"* Mack., *C. Leavenworthii* Dew. Frequent in usually moist sandy soil in e., s.e. and n.-cen. Tex., rare in parts of "Edwards Plateau" (Enchanted Rock), spring; e. N.A., w. to Mich., Ia., Mo., Okla. and Tex.

Intergrades freely with *C. Muhlenbergii* and to some extent with *C. retroflexa*, and even rarely with the *C. vulpinoidea-C. triangularis* plexus; the description above applies to the essentially "pure" *C. cephalophora*.

52. *Carex retroflexa* Muhl. Rhizomatous perennial; rhizomes blackish, fibrous, 1-2 mm. thick, with extremely short internodes, the plants thus appearing tufted; culms erect, 12-45 cm. long, slender, about 1 mm. thick, surpassing the leaves; sheath venters flat, the orifices nearly straight; blades 3-15 cm. long, 1-2 mm. broad, ascending, long-tapered to a setaceous tip; inflorescences oblong to linear-oblong or interrupted-spiciform, 10-35 mm. long, about 5 mm. thick, of 3 to 6 very short sessile androgynous spikelets (each with 3 to 10 perigynia), the lower of these spikes sometimes separated from the rest; bractless or often the bract at the lowest node developed, setaceous and 10-25 mm. long; perigynia spreading or at length some of them even slightly reflexed, with ovate to obovate bodies 2-3 mm. long, plano-convex or very unequally biconvex, in the basal half strongly discolored white or brown and taking on a spongy-coriaceous texture, with several nerves visible under a lens, in the distal half firm-membranous, green, passing abruptly or often insensibly narrowed into a bidentate subulate beak a third as long as the body; achene lenticular. *C. texensis* (Torr.) Bailey. Infrequent in sandy woodland, e., s.e. and n.-cen. Tex., spring; e. U.S. w. to Ill., Mo., Okla. and Tex.

This species grades freely into *C. cephalophora* and *C. Muhlenbergii*.

53. *Carex atlantica* Bailey. Tufted perennial (internodes of the branching rhizomes less than 1 mm. long); culms 2-5 dm. long, about 1 (-2) mm. thick; sheaths stramineous, tight, ventrally papery, tending to split, the orifice horizontal or shallowly U-shaped; inflorescence interrupted-spiciform, 3-5 cm. long, 5-8 mm. thick, of 3 or 4 subglobose bractless spikelets each with 8 to 20 perigynia (rarely as many as 40) and separated by bare axis internodes 5-14 mm. long, the terminal spikelet attenuate basally (in the staminate portion), gynecandrous, the rest usually wholly pistillate; scales slightly shorter than the perigynia; perigynial bodies spreading at maturity, 1.5-1.8 mm. long, broadly ovate to nearly orbicular, plano-convex, firm, marginally sharp but not winged, shiny, stramineous, with several strong nerves ventrally (use lens), abruptly narrowed to the beak which is linear, 0.7-0.9 mm. long and bidentate; achene lenticular. *C. incomperta* Bickn., *C. Howei* Mack. Infrequent or rare at edges of clear acid streams in e. and s.e. Tex. (Hardin, Nacogdoches, Newton and Tyler cos.), spring; e. N.A., w. to Mich., Ind., Tenn. and Tex.

54. *Carex hyalina* Boott. Rhizomes 2-3.5 mm. thick, branching, black-fibrous, with internodes 0.5-1 mm. long; culms 25-60 cm. long, about 1 mm. thick, erect, sharply triangular; sheath venters pale-hyaline; blades 1-2 mm. broad, shorter than (or the uppermost equaling) the culms; inflorescence 15-35 mm. long, 8-11 mm. thick, of 2 to 4 noticeably separated sessile ascending gynecandrous subglobose (burlike) to prolate basally abruptly attenuate heads 8-12 mm. long and 8-11 mm. broad; scales much shorter than their perigynia; perigynia 15 to 30 per spikelet, divaricate, 5.5-6.5 mm. long (including the beak), 2.5-3.2 mm. broad, widest well below the middle, the body (poorly differentiated) broadly ovate, widest near the middle, at anthesis pale-greenish-stramineous, membranous and distended only over the achene, at maturity very firm, unequally biconvex centrally and with the margins and wings strongly curved toward the ventral surface, stramineous with a brownish submarginal zone, strongly veined ventrally, with transverse wrinkles between the veins and in the margins and wings; beak poorly differentiated, elongate-triangular, 1.5-2 mm. long, green turning brownish; achene lenticular. Infrequent to rare in mud in e. Tex. (Cass, Houston and Walker cos.), very rare in n.-cen. Tex. (Dallas Co.), Apr.-May; Ark., Okla. and Tex.

55. *Carex Brittoniana* Bailey. Tufted perennial; rhizomes 2-4 mm. thick, black-fibrous, with internodes about 1 mm. long, branching; culms 35-75 (-90) cm. long, 2-2.5 (-3) mm. thick, erect, sharply triangular; sheath venters stramineous-hyaline; blades 2.5-5 mm. broad, flat, shorter than the culms; inflorescence 25-50 mm. long, 10-25 mm. broad, of 2 to 5 clumped or slightly separated ascending nearly globose to ovoid burlike basally strongly attenuate gynecandrous sessile spikelets 11-16 mm. long; bracts essentially absent; perigynia (30 to) 40 to 50 (to 65) per bur, (5.5-) 6-8 (-8.5) mm. long (including the beak), (3.7-) 4-5.5 (-6) mm. broad (including the wings), at maturity divaricate, the body very broadly ovate to very broadly elliptic to nearly orbicular, occasionally broader than long, basally broadly rounded to slightly cordate, at anthesis thin-membranous, pale-greenish-stramineous, distended only over the achene, at maturity firm to subcoriaceous, plano-convex centrally, stramineous with a submarginal brown zone, ventrally nearly veinless; beak 2.5-3 (-3.5) mm. long, strongly differentiated, at anthesis green, at maturity brown, bidentate; achene lenticular. Frequent in moist areas in Rio Grande Plains, s.e. and n.-cen. Tex., infrequent in Edwards Plateau, Plains Country and e. Tex., Mar.-May; also Okla. Purported also to occur in Lee Co., Fla.

Poorly developed (especially drought-affected) specimens often resemble *C. hyalina* because of the few developed perigynia with long beaks.

56. *Carex reniformis* (Bailey) Small. Tufted perennial; culms 2-7 dm. long, 1-2 mm. thick, sharply triangular; sheath venters stramineous-hyaline; lower blades very short, upper ones 1.5-4 mm. broad, shorter than the culms; inflorescence (1.5-) 3-4.5 (-5) cm. long, 7-10 mm. thick, of 3 to 7 more or less strongly separate gynecandrous erect subglobose apically rounded basally abruptly attenuate spikelets 6-10 (-13) mm. long and 5-8 (-9) mm. broad; bracts essentially absent; scales half to two thirds as long as their perigynia; perigynia 25 to 40 per spikelet, erect, (3.3-) 3.8-5 (-5.5) mm. long (including the beak), (2.3-) 2.6-3.5 (-4.5) mm. broad, broadest near or below the middle, the bodies nearly orbicular to broadly oblong to obovate, winged, at anthesis extremely thin, distended only over the achene, membranous but at maturity firm to subcoriaceous, nearly plano-convex or concavo-convex, stramineous or with brownish submarginal staining, ventrally shiny and essentially veinless; beak well-differentiated from body, green turning pale-brownish, 1-1.7 mm. long, bidentate; achene lenticular. *C. brevior* (Dew.) Mack. Frequent in s.e., e., and n.-cen. Tex., in mud, occasionally in woodlands, usually in open places, Apr.-May; e. N.A. w. to B.C., Wash., Ore., Colo., N.M. and Tex.; typical form in s.e. U.S.; *C. brevior* form elsewhere.

The form known as *C. brevior* is the common one in Texas, having on the average (at maturity) subcoriaceous perigynia with bodies longer than broad; the typical form occurs in east and southeast Texas and has merely firm perigynia with bodies almost as broad as long, but there is no means of discerning two different species in this group of populations. A report of the occurrence in Texas of *C. Bicknellii* Britt. has been found to be based on a specimen of *C. reniformis*.

57. *Carex alata* Torr. Tufted perennial rather like *C. Longii* but the inflorescence perhaps on the average with the spikelets a little more separated from each other; perigynia (3.7-) 4-5 mm. long, 3.1-3.5 mm. broad, thus averaging longer and proportionately broader than in *C. Longii*, and with the ventral veins slightly less conspicuous. Rare in mud, e. Tex. (Anderson Co.), Apr.; otherwise attributed to Coastal States, Mass. to Fla. and Ind., Mich. and O.

The plant referred here probably represents an isolated product of ancient hybridization of the *C. tribuloides*-*C. Longii* plexus with plants here called *C. reniformis*; that it should be dignified with a botanical name is questionable and the application of the name *C. alata* is even more doubtful.

58. *Carex albolutescens* Schwein. Tufted perennial; culms 25-75 cm. long, 1-2 mm. thick, sharply triangular, erect; sheath venters broadly stramineous-hyaline; blades 1.5-3 mm. broad, shorter than the culms, in most specimens rather stiffly ascending, the lower ones extremely short; inflorescence interrupted-spiciform to moniliform-spiciform, 25-45 mm. long, 6-10 mm. thick, of 3 to 10 sessile basally attenuate ovoid apically rounded ascending gynecandrous spikelets 6-11 mm. long and 5-6 mm. thick; bracts absent; scales shorter than the perigynia; perigynia 30 to 50 per spikelet, 2.8-3.2 (-3.5) mm. long, 1.6-2.2 mm. broad, widest below the middle, the body broadly obovate, widest above the middle, at anthesis stramineous, very thin and distended only over the achene,

winged, at maturity stramineous and firmer, somewhat plano-convex, ventrally nearly veinless; beak 0.6-1 mm. long, flat, bidentate, serrulate, at anthesis green, at maturity brownish, contrasting with the body; achene lenticular. Infrequent or rare in moist sand in e. (Polk Co.) and s.e. (Jefferson Co.) Tex., Apr.; otherwise said to occur in Coastal States, N.S. to Fla.; also Mich., Ill., Ind., Mo., Tenn. and La.

The group of plants now passing under this name combines characters of the *C. brevior* form of *C. reniformis* and of *C. festucacea* Schkuhr (including *C. normalis* Mack.), which has been found in Okla. and La. and should eventually be found in Texas; *C. festucacea* is separated from *C. albolutescens* usually by the closer clustering of the spikelets, greener, veinier sheath venters (as in *C. tribuloides* and *C. Longii*), usually broadly ovate or broadly ellipsoid perigynial bodies (broadest below the middle), with somewhat veinier venters and weaker color-contrast of the body and beak.

59. *Carex Longii* Mack. Tufted perennial, the rootstocks with very short internodes; culms sharply triangular, 3-8 dm. long, erect, 1.5-2 mm. thick; sheaths short, the venters mostly green and veiny except for the immediate vicinity of the orifice; blades 1.5-4 mm. broad, shorter than the culms, at least the lower ones often relatively stiff and diverging slightly from the stem; inflorescence moniliform-spicate, 3-5 cm. long, 12-15 mm. thick, of 5 to 10 sessile basally abruptly attenuate narrowly ovoid ascending gynecandrous spikelets 7-11 mm. long and 5-8 mm. thick; bracts absent except occasionally a small setaceous one at the base of the lowest spikelet; scales shorter and narrower than their perigynia; perigynia 55 to 80 per spikelet, winged, when immature silvery-green, scalelike and subappressed, at maturity brownish and plano-convex, very firm, with tip erect, ventrally veiny, (3-) 3.5-4.2 (-4.5) mm. long, 1.7-2.5 mm. broad (including the wings), broadest near the middle (meaning in the upper half of the "body"), the broadly triangular "beak" about 1 mm. long and scarcely differentiable from the "body"; achene lenticular. Infrequent in mud and shallow water in e. and s.e. Tex., Apr.-early June; Coastal States, Mass. to Tex., Ind., Mich.; Mex.; Berm.; also reported in Venez.

Exceedingly like *C. tribuloides* except for perigynial shape. Plants intermediate between *C. Longii* and *C. reniformis* occur, probably indicating hybridization. Plants referred here to *C. alata* combine some of the characters of both species. The report of the occurrence in Texas of *C. molesta* Mack. is probably based on such a hybrid product.

60. *Carex tribuloides* Wahl. Tufted perennial; culms 3-8 dm. long, 1-2 mm. thick, basally slightly arcuate-ascending, mostly ascending, apically strongly angled; sheaths short, the venters mostly veiny except for the hyaline area near the orifice; blades (1-) 2.5-5 mm. broad, shorter than the culms and at least the lower ones often relatively stiff and diverging from the culm at an angle of 10-30° (-50°); inflorescence elongate, capitate or shortly subspicate, 25-50 mm. long, 9-15 mm. thick, of 5 to 15 closely set sessile burlike obovoid to oblong ascending gynecandrous spikelets 7-10 mm. long and 3-5 mm. thick; bracts absent except occasionally a small setaceous one at the base of the lowest spikelet; scales half to two thirds as long as their perigynia; perigynia 50 to 80 per spikelet, much-flattened and scalelike, distended only over the achene, winged, 3.5-5.2 mm. long (including the bidentate beak which is about 1 mm. long), 1-1.5 mm. broad including the wings (broadest near the middle, i.e., in the upper half of the "body"), stramineous-brown, ventrally veiny, stiffly ascending and apically not appressed nor incurved; achene lenticular. Rare in wet sand, s.e. Tex. (Jefferson and Montgomery cos.), May; e. temp. N.A. w. to Minn., Mo., Okla. and Tex.

61. *Carex praegracilis* W. Boott. Perennial; rhizomes 2-4 mm. thick, blackish, fibrous, creeping (but with internodes only 1 mm. long); culms rising at close intervals, 12-30 cm. long, 1-3 mm. thick, leafy; blades mostly folded, long-tapered to a fine point, the uppermost ones usually slightly exceeding the inflorescence; inflorescence 15-45 mm. long, 6-10 mm. thick, of about 6 to 15 short glomeriform androgynous spikelets, the lower 1 or 2 spikelets usually weakly separated from the rest; scales hyaline marginally, acuminate, longer than the perigynia; perigynia (about 10 per spikelet) plano-convex, ascending, thin-coriaceous when mature and with sharp coriaceous margins, the body obovate or ovate, 3-4 mm. long, 1.5-2 mm. broad, tapering into a serrulate beak half the length of the body or more; achene lenticular. Infrequent in moist canyons of basaltic mts. at elev. of 4,000-8,000 ft. in the Trans-Pecos (Chisos and Davis mts.), spring-early summer; temp. w. N.A., in mts. s. to Mexico City.

FAM. 28. PALMAE JUSS.¹⁹

PALM FAMILY

Trees, shrubs or perennial vines, endogenous in growth; leaves persistent and often shedding after withering and natural breaking of the petioles, in some detaching cleanly from sheathing base of the petiole and leaving rings on the trunk; leaf blades firm and durable, sometimes entire but mostly pinnate or palmate, the ultimate divisions with strong midrib and lesser parallel lateral veins; inflorescence or spadix various, ordinarily a long branching structure issuing from axils of present or of fallen leaves, each branch subtended by a bract or nodifrond or in some cases enclosed in a woody spathe-like structure or cymba; flowers paleaceous and very small in proportion to size of plant, perfect or unisexual, usually 3-merous or multiples thereof; calyx 3-parted or tridentate, sometimes subtended by involucre bracts; corolla polypetalous or gamopetalous: stamens 3, 6 or multiples thereof; pistils 1 to 3 in most species, ripening into a drupelike or fleshy fruit of many sizes and shapes, the exterior pulp sometimes edible, commonly with only 1 seed coming to maturity; seed a hard body often inseparably attached to carpellary parts; albumen sometimes partly liquid at maturity but commonly firm and hard and either continuous and plain in structure or ruminant by intrusion of lateral walls, placement of the embryo from basal to apical.

The genera and species are many, the latter in the thousands and often limited in distribution; mostly in tropical regions, with only one genus in Texas. Plants of most palms are highly ornamental, and several species are cultivated in the warmer areas of southern Texas, especially in the Rio Grande Valley. Among these are species of *Phoenix*, *Sabal* and *Washingtonia*.

1. SABAL ADANS.

Plant spineless, either acaulescent or caulescent, sometimes tall heavy trees; base of bole oblique, at first knoblike and rounded, sometimes not rising above the surface; petiole either ending at or near the base of the blade and the blade palmate or extending through the blade as a strong downwardly curved midrib and the blade costapalmate, segments in either case many, the hastula usually prominent; spadices or flower clusters intrafoliar, with many narrow acuminate nodifronds from which the separate flower clusters issue; flowers perfect, stamens 6; ovary solitary, superior; carpels 3, with the united styles forming a single central pistil, stigma usually not divided; fruit a berrylike or drupelike small body, exterior moderately fleshy, globular to oblate or pyriform; seed commonly flattened endwise, very hard, regular, the micropyle lateral, albumen plane or homogeneous.

A small genus of about 25 species confined to the Western Hemisphere.

1. Hastula short and obtuse, usually less than 5 cm. long; leaf blade palmate, split or divided nearly to middle; plant commonly acaulescent, only now and then with a short visible or an emerged trunk 1. *S. minor*.
1. Hastula elongated and acute, 10 cm. or more long; leaf blade costapalmate, downwardly curved; a tree 2. *S. texana*.

1. *Sabal minor* (Jacq.) Pers. BUSH PALMETTO, DWARF PALMETTO. Usually acaulescent, only occasionally developing an abbreviated stem that might become 6 m. tall; leaf blade bluish, not glaucous, stiff in appearance, to 15 dm. wide, divided to about two-thirds its length into numerous segments; petiole extending on lower side of blade as a midrib; fruits black, globular or oblate, dull or shining, 8-13 mm. in diameter. *Sabal louisiana* (Darby) Bomhard. In lowlands, swamps, river terraces and floodplains in e. Tex., w. to the Edwards Plateau and s. to Aransas Co.; from n.e. N.C., s. to s. Fla., w. to s.w. Ark. and Tex.

According to Bailey, the conspicuously caulescent plants, such as those found in Brazoria County, represent the optimum emergence of this species. Other than size, there seems to be no botanical difference between the dwarf acaulescent plants and those that

¹⁹ Adapted from L. H. Bailey in C. L. Lundell, *Flora of Texas* III:197-199. 1944.

develop a prominent trunk. The arborescent plants have been given the name *S. louisiana*.

2. *Sabal texana* (Cook) Becc. TEXAN PALMETTO, RIO GRANDE PALMETTO, PALMA DE MICHAROS. Usually tall stout trees to 16 m., with a trunk to 8 dm. in diameter; leaf blade green, to 1 m. wide or more, the segments many; petiole stout, equaling or exceeding the blade in length; fruits dull-black, 18-22 mm. in diameter. *S. mexicana sensu* Small, not Mart., *S. exul* (Cook) Bailey. On flatlands along the Rio Grande in Cameron Co. and across the river in adj. Tam.; introd. at Victoria, Tex., but apparently not yet spontaneous.

The "saw palmetto," *Serenoa repens* (Bartr.) Small [*S. serrulata* (Michx.) Hook.], has been reported from Texas, but it is not known to be native west of southeastern Louisiana. It has, however, been introduced as an ornamental at Brownsville. It may be superficially distinguished by its armed petioles with short, recurved spines along their edges and the palmately veined flabellate leaves without even the rudiment of a midrib.

A yet unidentified young plant of *Phoenix* (not *P. canariensis* Chab., *fide* H. E. Moore, Jr.) has been found growing naturally in a wooded-thickety ravine along Arroyo Colorado, 4 miles east of Harlingen. This plant could represent a naturalized species of palm in the Rio Grande Valley.

FAM. 29. ARACEAE JUSS. ARUM FAMILY

Perennial herbs from corms, rhizomes or thick roots, with soft succulent stems and leaves, usually with slender raphides and frequently with acrid or pungent juices; the veiny leaves simple or compound; flowers unisexual or perfect, crowded on a spadix which is usually subtended by a foliaceous or colored spathe; perianth none or composed of 4 to 6 similar hypogynous segments; stamens usually 4 to 6, hypogynous, opposite the perianth segments when these are present; ovary superior; fruit usually a berry, indehiscent or rupturing irregularly; seeds with fleshy albumen or none.

A large family, chiefly tropical, of about 115 genera and 2,000 species.

- 1. Plants floating on water; pistillate flowers solitary at base of inflorescence 5. *Pistia*, p. 343.
- 1. Plants rooted in soil; pistillate or perfect flowers several to many (2)
- 2(1). Spathe well-developed, fleshy or petaloid (3)
- 2. Spathe obscure or like the foliage leaves; flowers perfect, with perianths of 6 segments (4)
- 3(2). Flowers covering only the base of the spadix; leaves compound 1. *Arisaema*, p. 341.
- 3. Flowers almost completely covering the spadix; leaves simple 2. *Peltandra*, p. 342.
- 4(2). Spadix naked, terminating the terete scape; leaf blades oblong 3. *Orontium*, p. 343.
- 4. Spadix much-overtopped by the swordlike spathe that resembles the foliage leaves; leaf blades linear and more or less ensiform 4. *Acorus*, p. 343.

1. ARISAEMA MART. INDIAN-TURNIP

Low perennial monoecious herbs; the tuberous rhizome, tuber or corm sending up a simple scape sheathed with the petioles of the veiny leaves, with several sheaths surrounding base of plant; spathe convolute below and mostly expanded and arched over the spadix; flowers unisexual; perianth none; *staminate flowers* above the pistillate on the spadix, composed of a cluster of almost sessile 2- to 4-celled anthers that open by terminal slits or pores; *pistillate flowers* consisting of a 1-celled ovary that contains as many as 6 erect orthotropous ovules and a broad stigma; fruit a 1- to few-seeded globose scarlet berry.

About 150 species in America, Asia and Africa.

1. Primary leaf pedately divided into 5 to 15 very unequal leaflets; the oblong summit of the spathe with inrolled margins; spadix slender, tapering, long-exserted; fruiting head conical1. *A. Dracontium*.
1. Primary leaf palmately divided into 3 or 5 segments; the ovate to lanceolate arching hood or spathe flat; spadix cylindric-tapering to clavate, included; fruiting head ovoid or subglobose (2)
- 2(1). Primary leaf with 5 segments, the lateral segments sometimes partly united; spathes green or yellowish-green; hood broadly ovate, abruptly pointed, 3-5 cm. wide; spadix cylindric-tapering, curved3. *A. quinatum*.
2. Primary leaf with 3 segments, the lateral segments rarely bilobed; spathe typically suffused or striped with purple or red-brown; hood narrowly ovate to lanceolate, acute-acuminate, 2-3 cm. wide; spadix cylindric to somewhat clavate, straight ..
.....2. *A. triphyllum*.

1. *Arisaema Dracontium* (L.) Schott. GREEN DRAGON, DRAGON-ROOT. Leaf usually solitary, with a petiole to 5 dm. long at anthesis; leaflets sometimes confluent at base, elliptic to oblanceolate, acuminate, the central one to 2 dm. long, the outer ones successively smaller, with veins similar to those of *A. triphyllum*; peduncle to 25 cm. long; spathe thin, about 6 cm. long, light green; spadix with long tapering tip to 15 cm. long or more; berries about 1 cm. in diameter. *Muricauda Dracontium* (L.) Small. Rich woodlands and alluvial soils in woods and thickets in e. and s.e. Tex., w. onto the Edwards Plateau, May-June; Fla., w. to Tex., n. to N.H., Vt. and s.w. Que., s. Ont., Mich. and Wisc.

2. *Arisaema triphyllum* (L.) Schott. JACK-IN-THE-PULPIT, INDIAN-TURNIP. Leaves mostly 2, with petioles to 4 dm. long at anthesis; leaflets 3, elliptic to rhombic-ovate, acute to acuminate, the lateral ones asymmetrical, with veins parallel from midrib to margin; peduncle to 2 dm. long; spathe suffused or striped with purple or red-brown; hood 2-3 cm. wide; spadix straight; berries about 1 cm. in diameter. Wet woods, swamps and boggy areas in e. and s.e. Tex., May-June; from Ga., w. to Tex., n. to s.e. N.Y., Conn. and s.e. Mass.

Several segregates have been proposed in this species, which are probably found in our area. The most significant are var. *pusillum* Peck with lateral leaflets almost symmetrical and with the expanded limb of the spathe 1.5-3 cm. wide and usually all brown or red within; var. *Stewardsonii* (Britt.) Stevens with the inrolled tubular half of the spathe sharply and deeply corrugated.

3. *Arisaema quinatum* (Nutt.) Schott. Leaves mostly 1, with petioles to about 3 dm. long at anthesis; leaf segments 5, broadly ovate-elliptic to suborbicular-oval, tapering at the somewhat oblique base, abruptly acuminate at apex, glaucous beneath, to about 16 cm. long and 10 cm. wide, the lower 2 conspicuously the smallest; peduncle to 2 dm. long; spathe green or yellowish-green, the tube 5-6 cm. long; hood broadly ovate and abruptly acuminate, about as long as the tube and 3-6 cm. wide; spadix noticeably broadened near base, tapered to apex, curved; fruit 6-7 mm. thick. Moist wooded slopes in e. Tex., Apr.-May; from Tex. e. to Ga. and n. to Tenn. and N.C.

2. PELTANDRA RAF.

ARROW-ARUM

An American genus of several species.

1. *Peltandra virginica* (L.) Kunth. ТУСКАНОЕ. Plants monoecious, from thick fibrous or subtuberous roots, consisting of palmately 3-nerved and pinnately veined leaves produced at base along with one or more simple scapes; petiole to about 4 dm. long; leaf blade oblong to broadly triangular, with more or less divergent well-developed basal lobes narrowed to the tip, to 2 dm. long and 15 cm. wide, the basal lobes to 75 mm. wide, shorter than width of blade; scape to 35 cm. tall, in anthesis about equaling the leaves; spathe green with pale or whitish margins, somewhat leathery, to 1 dm. long; flowers unisexual, thickly covering the slender and tapering spadix throughout (or only its apex naked); perianth none; anther masses sessile, naked, covering the upper part of the spadix, each of 4 to 6 pairs of cells embedded in the margin of a thick and shield-shaped connective, opening by terminal pores; ovaries at the base of the spadix, each surrounded by several distinct scalelike staminodia, 1-celled; berry in an ovoid fleshy

head, green or light-brown, to about 1 cm. long when dried. *P. Tharpit* Barkl. Swamps, moist woodlands, bogs, along streams and about bodies of water in e. Tex., Apr.-May; from Fla., w. to Tex., n. to s. Me., N.H., Vt., s.w. Que., n. N.Y. and s. Ont.

A number of varietal segregates have been proposed based mainly on the shape and size of the leaf blades.

3. ORONTIUM L. GOLDEN CLUB

A monotypic genus of eastern North America.

1. *Orontium aquaticum* L. Plants aquatic, with a deep stout rhizome and basal long-petioled entire leaves; petioles to 2 dm. long; leaf blade with veins parallel from base to apex, to 2 dm. long, about a third as wide; scape to 4 dm. long; spathe incomplete and distant, merely a leaf sheath investing the lower part of the slender scape and bearing a small and imperfect bractlike blade; spadix 2-5 cm. long; flowers perfect, the lower ones with 6 concave sepals and 6 stamens, the uppermost flowers with 4; filaments wide and thin; anthers 2-celled, opening obliquely lengthwise; ovary 1-celled, with an anatropous ovule; fruit a blue-green or brownish utricle. Sandy, muddy and peaty shores and shallow water in e. (?) Tex., Apr.-June; from Fla. w. to La. (Cameron Parish) and probably Tex., n. to Mass., cen. N.Y., W.Va. and Ky.

This species has not yet been found in Texas, but since it occurs in Cameron Parish, La. adjacent to Jefferson and Orange counties, Texas, there is a good possibility that it occurs in marshes along the Sabine River in Texas. A specimen of *Lysichiton americanum* Hult. & St. John in the University of Texas herbarium bears the label "Gregg Co., March 20, 1943, Mrs. C. L. York." This typically far northern species, which was probably under cultivation at this Texas locality, resembles *O. aquaticum* but differs from it superficially by the more slender peduncle that is distinctly demarcated from the spadix.

4. ACORUS L. SWEETFLAG. CALAMUS

A genus of 2 species in the Northern Hemisphere.

1. *Acorus Calamus* L. Aromatic plants with thick creeping rhizome and ensiform leaves crowded at the base, erect, linear and more or less ensiform, to 2 mm. long and 25 mm. wide; scape resembling the leaves; spadix cylindrical, diverging laterally from a tall 3-angled scape, the upper and more foliaceous prolongation of the scape may be considered as a kind of open spathe, covered with yellowish-brown perfect flowers, to 1 dm. long and 1 cm. thick at anthesis, to as much as 2 cm. thick at maturity; perianth of 6 short concave segments; stamens 6, the linear filaments thin and flat, with 1-celled anthers reniform and opening transversely; ovary 2- or 3-celled; fruit obpyramidal about 4 mm. long. Wet places and borders of quiet water in n.-cen. and n.e. (Marion Co.) Tex., May-Aug.; from P.E.I., s. to Fla., w. to Mont., Ore. and Tex.; early introd. from Eur. and naturalized.

5. PISTIA L. WATER-LETTUCE. WATER-BONNET

A monotypic genus in southern United States and Latin America.

1. *Pistia Stratiotes* L. Plants monoecious, floating herbs; leaves clustered on very short branches at the nodes of the rootstock; leaf blades entire, cuneate to obovate-cuneate, to about 25 cm. long, strongly ribbed, dilated upward; spadix adnate to the axillary spathe; spathe about 15 mm. long, pubescent, the upper part ovate; flowers unisexual, the pistillate solitary and the staminate above the pistillate; perianth none. Streams, lakes and ponds in s. and s.w. Tex., spring; from Fla., w. along the coast to Tex., through Latin Am. to S.A.

FAM. 30. LEMNACEAE S. F. GRAY²⁰ DUCKWEED FAMILY

Minute green aquatic herbs floating on or below surface of water, often forming a solid cover over the surface, occasionally in wet seepage places, much-reduced and

²⁰ Ref.: E. H. Daubs, A Monograph of Lemnaceae. Urbana, 1965.

simplified in structure, stemless, rootless or with few nonfunctional roots, vascular tissue lacking in many of the species, reproducing chiefly by budding from a single basal pouch or 2 lateral pouches, many successive generations sometimes remaining attached by short stipes; flowers from a saclike spathe in a pouch at the basal margin of the frond or breaking through the surface to one side of the spathe, consisting either of a single stamen or a single pistil, often 2 staminate flowers and 1 pistillate flower to a spathe; fruit a 1- or 2-seeded utricle; seed large, smooth or ribbed.

A family consisting of 4 well-defined genera and including about 40 species.

1. Thallus with 1 or more roots and 2 lateral reproductive pouches; inflorescence of 2 staminate and 1 pistillate flowers surrounded by a membranaceous spathe (2)
1. Thallus rootless, each with a single basal reproductive pouch; inflorescence of 1 staminate and 1 pistillate flowers with a spathe (3)
- 2(1). Roots usually 2 or more on each thallus; mature thallus usually conspicuously 5- to 18-nerved, the ventral surface usually reddish-purple1. *Spirodela*, p. 344.
2. Roots solitary on each thallus; mature thallus 1- to 3-nerved, the ventral surface typically green or rarely streaked or tinged with brown2. *Lemna*, p. 345.
- 3(1). Thallus globose to ellipsoid, more or less obviously 3-dimensional, usually only mother- and daughter-thalluses connected; stipe attachment within the reproductive pouch3. *Wolffia*, p. 346.
3. Thallus flat, thin, lingulate, usually falcate, appearing 2-dimensional, solitary or united in stellate colonies; stipe attachment on one side of the reproductive pouch4. *Wolffiella*, p. 347.

1. SPIRODELA SCHLEID.

DUCK-MEAT

Thallus floating, solitary or usually in clusters of 2 to 5 or more, orbicular to obovate or elliptic-reniform, with 2 to numerous roots fascicled on ventral surface, palmately nerved; reproductive pouches 2, one on either side of the basal end; inflorescence arising from a pouch that consists of a saclike spathe enclosing 1 pistillate and 2 or 3 staminate flowers; ovary somewhat winged on the shoulders, 1- to 4-ovuled; fruit a utricle, slightly winged; seed longitudinally ribbed and transversely striate or smooth with a spongy outer layer.

About 6 species, cosmopolitan.

1. Roots 4 to several; thallus orbicular-obovate, 3-10 mm. long, almost as wide as long, conspicuously several-nerved with the nerves radiating from the stipe base1. *S. polyrhiza*.
1. Roots 2 to 5; thallus oblong-obovate to somewhat elliptic-reniform, 2.5-5 mm. long, not conspicuously nerved2. *S. oligorhiza*.

1. *Spirodela polyrhiza* (L.) Schleid. Thallus with 4 to 12 fascicled roots, conspicuously orbicular-obovate, 3-10 mm. long, almost as broad as long, dark-glossy-green above, usually reddish-purple beneath, with 5 to 11 conspicuous radiating nerves that create a peltate appearance, the stipe marginal or submarginal and the reproductive pouches on either side; roots provided with a single vascular strand and a long pointed rootcap; forming turions at all season but abundantly so in the fall. In ponds, lakes, bayous and sluggish streams throughout Tex.; cosmopolitan but apparently lacking in S.A.

This is the largest of the surface-floating duckweeds. It is often present as scattered, large thalluses in masses of *Lemna*, *Wolffiella* and *Azolla*, and occasionally in almost pure stands. The plants winter by producing buds that are dense and sink to the bottom of the pond.

2. *Spirodela oligorhiza* (Kurtz) Hegelm. Thallus with 2 to 5 roots, oblong-obovate to somewhat elliptic-reniform, 2.5-5 mm. long, 1.5-3 mm. broad, obscurely 3- to 5-nerved, closely resembling in size and shape some species of *Lemna*; dorsal surface yellow-green, flat to convex; ventral surface convex, frequently somewhat inflated, commonly red-purple-pigmented. On lakes and ponds, rare in e. Tex.; in the Far East, S. Pac. and U.S.

2. LEMNA L.

DUCKWEED. DUCK-MEAT

Diminutive free-floating aquatics or growing on wet surfaces; thallus solitary or in groups of 2 or more, with 1 to 3 nerves and a single root without vascular tissue, bearing on either side a meristematic pouch in which are vegetative and flower buds; vegetative buds usually disarticulate to form independent plants (in *L. trisulca* often remaining attached); flowers unisexual, produced in a membranous spathe; staminate flowers usually 2 to a spathe, each flower consisting of a single stamen; pistillate flowers usually 1 to a spathe and having a single pistil; ovary 1- to 3-ovuled; seeds usually early-ribbed and containing a distinct operculum.

About 15 species, mostly world-wide in distribution.

1. Thallus elliptic to lanceolate, commonly dilated below middle, usually submersed, long-stipitate, frequently with many remaining attached to form long chains, commonly denticulate near and at apex1. *L. trisulca*.
1. Thallus obovate to oblong, usually floating, short-stipitate or sessile, characteristically 2 to 5 attached, entire (2)
- 2(1). Dorsal surface flat, smooth, with no prominent protuberances, nerveless or very obscurely 1-nerved (3)
2. Dorsal surface with more or less prominent protuberances, indistinctly to prominently 3-nerved (4)
- 3(2). Thalluses often 8 to 10 attached, obliquely oblong, thin and flat, without papules, the surface texture uniform throughout2. *L. valdiviana*.
3. Thalluses seldom more than 2 remaining attached, oval, symmetrical, thick, with a low median ridge bearing 2 or more papules, usually with a thin margin
.....3. *L. minima*.
- 4(2). Root sheath with definite wings or appendages (5)
4. Root sheath without wings or appendages (6)
- 5(4). Thallus distinctly 3-nerved, flat, thin4. *L. trinervis*.
5. Thallus usually not prominently nerved, generally biconvex, the apical papilla prominent5. *L. perpusilla*.
- 6(4). Ventral surface of thallus flat or slightly convex but not inflated; dorsal surface of thallus dark-green, the air spaces not prominent; fruits broad but not winged at the shoulders; seed 16. *L. minor*.
6. Ventral surface of thallus noticeably convex, usually inflated; dorsal surface of thallus mottled yellow-green, the air spaces prominent; both surfaces of thallus showing red-purple coloring; fruits winged at the shoulders; seeds usually 2
.....7. *L. gibba*.

1. *Lemna trisulca* L. IVY DUCKWEED. Often forming dense masses, usually floating just beneath the surface except when flowering, mother- and daughter-thalluses often remaining attached for several generations by long, attenuate stipes; thallus 5-15 mm. long, 2.5-5 mm. wide, lanceolate-elliptic to oblanceolate, flat on both surfaces, translucent, attenuate below into a slender stipe, entire or mostly denticulate at the apex, each with a solitary root or in some thalluses the root lacking; rootcap acutely pointed. In ponds and slow-moving streams, reported from Tex.; in temp. zones of the N. Hemis.

2. *Lemna valdiviana* Phil. Thallus narrowly elliptic to oblong or oval, solitary or several together, 2-5 mm. long, 0.5-2 mm. wide, symmetrical to somewhat falcate, obscurely 1-nerved or nerveless, the dorsal surface of conspicuously uniform texture throughout, light-green and often translucent. In ponds, lakes, ditches and about springs throughout Tex.; widespread in the W. Hemis.

3. *Lemna minima* Phil. Thallus solitary or in small clusters, oblong to elliptic or somewhat ovoid, 1-2.5 mm. long, 0.7-1.5 mm. wide, sometimes with only occasional members larger, thick, the dorsal surface convex, commonly nerveless or with an obscure nerve and a row of papules along the middle, usually with a thin margin around the thallus that becomes hyaline near the base, the air chambers in 1 layer. In ponds, lakes, canals and lagoons, mostly in the w. half of Tex.; in w. U.S. and S.A.

4. *Lemna trinervis* (Aust.) Small. Thallus solitary or several attached, 2.5-5 mm. long, 1.5-3 mm. wide, obovate, with an obtuse apex and subacute base, very nearly symmetrical, thin and membranous, flat on both surfaces, light to medium green, not pigmented, papillae lacking or at least not prominent, with 3 distinct and prominent nerves; root sheath winged, the rootcap acute. *L. perpusilla* var. *trinervis* Aust. In lakes, streams, ditches and canals throughout Tex.; mostly in the W. Hemis.

5. *Lemna perpusilla* Torr. Thallus solitary or in small clusters, obovate to orbicular-obovate, oblique, 1-2.5 mm. long, 0.7-2 mm. wide, obscurely 1- to 3-nerved, rather thick, usually light-green, not pigmented, with large air spaces within that are in 1 layer, the apical papilla usually prominent, sometimes with a row of papules along the midnerve. In ponds and lakes in cen. and s. Tex.; distributed more or less throughout the world.

6. *Lemna minor* L. WATER LENTIL. Thallus solitary or clustered, suborbicular to elliptic-obovate, 2-4 mm. long, 1.5-3 mm. wide, opaque, with 2 layers of air spaces within that are not inflated, nearly flat on both sides, obscurely 1-nerved above, the dark-green surface often suffused with red or purple, a low median ridge often terminated by a conspicuous papilla or sometimes with a row of papules along the median ridge. In quiet waters of sloughs, lakes, canals and ponds, mostly in the w. half of Tex.; distributed throughout the world.

7. *Lemna gibba* L. INFLATED DUCKWEED, WIND-BAGS. Thallus solitary or few in a group, orbicular-obovate, 2-5 mm. long, 2-4 mm. wide, thick, with 2 layers of air spaces within, dark-green above and often suffused with red or purple, with a slight ridge and 1- to 3-nerved above and conspicuously round, usually inflated-gibbous on the ventral side because of the enlargement of the lower tier of air spaces or these not much enlarged and the thallus merely convex below. In ponds, marshes and slow streams in w. Tex.; widely distributed throughout most of the world.

3. WOLFFIA HORKEL

WATER-MEAL

Diminutive floating rootless herbs, scarcely visible to the naked eye as individuals and often forming uninterrupted green masses on the surface of the water as a thin green scum; thallus spheroid to ellipsoid, sometimes flattened above, with a single funnel-shaped reproductive pouch at one end that bears asexually successive daughter-fronds, sometimes bearing masses of red pigment bodies in each epidermal cell; inflorescence breaking through the upper surface of the frond, composed of 1 staminate flower consisting of a single stamen and 1 pistillate flower consisting of a single pistil; utricle spherical, smooth.

About 10 species, mainly in the tropics and subtropics. The thallus, about the size of a pinhead, is the smallest seed plant known.

- 1. Thallus mostly globular, the dorsal surface strongly convex and without a papilla, without pigmented cells in epidermis1. *W. columbiana*.
- 1. Thallus typically ellipsoidal or broadly ovoid, punctate on all surfaces, with brown pigment cells in epidermis (2)
- 2(1). Thallus with a prominent conical papilla in center of dorsal surface2. *W. papulifera*.
- 2. Thallus with dorsal surface flat or slightly rounded and without a papilla3. *W. punctata*.

1. *Wolffia columbiana* Karst. Thallus solitary or paired, globular or rarely ellipsoidal, 0.8-1.4 mm. long, 0.4-0.8 mm. wide, scarcely if at all flattened, green on all surfaces, not conspicuously punctate, the dorsal surface not flattened and without a papilla. On lakes and in sloughs of e. Tex.; from N.E. to Calif., s. to n. S.A.

2. *Wolffia papulifera* Thomps. Thallus solitary or paired, mostly broadly ovoid, 0.5-1.5 mm. long, 0.3-1 mm. wide, green, brown-punctate on all surfaces, the dorsal surface flattened and bearing a conspicuous papilla. On surface of lakes and ponds in e. Tex. and on the Edwards Plateau; from Va. s. to Fla., w. to Tex., Kan. and Ill.

3. *Wolffia punctata* Griseb. Thallus ellipsoid to ovoid-oblong, usually tapering to an acutish apex, 0.7-1.2 mm. long, 0.4-0.7 mm. wide, the dorsal surface flattened and without a papilla, punctate on all surfaces with brown pigment cells. Reported from Texas by Muenscher and others; from Conn. to Ont. and Minn., s. to Tex. (probably) and the W.I.

4. WOLFFIELLA HEGELM.

MUD-MIDGET. BOG-MAT

Thalluses flat, thin, membranous, elongate or straplike, frequently falcate, solitary or commonly 2 remaining attached, sometimes many remaining connected to form extensive colonies, rootless, usually floating submersed except for a small area at the base, more or less punctate with brown pigment cells in epidermis of all surfaces, commonly reproducing by budding from a single triangular (in outline) basal pouch, rarely flowering; flowering cavities on dorsal surface at one side of median line; flowers not enclosed in a spathe, unisexual, consisting of a single stamen or a single pistil, the pistillate flower with a single orthotropous ovule; fruit a slightly laterally compressed utricle with the style persistent; seed smooth, with spongy outer coat, the prominent operculum flattened.

About 8 species, primarily in the New World.

1. Thallus lingulate (strap-shaped), strongly curved, up to 4 times as long as wide, usually 2 attached to form a circle1. *W. lingulata*.
1. Thallus more or less sickle-shaped, mostly 5 times or more longer than wide, usually several to many cohering in colonies (2)
- 2(1). Thallus broad at base, abruptly tapered to the obtuse-rounded apex, slightly falcate2. *W. gladiata*.
2. Thallus narrow at base, gradually tapered to a slender sharp point, usually doubly falcate3. *W. floridana*.

1. *Wolffiella lingulata* (Hegelm.) Hegelm. Thalluses broadly oblong to linear, somewhat curved, 5-10 mm. long, 1-5 mm. wide, the surfaces concave or channelled, the parent- and daughter-thalluses often recurved and together appearing like a segment of a band. Reported from Tex.; in La. and Calif., probably Tex., s. through Latin Am. to Urug.

2. *Wolffiella gladiata* (Hegelm.) Hegelm. Thalluses 3.5-8 mm. long, 1-2 mm. wide at the broad base, tapered to an obtuse-rounded apex, usually several or many cohering to form submerged colonies, somewhat falcate. Growing in fresh nitrogenous water pond on Brazoria National Wildlife Refuge, s.e. of Angleton, associated with *Lemna*, *Riccia fluitans* and *Ricciacarpus natans* (fide R. J. Fleetwood), spring-summer; La., Tex. and Calif., s. through Latin Am. to Urug.

3. *Wolffiella floridana* (J. D. Sm.) Thomps. Thalluses fistulose, usually several in a group, sometimes paired or solitary, thin, sickle-shaped or conically elongated, attenuate to an acuminate apex, 5-10 mm. long, 0.4-0.7 mm. wide, green on all surfaces, often brown-punctate. On lakes and ponds in e. Tex.; in inland waters of the U.S. along the Atl. and Gulf coasts, and in the Miss. Valley n. to Mo.

FAM. 31. MAYACACEAE KUNTH

BOGMOSS FAMILY

Small mosslike plants of wet soils and shallow flowing water; leaves cauline, numerous, crowded on stem; peduncles axillary, 1-flowered, arising along stem; flowers perfect, regular, hypogynous, 3-merous; sepals and petals each 3, quite distinct from each other; stamens 3, opposite the sepals; filaments filiform; anthers oblong to ovoid, basifixed, opening by a terminal pore; ovary 1-celled, superior; ovules several; style filiform; fruit a 3-celled and 3-valved capsule, dehiscent between the placentae.

A monogeneric family.

1. MAYACA AUBL.

Characters of the family. About 10 species in tropical and warm-temperate America, one in tropical Africa.

1. *Mayaca Aubletii* Michx. Bogmoss. Stems tufted or matted, to 2 dm. long, usually much less; leaves linear-lanceolate, 3-5 mm. long, 1-nerved; pedicels much-exceeding the leaves in length; sepals lanceolate, about 4 mm. long; petals pink or whitish, obovate, about 4 mm. long, persistent with sepals; capsule subglobose, about 4 mm. in diameter.

M. Michauxii Schott & Endl. Springy and seepage areas, mainly along and in streams, and about ponds in s.e. Tex., May-July; on Coastal Plain from Va. (?) s. to Fla. and w. to Tex.

A second species, *M. fluviatilis* Aubl., with pedicels shorter than the leaves and its capsule more ellipsoid, occurs east of Texas. It may eventually be discovered in seepage areas in extreme southeast Texas.

FAM. 32. XYRIDACEAE AGARDH²¹

YELLOW-EYED GRASS FAMILY

Perennial or sometimes annual rushlike herbs with narrow mostly basal and tufted leaves that sheath the lower part of a naked scape which is terminated by a globose to cylindrical headlike spike of perfect trimerous flowers; floral bracts usually densely spirally imbricate, coriaceous or rigid, typically concave and dorsally marked with a blotch of different color or texture, the upper bracts subtending a solitary flower, the lower ones often sterile and forming an involucre; calyx irregular, glumaceous, the 2 persistent lateral sepals cymbiform and dorsally keeled or winged, the larger anterior sepal obovate and enfolding the corolla in bud and deciduous with it; petals yellow or rarely whitish, obovate, with claws that are more or less coherent, fugacious; stamens inserted on the petal claws, the basifixed anthers extrorse; staminodes (when present) alternate with the petals, bifid and bearded at apex; style 3-cleft; capsule ellipsoid, free, 1-celled, with 3 parietal somewhat projecting placentae, 3-valved, with numerous more or less ribbed ellipsoid to fusiform orthotropous seeds.

A family of two genera, mostly in tropical regions.

1. XYRIS L.

YELLOW-EYED GRASS

Characters of the family. A genus of about 250 species distributed mostly in tropical and subtropical regions in America, Africa and Australia.

1. Keel of lateral sepals ciliate or fimbriate (2)

1. Keel or lateral sepals lacerate, usually quite thin, rarely entire (4)

2(1). Tips of lateral sepals exerted beyond the subtending bract, fimbriate (usually crisped); spikes seldom shorter than 1 cm.; seeds seldom shorter than 0.8 mm., fusiform, with broad flat longitudinal ridges; sheaths of the scape exceeded by the leaves3. *X. caroliniana*.

2. Tips of lateral sepals not exerted beyond the subtending bract and not fimbriate (in old or dried spikes the lateral sepals may separate from the bracts and appear to be exerted but exertion is supposed to mean that bracts are shorter than sepals); seed lengths and shapes various but the seeds without broad flat longitudinal ridges; sheath lengths various (3)

3(2). Leaves ascending, twisted, strongly grooved; spikes ovoid, the bracts and lateral sepals with a small apical tuft of short reddish-brown hairs; bases of leaves abruptly expanded, pinkish or purplish, becoming dark-brown, the bases of the plants therefore bulbous and the outermost leaves often scalelike5. *X. torta*.

3. Leaves spreading, scarcely twisted; spikes lance-ovoid to ellipsoidal; bracts and sepals not as above; bases of leaves longitudinally striate (the innermost fresh leaf bases white, the striae in sharp dark contrast) and with the bases of the plants often invested by a stubble or ramentum of fibrous dead leaf bases2. *X. ambigua*.

4(1). Leaves filiform or rarely somewhat linear, the blades gradually expanding below into lustrous rich-brown or tan hard bases; plants densely cespitose; spikes ovoid and seldom longer than 1 cm.1. *X. Baldwiniana*.

4. Leaves broader or not as above, the bases softer or of a different color; plants or spikes not as above (5)

²¹ Adapted mainly from Robert Kral in Sida 2(3): 177-260. 1966.

- 5(4). Bases of the leaves rather abruptly expanded into thickened flaring equitant zones, thus the plant bulbous-based (the outer leaves are often shorter, darker and scapelike); scapes often flexuous, usually quite twisted, the green upper portion of leaf blades often conspicuously twisted; flowers opening in the afternoon 4. *X. platylepis*.
- 5. Bases of the leaves and the plant bases not as above; scapes usually not flexuous, the blades not conspicuously twisted; flowers opening in the early or late morning (6)
- 6(5). Plant bases greenish, pale to dark-brown or stramineous 7. *X. Jupicai*.
- 6. Plant bases pinkish or purplish (7)
- 7(6). Summit of scape not flattened and broad relative to the spike; scape ridges usually more than 3 and therefore the upper scape broadly oval or almost round in outline (except for projecting ridges); habitats various, usually not alluvial; foliage pinkish- or purplish-based but the surfaces (particularly of the outermost leaves) papillose or tuberculate-scabrid 8. *X. difformis* var. *Curtisii*.
- 7. Summit of scape quite evidently flattened and broad relative to the spike (at least on living specimens); scape ridges few, usually 2 or 3, the 2 most prominent ones along the scape edges and therefore the upper scape narrowly ellipsoidal or fusiform in cross section; plants commonly of wet situations in sun or shade; foliage smooth, a very deep-rich-green except for the reddish or purplish color of the leaf bases (8)
- 8(7). The two principal scape ridges noticeably and abruptly flattened and winglike below the spike and in the plane of the flattened scape, their combined width (on live specimens) broader than the scape, thus the outline of the cross section of the scape bicaudate; fruiting spikes seldom longer than 15 mm., ovoid, acute; seeds translucent, ovoid or ellipsoidal, seldom longer than 0.6 mm. 8. *X. difformis* var. *difformis*.
- 8. The two principal scape ridges not abruptly flattened, the scape itself flattened and 2-edged and (in cross section) narrowly elliptic; fruiting spikes seldom shorter than 15 mm., broadly ellipsoidal or oblong, blunt; seeds farinose, dark when ripe, fusiform or narrowly oblong and never as short as 0.6 mm. 6. *X. iridifolia*.

1. *Xyris Baldwiniana* Schult. In large tufts, the leaf bases usually brownish, lustrous; leaves filiform to linear-filiform, 1-3 dm. long, straight or slightly twisted, green, expanding more or less abruptly toward the lustrous base; sheath of the scape from one half as long to nearly as long as the principal leaves, tightly investing the scape except for the loose orifice and a short blade; scape 2-4 (-5) dm. long, usually broader than the leaf, terete below, one-ridged and tending to be terete above; spikes at the seed-bearing time ovoid to ellipsoidal, 4-7 mm. long, acute or blunt, of a few tightly imbricate bracts; fertile bracts ovate to obovate, 4-5 mm. long, not keeled, the apex rounded, the exposed margin entire, becoming erose with age, the matrix dull- to dark-brown or reddish-brown, the dorsal area elliptic and dull-green; lateral sepals included, slightly shorter than the bracts, linear but slightly curvate, reddish-brown, the keel lacerate from the tip to about the middle or slightly beyond; petal blades cuneate-obovate, about 3-4 mm. long, unfolding in morning; seeds oblong to narrowly ellipsoidal, 0.8-1 mm. long, the longitudinal lines evident, translucent, yellowish or pale-amber. Atypical plants erroneously reported as *X. Elliottii* Chapm. In moist sands or sandy peats of pine flatwoods, hillside bogs, roadside ditches, and savannahs in e. Tex., May-July; in Coastal Plain, N.C. s. into n. Fla. and w. to Tex.

Plants now referred here with extremely narrow and flat leaves, apparently the var. *tenuifolia* (Chapm.) Malme (*X. tenuifolia* Chapm.), could possibly be a hybrid of this species and *X. Elliottii* Chapm. if it were not for the fact that the latter species is thought not to occur farther west than southern Mississippi.

2. *Xyris ambigua* Kunth. Solitary or in small tufts, the base hard, often fibrous; leaves broadly linear, spreading, 1-4 dm. long, 3-20 mm. broad, a dark- and lustrous-green above the equitant portion (about two thirds the total leaf length), the basal equitant portion stramineous, brownish or pinkish, narrowing more or less gradually to an abrupt slightly

incurved tip, the surface smooth or slightly papillose, the margins papillose and rather harshly scabrous; sheaths of the scapes from one third to nearly as long as the principal leaves, rather loosely investing the scape except for a distal bladelike portion, their bases usually lustrous, stramineous to castaneous; scape (1.5-) 7-10 dm. long, twisted but rarely flexuous, many-ribbed below, becoming flattened and 2-edged above; spikes at seed bearing time ellipsoidal to lance-ovoid, 1-3 cm. long, of many tightly imbricated bracts; fertile bracts broadly obovate to suborbicular, 5-8 mm. long, not keeled, the apex rounded, the exposed margin subentire or erose with age, the matrix reddish-brown or pale-brown, the dorsal area roughly rectangular and olive to dark-brown; lateral sepals included, curvate, dark-lustrous-brown, the thickened keel nearly as broad as the sepal sides and ciliate-sabrid; petal blades obovate, about 8 mm. long, unfolding in morning; seeds ellipsoid to broadly ovoid, caudate at one end, 0.5-0.6 mm. long, lustrous, with 20 or 22 distinct papillose longitudinal lines and several faint cross lines. Moist sands or sandy-peats of bog margins, savannahs, pine flatwoods, lake shores and roadside ditches in e. Tex., May-July; in Coastal Plain from Va. s. to Fla. and w. to Tex.

3. *Xyris caroliniana* Walt. Solitary or in small tufts, the bases deeply set in the substrate; outer leaves scaly, castaneous; principal leaves linear, 2-5 dm. long, 2-5 mm. broad, twisted and flexuous, fleshy, minutely tuberculate along the margins, otherwise smooth and lustrous, blunt to acute at tip, the base abruptly dilated, dark-brown, shiny, long-persistent as scales; sheaths of the scapes shorter than the leaves, tight below, loose toward the oblique orifice which is tipped by a short (2-4 mm.) blade; scapes linear, 5-11 dm. long, twisted, flexuous, smooth, terete and minutely ridged below, becoming oval in cross section and smooth to 1-ridged above, the ridges (if present) minutely tuberculate; spikes (13-) 15-30 mm. long, elliptic to narrowly oblanceolate in outline, blunt to broadly acute, of few to many closely imbricate bracts; fertile bracts 5-10 (-13) mm. long, oblong to obovate, entire or emarginate, becoming erose, the matrix reddish-brown to tan with an elliptic or rectangular gray-green or brown dorsal area; lateral sepals linear, slightly to conspicuously exerted, tan to reddish-brown with a broad keel which is entire below but fimbriate at its exerted apex; petal blades obovate, 8-9 mm. long, yellow or white, in most populations opening in the afternoon; seeds fusiform, narrow, 0.8-1 mm. long, translucent with about 20 pale longitudinal lines, the vertical lines not evident. *X. flexuosa* Muhl., *X. torta* Kunth, *X. arenicola* Small. Moist sands of pine flatwoods or savannahs, in well-drained sands or lower reaches of scrub oak-pine barrens in e. Tex., June-Aug.; from N.J. s. to Fla. and w. to Tex.

4. *Xyris platylepis* Chapm. Solitary or in small tufts, the bases shallowly set on the substrate, perennating by means of pale fleshy lateral buds; outer leaves scaly, pinkish, becoming dull-gray-brown; principal leaves linear, 2-4 (5) dm. long, 5-10 mm. broad, twisted, ascending, flexuous, fleshy, minutely tuberculate or smooth along the margin, otherwise smooth, blunt to acute at tip; equitant portion of leaves dilated, fleshy, ivory-white or pink or purplish toward the base; sheaths of the scape shorter than the leaves, castaneous or pale-brown and tight toward the base, more lax toward the oblique short bladed orifice; scapes 5-11 dm. long, twisted, flexuous, smooth to minutely ridged and terete below, oval in cross section and smooth to 1-ridged above the ridges (if present), papillate; spikes elliptic to ovoid or oblong, 1.5-3 (4) cm. long, of numerous closely imbricate bracts; fertile bracts obovate, 5-7 mm. long, entire (becoming slightly erose with age), brownish or pale-tan with an oblong to deltoid dark-green dorsal area; lateral sepals included, light-brown, about the length of the subtending bracts, linear, the keel narrow except toward the apex where it is lacerate; petal blades broadly obovate, about 5 mm. long, yellow or white, opening in the afternoon; seeds ellipsoidal, 0.5-0.6 mm. long, translucent, with 10 to 12 rather irregular longitudinal lines together with a scattering of less distinct vertical lines. In moist to wet sands or sandy peats of pineland pond-margins, savannahs, bogs and roadsides ditches in e. Tex., summer; Coastal Plain, Va. to s. Fla., w. to Tex.

5. *Xyris torta* Sm. Solitary or in tufts of a few individuals, bulbous-based; leaves of 2 sorts, the outer scalelike (from the bud scales), the inner elongate-linear; principal leaves linear, ascending, 2-5 dm. long, 2-5 mm. wide, twisted, grooved longitudinally, the upper (blade) portion dark-green, lustrous, narrowing rather abruptly to a blunt incurved thickened tip, the equitant portion pinkish, purplish or yellow-green, flaring rather abruptly to the fleshy pale or castaneous base, the surfaces smooth or papillose,

the margins narrowly incrassate and smooth or papillose; outer leaves usually much shorter than the inner, maroon or more commonly a dark-lustrous-brown, often scalelike with very dilated bases and slender often acuminate tips; sheaths of the scape shorter than the principal leaves, tightly clasping below, becoming looser toward the orifice which has a short erect slightly divergent blade at its tip; scapes 1.5-8 (-10) dm. long, 1-1.5 (-2) mm. broad, slightly to very twisted and flexuous above toward the spike; spikes at seeding time broadly ovoid or ellipsoidal to lance-ovoid or rarely oblong, 8-25 mm. long, 6-10 mm. broad, of many tightly imbricated bracts; fertile bracts broadly obovate to suborbicular, 5-7 mm. long, deep-lustrous-brown within, dull-brown on the outer surface except for a pale-gray-green elliptical subapical dorsal area, exposed margin of the bract entire or sparingly ciliate except for a short-fimbriate usually slightly emarginate apex; lateral sepals included, slightly shorter than the subtending bract, lustrous-brown, lunate, the brown thickened keel ciliate-scabrid from near the base to the apex where appears a small tuft of reddish-brown or blonde trichomes; petal blades obovate, about 4 mm. long, unfolding in the morning; seeds ellipsoidal, about 0.5 mm. long, caudate, with 14 to 18 prominent longitudinal lines (these under high magnification a series of contiguous papillae) and indistinct narrower cross lines, translucent except for the region of the embryo. Incl. var. *occidentalis* Malme. Sphagnous bogs, stream banks, lake and pond shores, wet sandy swales and acid sandy swamps in e. Tex., June-July; from Can., s. to Ga., Tex. and Okla.

6. *Xyris iridifolia* Chapm. Solitary or in small tufts, the pinkish or purplish keeled bases shallowly set on a mucky substratum; leaves linear, iridiform, 4-7 dm. long, 10-25 mm. broad, flat or slightly twisted, smooth, a deep-rich-green, broadly acute to blunt and incurved at tip, the base slightly dilated and keeled, pink or pale-maroon with a broadly hyaline margin; sheaths of the scape shorter than the leaves, deep-brown or reddish-brown and tight below, becoming somewhat looser and green above, the oblique orifice with a short cusplike blade; scapes 6-8 dm. tall, linear, straight or slightly twisted, terete and 2-ridged below, conspicuously broadened and flattened above, the edges smooth; spikes oblong to broadly oblanceolate, rarely ovoid, 20-35 mm. long, blunt, of numerous closely imbricate bracts with the lowest ones barren; fertile bracts 6-7 mm. long, broadly obovate to suborbicular, entire, the outer surfaces dark-purplish- or reddish-brown, shining except for a paler-green or gray-green oval or triangular dorsal area; lateral sepals included, linear, about the length of the bracts, castaneous, with a broad lacerate keel; petal blades cuneate, about 3 mm. long, opening in the morning; seeds oblong-fusiform, 0.8-1 mm. long, opaque, dark, farinose, the regularly arranged longitudinal lines obscured by the farina. Wet sands but more commonly wet sandy clay, sandy peat, peat muck or alluvium of stream banks, cypress swamps, marshes or pineland pond margins with the bases commonly submersed, e. Tex., July-Sept.; in Coastal Plain from s.e. Va. s. to n. Fla. and w. to Tex.

7. *Xyris Jupicai* Rich. Short-lived perennial, solitary or in small tufts, dying completely after one year from seed or perennating from bulbous lateral over-wintering buds; leaves linear, 1-6 dm. long, 5-10 mm. broad, ascending, lustrous, yellow-green, pale or stramineous toward the base; sheaths of the scape shorter than the principal leaves, somewhat loose toward the oblique orifice which terminates in a short cusplike blade; scapes 2-7 (-9) dm. long, terete and many-ridged below, becoming somewhat flattened and narrower and usually one- or two-edged above; spikes at seeding time ovoid to ellipsoidal or oblong, 5-15 mm. long, of numerous rather loosely imbricated bracts; fertile bracts obovate to oval, 5-7 mm. long, the exposed margins subentire, the outer surface pale- to dark-brown and dull, the dorsal area rectangular to elliptic and green or brownish on old spikes; lateral sepals included, about the length of the bracts, linear and slightly curvate, the thin wings broad, the somewhat thicker keel lacerate for the upper two thirds or one half its length; petal blades cuneate, about 3 mm. long, opening in the morning; seeds broadly ellipsoidal, 4-5 mm. long, the longitudinal ribs numerous but faint, cross lines not evident. Wet sands or sandy peat or alluvium of roadside ditches, flatwoods, pond margins, cypress swamps and lake shores, but particularly in mechanically disturbed wet lands in e. Tex., June-Aug.; in Coastal Plain from N.J. s. to Fla. and w. to Tex. and Ark.

8. *Xyris difformis* Chapm. Solitary or in small tufts, the soft pinkish or purplish (rarely greenish) bases rooted on wet sand or muck; principal leaves broadly linear or linear-

elliptic, 1-5 dm. long, 5-15 mm. broad, usually flabellate-spreading, dark and lustrous-green but toward the bases becoming pinkish, purplish or reddish, apex acute and slightly incurved, the surface smooth, the margin above the equitant portion usually papillose or rarely smooth; sheaths of the scapes shorter than most of the leaves, thin, tight except at the slightly loosened oblique orifice whose upper margin converges to a short cusplike blade; scapes linear, 15-70 cm. long, terete, brownish and twisted below, straightening and becoming deep-green and oval in cross section above with 2 prominent broad thin ridges whose combined breadth is at least equal to that of the scape and whose margins are papillose; spikes at seed-bearing time ovoid, about 1 cm. long, acute, dark, of many usually tightly imbricated bracts of which the lower few are barren; fertile bracts 5-7 mm. long, obovate to oval, not keeled, the apex rounded and subentire, the outer surface usually deep-brown, lustrous, the dorsal area greenish or gray-green, rectangular to round or elliptic; lateral sepals included, about the length of the bracts, the broad wings thin and pale-brown, the keel slightly thicker and darker with its margin jagged from about the middle to the apex; petal blades cuneate, about 4 mm. long or less, unfolding in the morning; seeds broadly ellipsoidal, about 0.5 mm. long, translucent, with 24 to 28 very fine straight longitudinal lines of small papillae, the vertical lines straight but indistinct. (?) *X. elata* Chapm. Wet sands or sandy peats of flatwoods, pond margins, ditches and lake shores, but more often on alluvial situations (often in fairly heavy shade) in e. Tex., spring-summer; primarily on the Coastal Plain from Tex. to s.e. Can. and the Great Lakes system.

Var. *Curtissii* (Malme) Kral. Similar to var. *difformis* but smaller, usually less than 2 dm. high, more tufted and with the margins of the equitant portion of the leaves very broad and pinkish-translucent, the surfaces papillose or low-tuberculate with the papillae or tubercles in slightly diagonal lines, the bases pinkish or purplish and similarly papillate; sheaths of the scape looser with the bases a rich-brown or sometimes castaneous; scapes rarely to 2 dm., terete with many low ridges below, the margins of the ridges papillate or scabrid; spikes at seed-bearing time broadly ovoid to ellipsoidal, seldom longer than 5 mm., of but few bracts; fertile bracts 3-4 mm. long, suborbicular to broadly obovate, the outer surfaces pale to deep brown and lustrous, the ellipsoidal dorsal areas gray-green and becoming brown and indistinct with age; lateral sepals included, about the length of the bracts, linear-curved, a lustrous-brown, the thin wings broad, the slightly thicker keel broadened and somewhat lacerate toward its tip or even entire; petal blades obovate to cuneate, slightly less than 3 mm. long, unfolding in the early morning; seeds oblong to ellipsoidal, about 0.5 mm. long, translucent, with 12 or 14 faint longitudinal lines, the vertical lines even more faint. Sandy peats of ditches and bogs, flatwoods or acid seepage areas in e. Tex., spring-summer, from the Great Lakes system and s.e. Can. s. to Fla. and Tex.

FAM. 33. ERIOCAULACEAE DESV.²²

PIPEWORT FAMILY

Perennial or rarely annual aquatic or marsh herbs, mostly short-stemmed; roots tufted, fibrous, knotty or spongy, often septate; leaves mostly basal and tufted, narrow, grasslike; inflorescence capitate, in terminal solitary or umbellately aggregate involucrate heads, borne on long slender scapose peduncles that are sheathed at the base; florets numerous, small, sessile or short-pedicellate on a variously shaped receptacle, each borne in the axil of a scarious scalelike colored or colorless receptacular bractlet, unisexual, mostly androgynous, the staminate and pistillate mixed together or the staminate in the center and the pistillate on the periphery, the sexes very rarely in separate heads; perianth scarious or membranous, rarely hyaline, 2- or 3-merous, usually in 2 distinct series, the outer (calyx) free or rarely partially connate, the inner (corolla) often united in an infundibular fashion, rarely absent; stamens as many or twice as many as the outer perianth segments and alternate with them, inserted on the corolla (when present); filaments distinct; anthers small, 2- or 4-celled, composed of 1 or 2 thecae, opening by longitudinal slits, introrse; ovary superior, 2- or 3-celled; style terminal, often appendaged; stigmas 2 or 3, simple or lobed; ovules solitary and pendulous in each cell, ortho-

²² Adapted from H. N. Moldenke in C. L. Lundell, *Flora of Texas* III: 3-9. 1942.

tropous; fruit a 2- or 3-celled and 2- or 3-seeded membranous capsule, loculicidally dehiscent; seeds solitary, pendulous.

About 1,150 species in 13 genera, mostly tropical and subtropical.

- 1. Stamens 4 or 6, twice as many as the outer perianth segments; peduncles glabrous or at most puberulent1. *Eriocaulon*, p. 353.
- 1. Stamens 2 or 3, as many as the outer perianth segments; peduncles villous above
.....2. *Lachnocaulon*, p. 354.

1. ERIOCAULON L. PIPEWORT

Stems short; leaves tufted, membranous or very thin and pellucid, more or less linear or linear-lanceolate and grasslike, sessile and clasping at base, very often fenestrate; peduncles solitary or aggregate, slender, sheathed, usually glabrous and several-costate; florets dimerous or trimerous, the staminate mixed with the pistillate or segregated on separate heads or (rarely) on separate plants; perigonium almost always double; staminate florets with the sepals free at the base and often more or less connate into a split spathe, the 2 or 3 petals united below into a tube, free at apex, the lobes usually bearing a small black gland on the inner surface near the apex; stamens twice as many as the sepals (or rarely 3) and exserted; anthers 4-celled, mostly black, composed of 2 thecae; pistillate florets with free or (rarely) spathaceous-connate sepals; petals free or rarely none, usually each bearing a small black gland slightly below the apex within; style appendages none; stigmas 2 or 3, simple.

A genus of about 400 species, widely distributed in marshy places in tropical and subtropical regions, the greatest number in tropical America; numerous also in tropical Asia and Africa; one species in northwestern Europe and northeastern North America; several on the Coastal Plain of eastern and southern United States.

- 1. Heads when mature glabrous or subglabrous, olivaceous, not white-villous
.....1. *E. Körnickianum*.
- 1. Heads when mature always white-villous at the summit (2)
- 2(1). Receptacular bractlets surpassing the florets, long-acuminate; heads very tough and hard, not at all compressed in drying; leaves mostly rigid
.....2. *E. decangulare*.
- 2. Receptacular bractlets about equaling or shorter than the florets; heads more or less compressed in drying; leaves mostly lax (3)
- 3(2). Staminate florets with the anterior petal much larger than the posterior one; plants mostly dioecious or practically so; heads 5-14 mm. in diameter
.....3. *E. compressum*.
- 3. Staminate florets with the petals equal or subequal; plants always plainly monoecious; heads 3-7 mm. in diameter (4)
- 4(3). Heads loose-flowered, greatly compressed in drying .4. *E. septangulare*.
- 4. Heads dense-flowered, scarcely compressed in drying .5. *E. texense*.

1. *Eriocaulon Körnickianum* Van Heurck & Muell. Arg. Leaves erect, to 25 mm. long, 1 mm. wide, glabrous, 3-nerved; peduncles aggregate, as many as 25, to 1 dm. tall, pale-green, 3- or 4-costate, twisted, the basal sheath to 25 mm. long; heads globose or hemispheric, 2-4 mm. in diameter, compressed in drying. In springy places on prairies and wet sandy soil in e. Tex., spring; Ark., Okla. and probably Tex.

No Texas material has been seen but the type is considered to have been collected in "East Texas" (Tyler Co.) by Charles Wright.

2. *Eriocaulon decangulare* L. Plants monoecious; leaves to 35 cm. long and 1 cm. wide at the middle, many-nerved, the margin often revolute; peduncles 1 to 3 per plant, rigid, to 1 m. tall, usually much smaller, many-costate, not noticeably twisted, the basal sheath to 16 cm. long; heads globose or hemispheric, 7-12 mm. in diameter. In moist meadows and pinelands, savannahs, bogs, swamps and pond-margins in e. Tex., spring; from N.J. to Fla. and w. along Gulf Coast to e. Tex.

Plants with binary heads are sometimes found.

3. *Eriocaulon compressum* Lam. Plants rarely monoecious; leaves dull, to 25 cm. long and 6.5 mm. wide, many-nerved; peduncles mostly solitary, rarely 2 or 3, to 85 cm. tall, 10-striate, more or less twisted, the basal sheath about as long as leaves. In still shallow water of acid ponds, swamps and low pinelands, and in streams in e. Tex., spring; from s. N.J. to Fla., w. to La. and e. Tex.

4. *Eriocaulon septangulare* With. Leaves to 18 cm. long and 3.5 mm. wide, usually much smaller, 3- to 8-nerved; peduncles mostly solitary, to 55 cm. tall or more in deep water, 7-costate, usually not twisted. In still water and on shores of ponds in (?) e. Tex., spring; from Nfld. to Va., w. to Ont., Minn. and Ind., reported from Tex. but doubtfully in the state; also in the Hebrides and adj. is., n. Scot. and Ire.

5. *Eriocaulon texense* Körn. Leaves spreading, plane, to 65 mm. long and 3 mm. wide, 10- to 13-nerved; peduncles solitary or 2 to 4, to 35 cm. tall, 5- or 6-costate, slightly twisted, glabrous, the basal sheaths longer than the leaves. In bogs, swamps and moist pinelands in e. Tex., Apr.-June; from e. Tex. to s.w. Ala.

2. LACHNOCAULON KUNTH

A genus of about 10 species, all North American.

1. *Lachnocaulon anceps* (Walt.) Morong. HAIRY PIPEWORT, WHITEHEAD BOG-BUTTON. Stems short; leaves tufted, bright-green, olivaceous in age, linear-lanceolate, to 7 cm. long and 2.5 mm. wide; peduncle rarely more than 3 dm. tall, 3-costate, twisted, densely villous above, the sheaths to 7 cm. long; heads obconic-globose or hemispheric, 3-6 mm. in diameter; involucre bractlets fuscous or olivaceous-grayish, ovate to obovate, obtuse to subacute, long-villous on the back at the apex; receptacular bractlets olivaceous-fuscous, spatulate, very obtuse, pilose on the back at the apex; florets trimerous; *staminate florets* with 3 sepals, no petals, 3 stamens, the filaments united below and coalescent with a rudimentary corolla or pistil, free above, and with oblong 2-celled anthers composed of 1 theca; staminate sepals fuscous, oblong-obovate, connate at the base, rounded-obtuse and comose at the apex; *pistillate florets* with 3 free sepals, petals reduced to hairs, a single style, 2 or 3 style appendages, 2 or 3 simple or bifid stigmas and a 2- or 3-locular ovary; pistillate sepals free, whitish, oblong-spatulate, longer than the receptacular hairs, obtuse to acute, pilose at the apex. In wet places in s.e. Tex., May-Oct.; Va. s. to Fla., along the Gulf Coast to Tex.; also Isle of Pines, Cuba.

The white pistillate flowers mingled with the brown staminate ones impart a mixed gray and dark appearance to the heads.

FAM. 34. BROMELIACEAE JUSS.²³

PINE-APPLE FAMILY

Herbs or rarely shrubby perennials, mostly epiphytic; roots usually present but often serving merely as holdfasts in the epiphytic species; leaves spirally arranged, usually basal, dilated-sheathing below, simple, entire to spinose-serrate, bearing peltate moisture-holding scales at least when young; inflorescence simple or compound, of spikes or racemes, usually bearing conspicuous bracts; flowers perfect or unisexual (and with male and female flowers on different plants); perianth heterochlamydeous, the sepals and petals free or connate; stamens 6 in 2 series, the filaments free or joined to the petals or to each other; style 3-parted; ovary superior (in ours), 3-celled; placentae axile; fruit capsular or baccate; seeds naked, winged or plumose; embryo small, situated at the base of the copious mealy endosperm.

A family of nearly 2,000 species in about 60 genera that are indigenous to the New World with the exception of some species of *Pitcairnia* in Africa.

1. Seeds narrowly winged to almost naked; flowers functionally dioecious; leaves spinose-serrate1. *Hechtia*, p. 355.

1. Seeds with a basal plumose appendage; flowers perfect; leaves entire
.....2. *Tillandsia*, p. 355.

²³ Adapted from Lyman B. Smith in C. L. Lundell, *Flora of Texas* III: 200-207. 1944.

1. HECHTIA KL.

Mostly coarse herbs with the habit of *Yucca* or *Agave*; stem short or practically none; leaves densely rosulate, usually recurving, acuminate, pungent, coarsely spinose-serrate in most species, lepidote throughout or only on the under side; scape lateral, erect or ascending; lower scape bracts foliaceous, the upper usually vaginiform; inflorescence amply paniculate; branches from capitate to lax and very elongate; flowers small, subsessile to distinctly pedicellate, unisexual but usually some remnant of the nonfunctional sex present; sepals squamiform, free; petals naked usually free but sometimes joined to a ring of filaments by their centers; stamens varying from exerted to included, the anthers usually ovate; ovary glabrous or lepidote, from wholly superior to more than three fourths inferior; capsule ovoid or ellipsoid, septicidal and loculicidal at the same time; seeds numerous, oblong, narrowly winged or sometimes almost naked, often sculptured.

A genus of about 35 species, ranging from southern Texas to Guatemala and El Salvador, but predominantly Mexican.

1. Sepals obtuse or apiculate, brown, 4 mm. long; leaves repand-serrate toward base with spines relatively close3. *H. glomerata*.
1. Sepals acute, white or scarious, to 6 mm. long; flowers 8-10 mm. long; leaf margins scarcely repand, all their spines remote (2)
- 2(1). Sepals as broad as long, 5-nerved; branches of the inflorescence very laxly flowered toward base1. *H. texensis*.
2. Sepals much longer than broad, generally 1- to 3-nerved; branches of the inflorescence densely flowered2. *H. scariosa*.

1. *Hechtia texensis* Wats. FALSE AGAVE. Plants about 2 m. tall; leaves in a dense rosette, linear-triangular, the margins with distantly placed spines, densely covered with grayish-white scurfy scales on the lower surface; scape erect, supporting a laxly branched inflorescence of numerous small flowers; branches of the inflorescence to 2 dm. long; sepals broadly ovate, acute; capsules ovoid, acute, dark-brown, lustrous, about 1 cm. long. A rare endemic on dry limestone bluffs in the Big Bend of the Rio Grande in Brewster Co.

This species and *H. scariosa* are very closely allied. Since *H. texensis* is apparently represented only by the type collection additional collections should be obtained in order to better clarify these two species.

2. *Hechtia scariosa* L. B. Sm. Plant very similar to *H. texensis* but with narrower, generally fewer-nerved sepals. The somewhat shorter branches of the inflorescence are also more densely flowered, especially toward their base. On dry limestone slopes and ridges in Brewster Co., Tex. and n. Mex., Feb.-May.

3. *Hechtia glomerata* Zucc. GUAPILLA. Plant to 18 dm. tall; leaves in a dense spreading rosette, linear-lanceolate, the margins with approximate spines, densely covered with whitish or pale-brown scales on the lower surface; scape erect or ascending, slender, supporting a laxly compound inflorescence. *H. Ghiesbreghtii* Lem. In gravel and on sandstone formations in Starr and Zapata cos., Tex. and n. Mex.; May-Aug.

2. TILLANDSIA L.

Caulescent or acaulescent herbs of variable habit; leaves rosulate or fasciculate or distributed along a stem, polystichous or distichous, entire, ligulate or subtriangular; scape usually distinct; inflorescence various, usually of distichous spikes or sometimes reduced to a single polystichous spike by the reduction of the spikes to single flowers or rarely the whole inflorescence reduced to a single flower; flowers perfect; sepals usually symmetric, free or equally or posteriorly joined; petals free, naked or rarely with vertical folds; stamens of various lengths relative to the petals and to the pistil; ovary superior, glabrous; ovules usually many and caudate; capsule septicidal; seeds erect, narrowly cylindrical or fusiform, the plumose appendage white, straight, basal.

A genus of about 500 species, ranging from southern United States to northern Argentina and Chile.

1. Stamens exerted; plant stemless; leaves polystichous, their bases forming a pseudo-bulb, their blades 5 mm. thick3. *T. Baileyi*.
1. Stamens deeply included; plant caulescent, appearing like a coarse moss; leaves distichous, their blades 0.5-2 mm. in diameter (2)
- 2(1). Stem not more than 1 dm. long, wholly concealed by the imbricate leaf sheaths; inflorescence terminal1. *T. recurvata*.
2. Stem elongate, often several meters long, exposed between alternating bunches of leaves; inflorescence pseudolateral, one-flowered2. *T. usneoides*.

1. *Tillandsia recurvata* L. BALL MOSS, GALLITOS. Plants typically in dense ball-like clumps, rarely more than 15 cm. tall; scape slender, subfiliform, mostly rising conspicuously above the leaves, supporting 1 or 2 erect flowers. *Diaphoranthema recurvata* (L.) Beer. Epiphytic and saxicolous in s.w. Tex. from Brewster Co. e. to Blanco, Hays and DeWitt cos., throughout year; from Fla. w. to Ariz., s. to Arg. and Chile.

2. *Tillandsia usneoides* (L.) L. SPANISH MOSS, PASTLE. Plants forming slender branching strands to 8 m. long that commonly festoon the branches of trees and other supports; inflorescence a solitary sessile flower. *Dendropogon usneoides* (L.) Raf. Epiphytic or on wires, fences and other such supports in cen. and s. Tex., Feb.-June; from Va., s. to Fla. and along the Gulf Coast to Tex., s. to cen. Arg. and Chile.

The fibrous stems, after retting, are used in stuffing upholstery.

3. *Tillandsia Baileyi* Small. Plants forming loose clumps, 25 cm. or more tall; peduncle rather stout, nearly concealed by the tubular sheaths of the foliaceous bracts, about as long as or shorter than the leaves, supporting 1 or 2 spikes of several flowers each. Epiphytic on live oaks and other trees in extreme s. Tex., s. to Guat., Feb.-May.

FAM. 35. COMMELINACEAE R. BR.

SPIDERWORT FAMILY

Succulent perennial or annual herbs, acaulescent or with nodose stems, the roots fibrous or sometimes much-thickened and tuberlike; leaves alternate, flat or somewhat channeled, entire, parallel-veined, sheathing by a basal membranous and often closed sheath; inflorescence terminal and/or axillary, a simple or compound cyme or thyrses, occasionally 1-flowered, sometimes attended by a cymbiform spathe or foliaceous bracts; flowers usually actinomorphic but sometimes zygomorphic, bisexual; calyx of 3 usually free and imbricated herbaceous sepals; corolla mostly ephemeral and deliquescent, the 3 colored petals equal or unequal and free or united into a tube, the third petal sometimes much-reduced; stamens typically 6 but sometimes fewer or only one, some occasionally reduced to staminodes; filaments usually distinct, often bearded with moniliform hairs; ovary superior, sessile or stipitate, usually 3-celled; fruit a loculicidal capsule, sometimes enclosed by fleshy sepals, rarely fleshy and indehiscent.

A large family mainly in tropical and subtropical regions. About 600 species in nearly 40 genera.

1. Flowers solitary or in racemes; inflorescence subtended or enclosed by a single clasping or folded leafy bract (2)
1. Flowers in umbels, glomerules or cymes; inflorescence subtended by 2 or more leaves with reduced sheaths but a distinct blade (3)
- 2(1). Floral bract folded, abruptly different from the stem leaves
.....1. *Commelina*, p. 357.
2. Floral bract not folded, similar to the upper stem leaves but shorter and wider
.....2. *Commelinantia*, p. 359.
- 3(1). Stamens 5 or 6 (4)
3. Stamens 1 to 3 (5)
- 4(3). Petals tapering into a claw, the claws coherent to form a tube; stamens borne on the petals3. *Setcreasea*, p. 359.
4. Petals broad at base, spreading from base; stamens free from petals
.....4. *Tradescantia*, p. 360.

- 5(3). Leaves ovate-cordate, clasping at base, rarely to 35 mm. long; flowers in axillary glomerules5. *Callisia*, p. 365.
- 5. Leaves linear to linear-lanceolate, not clasping, mostly more than 50 mm. long; flowers in long-peduncled cymes6. *Aneilema*, p. 366.

1. COMMELINA L.²⁴

WIDOW'S-TEARS. DAY-FLOWER

Plants herbaceous, annuals or perennials; stems at first erect, in some species eventually decumbent; leaves ovate to linear, forming a sheath at the base, margin of leaf and throat of sheath often lined with white or reddish trichomes; flower buds borne inside of a cymbiform spathe that is open across the top, 3 to 5 buds are produced in each spathe, the buds opening in succession 3 or 4 days apart; flowers blue or sometimes paler, exerted above the spathe shortly after dawn to remain until midday after which they recede into the spathe as a juicy mass; sepals 3, one subequal to the other 2; petals 3, one of which is subequal to the other 2 and often paler; stamens 3, the smaller staminodia 3; ovary 3-carpellate; fruits usually 1 or 2 or sometimes 3 per spathe; seeds 1 to 3 per fruit.

About 225 species, mainly in tropical and subtropical regions of both hemispheres.

- 1. Spathes open across the top and down adaxial side to spathe stalk, the margins not connate at base (2)
- 1. Spathes open across the top but closed down the adaxial side, the margins connate at base; perennials; seeds smooth, farinose (4)
- 2(1). Two posterior petals blue; anterior petal much smaller, white, lanceolate; capsule 2-celled, 4-seeded (no rudiment of third cell); annual; stems decumbent at base, rooting at lower nodes; leaves lanceolate, 8-12 cm. long; anthers 6; seeds 3.5-4 mm. long, gray, rugose1. *C. communis*.
- 2. All three petals blue; anterior petal ovate, slightly smaller; capsule 3-celled, 5-seeded (posterior cell 1-seeded, indehiscent) (3)
- 3(2). Plants annual; roots fibrous; stems creeping (at least at base), rooting at the nodes; spathes short-peduncled, acute to acuminate, 1-3.5 cm. long, glabrous or nearly so; posterior petals long-stalked, 6-8 mm. long; anthers 5 (posterior lacking)2. *C. diffusa*.
- 3. Plants perennial; roots tuberous, clustered; stems erect, not rooting at the nodes; spathe long-peduncled, caudate, 4-7.5 cm. long, pubescent; posterior petals short-stalked, 10-12 mm. long; anthers 63. *C. dianthifolia*.
- 4(1). All three petals blue, ovate, equal or nearly so; plant strictly erect, relatively stout and broad-leaved; sheaths ciliate with ferruginous hairs, without evident auricles; spathes crowded at summit of stem, short-stalked; two anterior cells of capsule each 2-seeded, the posterior cell relatively large but 1-seeded and indehiscent4. *C. virginica*.
- 4. Two posterior petals blue, the anterior petal much smaller and white; plants often lax or slightly decumbent from base, more slender and narrower-leaved; sheaths ciliate on rounded auricles with white hairs; spathes more scattered, both near summit of and in axils along stem, longer-stalked; cells of capsule all 1-seeded, the posterior cell normal and dehiscent, becoming reduced, tardily dehiscent to even obsolete (5)
- 5(4). Leaf blades lanceolate-ovate to ovate, 3-8 cm. long; posterior petals 8-12 mm. long; seeds scarcely flattened; roots scarcely fleshy; stems mostly reddish, more or less decumbent at the base and rooting at the lower nodes5. *C. elegans*.
- 5. Leaf blades linear-lanceolate to oblong-lanceolate, 8-14 cm. long; posterior petals 10-25 mm. long; seeds somewhat flattened; roots evidently fleshy; stems green, erect or somewhat diffuse from the base but not decumbent and rooting at the nodes (6)

²⁴ Adapted from Clyde K. Brashier in Bull. Torrey Club 93: 1-19. 1966.

- 6(5). Blades of middle and upper leaves broadly oblong-lanceolate, less than 5 times as long as wide, 14-32 mm. wide6. *C. erecta* var. *erecta*.
 6. Blades of middle and upper leaves narrowly oblong-lanceolate or linear-lanceolate, more than 5 times as long as wide, 5-20 mm. wide (7)
 7(6). Spathe 13-23 mm. long (mostly 15-20 mm.)6. *C. erecta* var. *angustifolia*.
 7. Spathe 22-33 mm. long (mostly 25-28 mm.)6. *C. erecta* var. *Deamiana*.

1. *Commelina communis* L. Plant annual, with a fibrous root system, to 5 dm. tall; stems erect at first, later becoming prostrate and spreading due to numerous branches being produced, to 4 mm. in diameter, some internodes as much as 16 cm. long; leaves broadly lanceolate, smooth beneath, scabrous and often with scattered white hairs above, to 12 cm. long and 4 cm. wide; throat of leaf sheath with or without pubescence; spathe stalk to 7 cm. long; spathes glabrous to very slightly pubescent with long white hairs, 2-3 cm. long, 8-13 mm. high, open across top and down the side to the spathe stalk, tapering to a blunt tip on abaxial end, the bottom forming a straight line while the top is curved. On stream banks and in low thickets, a common garden weed, in e. Tex., May-Oct.; from S.D. to Tex., e. to the Atl. Ocean.

2. *Commelina diffusa* Burm. f. Plant annual, with a fibrous root system; stems at first erect, later becoming decumbent because of profuse branching and layering, rarely more than 1.5 mm. in diameter, the larger internodes to 10 cm. long; leaves broadly lanceolate, glabrous beneath, glabrous to slightly scabrous above, 3.5-11 cm. long, 9-22 mm. wide; leaf sheaths 5-10 mm. long, the throat usually lined with long white hairs or sometimes with only short hairs; spathe stalk 1-2 cm. long; spathe glabrous, open across top, tapering to a slightly attenuated tip at the abaxial end and open down the adaxial side to the point of attachment to the stalk, the bottom usually decurved at the tip. In floodplain woods and wet clays in e. and s. Tex., Apr.-Nov.; in s.e. U.S., w. to Tex., Okla. and Kan.

3. *Commelina dianthifolia* Delile. Plant perennial, erect to suberect; stem branching profusely; internodes 4-12 (-15) cm. long; leaves linear, finely pubescent to glabrous, to 15 cm. long and 8 cm. wide; leaf sheaths 1.5-2 cm. long, often having a purplish-tint; spathes open across top and down adaxial side, tapering to a long-attenuated tip on the abaxial side, often purplish in hue, 2.5-8 cm. long, 7-17 mm. high; juncture of adaxial side of spathe and top of spathe forming a smooth curve, not angular as in our other perennial species. In rocky soils in Trans-Pecos Tex., July-Sept.; from Tex. to N.M. and Ariz.

4. *Commelina virginica* L. Plant perennial, overwintering by a tuberous root system, commonly producing new plants by elongated prostrate rhizomes that turn up at the ends; stem erect to decumbent, 3-6 mm. in diameter at base, the longest internodes usually 8-18 cm.; leaves broadly lanceolate, when mature to 2 dm. long and 65 mm. wide, finely pubescent, especially scabrous to the touch when rubbed from the tip toward the base; leaf sheaths heavily pubescent at throat and down the open edge, the hairs sandy-red to dark-red in color; spathes terminal and usually clustered, occasionally produced singly at top, glabrous to very finely pubescent, to 35 mm. long and 2 cm. high, closed down the adaxial side, open across the top, tapering to a point on abaxial side. In low woods in e. and n.-cen. Tex., May-Oct.; from e. Tex. and Okla., n. to Ill. and Md., e. to the Atl. Ocean.

5. *Commelina elegans* H.B.K. Roots slender; stems at first erect, branching at the base, the branches decumbent, to 9 dm. long, rooting at the lower nodes, with puberulent internodes; leaves ovate to elliptic or ovate-lanceolate, 3-8 cm. long, acute to acuminate at apex, often rounded at the base; sheaths 1-1.5 cm. long, naked or sparingly long-ciliate on the margins; spathes short-peduncled, rather broad, glabrous or puberulent, 1.5-2 cm. long, acute; posterior petals blue, 8-12 mm. long, the anterior petal much smaller and white; capsules obovoid, about 4 mm. long, reticulated especially on the dorsal lobe; seeds 3, smooth. Moist shaded situations in extreme s. Tex., July-Oct.; also in s. Fla. and trop. Am.

6. *Commelina erecta* L. **HIERBA DEL POLLO**. Plant perennial, overwintering by means of tuberous roots; sprouting by means of adventitious buds on the roots in the spring; stem to 3 m. long, usually much shorter, at first erect, later becoming decumbent; leaves

linear to ovate-lanceolate, to 15 cm. long and 14-35 mm. wide, slightly scabrous with fine pubescence above, glabrous beneath; leaf sheath to 25 mm. long, the pubescence white on the margins, becoming denser around the throat of the sheath; spathes 13-35 mm. long, 8-23 mm. high, glabrous to heavily pubescent, the hairs often becoming clustered near the base of spathe, adaxial side of spathe closed, top of spathe open, with the abaxial side tapering to a point to give a somewhat cymbiform appearance. Commonly in sandy or rocky soils in e. two thirds of Tex., often a weed in fields and gardens, May-Oct.; from Wisc. s. to Fla. and Ariz., w. to Wyo.

The aggregate species occurs in sandy or clayey soils in pinelands, open woodlands and in grassy areas, on limestone slopes, in thickets and on stream banks throughout Texas, often occurring as a weed in gardens and fields, May-Oct.; found in most of the eastern half of the United States. The segregates distinguished in the key and their synonymy are:

Var. *erecta* (including f. *erecta* and f. *intercurva* Fern.)

Var. *Deamiana* Fern.

Var. *angustifolia* (Michx.) Fern. Incl. f. *angustifolia* and f. *crispa* (Woot.) Fern., *C. angustifolia* Michx., *C. crispa* Woot., *C. erecta* var. *crispa* (Woot.) Palm. & Steyerl.

2. COMMELINANTIA THARP

We have one of the two species in this American genus.

1. *Commelinantha anomala* (Torr.) Tharp. FALSE DAY-FLOWER, WIDOW'S-TEARS. Tufted leafy annual, pale or yellowish-green and often glaucescent throughout, to about 8 dm. high; stems erect, clustered, at first simple but later much-branched and spreading, with the branches emerging through the back of the leaf sheaths just above the nodes; basal leaves linear-spatulate, tapered to a long ciliate petiole, 2-3.5 dm. long; upper cauline leaves sessile on the sheath or short-petioled, to 2 dm. long, broadly to narrowly lanceolate, often somewhat cordate and clasping at base, acute to acuminate at apex; inflorescence typically a simple scorpioid peduncled raceme that terminates the stems and branches and is subtended by a single broad flat erect cordate clasping spathe, rarely reduced to one axillary flower; flowers subtended by a small ovate persistent bract 3-5 mm. long; calyx of 3 similar green imbricated persistent sepals; sepals keeled, slightly hooded, blunt, 9-12 mm. long, somewhat glandular-ciliate above the middle; the showy lavender-blue petals rhomboid, 15-18 mm. long and somewhat broader than long; the small white petal ovate-rhombic, 3-4 mm. long and longer than broad; stamens 6, all fertile but dissimilar in size (of 4 distinct forms) and pubescence; ovary oblong, 3-celled, with 2 superimposed ovules in each cell, the stigma capitate; capsule oblong, loculicidally 3-valved, 6-8 mm. long; seeds grayish-brown. *Commelina anomala* (Torr.) Woods., *Tinantia anomala* (Torr.) C. B. Clarke. On limestone gravel, among boulders and in crevices in ravines and on open-wooded slopes on the Edwards Plateau of cen. Tex., Apr.-July; endemic.

3. SETCREASEA K. SCHUM. & SYDOW

Perennial herbs from tuberous roots; cymes sessile, usually many-flowered, either in terminal or axillary clusters; sepals distinct, concave, subequal, greenish or scarious; petals distinct, tapering at base into slender claws that cohere to form a slender tube; stamens 6, all perfect, subequal, often more or less hairy, borne on the petals; style slender, 3-lobed; capsule stipitate, 3-celled, with the cells dehiscent and 2-seeded.

A small genus of southwestern United States and Mexico.

1. Leaves narrowly lanceolate, acuminate; filaments smooth; anther cells separated by a wide connective; distribution in mountains of Trans-Pecos Texas
..... 1. *S. leiandra*.
1. Leaves ovate to oblong-elliptic or elliptic-lanceolate, obtuse to mostly abruptly acute-apiculate (2)

- 2(1). Ovary and fruit more or less pubescent; pedicels glabrous; sepals with a long tuft of silky hairs at base; filaments usually adorned with moniliform hairs; anther cells separated by a narrow thick connective; distribution in extreme south Texas; flowering mainly from February to May 2. *S. Buckleyi*.
2. Ovary and fruit glabrous; pedicels densely clothed with long white hairs; sepals smooth; filaments without hairs; anther cells separated by a broad membranous connective; distribution on open slopes and on cliffs and ledges in mountains of Trans-Pecos Texas; flowering mainly from July to October 3. *S. brevifolia*.

1. *Setcreasea leiandra* (Torr.) Pilg. Plant from a cluster of slender fibrous-thickened roots; stems erect, 3-5 dm. long, somewhat branching and naked above, slender, glabrous; leaves distant, narrowly lanceolate, acuminate, 7.5-16 cm. long, 1-2.5 cm. wide, essentially glabrous or somewhat pubescent, the margins smooth or only slightly ciliate-scabrous; margin of wide short sheath glabrous or nearly so; involucre leaves 2, connate, ovate-lanceolate, acuminate, cordate and somewhat dilated at base, 24-45 mm. long, very unlike the lower stem leaves; umbel sessile, many-flowered; pedicel densely clothed with long white hairs or occasionally only with short glandular hairs; sepals oblong, rather obtuse, usually glandular-pubescent as well as villous; corolla purplish-red; petals roundish-obovate, a little narrowed at base; filaments smooth; anther cells separated by a wide connective; capsule oval, somewhat 3-lobed, stipitate, the 3 cells 2-seeded; seeds 1 mm. in diameter, slightly rugose. *Tradescantia leiandra* Torr. (as *T. biandra*), *Treleasea leiandra* (Torr.) Rose, *Neotreleasea leiandra* (Torr.) Rose. In moist rocky places, on ledges, among shrubs and in canyons of the Trans-Pecos, July-Oct.; also n. Mex.

Those plants in the Capote Falls region in Presidio County that have pedicels provided only with short glandular hairs instead of long white hairs are separated as var. *glandulosa* Correll.

2. *Setcreasea Buckleyi* I. M. Johnst. Stem loosely branched, elongate, trailing, to 5 dm. long or more; leaves typically elliptic, subobtuse to acute-apiculate, to about 12 cm. long and 35 mm. wide; margin of sheaths more or less pubescent; involucre leaves 2, similar to the lower stem leaves but smaller; umbel sessile, few- to many-flowered; pedicels usually glabrous except near summit; sepals with a tuft of long white hairs at base; corolla pale-pink to whitish; petals suborbicular-obovate, about 1 cm. long; filaments usually adorned with long moniliform hairs; anther cells separated by a narrow thick connective; capsule subglobose, about 3.5 mm. in diameter, usually somewhat pubescent (especially when young). *Tradescantia speciosa* Buckl. On clay mounds among chaparral usually near the coast, inland to Webb Co. and e. to Gonzales Co., flowering mostly Feb.-May, sometimes later; also adj. Mex.

3. *Setcreasea brevifolia* (Torr.) K. Schum. & Sydow. Plant low, with coarse rhizomes; stems prostrate, simple or somewhat branched (especially above), to 3 dm. long or more; leaves approximate, thickish, somewhat glaucous, broadly ovate to elliptic-lanceolate, obtuse to acute-apiculate at apex, to 8 cm. long and 3 cm. wide, the margins serrulate and sometimes submarginally long-hairy on upper surface; sheaths ciliate or villous on margins; involucre leaves 2, similar to the lower leaves, to about 6 cm. long; umbel sessile, several-flowered; pedicels densely clothed with long white hairs; sepals smooth, lanceolate; corolla deep-pink to reddish-purple, the petals obovate; filaments glabrous; anther cells separated by a broad membranous connective; capsule obovoid to subglobose, smooth, about 4 mm. in diameter. *Tradescantia leiandra* var. *ovata* Coult., *Neotreleasea brevifolia* (Torr.) Rose, *Treleasea brevifolia* (Torr.) Rose, *Setcreasea ovata* (Coult.) Faruqi, Celarier & Mehr. Among rocks or in crevices, on grassy slopes or on sheltered cliffs or north-facing slopes in mts. of the Trans-Pecos, July-Oct.; also n.e. Mex.

4. TRADESCANTIA L.²⁵

SPIDER LILY. SPIDERWORT

Subsucculent perennial herbs; stem erect to trailing, herbaceous, frequently producing subterranean stolons; leaves alternate, sessile, linear to oblong-elliptic (in our species),

²⁵ Adapted from Edgar Anderson and R. E. Woodson, Jr. in *Contr. Arnold Arb.* 9: 1-132. 1935.

the blade basally produced into a perfoliate sheath; inflorescence an umbellate dichotomous helicoid cyme, terminal or lateral, subtended by 2 or infrequently 3 subequal or unequal foliaceous or rarely scarious bracts; pedicels subtended by solitary or paired hyaline or slightly foliaceous bracteoles; sepals 3, separate, equal, more or less concave or navicular, foliaceous to petalaceous or hyaline; petals 3, separate, equal, ephemeral; stamens 6, fertile, equal, hypogynous; anther sacs reniform (in our species), dehiscing longitudinally, united by a broadly trapezoid connective; filaments (in our species) abundantly pilose; ovary 3-celled; ovules 3 to 6, uniseriate, orthotropous; style filiform; stigma capitate; capsule dry, loculicidally 3-valved; seeds naked, roughly oblongoid to subtrigonal or subspherical, more or less rugose and radiately ridged, the micropyle persistently pitted, the funicular scar linear to punctiform.

About 60 species in temperate and tropical America.

1. Stems creeping or trailing, rooting at the nodes (at least in part); sepals with a definite puberulent keel 12. *T. micrantha*.
1. Stems erect or ascending, more or less diffuse in some species, not rooting at the nodes; sepals more or less concave but not definitely keeled (2)
 - 2(1). Leaf blade broader than the sheath (at least the upper ones) 1. *T. edwardsiana*.
 2. Leaf blade narrower than the sheath or about as broad (3)
 - 3(2). Sepals eglandular-pubescent throughout or glabrous, or merely eglandular-barbate at the tips (4)
 3. Sepals glandular-puberulent (at least in part), rarely glabrate (7)
 - 4(3). Sepals glabrous or only the tips eglandular-barbate 5. *T. ohioensis*.
 4. Sepals more or less pubescent generally (5)
 - 5(4). Bracts conspicuously saccate, the blades greatly reduced, densely and minutely velutinous 4. *T. gigantea*.
 5. Bracts not conspicuously saccate, the blades well-developed, glabrous to more or less pilose (6)
 - 6(5). Stems 12-49 cm. tall, more or less pilose or hirsute, infrequently glabrate; leaves relatively firm in texture, usually edged with purple; sepals relatively firm, dull-green to more or less florid (particularly after anthesis), scarcely inflated 2. *T. hirsutiflora*.
 6. Stems 2-7 cm. tall in bloom, as tall as 30 cm. in fruit, pilose to villous; leaves relatively firm in texture, usually edged with pink or purple; sepals somewhat petalaceous, usually strikingly florid, occasionally pale-green, not inflated 3. *T. Tharpii*.
 - 7(3). Sepals glandular-pubescent throughout or with a few eglandular hairs at the tips, rarely glabrate (8)
 7. Sepals with both glandular and eglandular hairs interspersed (9)
 - 8(7). Plants glaucous; stems branching; funicular scar about as long as the seed 10. *T. occidentalis*.
 8. Plants subglaucous; stems simple; funicular scar much shorter than the seed 11. *T. Wrightii*.
 - 9(7). Plants erect or ascending; stems simple or branching infrequently; roots relatively long and slender (10)
 9. Plants more or less diffuse and spreading; stems much-branched; roots fleshy and somewhat tuberoid (at least in part) (11)
 - 10(9). Stems spreading-pubescent, infrequently glabrate; roots relatively slender, glabrate or only slightly grayish-puberulent 2. *T. hirsutiflora*.
 10. Stems densely arachnoid-villous; roots rather stout and fleshy, densely ferruginous-tomentose 6. *T. Reverchonii*.

- 11(9). Stems minutely puberulent to subglabrous; leaves stiff and usually somewhat crisped 7. *T. humilis*.
11. Stems densely pubescent to arachnoid-pilose; leaves relatively flaccid and lax (12)
- 12(11). Pedicels and sepals with glandular and eglandular hairs interspersed; pedicels 20-30 mm. long 8. *T. subacaulis*.
12. Pedicels and sepals densely covered with long glandular hairs; pedicels 25-45 mm. long 9. *T. pedicellata*.

1. *Tradescantia edwardsiana* Tharp. Roots long and slender, relatively fleshy, very inconspicuously and irregularly pilose; stems erect or ascending, relatively stout, straight, not flexuose, densely and minutely puberulent to glabrate; nodes 3 to 6; internodes to 11 cm. long; leaves relatively firm, somewhat subsucculent and crisp, light-green, not glaucous or subglaucous, the anastomosing secondary veins not evident in desiccation, elliptic-lanceolate, acuminate, gradually constricted into the sheath, 7-30 cm. long, 15-45 mm. broad, minutely puberulent to essentially glabrate, the sheath to 3 cm. long and 2 cm. broad; cymes umbellate, few- to several-flowered, terminal, usually also lateral at the upper nodes, the lateral inflorescences with a definite peduncle; bracts foliaceous, 4-18 cm. long, to 35 mm. broad, widely spreading; pedicels 1.5-3 cm. long, reflexed and somewhat accrescent in fruit, green, minutely and densely puberulent; sepals elliptic, acuminate, 6-9 mm. long, green, not inflated, glandular-puberulent; petals broadly ovate, 1-1.2 cm. long, white to pale-mauve, rarely bright-pink; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, glandular-puberulent; capsules obovoid-trigonal, 8-10 mm. long; seeds 3-4 mm. long, roughly compressed-oblongoid, the linear funicular scar about as long as the seed. Rich woods and along moist alluvial terraces and ravines, s.-cen. Tex., Feb.-May; endemic.

2. *Tradescantia hirsutiflora* Bush. Roots relatively long, somewhat fleshy, inconspicuously and irregularly pilose to glabrate; stems erect or ascending, straight or very slightly flexuose, more or less spreading-pilose or hirsute, infrequently glabrate; nodes 2 to 5; internodes to 21 cm. long; leaves firmly membranaceous, deep-green to somewhat subglaucous, linear-lanceolate, long-acuminate, 14-32 cm. long, to 2 cm. broad, scatteringly pilose, infrequently glabrate or glabrous; sheath rather turgid and inflated, to 2 cm. long and broad; cymes umbellate, few- to many-flowered, terminal, solitary or accompanied by lateral pedunculate inflorescences at the upper nodes; bracts foliaceous, widely spreading or divaricate, to 16 cm. long and 14 mm. broad, scatteringly pilose to glabrate or glabrous; pedicels 1.5-3 cm. long, pilose or very rarely glabrate, more or less reflexed and accrescent after maturity; sepals broadly elliptic, acute to acuminate, 7-13 mm. long, dull-green, not infrequently somewhat suffused or edged with rose, not inflated, pubescent with eglandular or glandular and eglandular hairs interspersed; petals broadly ovate, 12-18 mm. long, bright-blue, rarely pink; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, pubescent with eglandular or glandular and eglandular hairs interspersed, rarely glabrate; capsules obovoid-oblongoid, 5-7 mm. long; seeds roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. In sandy soil in prairies and open woods and on banks in e. half of Tex., Mar.-June; from w. Fla., Tex., adj. Ark. and e. Okla.

3. *Tradescantia Tharpia* Anders. & Woods. Roots short and fleshy as well as slender and fibrous, glabrate; stems erect, straight, rarely branching, shaggy pilose to villous; nodes 1 or 2; internodes to 9 cm. long; leaves firmly membranaceous, green, not glaucous, the margins frequently hyaline or edged with rose, linear-lanceolate, long-acuminate, 14-30 cm. long, to 25 mm. broad, laxly and irregularly pilose or villous, widely spreading, the sheath to 15 mm. long and 3 cm. broad, usually imbricated at the base of the stem; cymes umbellate, multiflorous, terminal, solitary; bracts foliaceous, to 26 cm. long and 25 mm. broad, widely spreading; pedicels very slender, 4-6 cm. long, laxly pilose, more or less purple or rose-colored, rarely pale-green, after flowering reflexed and somewhat accrescent; sepals broadly elliptic, acute to acuminate, 12-16 mm. long, uniformly eglandular-pilose, somewhat petalaceous, purple or rose-colored, rarely pale-green, not inflated; petals broadly ovate, 18-22 mm. long, deep-rose or purple, not infrequently blue; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, uniformly eglandular-pubescent, rarely glabrous; capsules obovoid-trigonal, 5-7 mm. long; seeds

roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. In clay soils of rocky prairies and open woodlands in n.-cen. Tex., Mar.-Apr.; from s.w. Mo. and adj. Kan. to Tex. and e. Okla.

4. *Tradescantia gigantea* Rose. Roots relatively thick and fleshy, irregularly pilose to glabrate; stems erect or ascending, straight, branching rather infrequently, densely and minutely eglandular-puberulent above, glabrate below; nodes 3 to 5; internodes 4-16 cm. long; leaves firmly membranaceous, glaucous, linear-lanceolate, long-acuminate, 10-35 cm. long, to 25 mm. broad, glabrous or the uppermost not infrequently densely and minutely velutinous and pouched as in the bracts; sheath rather turgid and inflated, to 25 mm. long and 3 cm. broad; cymes umbellate, few- to many-flowered, terminal, solitary or axillary at the upper nodes; bracts conspicuously saccate, greatly reduced, more or less foliaceous, to 1 dm. long and 2 cm. broad, minutely and densely velutinous, sharply reflexed or divaricate; pedicels 12-25 mm. long, densely and minutely eglandular-velutinous, more or less reflexed and accrescent in fruit; sepals broadly elliptic, acute, to 11 mm. long, densely and minutely eglandular-velutinous as in the bracts and pedicels; petals broadly obovate, rounded to broadly obtuse, 15-18 mm. long, bright-magenta-pink to blue; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, uniformly and minutely eglandular-velutinous as in the sepals; capsules 6-7 mm. long; seeds roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. In limestone soils and pasturelands in cen. Tex., Mar.-May; endemic.

5. *Tradescantia ohioensis* Raf. Roots relatively slender, somewhat fleshy, irregularly pilose to glabrate; stems erect or ascending, straight or slightly flexuose, glabrous, glaucous and subsucculent; nodes 3 to 8; internodes to 18 cm. long; leaves firmly membranaceous, glaucous, linear-lanceolate, long-acuminate, to 45 cm. long and 45 mm. broad, glabrous or infrequently more or less pilose at the sheath; sheath rather turgid and inflated, to 4 cm. long and 45 mm. broad; cymes umbellate, few- to many-flowered, terminal, solitary, frequently accompanied at the upper nodes by lateral pedunculate inflorescences; bracts foliaceous, glaucous, glabrous or minutely barbate at the tips, to 25 cm. long and 22 mm. broad, sharply reflexed or divaricate; pedicels to 25 mm. long, glabrous, more or less reflexed and somewhat accrescent in fruit; sepals elliptic, acute to acuminate, to 15 mm. long, glaucous, infrequently somewhat suffused with rose or purple, glabrous or more or less eglandular-barbate at the tips; petals broadly ovate, to 2 cm. long, blue to rose or magenta, rarely white; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, glabrous or with a tuft of weak eglandular hairs at the base of the style; capsules obovoid-trigonal, 4-6 mm. long; seeds roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. *T. canaliculata* Raf., *T. reflexa* Raf. In meadows, prairies and thickets, less frequently in woods, commonly spreading to roadsides and railroad right-of-ways in e. two thirds of Tex., Feb.-May; from s. N.E. to Fla., and w. to Minn. and Tex.

The most common and widespread species in the U.S. where it is frequently cultivated and escapes to become naturalized.

6. *Tradescantia Reverchonii* Bush. Roots rather stout and fleshy, densely ferruginous-tomentose; stems erect or ascending, straight or very slightly flexuose, simple or branching infrequently, densely arachnoid-villous, rarely glabrate; nodes 3 to 6; internodes to 3 dm. long, the uppermost usually much-abbreviated; leaves firmly membranaceous, deep green to somewhat subglaucous, linear-lanceolate, long-acuminate, 10-35 cm. long, to 28 mm. broad, arachnoid-villous; sheath to 35 mm. long and 3 cm. broad; cymes umbellate, few- to several-flowered, terminal, solitary or infrequently accompanied by lateral pedunculate inflorescences at the upper nodes; bracts foliaceous, somewhat saccate, widely divaricate, to 7 cm. long and 14 mm. broad, arachnoid-villous as in the leaves; pedicels 15-23 mm. long, pilose or villous, more or less reflexed and accrescent in fruit; sepals broadly elliptic, acute to acuminate, 9-12 mm. long, dull-green, frequently somewhat suffused or edged with rose or purple, not inflated, pubescent with glandular and eglandular hairs interspersed; petals broadly ovate, 15-18 mm. long, bright-blue, rarely white; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, pubescent with glandular and eglandular hairs interspersed; capsules obovoid-trigonal, 6-8 mm. long; seeds roughly compressed-oblongoid, 3-4 mm. long, the linear funicular scar about as long as the seed. In rocky open woods and sandy soils in e. half of Tex., Mar.-July; also w. La.

7. *Tradescantia humilis* Rose. Roots stout and fleshy, commonly tuberoid, accompanied by slender roots in varying quantity, irregularly pilose to glabrate; stems more or less diffuse and spreading, much-branched (particularly at the base), densely and minutely puberulent or scabridulous to glabrate; nodes 2 to 7; internodes to 12 cm. long; leaves firmly membranaceous, deep-green or paler and somewhat subglaucous, minutely puberulent or scabridulous to glabrate, to 2 dm. long and 2 cm. broad, rather stiff and somewhat recurved to falcate, the margins usually more or less crisped and tinged with rose or purple; sheath to 15 mm. long and 22 mm. broad; cymes umbellate, few- to many-flowered, terminal, solitary or more frequently accompanied by lateral pedunculate inflorescences at the upper nodes; bracts foliaceous, more or less recurved and crisped as in the leaves, minutely puberulent or scabridulous to glabrate, to 15 cm. long, and 15 mm. broad; pedicels 15-25 mm. long, mixed-puberulent or -pilose, sharply spreading and slightly accrescent in fruit; sepals broadly elliptic, acute to acuminate, dull-green, occasionally somewhat edged or suffused with purple, 9-11 mm. long, pubescent with glandular and eglandular hairs interspersed; petals broadly ovate, 11-19 mm. long, bright-blue, occasionally pink; ovary ovoid, pubescent with glandular and eglandular hairs as on the sepals, rarely glabrate; capsules obovoid-oblongoid, 6-7 mm. long; seeds roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. In sandy and rocky soil in e. half of Tex., Mar.-June; endemic.

8. *Tradescantia subcaulis* Bush. Roots stout and fleshy, usually somewhat short and tuberoid toward the distal end and there more or less ferruginous-tomentose, slender roots also present in varying quantity; stems more or less diffuse and spreading, much-branched, densely arachnoid-villous, rarely nearly glabrate; nodes 1 to 3; internodes to 11 cm. long; leaves firmly membranaceous, deep-green, more or less arachnoid-villous as on the stems, linear-lanceolate, long-acuminate, 10-18 cm. long, to 15 mm. broad, relatively lax and flaccid; sheath 4-8 mm. long, to 14 mm. broad; cymes umbellate, few- to several-flowered, terminal, solitary or accompanied by lateral pedunculate inflorescences at the upper nodes; bracts foliaceous, rather lax and flaccid as the leaves, arachnoid-villous, to 11 cm. long and 2 cm. broad; pedicels 2-3 cm. long, mixed-puberulent or -pilose, sharply spreading and somewhat accrescent in fruit; sepals broadly elliptic, acute to acuminate, 7-8 mm. long, dull-green or occasionally somewhat petalaceous and more or less suffused with rose or purple, pubescent with glandular and eglandular hairs interspersed; petals broadly ovate, 13-14 mm. long, bright-blue; ovary ovoid, pubescent with glandular and eglandular hairs interspersed; capsules obovoid-trigonal, 5-6 mm. long; seeds roughly compressed-oblongoid, 2-3 mm. long, the linear funicular scar about as long as the seed. In sandy soil in s.e.-cen. Tex., Mai.-June; endemic.

9. *Tradescantia pedicellata* Celarier. Roots large and fleshy, usually interspersed with tuberosities and slender roots in varying amounts; stems more or less diffuse and spreading, much-branched (mostly from base), densely covered with short to long glandular or eglandular hairs or both types interspersed; nodes 2 to 5; internodes to 1 dm. long; leaves membranaceous, dark-green to light-yellowish-green, the veins quite pronounced in lighter colored individuals, linear-lanceolate, mostly 2-3 dm. long, to 1 cm. broad, recurved and somewhat lax, sparsely to densely covered with short and long hairs that are glandular, eglandular or both and mostly restricted to lower surface and margins; cymes umbellate, few- to many-flowered, terminal and usually accompanied by lateral pedunculate inflorescences; bracts foliaceous, somewhat recurved and lax as in the leaves, one of the pair usually much longer than the other, to 15 cm. long, 3-6 mm. broad, sparsely to densely covered with glandular or eglandular hairs or (more frequently) the two types interspersed; pedicels very long and slender, 25-45 mm. long, densely pubescent with medium to long glandular hairs; sepals broadly elliptic, acute to acuminate, 6-11 mm. long, densely and uniformly covered with medium to long glandular hairs, not inflated; petals broadly ovate, pink to dark-blue; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, the terminal one third of ovary with scattered glandular hairs, terminating with a dense tuft at base of style; seeds compressed-oblongoid, 2-4 mm. long, the linear funicular scar about as long as the seed. Rocky soil in the Edwards Plateau of cen. Tex.; endemic.

This plant may possibly have originated from a cross between *T. occidentalis* and *T. humilis*.

10. *Tradescantia occidentalis* (Britt.) Smyth. Roots rather stout and fleshy, usually accompanied by slender fibrous roots in varying quantity, irregularly pilose to glabrate; stems erect or ascending, straight, more or less branching, glabrous, glaucous and somewhat subsucculent; nodes 2 to 6; internodes to 25 cm. long; leaves firmly membranaceous, glaucous, entirely glabrous, linear-lanceolate, long-acuminate, to 5 dm. long and 2 cm. broad, stiff and widely divaricate or falcate; sheath rather turgid and inflated, to 3 cm. long and 35 mm. broad; cymes umbellate, few- to many-flowered, terminal, solitary, usually accompanied by one or more lateral pedunculate inflorescences at the upper nodes; bracts foliaceous, glabrous, glaucous, sharply reflexed or divaricate, to 21 cm. long and 2 cm. broad; pedicels 1-2 cm. long, glandular-puberulent, reflexed and somewhat accrescent in fruit; sepals elliptic, acute to acuminate, 4-10 mm. long, glaucous or somewhat suffused with rose or purple, uniformly glandular-puberulent, very rarely with a terminal barb of weak eglandular hairs (in hybrid specimens); petals broadly ovate, 7-16 mm. long, bright-blue to rose and magenta; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, glandular-puberulent, very rarely glabrate or glabrous; capsules oblongoid-trigonal, 4-7 mm. long; seeds roughly compressed-oblongoid, 2-4 mm. long, the linear funicular scar about as long as the seed. In prairies and plains, mostly in sandy or rocky soils throughout Tex., Mar.-July; mainly from N.D. to Tex., w. to Mont. and Ariz.

11. *Tradescantia Wrightii* Rose & Bush. Roots relatively slender, somewhat fleshy, irregularly and inconspicuously pilose to glabrate; stems erect or ascending, straight, simple, glabrous, glaucous or glaucescent, somewhat subsucculent; nodes 1 to 3; internodes to 15 cm. long; leaves firmly membranaceous or somewhat subsucculent, glabrous, glaucous or glaucescent, linear-lanceolate, long-acuminate, to 1 dm. long and 2-5 mm. broad, spreading or ascending; sheath 1-2 cm. long, to 1 cm. broad; cymes umbellate, few- to several-flowered, terminal, solitary; bracts foliaceous, glabrous, glaucous or glaucescent, spreading or ascending, to 7 cm. long, 3-6 mm. broad; pedicels 12-17 mm. long, glabrous or rarely with a very few glandular hairs, reflexed and somewhat accrescent in fruit; sepals elliptic, acute to acuminate, 5-6 mm. long, glaucous or glaucescent, glabrous or rarely with a few glandular hairs at the base; petals broadly ovate, about 1 cm. long, rose to magenta and purple; filaments abundantly pilose, the connective broadly trapezoid; ovary ovoid, glabrous or rarely with a very few glandular hairs at the base of the style; capsules obovoid-trigonal, 3-4 mm. long; seeds broadly compressed-oblongoid to oblongoid-trigonal, about 2 mm. long, the linear funicular scar much shorter than the seed. On moist canyon stream-banks in the Trans-Pecos, May-Sept.; endemic.

12. *Tradescantia micrantha* Torr. Roots slender and fibrous, glabrate or very minutely puberulent; stems creeping or trailing, branching rather frequently, rooting at the nodes (at least in part), somewhat fleshy and subsucculent, glabrous, nodes 3 to 10; internodes to 5 cm. long; leaves somewhat subsucculent, deep-green, oblong-elliptic, acute to acuminate, to 35 mm. long and 3-8 mm. broad, sharply spreading or slightly falcate, the margins ciliate, otherwise glabrous or essentially so; sheath 2-4 mm. long, 2-5 mm. broad, papery, more or less pilosulous or scabridulous; cymes umbellate, few- to several-flowered, terminal, solitary; bracts foliaceous, similar to the leaves, to 17 mm. long, 4-7 mm. broad; pedicels 8-12 mm. long, very slender, glabrous or essentially so, spreading and slightly accrescent in fruit; sepals ovate-lanceolate, acuminate, 4-5 mm. long, hyaline, keeled, minutely scabridulous; petals ovate, 5-7 mm. long, bright-rose or pink; ovary ovoid, glabrous; filaments rather sparsely pilose, the connective trapezoid; capsules about 2 mm. long; seed oblong, compressed, grayish, strongly transversely corrugated, about 1.5 mm. long, the linear funicular scar about a third as long as seed. In sandy or clayey soils in open oak or mesquite woods and prairies in s. coastal Tex., May-Sept.; endemic.

5. CALLISIA L.

About 12 species in temperate and tropical America.

1. *Callisia repens* L. Creeping or ascending often delicate herb; stems slender, glabrous; leaves cordate-ovate, 15-35 mm. long, to 13 mm. wide, acuminate at apex, clasping at base, sometimes purplish, the margins ciliate; flowers small, in axillary glomerules, scarcely exerted from the leaf sheaths; sepals 3, linear-oblong to linear-lanceolate, some-

what falcate, 3-4 mm. long, about 0.8 mm. wide, dorsally pilose, persistent; petals 3, white, oblong, shorter than the sepals; stamens at least 3; filaments glabrous; ovary oblong-ellipsoid, pilose at the apex; style filiform, glabrous; stigma penicillate; capsule oblong, 1.5 mm. long, valvate, membranous, 2- or 3-valved, compressed; seeds dark-brown, wrinkled, about 1 mm. long and 0.8 mm. broad. On rocky and in gravelly often moist soil in shade, in s. Tex., flowering in early spring; also throughout the W.I. and cont. trop. Am.

6. ANEILEMA R. BR.

About 100 species, mostly in warm regions in the Old World.

1. *Aneilema nudiflorum* (L.) Kunth. Herbs with diffuse often creeping stems and branches, 1-3 dm. tall; leaves linear to linear-lanceolate, acuminate, 3-11 cm. long, ciliate at the base; cymes long-peduncled, subtended by involucre of leaflike bracts; perianth regular; petals blue or purplish, 5-8 mm. long; stamens 3; capsule borne in a spathe, oval to globular, 4-5 mm. long, minutely beaked. Roadsides, woods and groves on the Coastal Plain of s. Tex., summer-fall; from Fla. to Ga. and Tex.

FAM. 36. PONTEDERIACEAE H.B.K.

PICKEREL-WEED FAMILY

Perennial aquatic of bog plants with floating or creeping rootstocks and sheathing leaves; leaves alternate, straplike or differentiated into petiole and blade; inflorescence axillary from the stem or rootstock, from a spathe; flowers solitary or in several- to many-flowered spikes or panicles, perfect, more or less irregular; perianth salverform or funnel-form, the tube mostly well-developed, free from the ovary, the 6 lobes similarly colored; stamens 3 or 6, inserted in throat of perianth, mostly unequal or dissimilar, the anthers introrse; style 1; stigma 3-lobed or 6-toothed; ovary superior; fruit a perfect or incompletely 3-celled many-seeded capsule or a 1-seeded utricle; seeds ribbed.

About 30 species in a half dozen genera in temperate and tropical regions.

1. Stamens 6; perianth funnel-form (2)

1. Stamens 3; perianth salverform (3)

2(1). Plants typically free-floating; fruit a many-seeded dehiscent capsule 1. *Eichhornia*, p. 366.

2. Plants rooted in mud; fruit a 1-seeded utricle 2. *Pontederia*, p. 367.

3(1). Perianth regular or nearly so; style usually stout, about as long as or shorter than the short stamens 3. *Heteranthera*, p. 367.

3. Perianth markedly zygomorphic; style slender, almost as long as the long stamen ... 4. *Eurystemon*, p. 368.

1. EICHHORNIA KUNTH

WATER-HYACINTH

Floating aquatic herbs, rooting at nodes; aerial leaves broad, the petiole usually spongy-inflated; inflorescence pedunculate, spicate to paniculate, from a spathe, the spathe subtended by a sheath that often has a small dilated blade; perianth funnel-form, slightly 2-lipped; stamens 6, the 3 upper all included, the 3 lower more exserted; anthers oblong, basifixed; ovary 3-celled; capsule membranaceous, many-seeded. Also spelled *Eichornia*.

About six species in the tropics and warm temperate regions of America and Africa.

1. Petioles inflated at the base; plants with a short naked stem bearing new plants at the nodes; peduncle below the flowers exserted from the spathe; perianth lobes entire 1. *E. crassipes*.

1. Petioles not inflated; plants with a continually growing stem, bearing leaves for its entire length; peduncle below the flowers included in the spathe; perianth lobes marginally erose 2. *E. azurea*.

1. *Eichhornia crassipes* (Mart.) Solms. Leaf blade suborbicular to broadly elliptic, to 1 dm. long; flowers showy, light-blue to bluish-purple, 4-6 cm. long and broad. *Piaropus crassipes* (Mart.) Britt. Ponds, streams and ditches in s. and e. Tex., Apr.-July; from Va. s. to Fla., w. to Mo. and Tex.; also Mex., W.I., C.A. and S.A. A beautiful, noxious weed!

2. *Eichhornia azurea* (Sw.) Kunth. Except for the uninflated petioles and cross-margined perianth lobes, this species is quite similar in habit to *E. crassipes*. It also grows in the same kind of habitats. Rather widespread in Latin Am., apparently introd. in s. Tex., July.

2. PONTEDERIA L. PICKEREL-WEED

Stout herbs with thick creeping rhizomes rooted in mud; leaves erect, long-petioled, with a sheathing stipule within the petiole; leaf blades variable, broad or narrow; inflorescence an erect spike of violet-blue ephemeral flowers from a sheathing spathe, with a solitary leaf on the flowering stem; perianth funnellform, 2-lipped, the tube revolute-coiled after flowering; stamens 6, the 3 upper unequally inserted, the 3 lower long-exserted; anther elliptic, blue, versatile; ovary 3-celled; fruit a 1-seeded utricle.

About 6 species in warm regions of the western hemisphere.

- 1. Perianth villous in bud, becoming glabrate with age, rarely sparsely glandular 1. *P. cordata* var. *cordata*.
- 1. Perianth persistently pubescent with short glandular hairs 1. *P. cordata* var. *lanceolata*.

1. *Pontederia cordata* L. var. *cordata*. Stem up to 1 m. tall; leaf blades varying from deltoid-ovate to triangular-lanceolate, prominently and deeply cordate to truncate or rarely narrowed at base, to 2 dm. long; spike to 15 cm. long. In marshes and ditches in shallow water of e. Tex., June-Sept.; P.E.I. and N.S., s. to Fla., w. to Mo., Okla. and Tex.

Var. *lanceolata* (Nutt.) Griseb. Similar to var. *cordata* in habit and habitat; leaf blade usually somewhat firmer than in that variety. *P. lanceolata* Nutt. Fla. w. to e. Tex., locally n. to Del.

3. HETERANTHERA R. & P. MUD-PLANTAIN

Herbs submersed, floating or rooted in mud, forming a rosette or with elongate simple or branched stems; leaves sessile or petiolate; leaf blades straplike to ovate or lanceolate to reniform, leathery to thin and pellucid; flowers solitary or several in a spike, from a spathe that arises from the sheathing side of a petiole or in the axils of leaves; perianth salverform, the limb more or less equally 6-parted, ephemeral; stamens 3, equal or unequal; anthers ovate to sagittate, basifixed; capsule 1- or incompletely 3-celled by intrusion of the placentae, many-seeded.

About a dozen species in America and Africa, mostly tropical.

- 1. Leaves sessile, linear, grasslike, pellucid; spathe sessile in axils of leaves; stamens all alike; anthers coiled with age (2)
- 1. Leaves petiolate, with an expanded thickish blade; spathe peduncled; stamens dimorphic; anthers not coiled (3)
- 2(1). Perianth tube much less than twice as long as the spathe; seeds ellipsoid, yellow-brown, the 10 to 12 membranaceous wings evanescent 1. *H. dubia*.
- 2. Perianth tube twice as long as the spathe or longer; seeds nearly globose, black-brown, the 14 to 16 wings persistent 2. *H. Liebmannii*.
- 3(1). Spathe 1-flowered; leaf blade ovate to elliptic or elliptic-lanceolate 3. *H. limosa*.
- 3. Spathe 3- to 10-flowered; leaf blade round-reniform . . . 4. *H. reniformis*.

1. *Heteranthera dubia* (Jacq.) MacM. Plants submersed, the small yellow flowers usually expanded on the water surface; leaves to 15 cm. long; spathe to 5 cm. long; perianth tube to 7 cm. long. *Zosterella dubia* (Jacq.) Small. Streams and quiet waters in s. and s.-cen. Tex., Apr.-June; Fla., w. to Tex. and Mex., n. to Que. and Ont., w. to Ore.

2. *Heteranthera Liebmannii* (Buch.) Shinners. Plant similar in habit and habitat to *H. dubia*; spathe to 6 cm. long; perianth tube to 12 cm. long. *Zosterella longituba* Alex. On mud or floating in ponds and ditches in s. and w. Tex., Apr.-July; Tex. and Ala., s. to Mex. and W.I.

This species is more abundant in Texas than the closely allied *H. dubia*.

3. *Heteranthera limosa* (Sw.) Willd. Plants rooted in mud to form rosettes, also represented by another distinct form with an elongated creeping stem that roots at the nodes; leaf blade to 1 dm. long, usually much shorter; spathe conspicuously peduncled; flowers white to purplish-blue. Ponds, tanks and in wet soil of low woods in s., cen. and w. Tex., rare in e. Tex., May-Oct.; Fla., w. to N.M. and Mex., n. to Minn., Neb. and Colo.; also trop. Am.

What we consider to be two forms of this species, as noted above, might prove to be distinct entities with further study.

4. *Heteranthera reniformis* R. & P. Plants creeping in mud or floating in shallow water; leaf blades to 3 cm. long and 5 cm. wide; spathe short-peduncled; flowers white or pale-blue. *H. peduncularis* Benth. In streams in w. to s.e. Tex., Aug.-Sept.; Fla., w. to Tex. and Mex., n. to Conn., Ill. and Neb.

4. EURYSTEMON ALEX.

A monotypic genus.

1. *Eurystemon mexicanum* (Wats.) Alex. Erect herb rooted in mud, to 4 dm. tall, noticeably glandular-pubescent above; leaves sessile, sheathing the stem, to 15 cm. long, straplike; flowers about 12 in an open spike that appears to be terminal, pale-blue to indigo-blue, from a spreading foliaceous spathe; perianth salverform, the limb conspicuously zygomorphic; stamens 3, strikingly dissimilar; anthers basifixed, anther on longest filament bluish and much larger than those on the two short inflated filaments; capsule 3-celled, many-seeded. *Heteranthera mexicana* Wats. In ditches and about ponds in s. and n.w. Tex., June-Aug.; also n. Mex.

FAM. 37. JUNCACEAE JUSS.

RUSH FAMILY

Annual or perennial grasslike or sedgelike herbs, usually growing in wet places; leaves (like those of Cyperaceae and Gramineae) definitely formed into a lower sheath and an upper blade or the latter reduced in some species; inflorescence a terminal (or in a few species apparently lateral) flaring panicle either of individual flowers subtended by pairs of scalelike bracts or usually of glomerules or heads of flowers, the flowers of the heads being subtended by 3 or only a single scalelike bract or occasionally the inflorescence reduced to only a single glomerule or head; perianth of 6 separate scales in 2 series, an outer whorl of 3 (sepals) and an inner whorl of 3 (petals), these all usually of about the same scalelike chartaceous to hyaline texture, narrowly ovate to lanceolate or subulate, usually sharply acute; stamens 3 or 6, when 3 then opposite the sepals (at the corners of the capsule); filaments basally united into a minute flange around (but free from) the ovary; carpels 3; styles 3; placentas 3; ovary superior, 1- to 3-locular; placentas axile or by reduction of the septa more or less parietal; capsules loculicidal; ovules and seeds minute, 3 to many.

A family of about 9 genera and 400 species very widely distributed but not as common in the tropics as in cool, wet climates.

1. Seeds numerous1. *Juncus*, p. 369.
 1. Seeds 32. *Luzula*, p. 377.

1. JUNCUS L. RUSH. BOG-RUSH

Characters of the family but seeds numerous, never only 3. Rushes and sedges (Cyperaceae) are often confused by those who do not take the trouble to look at the flowers, which are diagnostic. The certain identification of any species (of sedge or rush) requires mature or nearly mature fruit and usually the examination of it under a strong lens.

A cosmopolitan genus of perhaps 300 species. Rushes have some forage value, but are nowhere abundant enough to be of great economic importance.

1. Inflorescence pseudolateral, the stem apparently continuing beyond it (2)
1. Inflorescence terminal or both terminal and lateral, with either long or short leafy bracts (6)
- 2(1). Flowers in glomerules of 2 to 5 flowers, each glomerule subtended by as many bracteoles as there are flowers, or an occasional flower also with an extra bracteole at the base of the perianth 10. *J. Roemerianus*.
2. Flowers mostly solitary, most of them obviously subtended by a pair of bracteoles in addition to the bracteole at the floriferous node (3)
- 3(2). Rhizomes much-branched, forming extensive mats in the mud; stamens 6, the anthers about 4 times as long as the filaments; capsule narrowly ovoid, acute (4)
3. Rhizome (if present) very short and not extensively creeping or branching, the plants thus essentially tufted; stamens 3, the anthers about equaling the filaments; capsules obovoid and obtuse or nearly spherical (5)
- 4(3). Culms essentially terete, 1-2.5 mm. thick basally, not twisted; bract 3 to 8 times as long as the inflorescence 6. *J. balticus*.
4. Culms compressed, 2-3 mm. thick basally, often twisted; bract 2 or 3 times as long as the inflorescence 7. *J. mexicanus*.
- 5(3). Capsules obovoid, obtuse or even depressed apically; flowers numerous, 30 to 100 per panicle; upper sheaths bladeless 8. *J. effusus*.
5. Capsules nearly spherical or slightly ovoid, apically turgid; flowers few, 2 to 25 per panicle; upper sheaths bearing blades 9. *J. coriaceus*.
- 6(1). Individual flowers with a pair of bractlets in addition to the bractlet at the base of the pedicel (7)
6. Individual flower with only one bractlet at the base of the very short pedicel (11)
- 7(6). Annual 5-30 cm. tall; culms floriferous more than a fourth the length, usually more than a third the length; leaf sheaths not auricled nor prolonged terminally .
..... 5. *J. bufonius*.
7. Perennials 8-125 cm. tall; culms floriferous less than half the length; leaf sheaths auricled and/or prolonged (8)
- 8(7). Leaf auricles scarious or broadly scarious-margined, 1-2.5 mm. long, prolonged, distinctly longer than broad; plant 8-45 cm. tall ... 1. *J. tenuis*.
8. Leaf auricles membranous or subcoriaceous, white to brown, 0.3-1 mm. long, not prolonged; plants 20-125 cm. tall (9)
- 9(8). Leaf blades strongly involute, appearing channeled on the ventral side; bractlets acute or acuminate; inflorescence diffuse 4. *J. dichotomus*.
9. Leaf blades flat or involute; bractlets obtuse or acute; inflorescence crowded (10)
- 10(9). Perianth 4-5 mm. long; some flowers solitary, some in heads
..... 3. *J. Dudleyi*.
10. Perianth 3.3-4.2 mm. long; flowers solitary (though inflorescence crowded, none of the flowers in true heads) 2. *J. interior*.
- 11(6). Leaf blades not septate (i.e., not nodulose), i.e., cross-partitions not palpable nor tangible when finger is run along the blade (included here is *J. saximontanus* with incomplete partitions; see also *J. polycephalus*) (12)
11. Leaf blades septate, nodulose or cross-partitioned (16)

- 12(11). Anthers 6; blades with inconspicuous incomplete septa; plants of higher elevations, Trans-Pecos Texas15. *J. saximontanus*.
12. Anthers 3; blades nonseptate entirely (13)
- 13(12). Tufted annual; culms mostly less than 10 cm. long; blades about 0.5 mm. broad at the middle14. *J. capitatus*.
13. Perennials; culms mostly more than 10 cm. long; leaves 1-5 mm. broad (14)
- 14(13.) Stems first ascending 5-20 cm., then stoloniform-creeping or floating and greatly elongate; capsule very narrow but obtuse13. *J. repens*.
14. Stems erect or nearly so; capsule obovoid, plump (15)
- 15(14). Perianth 4-5 mm. long, half again as long as the capsule; anthers yellow; largest transverse dimension of the compressed culm 0.5-1 mm.
.....12. *J. filipendulus*.
15. Perianth 2.5-3.5 mm. long, about equaling the capsule; anthers orangish to reddish-brown; culms 1.5-3 mm. broad11. *J. marginatus*.
- 16(11). Seeds caudate, i.e., with tails nearly as long as the body of the seed
.....24. *J. trigonocarpus*.
16. Seeds not caudate (17)
- 17(16). Stamens 6 (18)
17. Stamens 3 (21)
- 18(17). Culms decumbent basally but rhizomes not having tuberlike enlargements; leaves laterally flattened, with one edge toward the stems, with weak usually incomplete septa15. *J. saximontanus*.
18. Culms essentially erect but connected by slender rhizomes which often bear tuberlike enlargements; leaves essentially terete, with usually conspicuous complete septa (19)
- 19(18). Culms 30-100 cm. tall, 2-4 mm. thick; basal bract usually much-exceeding the inflorescence; heads mostly closely crowded, 8-15 mm. thick, 25- to 50-flowered .
.....18. *J. Torreyi*.
19. Culms 5-40 cm. tall (rarely taller in *J. texanus*), 0.7-2 mm. thick; basal bract shorter than to slightly exceeding the inflorescence; heads mostly well-separated, mostly 7-10 mm. thick, 20- to 30-flowered (20)
- 20(19). Inflorescences 2-5 cm. long; capsules slightly exserted, 3 to 4 times as long as broad; anthers a little shorter than their filaments; plants mostly of Trans-Pecos Texas16. *J. nodosus*.
20. Inflorescences at maturity mostly 5-10 cm. long; capsules at maturity subulate-beaked, more than 4 times as long as broad, much-exserted; anthers much longer than their filaments17. *J. texanus*.
- 21(17). Heads nearly spherical when mature, 15- to 100-flowered (22)
21. Heads or glomerules hemispherical or narrower at maturity, 2- to 10-flowered (27)
- 22(21). Capsules 1.5-2.2 mm. long23. *J. brachycarpus*.
22. Capsules longer (23)
- 23(22). Capsules narrowly ovoid, to elliptic-ovoid, 2.5-3.3 mm. long, about equaling the petals but usually shorter than the sepals, apically blunt or bluntly apiculate; sepals and petals paleaceous, drying semirigid27. *J. acuminatus* f.
sphaerocephalus.
23. Capsules usually subulate (at least terminally), usually at least 3.5 mm. long, apically acute; sepals and petals semirigid and subspinescent (24)
- 24(23). Uppermost sheath (not that of the bract of the inflorescence) much longer than its blade22. *J. megacephalus*.
24. Uppermost sheath shorter than its blade (25)
- 25(24). Flowering culms 1-1.5 mm. thick near the middle, arising erect and separately from short whitish rhizomes; leaves few, scattered on the culm, the blades essentially terete and about 1 mm. thick near the middle; sepals 0.5-0.8 mm. broad; petals 0.3-0.5 mm. broad21. *J. sctripoides*.

25. Flowering culms 2-4 mm. thick near the middle, a few ascending in a tuft from a non- or subrhizomatous base; leaves several in a basal cluster and also scattered on the culm, the blades laterally flattened and 3-7 mm. thick in the larger (dorsiventral) dimension; sepals 0.7-1.4 mm. broad; petals 0.5-1 mm. broad (26)
- 26(25). Blades 4-7 mm. thick in the larger dimension, with many weak incomplete septa; leaves and stems greenish, mostly crushed flat in prepared specimens; culms 6-10 mm. thick basally20. *J. polycephalus*.
26. Blades 3-4 (-6) mm. thick in the larger dimension, with several tough complete septa; herbage grayish or olivaceous, mostly tough and resistant to crushing; culms 3-5 mm. thick basally19. *J. validus*.
- 27(21). Capsules at least half again as long as the petals, 4-5.2 mm. long
.....25. *J. diffusissimus*.
27. Capsules 2.2-3.3 mm. long (28)
- 28(27). Sepals 3.3-4 mm. long27. *J. acuminatus*.
28. Sepals 2.2-2.9 mm. long (29)
- 29(28). Glomerules 5 to 35 per inflorescence26. *J. debilis*.
29. Glomerules 40 to 200 per inflorescence (30)
- 30(29). Sepals 2-2.5 mm. long, 0.6-0.8 mm. broad; petals 1.9-2.3 mm. long, 0.4-0.6 mm. broad; capsule golden-brown, 2.3-2.5 mm. long; septa of blades conspicuous
.....28. *J. nodatus*.
30. Sepals 2.6-2.9 mm. long, 0.9-1.1 mm. broad; petals 2.4-2.8 mm. long, 0.6-0.8 mm. broad; capsule dark-golden-brown to fuscous, 2.4-2.9 mm. long; septa of blades inconspicuous29. *J. Elliottii*.

1. *Juncus tenuis* Willd. SLENDER-RUSH. Tufted perennial 8-30 (-45) cm. tall; culms erect, simple, about 1 mm. thick; leaf blades flat, 0.5-0.9 mm. broad, occasionally slightly involute marginally, soft, often almost as long as the culms; aricles of sheaths scarious or broadly scarious-margined, 1-2.5 mm. long on the longer leaves, distinctly prolonged laterally more than centrally; panicle terminal, 3-6 (-9) cm. long, about a fourth or a fifth the total height of the plant, 15 to 25 (to 30) -flowered, with branches 0.15-0.2 mm. thick and ascending; bracts slender, soft, usually much-exceeding the panicle; bracteoles 3 beneath each flower (the lowest opposite the flower on the floriferous node); flowers solitary or occasionally several of them approximate; sepals 3-4 mm. long, greenish-white, long-tapered to the sharp point, soft, spreading in fruit (the almost setaceous tip then often broadly spreading); stamens 6; capsule oblong-ovoid, shorter than to rarely equaling the perianth. Incl. var. *anthelatus* Wieg. Moist sand in woods, e. and s.e. Tex., infrequent, spring, rarely summer; e. temp. N.A., w. to Minn., Ia., Mo., Okla. and Tex.; Euras.; also reputedly in w. N.A., Mex., S.A. and N. Afr.

2. *Juncus interior* Wieg. Tufted perennial 3-8 dm. tall; culms erect, simple, 1.3-2.5 mm. thick (rarely more slender), tough, wiry; leaf blades flat and 1-1.5 mm. broad or usually somewhat involute marginally (making them narrower and more wiry) and prolonged to a sharp involute tip, usually about half as long as the culms; aricles of sheaths firm-membranous, not scarious, whitish to yellowish, rounded, not at all prolonged; panicle 1-4 (-6) cm. long, (3 to) 10 to 25 (to 50) -flowered, more densely flowered than in *J. tenuis*, with branches 0.3-0.5 mm. thick, wiry and ascending; bracts slender, wiry, rather stiffly erect, equaling (or the lowest usually much-exceeding) the panicle, involute-tipped; bracteoles 3 beneath each flower (the lowest opposite the flower at the floriferous node); flowers solitary; sepals 3-5 mm. long, stramineous, long-tapered to the sharp point, firm, stiffly ascending (even at the tip and even in fruit); stamens 6; capsule narrowly oblong-ovoid, about equaling the perianth. Incl. var. *arizonicus* (Wieg.) Herm. and var. *neomexicanus* (Wieg.) Herm., *J. arizonicus* Wieg. and var. *curtiflorus* Wieg., *J. neomexicanus* Wieg. Moist usually calcareous soil, n.-cen. and s.e. Tex., w. portion of e. Tex. and coastal part of Rio Grande Plains, w. through Edwards Plateau, Plains Country and the Trans-Pecos, rather frequent, spring-summer; O. and Mich. s.w. to Tex. and w. to Mont., Colo. and Ariz.; n. Mex.

Some specimens seem intermediate between this species and *J. Dudleyi*, and others between it and *J. dichotomus*, of which *J. interior* is perhaps only a variety.

3. *Juncus Dudleyi* Wieg. Tufted perennial much like *J. interior* but the auricles averaging even firmer; panicle very compact, 1-2 (-3) cm. long, 7- to 25-flowered; flowers approximate in 1 to 3 glomerules but not true heads; sepals 4-5.5 mm. long, very firm to cartilaginous; capsule distinctly shorter than the perianth. *J. tenuis* var. *Dudleyi* (Wieg.) Herm. Moist calcareous soil, n.-cen. Tex., w. part of e. Tex. and Edwards Plateau, rare or scattered, spring-summer; s. Can. s. to Va., Tenn., N.M., Ariz. and Calif.; also n. Mex.

4. *Juncus dichotomus* Ell. Tufted perennial much like *J. interior* but the panicles more diffuse, (3-) 5-10 cm. long. Moist sandy soil, e. (and probably s.e.) Tex., infrequent to rare, apparently grading into *J. interior*, with which it is probably conspecific, spring; Coastal States, Mass. to Tex.; also reputedly Mex.

5. *Juncus bufonius* L. TOAD-RUSH. Tufted annual 4-18 (-30) cm. tall; culms 0.4-0.7 mm. thick, erect, mostly simple, often reddish-tinged; sheaths often swollen basally, thicker than the blades, hyaline-margined; blades involute-filiform, often arcuate especially terminally; panicles a fourth to four fifths the entire height of the plant, of a few ascending usually weak and somewhat arcuate branches (each with a few remote flowers), the subterminal flowers appressed or nearly so; bracteoles 3 beneath each flower, the lowest opposite the minute pedicel; perianth 4-6 (-8) mm. long, the parts erect, sharp-pointed, medially green, marginally broadly white-membranous; stamens 6 or less commonly reduced to 3; capsule turgid-ellipsoid. Moist soil in most of Tex. except extreme Panhandle and Rio Grande Plains, scattered, locally abundant, spring; temp. regions, nearly throughout the world, not nat. with us.

6. *Juncus balticus* Willd. var. *littoralis* Engelm. WIRE RUSH. Perennial from much-branched short rhizomes that form mats in the mud; aerial culms crowded, 3-10 dm. long, 1-2.5 mm. thick, erect, terete, nearly naked but closely beset basally with a few brownish bladeless sheaths which are rounded terminally; panicles appearing as if emerging subterminally from the side of the culm (actually terminal, far-overtopped by the terete pungent bract which is 3 to 8 times as long as the panicle and which appears as a continuation of the culm), of a few usually few-flowered usually drooping unequal branches; bracteoles 3 beneath each flower; perianth parts 3.5-5 mm. long, usually drab or brownish; stamens 6, the anthers about 4 times as long as the filaments; capsule narrowly ovoid, acute, mucronate. Moist soil in river bottoms, extreme n. part of Panhandle, infrequent to rare, spring through June; species widely distributed in cool-temp. areas; var. *littoralis* in much of e. N.A.; *J. mexicanus* below is perhaps conspecific with *J. balticus*.

7. *Juncus mexicanus* R. & S. Almost identical to *J. balticus* but culms compressed and usually twisted, and averaging thicker; bract only 2 to 3 times as long as the panicle. *J. balticus* var. *mexicanus* (R. & S.) O. Ktze. Infrequent to rare in buffalo-wallow lakes in the High Plains Country and formerly near springs in the Trans-Pecos, early summer; Tex. to Calif. and s. to cen. Mex. In Mexico and elsewhere the populations of this species usually show a few blades on the upper sheaths, but our populations do not.

8. *Juncus effusus* L. var. *solutus* Fern. & Wieg. SOFT RUSH. Rhizomes very short, thick, chestnut-color; aerial culms (plus bract) 6-12 dm. long, 2-4 mm. thick, strictly erect, very crowded in thick stands, essentially terete; basal sheaths chestnut-brown, bladeless, 5-15 cm. long, apically rounded; panicles 30- to 100-flowered, appearing as if emerging subterminally from the side of the culm (actually terminal, far-overtopped by the terete pungent bract which is 5 to 10 times as long as the panicle and which appears as a continuation of the culm), of a few densely-flowered much-branched unequal branches; bracteoles 3 beneath each flower; perianth parts 2.7-3.3 mm. long, usually brownish; stamens 3, the anthers about equaling the filaments; capsule obovoid, apically obtuse, truncate or even depressed, about equaling or slightly exceeding the perianth. Moist sandy soil or shallow fresh water, e. and s.e. Tex., locally abundant, spring; the species widely distributed in temp. areas; var. *solutus* in e. temp. N.A.

9. *Juncus coriaceus* Mack. Culms essentially tufted from dark knotty bases, (with bracts) 3-10 dm. long, 1-1.5 mm. thick, often arcuate, crowded or not, essentially terete; sheaths buffy or tawny, the lower bladeless or with setaceous rudiments a few mm. long, the upper with long weak curving blades 1-2 mm. broad and strongly involute, terminally pungent; panicle 2- to 25-flowered, appearing as if emerging from the side of the culm (actually terminal, far-overtopped by the terete or slightly compressed bract which is 3 to 20 times as long as the panicle and which appears as a continuation of the culm), of a few laxly flowered unequal branches; bracteoles 3 beneath each flower;

perianth parts 3-4 mm. long, brownish, firm, ascending (fl.) or spreading (fr.); stamens 3, the anthers about equaling the filaments; capsule nearly spherical or ovoid-spherical, about equaling or slightly exceeding the perianth. Moist sand, e. Tex., summer; Coastal States, N.J. to Tex. and inland to Ky., Ark. and Okla.

10. *Juncus Roemerianus* Scheele. Tufted perennial; culms with bracts 5-15 dm. long, 2-4 mm. thick, erect, simple, essentially terete; sheaths chestnut-color, with long wiry terete pungent erect blades; panicle much-branched and compound, 7-12 cm. long, appearing as if emerging from the sides of the culm (actually terminal, far-overtopped by the terete pungent bract which is about 3 times as long as the inflorescence and which appears as a continuation of the culm), the ultimate branchlets bearing glomerules of 2 to 5 flowers, each glomerule subtended by as many bracteoles as it has flowers or an occasional flower subtended by one additional bracteole; perianth 2.8-3.5 mm. long, brown, the apexes of the parts often slightly spreading; stamens 6, the anthers about 5 times as long as the filaments; capsule obovoid to elliptic-obovoid, apiculate, brown, shining, about equaling or shorter than the perianth. Infrequent in brackish-water ditches and coastal marshes, s.e. Tex., spring; Coastal States, Md. to Tex.

11. *Juncus marginatus* Rostk. Perennial from enlarged, bulblike bases (these often connected by short rhizomes); aerial culms 1 to 3 from each bulb, 15-100 cm. long, compressed, 1.5-3 mm. broad (in largest transverse dimension), leafy, erect or some culms basally shortly decumbent; sheaths much shorter than their internodes, with narrow hyaline margins near the corners; blades flat, soft, membranous, 3-15 cm. long, 2-5 mm. broad, mostly erect or distally decurved-arcuate, abruptly acute; panicles terminal, much-branched and compound, the branches ascending, each of the 10 to 80 ultimate branches bearing a glomerule of 2 to 12 essentially sessile flowers; each glomerule subtended by as many bracteoles as it has flowers or a few more; perianth 2.5-3.5 mm. long, brownish; stamens 3; capsule rotundly obovoid, about equaling the perianth, brown. Incl. var. *paucicapitatus* Engelm. and var. *setosus* Cov., *J. aristulatus* Michx., *J. biflorus* Ell. Moist soil in most of Tex., common in e. half, infrequent to rare in w. part, spring-summer; e. half of temp. N.A., rare w. to Ariz.

12. *Juncus filipendulus* Buckl. Perennial, tufted or from masses of slightly swollen bulbil-like bases; culms 15-30 cm. long, compressed, 0.5-1 mm. broad (in largest transverse dimension), leafy, erect or some of them basally shortly decumbent; sheaths shorter than their internodes; blades flat, soft, membranous, 2-10 cm. long, 1-2.5 mm. broad, mostly ascending; panicle terminal, few-branched, of 2 to 5 (to rarely 10) headlike glomerules or reduced to a single glomerule; glomerules hemispherical, 7-10 mm. across, stramineous, of 6 to 15 essentially sessile flowers, each subtended by 1 (rarely 2) bracteoles; perianth 4-5 mm. long, whitish to stramineous; stamens 3; capsule obovoid, much shorter than the perianth. Moist calcareous soil or shallow water along streams, infrequent in Edwards Plateau, rare in n.-cen. Tex. and e. part of Plains Country, spring-summer; also Okla.

13. *Juncus repens* Michx. Perennial but vegetative culms largely annual, weak, compressed, at first ascending but then arcuate-stoloniferous and creeping or floating, or growing along the bottom submerged, at each node with a cluster of basal leaves and fibrous roots and eventually at each emergent (not submerged) terrestrial node with an ascending floriferous culm (5-) 10-30 cm. long, this with only 1 or 2 nodes and these lower nodes bearing clusters of leaves; blades weak, ascending, more or less flat, 5-10 cm. long, 2-3 mm. broad, not septate, tapering to a fine point; panicle terminal, 7-13 cm. long, simple or few-branched, of 2 to ten 3- to 12-flowered rotate-turbinate glomerules which are terminal on the branches or else appearing sessile at the nodes; individual flowers 5-10 mm. long, subtended by only 1 bractlet at the base of the pedicel; sepals and petals rigid, lance-subulate, setaceous-tipped, the petals much longer than the sepals; anthers 3; capsule linear or at least very narrow, apically obtuse, about as long as the sepals. Margins of fresh water ponds and sandy loam soil, e. Tex., infrequent to rare, summer; Coastal States, Del. to Tex. and inland to Tenn., Ark. and Okla.

14. *Juncus capitatus* Weigel. Tufted annual; culms erect, 4-8 (-10) cm. long, about 0.5 mm. thick; blades all basal, linear, flat, about 0.5 mm. broad, setaceous-tipped, not septate; panicle terminal, unbranched, of 1 or 2 heads which appear sessile at the nodes (when 2 heads present they are 1-2 cm. apart), the head-bearing nodes usually each with a single leaflike bract which surpasses the head; heads 6- to 14-flowered; bracteoles solitary at the base of each flower, lance-ovate, subulate, setaceous-tipped, equaling or surpassing

the flowers; sepals about 5 mm. long, mostly membranous but subulate, setaceous-tipped; petals about 3 mm. long, ovate, acute, mostly membranous or hyaline; stamens 3, the anthers much shorter than the filaments; capsules delicate, shorter than the petals, obtuse, as thick as long. Rare in disturbed sandy soil, e. Tex., collected in 1944 in Walker Co., probably not persistent, spring; N. Afr., Eur., the Near East; adv. in Calif., La. and Tex.

15. *Juncus saximontanus* A. Nels. Culms basally shortly decumbent and/or sub-rhizomatous but tuber-bearing enlargements absent; flowering culms mostly in loose clumps, erect, 25-45 cm. long, compressed, 1-2 mm. thick near the middle; blades membranous, weakly septate (the septae often incomplete and not tangible in well-pressed specimens), laterally flattened, gladiate, tapering to a point; panicle terminal, 4-7 cm. long, sparingly branched, either of 6 to twenty 6- to 10-flowered turbinate glomerules (f. *brunnescens* (Rydb.) Herm.) or else the glomerules congested into fewer (2 to 5) pleioanthous (20- to 40-flowered) nearly round heads (typical form); bracteole solitary at the base of the pedicel; sepals 3-4 mm. long, lanceolate, acute, stramineous or usually brown to chestnut-color, chaffy; petals similar to sepals but shorter; anthers 6, much shorter than the filaments; capsules oblong, mucronate, a little shorter than the sepals, usually chestnut-brown at maturity. *J. parous* Rydb., *J. brunnescens* Rydb. Along creeks at 5,000-8,000 ft. elev., Trans-Pecos mts. (Chisos and Davis), infrequent; B.C., s. to Dgo. and e. to Colo., N.M., Tex. and Coah.

16. *Juncus nodosus* L. Perennial with long creeping rhizomes bearing tuberlike enlargements; flowering culms colonial, 11-30 cm. long, 0.7-1.2 mm. thick, erect, terete or slightly compressed; blades 2 or 3 per culm, terete, 0.5-1 mm. thick near the middle, long-tapered to a thin point, with some complete but sometimes weak and inconspicuous septa; inflorescence terminal, 2-5 cm. long, sparingly branched, of 2 to 4 heads; basal bract of inflorescence leaflike, about equaling the inflorescence or exceeding it by 1-3 cm. at most; heads mostly well-separated from each other, 7-10 mm. thick, 15- to 30-flowered; sepals and petals lanceolate, 3-4 mm. long, brownish-stramineous, with acute semirigid tips; bractlets solitary at the base of each pedicel; stamens 6 (occasionally 3, *vide* F. J. Hermann), the anthers shorter than the filaments; capsules at maturity slightly exserted, narrowly ellipsoid-trigonous, 3 to 4 times as long as thick, brownish, shining, wholly dehiscent (even the abruptly acute apex); seeds not tailed. Incl. var. *meridianus* Herm. Mud along creeks at elev. above 3,000 ft. in the Trans-Pecos, summer; temp. N.A. s. to Va., O., Ind., Ill., Ia. and Neb., at higher elev. to Coah., Chih., Nev. and Calif.

17. *Juncus texanus* (Engelm.) Cov. Perennial with elongate slender rhizomes bearing tuberlike enlargements; flowering culms colonial, erect, essentially terete, 2-4 (-6) dm. long, 1-2 mm. thick near the middle, simple; leaves few; blades essentially terete, with several complete (though in some specimens weak) septa; inflorescence terminal (subtended by a bract shorter than or only slightly surpassing it), at maturity 5-10 cm. long, of 3 to 12 (to 19) 15- to 25-flowered heads which are remote from each other at the ends of the short branches and 8-10 (-11) mm. thick; bractlet solitary at the base of the pedicel; sepals and petals linear-lanceolate; stamens 6, the anthers longer than (often 2 to 3 times as long as) their filaments; capsules at maturity 4 to 8 times as long as thick, including the exserted prolonged slender-subulate beak which remains intact with dehiscence; seeds not tailed. *J. nodosus* var. *texanus* Engelm. Infrequent along ponds, lakes and streams, n.-cen. Tex. and Edwards Plateau, summer; endemic.

18. *Juncus Torreyi* Cov. Perennial with slender elongate rhizomes bearing tuberlike enlargements; flowering culms colonial, erect, 3-10 dm. long, 2-4 mm. thick near the middle; blades terete, ascending, with complete septa; inflorescence terminal, usually far-surpassed by the subtending terete bract, 2-5 (-10) cm. long, of 5 to 10 (to 17) heads which are mostly closely crowded, 8-15 mm. thick, 25- to 50-flowered; bractlet solitary at base of pedicel; sepals lanceolate, stramineous, 4-5 mm. long, with semirigid brownish subulate tips; petals similar to sepals but shorter; anthers 6, shorter than their filaments; capsule at maturity brownish, linear-subulate, trigonous, equaling or slightly surpassing the sepals, wholly dehiscent; seeds not tailed. Marshy margins of lakes, ponds and streams, abundant in the Trans-Pecos and Plains Country, less frequent in Edwards Plateau and n.-cen. Tex., rare in e. Tex., summer; N.Y. to Sask. and Wash., s. to D.C., Ala., Miss., Coah. and Calif.

19. *Juncus validus* Cov. Tufted perennial from a non- or subrhizomatous base; culms 2-10 dm. long, ascending or erect, basally 3-5 mm. thick, mostly 2-4 mm. thick near the middle, olive-gray; leaves several in a basal cluster and scattered along the culm, laterally compressed, slightly arcuate, 3-6 (-8) mm. thick in larger (dorsiventral) dimension, with strong complete septa; bract much shorter than the inflorescence; inflorescence terminal; heads 6 to 76, rounded or often lobulate, 10-15 mm. thick, each with (30 to) 40 to 50 (to 80) flowers; bractlet solitary at the base of the short pedicel; sepals (3-) 3.4-4.2 (-4.5) mm. long, 0.7-1.4 mm. broad; petals (2-) 2.5-3.5 (-4.3) mm. long, 0.5-1 mm. broad; both petals and sepals marginally hyaline (the petals sometimes broadly so) and both semirigid and subspinose at maturity, stramineous-brown or turning dark-brown; stamens 3; capsule 4.5-5 mm. long, brown or golden-brown, subulate; seeds not tailed. We have two varieties.

Var. *validus*. Inflorescence widely spreading, 5-25 cm. long, of (12 to) 15 to 76 heads and completely promptly dehiscent capsules. Abundant in e. and s.e. Tex. and less so w. to n.-cen. Tex. and n. part of Rio Grande Plains; in Coastal States, Ga. to Tex. and inland to Okla. and Mo.

Var. *fascinatus* M. C. Johnst. Inflorescences mostly 2-5 cm. long, of 6 to 15 heads, with capsules usually tardily dehiscent apically or even with an indehiscent beak. Endemic to Tex. in Edwards Plateau area (Central Mineral Region) and s. to n. part of Rio Grande Plains and n.-cen. Tex., uncommon e. to s.e. Tex., summer; endemic.

20. *Juncus polycephalus* Michx. Tufted perennials from subrhizomatous bases; culms 5-10 dm. long, erect, basally 6-10 mm. thick, 2-4 mm. thick near the middle, greenish; leaves several in a basal cluster and scattered along the stem; blades strongly laterally compressed, arcuate, 4-7 mm. thick near the middle in the larger (dorsiventral) dimension, greenish, with weak incomplete septa; inflorescence terminal, usually widely branched, 7-25 cm. long, 12-10 mm. thick; heads few to 20, of 40 to 80 flowers; bractlet solitary at the base of the short pedicel; sepals 3.5-4 mm. long, 0.7-0.8 mm. broad; petals 3-3.3 mm. long, about 0.5 mm. broad, marginally hyaline, greenish-brown turning stramineous to dark-brown, semirigid at maturity and subspinescent; stamens 3; capsule slightly exserted, tapering uniformly, dehiscing laterally but not at the short beaklike apex; seeds not tailed. Infrequent, Jasper and Tyler cos. in extreme s.e. Tex., summer; Coastal States, N.C. to Tex.

21. *Juncus scirpoides* Lam. Perennial from whitish rhizomes 3-15 mm. long, the internodes of the rhizomes 1-2 mm. long; flowering culms 20-45 cm. long, erect, 1-1.5 mm. thick near the middle; leaves few and mostly scattered along the flowering culm, not crowded basally; blades with strong complete septa, terete, rarely very slightly laterally compressed on drying, mostly about 1 mm. thick near the middle, ascending, only slightly arcuate; bract usually shorter than to only slightly surpassing the inflorescence; inflorescence 1-5 (-11) cm. long, terminal, unbranched or very sparingly branched; heads (solitary to) 2 to 5 (to 12), rounded or somewhat lobulate, 7-10 mm. thick, with 25 to 60 flowers; bractlet solitary at the base of the short pedicel; sepals 2.7-4 mm. long, 0.5-0.8 mm. broad; petals 2-3 mm. long, 0.3-0.5 mm. broad; sepals and petals green turning stramineous to stramineous-brown, semirigid to subspinescent; stamens 3; capsule 0.5-0.8 mm. thick, exserted usually even when immature, the tip long-subulate and its 3 valves fused into a perdurant indehiscent beak; seeds not tailed. Incl. var. *meridionalis* Buch. Frequent in e. Tex., infrequent in s.e. Tex., uncommon to rare w. to n.-cen. Tex. and n. and coastal parts of Rio Grande Plains and Edwards Plateau, also in Winkler Co. in the Trans-Pecos, always in deep sandy soils, summer; e. U.S., n. to N.Y., Pa., Ind., Mich. and w. to Okla. and Tex.

Some robust specimens seem to show intergradation to *J. validus* var. *fascinatus*.

22. *Juncus megacephalus* M. A. Curtis. Perennial from subrhizomatous bases; flowering culms 45-110 cm. long, 2-2.2 mm. thick near the middle; leaves few and mostly scattered along the culm, not crowded basally; blades terete, mostly about 1 mm. thick near the middle, ascending, only slightly arcuate, having strong complete septa; blade of the uppermost leaf (but not the bract!) much shorter than its sheath, sometimes reduced to a mucro; bract much shorter than the inflorescence; inflorescence terminal, sparingly branched, 2-5 (-10) cm. long, of 3 to 7 (to 15) heads which are 10-15 mm. thick and 40- to 100-flowered; bractlet solitary at the base of the short pedicel; sepals 4.1-4.3 mm. long, 0.6-0.8 mm. broad; petals about 3.5 mm. long, 0.3-0.4 mm. broad;

sepals and petals usually (reddish)-brown apically, stramineous basally; stamens 3; capsule about 0.8 mm. thick, lance-subulate, trigonous, golden-brown, not or only very slightly exserted, usually about equaling the sepals, laterally dehiscent but the 3 valves coalescent apically into an indehiscent beak. Infrequent to rare in deep sands very near the coast, s.e. Tex. (Aransas and Galveston cos.), summer; Coastal States, (Md.[?] and) Va. to Tex.

23. *Juncus brachycarpus* Engelm. Perennial, the bases subrhizomatous to shortly rhizomatous, whitish; flowering culms stiffly erect, 20-75 cm. long, 1-2 mm. thick near the middle; leaves scattered and subappressed along the culms; blades ascending, only slightly arcuate, essentially terete or basally laterally compressed, 1-2 mm. thick near the middle, with strong complete septa and always longer than their sheaths; bract shorter than or equaling the inflorescence; inflorescence terminal, 2-6 (-13) cm. long, of 2 to 10 (to 25) heads, sparingly branched; heads round, 7-9 mm. thick, with 25 to 60 flowers; bractlet solitary at the base of the short pedicel; sepals 2.7-3.4 mm. long, about 0.8 mm. broad; petals 2.2-2.3 mm. long, about 0.4 mm. broad; sepals and petals greenish with broad hyaline margins, turning golden brown medially at maturity or slightly darker terminally; stamens 3; capsule obovoid, 1.5-2.2 mm. long, about 1 mm. thick, abruptly apiculate, promptly and completely dehiscent; seeds not tailed. Frequent in moist loamy soils, e. and s.e. Tex., rare inland to n.-cen. Tex. and n. part of Rio Grande Plains, spring-early summer; e. and s.e. U.S. inland to O., Mich., Ill., Mo. and Okla.

24. *Juncus trigonocarpus* Steud. Perennial; culms erect or ascending, simple, tough, wiry, terete, 5-9 dm. long, 2-2.5 mm. thick, basally often trailing and rooting in the mire; leaves few, remote, subappressed; blades terete, wiry, nodulose, 7-20 cm. long, about 2 mm. thick; panicle terminal, compound-branched, 5-15 cm. long, about a fourth to a third as broad; primary branches of panicle erect, 1-9 cm. long, bearing nodes with short bracts and fascicles of short branches each of which bears a hemispheric or turbinate 6- to 15-flowered glomerule; bracteole solitary at the base of each pedicel; sepals and petals about 3 mm. long, lanceolate, rigidly subspinescent, strongly nerved, mostly green or stramineous with a chestnut-brown tip; stamens 3 or said to be sometimes 6; capsule 3.5-5 mm. long, exserted, narrow, tapered at both ends, acuminate apically, shining chestnut-brown, eventually completely dehiscent (even the tip); seeds with brown bodies 0.6-0.7 mm. long and white to stramineous "tails" on either end, the tail on the upper end slender and 0.5-0.6 mm. long, that on the lower end shorter and stouter. *J. caudatus* Chapm. Rare in seeps and bogs on sandy soil, e. Tex. (Henderson, Jasper and Tyler cos.), Sept.-Nov.; Coastal States, S.C. to Tex.

25. *Juncus diffusissimus* Buckl. Tufted weak perennial; culms 25-65 cm. long, erect, 1-2 mm. thick near the middle; leaves few, scattered on the culm; blades ascending, strongly laterally compressed, 1-2 mm. broad in the larger (dorsiventral) dimension, long-tapered to a setaceous tip, with some complete but rather inconspicuous septa; bract much shorter than the inflorescence; inflorescence terminal, widely and repeatedly branched, 5-20 cm. long; glomerules numbering 30 to 70 (to 130) per inflorescence, hemispherical or narrower, (1- or) 2- to 10-flowered; bractlet solitary at the base of the short pedicel; sepals (2-) 2.6-3.2 mm. long, 0.6-0.8 mm. broad; petals (1.8-) 2.3-3 mm. long, 0.4-0.5 mm. broad; petals and sepals paleaceous, acute but not subspinescent; stamens 3; capsules linear-lanceolate, trigonous, 4-5 (-5.2) mm. long, minutely apiculate, 1.5 to 2 times as long as the perianth, golden-brown, completely dehiscent. Frequent in e. Tex., less so w. to n.-cen. Tex., rare in Edwards Plateau (Central Mineral Region), in moist loamy soil, summer; Coastal States, Ga. to Tex. and inland to Ind., Mo. and Kan.

26. *Juncus debilis* Gray. Tufted weak perennial (or annual?); culms 15-30 cm. long, ascending, 0.5-1 mm. thick near the middle; leaves few, scattered on the culm; blades ascending, basally slightly laterally compressed, about 1 mm. broad near the middle, with some complete but inconspicuous septa; bract only 1-2 cm. long; inflorescence terminal, repeatedly branched, 3-10 cm. long, with 5 to 35 glomerules which are hemispherical or narrower and 2- to 10-flowered; bractlet solitary at the base of the short pedicel; sepals 2.2-2.8 mm. long, 0.6-0.8 mm. broad; petals 2.3-2.5 mm. long, 0.5-0.7 mm. broad; sepals and petals paleaceous, acute but not subspinescent; stamens 3; capsule broadly to narrowly ovoid, bluntly apiculate, 2.2-3 mm. long. Infrequent to rare in moist sand, extreme e. Tex. (Newton and Polk cos.), summer; Coastal States, Conn. to Tex., inland to Tenn. and Mo.

27. *Juncus acuminatus* Michx. Tufted perennial; culms 14-80 cm. long, erect, 1-3 mm. thick near the middle; leaves few at the base, mostly scattered on the culm; blades strongly laterally compressed, 1-3 mm. thick near the middle, toward the tip very narrow and nearly terete, with complete but rather weak septa; bract much shorter than the inflorescence; inflorescence terminal, variable, 3-15 cm. long, not or sparingly or much and repeatedly branched, in the typical form of (25 to) 40 to 60 hemispherical to turbinate 2- to 10-flowered glomerules, in the f. *sphaerocephalus* Herm. of 2 to 25 nearly round 15- to 60-flowered heads; bractlet solitary at the base of the short pedicel; sepals 3.3-4 mm. long, 0.7-1.2 mm. broad; petals 2.5-3.5 mm. long, 0.3-0.4 mm. broad in the typical form or 0.5-0.7 mm. broad in f. *sphaerocephalus*; sepals and petals paleaceous, drying semirigid, stramineous or often terminally a rich-reddish-brown; stamens 3; capsule narrowly ovoid to elliptic-ovoid, 2.5-3.3 mm. long, apically blunt or very bluntly apiculate, completely and promptly dehiscent. The typical form is infrequent in wet places in e. Tex., the f. *sphaerocephalus* locally frequent in e., s.e. and n.-cen. Tex., the n. parts of the Rio Grande Plains, Edwards Plateau and Trans-Pecos, late spring-summer; the typical form in most of e. U.S. w. to Wisc. and Tex.; f. *sphaerocephalus* from N.Y., Pa., Mich., Ind., Mo., Tex., Wash., Calif., Ariz., Chih., Michoac. and probably scattered elsewhere.

28. *Juncus nodatus* Cov. Perennial; roots not bearing tuberlike enlargements; culms erect, 6-12 dm. long, 3-5 mm. thick near the middle (as much as 1 cm. thick basally); basal sheaths of culm 6-15 mm. broad; blades 2-5 mm. thick near the middle, essentially terete to flattened; septa of blades complete, tough, conspicuous; bract much shorter than the inflorescence; inflorescence terminal, repeatedly much-branched, 7-16 cm. long; glomerules 40 to 200 per inflorescence, hemispherical or narrower, 2- to 10-flowered; bractlet solitary at the base of the short pedicel; sepals 2-2.5 mm. long, 0.6-0.8 mm. broad; petals 1.9-2.3 mm. long, 0.4-0.6 mm. broad; sepals and petals membranous, medially brown, marginally broadly hyaline; stamens 3; capsule obpyriform to narrowly ovoid, minutely apiculate, 2.3-2.5 mm. long, golden-brown. Infrequent, e. and s.e. Tex., rare w. to n.-cen. Tex., extreme n. edge of Rio Grande Plains and n. part of Plains Country (Wichita Co.), late spring-summer; La. to Tex. n. to Ind., Ill., Mo. and Kan.

29. *Juncus Elliottii* Chapm. Perennial; roots often ending in tuberlike enlargements; culms erect or arcuate, 3-9 dm. long, 1.5-2 mm. thick near the middle; basal sheaths of culm 4-8 mm. broad; blades 1-2 mm. thick near the middle, laterally compressed; septa of blades present, complete but weak and inconspicuous in prepared specimens; inflorescence terminal, repeatedly much-branched, 5-14 cm. long; glomerules 40 to 100 per inflorescence, 2- to 10-flowered, hemispherical or narrower; bractlet solitary at the base of the short pedicel; sepals 2.6-2.9 mm. long, 0.9-1.1 mm. broad; petals 2.4-2.8 mm. long, 0.6-0.8 mm. broad; sepals and petals dark-golden-brown to fuscous, chartaceous medially, narrowly white-hyaline marginally, becoming semirigid and subspinescent; stamens 3; capsule narrowly obpyriform to narrowly ovoid, 2.4-2.9 mm. long, minutely apiculate, at maturity fuscous. In moist or wet areas in savannahs and coastal prairies in s.e. Tex., May-Aug.; Coastal States, Del. to La. and Tex.

2. LUZULA DC. WOODRUSH

Tufted low perennials with weak pubescent foliage; inflorescence terminal, of a number of simple or nearly simple unequal branches topped by heads or short spikes of flowers; seeds only 3 per capsule.

A cosmopolitan genus of about 80 species.

1. Style at anthesis about 0.5 mm. long, with 3 slender branches 1-1.5 mm. long (whole structure later deciduous); bulblike subterranean structures present 1. *L. bulbosa*.
1. Style at anthesis 0.5-1 mm. long, with 3 branches 2-2.5 mm. long (later deciduous); bulblike structures absent 2. *L. echinata*.

1. *Luzula bulbosa* (Wood) Rydb. Weak tufted perennial, just underground with numerous slightly elongate whitish tuberlike structures (rhizomes?) 2-4 mm. thick; culms 10-25 (-35) cm. long, ascending, about 1 mm. thick; leaves few, only a few or none

clustered basally; blades membranous, flat, flaccid, 5-10 (-20) cm. long, 2-6 mm. broad, long-tapered, long-pilose marginally especially near juncture with sheath; bract shorter than the inflorescence, leaflike; inflorescence terminal, 3-6 cm. long, of 5 to 10 (to 13) branches which are mostly simple (a few of the longer ones with subsidiary branches) and ascending; bractlets 3 beneath each flower (2 at the base of the calyx and one at the base of the extremely short pedicel); flowers in 20- to 40-flowered ovoid-cylindric spikes or racemes which are 6-10 mm. long and 4-6 mm. thick (rarely almost round and capitate); sepals 3, 2.3-2.5 mm. long, ovate-deltoid, membranous and brownish medially, broadly hyaline marginally, acute; petals similar to sepals but only 1.9-2.2 mm. long; stamens 6, shorter than the sepals; style at anthesis about 0.5 mm. long, with 3 branches 1-1.5 mm. long (postantheically deciduous); capsule nearly globose to broadly obovoid, about equaling the sepals, terminally truncate and minutely apiculate, completely and promptly deciduous; seeds 3. *L. campestris* L. var. *bulbosa* Wood, *L. multiflora* (Retz.) Lej. var. *bulbosa* (Wood) Herm. Locally frequent in forested sandy soils and on grassy seepage banks, e. Tex., rare to s.e. Tex., spring; Coastal States, Mass. to Tex., inland to Ind., Ill., Mo., Kan. and Okla.

2. *Luzula echinata* (Small) Herm. var. *mesochorea* Herm. Much like *L. bulbosa* but more densely cespitose; tuberlike structures absent; leaves more densely crowded basally; branches of inflorescence tending to spread; perianth and capsules 2.5-3 mm. long; style at anthesis 0.5-1 mm. long, with 3 branches 2-2.5 mm. long (whole structure postantheically deciduous). Rare in sandy soil, especially on knolls and well-drained stream banks in hardwood forests, e. Tex., spring; the species in most of temp. e. U.S.; the var. *mesochorea* in Coastal States, N.C. to Tex. and inland to Ind., Ill. and Okla.

FAM. 38. LILIACEAE JUSS.

LILY FAMILY

Mostly perennial herbs, infrequently or only occasionally woody; rootstock a rhizome, bulb, corm or tuber; stems erect or climbing, often modified into fleshy subterranean storage organs or cladophylls; leaves basal or cauline, alternate or whorled, mostly lamellate but sometimes reduced to scales or sheaths, sometimes fleshy or with prickly margins, occasionally fibrous, the venation mostly parallel but also reticulate-parallel in some genera; inflorescence various; flowers bisexual or rarely unisexual (with the plants mostly dioecious), regular (in ours); perianth often large and showy, in 2 series of 3 segments each, very rarely fewer or more, usually undifferentiated into corolla and calyx, the segments imbricate or the outer series valvate, sometimes connate into a tube; stamens 6, rarely fewer or more, hypogynous or adnate to the perianth; filaments distinct or connate; anthers 2-celled, extrorse or antrorse, versatile or basifixed, dehiscing usually by vertical slits; pistil 1; ovary usually 3-celled; styles 1 or 3, sometimes divided or trifid; fruit a septicidal or loculicidal capsule or a berry; seeds various.

More than 4,000 species in about 250 genera throughout the world. Many are of great economic and horticultural importance.

1. Flowers or inflorescences in the axils of alternate stem leaves (2)
1. Flowers or inflorescences terminal (4)

2(1). Perianth tubular, the segments free only at tip; flowers one to several, drooping from the axils24. *Polygonatum*, p. 406.

2. Perianth of distinct segments (3)

3(2). Flowers numerous in ascending umbels; woody vines, often with tendrils; leaves broad, netted-veined; fruit a berry27. *Smilax*, p. 409.

3. Flowers usually 1 or 2, pendulous; herbaceous plants with parallel-veined scalelike leaves and no tendrils22. *Asparagus*, p. 406.

4(1). Flowers usually 1 to 3, rarely as many as 6 (5)

4. Flowers more than 6, variously arranged in clusters (11)

5(4). Flowers terminating a scape (6)

5. Flowers at apex of a more or less leafy stem (10)

- 6(5). Leaves 2, basal, ovate to elliptic or lanceolate, rarely linear, 1 cm. wide or more (7)
6. Leaves several, linear to setaceous, much less than 1 cm. wide (8)
- 7(6). Leaves numerous; perianth about 12 cm. long 10. *Hemerocallis*, p. 391.
7. Leaves 2, basal; perianth rarely to 5 cm. long 12. *Erythronium*, p. 392.
- 8(6). Filaments free, not united into a tube; perianth segments white with a dorsal green keel 15. *Milla*, p. 394.
8. Filaments more or less united to form a tube; perianth segments bluish-tinged or violet-purple (9)
- 9(8). Flower solitary, with 2 partly or wholly united bracts 13. *Ipheion*, p. 393.
9. Flowers 1 to 6, with 2 large and 2 small bracts 14. *Androstephium*, p. 393.
- 10(5). Leaves in a terminal whorl of 3; perianth yellowish to purplish-brown to pink or white 25. *Trillium*, p. 407.
10. Leaves in several whorls on the stem; perianth orange or red and spotted 11. *Lilium*, p. 391.
- 11(4). Flowers large and showy, about 12 cm. long 10. *Hemerocallis*, p. 391.
11. Flowers relatively small, much less than 12 cm. long (12)
- 12(11). Flowers in umbels (13)
12. Flowers in racemes, corymbs or panicles (14)
- 13(12). Plant with onion-odor; perianth not reflexed in fruit 8. *Allium*, p. 384.
13. Plant without onion-odor; perianth reflexed in fruit ... 9. *Nothoscordum*, p. 391.
- 14(12). Floral segments united except at apex into a tubular or campanulate perianth (15)
14. Floral segments distinct or slightly united only at base, the perianth lobes then much longer than the tube (16)
- 15(14). Bulbous, with slenderly linear leaves; flowers blue or bluish, smooth, in a dense terminal raceme 17. *Muscari*, p. 394.
15. Not bulbous; leaves lanceolate; flowers yellow or white, scurfy-roughened, in a spiral spicate raceme 26. *Alcetris*, p. 409.
- 16(14). Plants with a large woody caudex which is mainly subterranean or largely above ground and trunklike; leaves numerous, in large rosettes at apex of the caudex or of its branches, narrowly elongate, thin and flexible to mostly rigid and spine-tipped (17)
16. Plants herbaceous, without a large woody caudex; leaves not in large rosettes, never rigid or spine-tipped (20)
- 17(16). Flowers rosy-red or salmon-colored 18. *Hesperaloe*, p. 394.
17. Flowers white to greenish-white, cream-color or tinged with pink (18)
- 18(17). Flowers seldom less than 2 cm. long, all perfect; capsules large, not lobed or winged; seeds numerous in each cell of the capsule, flattened; leaf margins corneous or filiferous 19. *Yucca*, p. 395.
18. Flowers much less than 1 cm. long, all or many of them unisexual; capsules small, 3-lobed or -winged; seed solitary in each cell of the capsule, turgid; inflorescences with small scarious bracts (19)
- 19(18). Leaves rigid to not very rigid, the margins not spiny (sometimes serrulate); plants incompletely dioecious, some of the flowers perfect; capsule 3-celled, 3-lobed; seeds globose 20. *Nolina*, p. 402.
19. Leaves very rigid, the margins armed with sharp curved spines; plants completely dioecious; capsule 1-celled, winged; seeds trigonous; staminate flowers in dense catkinlike spikes 21. *Dasylirion*, p. 404.

- 20(16). Style single, sometimes cleft at tip (21)
 20. Styles 3 (24)
 21(20). Leaves ovate to lanceolate, alternate on the stem; flowers white; fruit a berry ..
23. *Smilacina*, p. 406.
 21. Leaves linear, grasslike, in a basal tuft; flowers yellow to orange or blue, rarely
 whitish; fruit a capsule (22)
 22(21). Flowers blue or purplish-blue; filaments filiform ..16. *Camassia*, p. 394.
 22. Flowers yellow to orange or pale-white; filaments somewhat flattened or roughened
 with processes (23)
 23(22). Floral segments 8 mm. long or less; distribution in southeast and south-central
 Texas 4. *Schoenolirion*, p. 382.
 23. Floral segments 10 mm. long or more; distribution in the western two thirds of Texas
 5. *Anthericum*, p. 383.
 24(20). Anthers ovate-cordate, 2-celled; leaves 2-ranked and equitant; inflorescence
 glutinous 1. *Tofieldia*, p. 380.
 24. Anthers peltate or reniform, with confluent cells; leaves and inflorescence not as
 above (25)
 25(24). Flowers sessile or very shortly pediceled, in a tight spicate raceme 2 cm. or
 less in diameter; filaments conspicuously exceeding the perianth segments
 6. *Schoenocaulon*, p. 383.
 25. Flowers long-pediceled or (if short-pediceled) in panicles; filaments rarely exceeding
 the perianth segments (26)
 26(25). Axis of inflorescence pubescent; perianth segments with narrow claws and
 conspicuous glands at base of blades; seeds flat, broadly winged
 7. *Melanthium*, p. 384.
 26. Axis of inflorescence glabrous; seeds not flat, narrowly winged or wingless (27)
 27(26). Perianth segments with 1 or 2 shining or colored glands at base
 3. *Zigadenus*, p. 381.
 27. Perianth segments without shining or colored glands at base
 2. *Stenanthium*, p. 380.

1. TOFIELDIA HUDS. FALSE ASPHODEL

About 20 species in the North Temperate Zone and Andes.

1. *Tofieldia racemosa* (Walt.) Small. Slender perennial, mostly tufted, with short or creeping rhizomes and simple usually 1-foliolate stems that are surrounded by a tuft of grasslike leaves at the base; basal leaves erect, equitant, linear, to 4 dm. long and 3-5 mm. wide; cauline leaf usually single and bractlike, inserted below middle of stem; scape 3-7 dm. high, minutely but distinctly pubescent, increasingly so above, bearing a racemose inflorescence to 15 cm. long; flowers creamy-white, the segments separate and spreading, 2 or 3 together at each node, with pubescent pedicels, subtended immediately below the perianth by a small perfoliate bractlet having 3 ovate lobes; terminal flowers opening first; perianth segments oblong to broadly elliptic-oblongate, concave, 3-nerved, obtuse, 4-5 mm. long; stamens 6, exceeding the perianth; anthers ovate-cordate, 2-celled; filaments flattened, subulate; capsule narrowly obovoid, firm-walled, about 3 mm. long, subtended by the persistent perianth and tipped by the 3 enlarged divergent styles; seeds narrowly ellipsoid, appendaged at both ends, about 2 mm. long. In wet sandy soils on pine savannahs and in pitcher plant bogs in s.e. Tex., June-Sept.; from Fla. to Tex., n. to N.J.

2. STENANTHIUM (GRAY) KUNTH

A monotypic genus.

1. *Stenanthium gramineum* (Ker) Morong. FEATHERBELLS. Glabrous perennial herb; stem erect from bulbous base that has fibrous remains of old leaf bases, leafy below or

with reduced leaves up to the panicle, to about 2 m. high, usually much smaller; leaves numerous, ascending, conduplicate, keeled, the largest to 2 dm. long and 3 cm. broad; panicle elongated, to 9 dm. long, lanceolate to lance-ovoid, the racemiform branches bearing wholly staminate or rarely some perfect sessile or short-pedicelled whitish, greenish or bronze-purple flowers, the terminal unbranched spiciform axis with subsessile to pedicelled perfect flowers; floral bracts ovate, concave, about 2 mm. long; perianths variable in size, 3-10 mm. long, the 6 segments linear-lanceolate and attenuate (rarely bluntish); stamens 6, coherent at base to ovary; capsules oblong-subcylindric to ovoid-urceolate, to 15 mm. long, with 3 short spreading beaks, deflexed or erect; seeds obliquely lanceolate, purple-brown, 4-8 mm. long, wingless or nearly so. In forests or on the edge of forests in e. Tex., June-Aug.; from Fla. to Tex., n. to Pa., Ind. and Mo.

Those plants with erect capsules are referred to var. *robustum* (Wats.) Fern.

3. ZIGADENUS MICHX.

DEATH CAMAS. POISON SEGO

Smooth and often glaucous perennials with rhizomes or bulbs, leafy stems and rather large paniced or racemed white to yellow or greenish to bronze perfect or polygamous flowers; perianth withering-persistent, spreading; floral segments oblong or oval, 1- or 2-glandular near the more or less narrowed but rarely definitely unguiculate base; stamens free from the floral segments and about as long as them; anthers cordate or reniform; capsules 3-lobed, 3-celled, dehiscent to the base; seeds oblong or linear, angled.

About 15 species in the Northern Hemisphere of America and Asia. When grazed, most of the species are usually fatal to sheep and some species even to cattle. The bulbs are also poisonous.

1. Perianth segments 8-17 mm. long, bearing a bilobed gland or 2 glands well above the base; filaments widened at the base (2)
1. Perianth segments 3-7 mm. long, bearing a single basal gland (3)
- 2(1). Stem from bulbous-thickened base; perianth segments obtuse, 8-12 mm. long; gland bilobed1. *Z. elegans*.
2. Stem from creeping rhizome; perianth segments acuminate, 12-17 mm. long; bearing 2 glands2. *Z. glaberrimus*.
- 3(1). Filaments widened at base; flowers usually in a simple raceme but also paniculate; bracts 10-20 mm. long3. *Z. Nuttallii*.
3. Filaments slender throughout; bracts 2-5 mm. long (4)
- 4(3). Flowers polygamous; inflorescence always paniculate4. *Z. leimanthoides*.
4. Flowers perfect, usually in a simple raceme5. *Z. densus*.

1. *Zigadenus elegans* Pursh. WHITE CAMAS, ALKALI-GRASS. Stem rather stout, erect, to about 8 dm. high; leaves crowded toward base, narrowly to broadly linear, to about 4 dm. long and 1 cm. wide, thin, attenuate at tip; inflorescence commonly a slender loose cylindric raceme, rarely a panicle; middle and upper bracts with scarious margins and summits, blunt to mucronate; pedicels usually slender; perianth pale or slightly suffused with purple or brown below, without or with only a small darkened spot outside at base; capsule lance-conic, 13-22 mm. long, 4-6 mm. in diameter, about twice as long as the persistent perianth; seeds 5-6 mm. long. On wet ledges and seepage in canyons of Guadalupe Mts. in the Trans-Pecos, June-Sept.; from Alas. to Ariz., Tex. and N.M., e. to Man., Minn., Ia. and Mo.

2. *Zigadenus glaberrimus* Michx. Rhizome subligneous, blackish, horizontal, elongate; stem slender, to 12 dm. high, leafy; basal leaves elongate, linear, attenuate, firm, to 4 dm. long and 15 mm. wide; panicle loosely pyramidal, to 3 dm. long; bracts ovate, acuminate, about 5 mm. long; pedicels 5-10 mm. long; flowers perfect; perianth segments 1-1.5 cm. long, white, lanceolate or lance-ovate, acute to acuminate, with 2 distinct glands just above the short but definite claw; filaments widened at base; capsule lance-conic, about 1 cm. long, barely equaling the connivent persistent perianth. Savannahs, bogs and wet pinelands, June-Sept.; from Fla. to Tex.(?), n. to s.e. Va.

This species is included here based solely upon a report of its occurrence in the state. It should occur in southeast Texas.

3. *Zigadenus Nuttallii* Gray. DEATH CAMAS, POISON CAMAS. Outer bulb coats papery, not fibrous; stem stout, to 75 cm. high, leafy-bracted; leaves mostly basal, coriaceous, falcate, to 3 dm. long and 1 cm. wide; raceme (rarely paniculate-branched) thick-cylindric, 1-2 dm. long, its scarious bracts caudate, deciduous; pedicels to 3 cm. long; perianth yellowish-white, free; perianth segments 6-8 mm. long, ovate or oval, each with an obovate yellowish basal gland; filaments about equaling the perianth, widened at base; capsules erect, ovoid to ellipsoid, thin-walled, three or four times the length of perianth, with filiform pedicels 15-25 mm. long. Prairies and hillsides of calcareous rocks throughout most of the e. third of Tex., Mar.-May; from Tenn. to Kan. and Tex.

4. *Zigadenus leimanthoides* Gray. Outer bulb coats fibrous; stem slender, erect, to about 15 dm. high; leaves elongate-linear, mostly crowded near the base, to 5 dm. long and 1 cm. wide; flowers crowded in paniced racemes (central axis to 3 dm. long); lower and middle bracts of panicle herbaceous; pedicels to 12 mm. long; perianth segments creamy or yellow to somewhat greenish-white, ovate-elliptic, 3-4 mm. long, each with a deeper yellowish spot on the contracted base; filaments subulate, slightly exceeding the perianth; capsules slender-conic, about 1 cm. long, with pedicels to 15 mm. long. Sandy pinelands and bogs of the Coastal Plain and Piedmont, very rare in n.e. Tex., May-Aug.; from Ga. to Tex., n. to N.J. and L.I.

5. *Zigadenus densus* (Desr.) Fern. BLACK SNAKEROOT, CROW-POISON. The barely thickened bulbs with smooth coats; stem slender, erect, to 15 dm. high, remotely bracted; leaves narrowly linear, mostly near the base, to 5 dm. long and 7 mm. wide; raceme simple (rarely branching below), densely subcylindric, to about 2 dm. long and 3-5 cm. thick; bracts small, firm, brownish, persistent; perianth creamy-white to pink, nearly or wholly free; perianth segments 4-5 mm. long, elliptic-obovate, obtuse, each usually with a very small obscure gland at base; capsules slenderly conical, with pedicels 1-2 cm. long. Damp pinelands and bogs in e. Tex., Apr.-June; from Fla. to Tex., n. to s.e. Va., N.C. and Tenn.

The bulb of this plant is very poisonous.

4. SCHOENOLIRION DURAND

Perennial herbs; stem naked, scaly and somewhat thickened at base, from a thick root-stock and fleshy-fibrous cluster of roots; leaves in a basal tuft, very narrow, elongate, flat, rather rigid, few-nerved; flowers yellow or whitish to pale-green, in lax simple or sparingly branched racemes; pedicels slender, exceeding in length the flowers and bracts, articulate just beneath the flower; floral segments 6, distinctly 3- to 5-nerved, spreading, exceeding the 6 stamens; style single, short; capsule depressed-globose, deeply 3-lobed; seeds subglobose, shining.

Three species in southern United States; one in California.

1. Flowers bright-yellow; larger leaves 4-8 mm. wide, strongly ribbed; in bogs, marshes or wet savannahs 1. *S. croceum*.
1. Flowers white or greenish-white; larger leaves mostly less than 4 mm. wide, not strongly ribbed; in mesophytic open forests or on ridges 2. *S. texanum*.

1. *Schoenolirion croceum* (Michx.) Wood. YELLOW SUNNY-BELL. Scape very slender, about 3 dm. high; principal leaves 4-8 mm. wide, strongly ribbed; raceme simple, to 15 cm. long and 4 cm. in diameter; bracts ovate to elliptic, concave, mostly obtuse, often tinged with purple; flowers yellow and mostly tinged with red; floral segments elliptic-oblong, 5-7 mm. long; seeds nearly 4 mm. long. *Oxytria crocea* (Michx.) Raf. In wet savannahs, marshy pinelands, bogs and on seepage slopes in s.e. Tex., Mar.-May; from Fla. to Tex., n. to N.C.

2. *Schoenolirion texanum* (Scheele) Gray. Resembling *S. croceum*; principal leaves mostly 4 mm. wide or less; flowers greenish-white; bracts rather narrow, acutish; seeds about 2 mm. long. *Oxytria texana* (Scheele) Pollard. On low ridges and in open mixed forests on the w. edge of s.e. Tex., Mar.-May; endemic.

This species seems to be confined to the region about Austin, Brazos and Walker cos.

5. ANTHERICUM L.

CRAG-LILY. AMBER-LILY

Plants with naked stems or with 1 or 2 setaceous bracteal leaves, from a cluster of thick cylindrical fleshy-fibrous roots; leaves narrowly linear, grasslike, surrounded at the base by the fibrous remnants of older ones; flowers yellow, in simple or compound racemes, with pedicels jointed at or below the middle, the 3- to 5-nerved essentially distinct segments spread from the base and twice longer than the anthers; style single, slender, elongated; capsules somewhat oblong to oblong-quadrate, with several flattened angular seeds in each cell.

About 300 American, African and Eurasian species.

1. Largest leaves 10 mm. wide or more, with obvious anastomosing veins; distribution in Rio Grande Valley and south-coastal Texas 1. *A. Chandleri*.
1. Largest leaves rarely to 8 mm. wide, without cross-veins; distribution in Trans-Pecos and Edwards Plateau 2. *A. Torreyi*.

1. *Anthericum Chandleri* Greenm. & Thoms. LILA DE LOS LLANOS. Plant erect, perennial; rootlike fibers fleshy, clavate at the apex, the neck of the root moderately fibrous; leaves as many as 15, flat, grasslike, lanceolate-linear, gradually diminishing above, acute, 35-45 cm. long, to 1 cm. wide or more, about 24-nerved, with transverse connecting veins, glabrous on both sides; scape to about 1 m. high, terete, glabrous, somewhat bracteate; inflorescence paniculate, to 35 cm. long, glabrous, the terminal raceme 2-2.5 dm. long, the lateral racemes 1-1.5 dm. long; bracts triangular-acuminate to lanceolate-attenuate, subscarios, to 2 cm. long; flowers 2 to 4 in axils of the bracts; pedicels about 1 cm. long, articulated below the middle; perianth orange-yellow to pale-yellow or stramineous, with three-nerved oblong-lanceolate lobes about 1 cm. long; stamens about half the length of perianth; filaments muricate; style 8 mm. long, glabrous; capsule oblong-ellipsoid, 1-1.2 cm. long. In clay soil in chaparral, thickets and prairies in the Rio Grande Valley and s.-coastal Tex., May-Nov.; also n.e. Mex.

2. *Anthericum Torreyi* Baker. Root a fascicle of thick fleshy fibers; radical leaves several, elongate, smooth, usually less than 7 mm. wide; stem scapiform, to about 1 m. high, very slender, often nearly simple above but more commonly somewhat paniculately branched, the branches erect; flowers 2 to 4 or more together in fascicles, the terminal ones racemose and mostly solitary; pedicels 1-1.2 cm. long, jointed about one third their length from the base; floral segments orange-yellow, narrowly oblong and elliptic, to 15 mm. long and 7 mm. wide, with 3 to 5 closely approximate greenish or brownish nerves along the middle; stamens scarcely half the length of the perianth; filaments roughened with short obtuse somewhat retrorse teeth; anthers linear-oblong; ovary obovate; style one third longer than the stamens, filiform; stigma minutely 3-lobed, ciliate-papillose; capsule oblong-obovate, obtuse, 3-lobed, 8-10 mm. long, thin; seeds 12 to 16, angular, black. In rich soils in canyons and on rocky cedar-oak hills in the Trans-Pecos and Edwards Plateau, June-Nov.; from Tex. to Ariz. and n. Mex.

6. SCHOENOCAULON GRAY

Herbaceous perennials with ovoid to oblong-cylindric bulbs, basal portion of plant covered by blackish scales and fibers; leaves all basal, grasslike, glabrous, the margins serrulate; scape naked, erect and simple, purplish below, glaucous above; spike slender, many-flowered, bracteate; flowers perfect, pale-green to yellowish-white, at first crowded but later distinct, sessile or shortly pedicellate; perianth segments 6, essentially free, persistent; stamens 6, subequal, inserted at base of perianth segments, persistent; filaments filiform to subclavate-filiform; anthers unilocular, reniform, peltate after dehiscence; ovary ovoid; styles 3, distinct, divergent and slightly recurved; capsule ovoid to ellipsoid, chartaceous, glaucous, persistent, 3-celled.

A New World genus of about 10 species, mainly in Mexico; south to Peru.

1. Perianth segments submembranous, elliptic to ovate-elliptic, with thin erose margins; spike 1.5-2 cm. in diameter; usually (but not always) flowering in autumn 1. *S. Drummondii*.
1. Perianth segments fleshy-thickened or leathery, linear-oblong, with thickish entire margins; spike 1-1.5 cm. in diameter; flowering in spring and summer 2. *S. texanum*.

1. *Schoenocaulon Drummondii* Gray. GREEN LILY. Scape to 6 dm. tall; leaves to 5 dm. long; perianth segments 2.5-3 mm. long and 1 mm. broad; filaments stout, subclavate-filiform, dilated above, 5-7 mm. long. In sandy gravelly soils along roadsides, in arroyos and prairies and edge of open woods in cen. Coastal Prairie and upper and cen. Rio Grande Plains, Sept.-Oct., rarely in spring; also n.e. Mex.

2. *Schoenocaulon texanum* Scheele. Scape to 55 cm. tall; leaves to 6 dm. long; perianth segments 3-4 mm. long and about 1 mm. broad or less, somewhat dilated below middle; filaments slightly dilated at base, usually noticeably recurved, 3.5-5 mm. long; capsules obliquely ovoid, appressed to rachis, 1-1.5 cm. long. Commonly in limestone soil on slopes, bluffs, in canyons and outwashes and on flats from n.e. Rio Grande Plains, through the Edwards Plateau to the Trans-Pecos, Mar.-July; also s.e. N.M. and Mex.

7. MELANTHIUM L.

Five species, all native of North America.

1. *Melanthium virginicum* L. BUNCHFLOWER. Perennial from a thick rootstock; stem to about 1.5 m. high, scurfy above; leaves firm, broadly linear, acuminate-attenuate, to 3 cm. broad; panicle to 45 cm. long, usually much shorter, somewhat scurfy, with ascending to spreading lateral branches; flowers creamy, changing to green or purplish, scurfy outside; floral segments 6, broadly oblong to ovate, rounded to cordate or hastate at base, flat, obtuse, 5-8 mm. long, 2 or 3 times the length of slender claw, with 2 dark glands at base; stamens borne at or above middle of each claw; capsule erect, ovoid, with furrows between the round-backed carpels, 13-18 mm. high, 3-beaked; seeds whitish, narrowly obovate, flat, broadly winged, about 10 in each cell, 5-7 mm. long. Meadows, bogs, swales, savannahs, edge of woodlands and low thickets in e. and s.e. Tex., May-July; from n. Fla. to Tex., n. to s. N.Y., O., Ind., Ill. and Ia.

8. ALLIUM L.²⁸

ONION. GARLIC. LEEK

Biennial or perennial herbs; scapes from a tunicated bulb, with mostly narrowly linear basal leaves; herbage usually with the characteristic odor and taste of onions or garlic; flowers in a terminal simple umbel, subtended by 2 to 4 membranous separate or united bracts, some or all of the flowers occasionally replaced by bulblets; pedicels slender, not jointed; perianth persistent, its 6 segments white to purple and distinct or united at the base; stamens inserted on the bases of the perianth segments; filaments filiform or dilated, sometimes toothed; style filiform, jointed; capsule obovate-globose, obtusely 3-lobed, often crested, loculicidally dehiscent; seeds obovoid or ovoid-reniform, wrinkled, black.

A genus of 450 or more species widely distributed in the North Temperate Zone. Sometimes segregated, with a few other Liliaceous genera, as a separate family, the Alliaceae.

1. Bulb coats (leaf bases) containing anastomosing fibers that usually persist as conspicuous fibrous reticula to enclose 1 or more bulbs (2)
1. Bulb coats without fibers or with parallel fibers, these never persisting as fibrous reticula (13)
- 2(1). Flowering pedicels mostly or entirely replaced by bulbils; flowers rarely producing capsules or seeds 1a. *A. canadense* var. *canadense*.
2. Umbels floriferous and capsuliferous; bulbils almost unknown (3)
- 3(2). Ovary and capsule usually crestless, if crested the flowers yellow (4)
3. Ovary and capsule usually crested; flowers pink or white; plants of far western Texas (12)
- 4(3). Bracts and spathe 3- to 7-nerved; interstices between fibers of reticula open (5)
4. Bracts of spathe 1-nerved; inner epidermal cells of innermost bulb coats contorted (their walls usually not sinuous); perianth segments spreading, becoming papery and rigid in fruit (11)

²⁸ Adapted from Marion Ownbey in Res. Stud. St. Coll. Wash. 18: 181-222. 1950.

- 5(4). Perianth campanulate or urceolate-campanulate, ultimately withering away from the capsule; reticula fine- or only moderately coarse-meshed; alveoli on seeds pustuliferous (6)
- 5. Perianth urceolate, permanently investing the capsule; reticula very coarse; alveoli on seeds not pustuliferous (9)
- 6(5). Perianth white; plants mostly of the Edwards Plateau and northward
..... 1e. *A. canadense* var.
Fraseri.
- 6. Perianth usually pink (7)
- 7(6). Pedicels filiform; usually slender plants of eastern Texas
..... 1b. *A. canadense* var.
mobile.
- 7. Pedicels stouter; plants usually more robust (8)
- 8(7). Umbel many-flowered; perianth segments thin; flowers fragrant; distribution north-central Texas 1c. *A. canadense* var.
hyacinthoides.
- 8. Umbel few- (5 to 25) flowered; perianth segments thicker; distribution central coastal Texas 1d. *A. canadense* var.
ecristatum.
- 9(5). Flowering bulbs with a cluster of stalked basal bulblets; inner epidermal cells of innermost bulb coats contorted, with sinuous walls; distribution southern Texas ..
..... 2. *A. Runyonii.*
- 9. Bulbs without basal bulblets; epidermal cells vertically elongate, regular, without sinuous walls (10)
- 10(9). Perianth deep-rose-color, fading to purple; flowers fragrant; distribution northern Texas 3a. *A. perdulce* var.
perdulce.
- 10. Perianth white or pale-pink, with deep-pink midribs, fading to pink; distribution western Texas 3b. *A. perdulce* var. *Sperryi.*
- 11(4). Interstices between fibers of reticula filled; flowers white, pink or red
..... 4. *A. Drummondii.*
- 11. Interstices between fibers of reticula open; flowers yellow; distribution western Texas 5. *A. Coryi.*
- 12(3). Leaves usually 2 per scape; bracts of spathe 3- to 5-nerved; ovary and capsule crested (usually conspicuously so) with 6 flattened processes; alveoli on seeds not pustuliferous 6. *A. macropetalum.*
- 12. Leaves 3 or more per scape; bracts of spathe mostly 1-nerved; ovary and capsule inconspicuously crested with 6 knoblike processes or sometimes appearing to be crestless; alveoli on seeds pustuliferous 7. *A. Geyeri.*
- 13(1). Ovary and capsule conspicuously crested; stamens exserted (14)
- 13. Ovary and capsule crestless; stamens included (15)
- 14(13). Perianth campanulate; umbel nodding 8. *A. cernuum.*
- 14. Perianth stellate; umbel erect 9. *A. stellatum.*
- 15(13). Bulb with a cluster of short-stalked bulblets at base; cells of inner epidermis of innermost bulb coats vertically elongate or contorted, with very sinuous walls ..
..... 10. *A. Elmendorffii.*
- 15. Bulb without basal bulblets; cells on inner epidermis not contorted (16)
- 16(15). Bulb about 1 cm. thick, solitary, proliferating from base by means of long slender rhizomes 11. *A. rhizomatum.*
- 16. Bulbs about 2 cm. thick, often clustered, sometimes stipitate (short-rhizomatous) at base, without long slender rhizomes 12. *A. Kunthii.*

1a. *Allium canadense* L. var. *canadense*. CANADA GARLIC. Bulb ovoid, without basal bulblets, often one of a cluster; inner bulb coats whitish, the epidermal cells obscure, vertically elongate, regular or nearly so; outer bulb coats persisting as a series of grayish or brownish fibrous fine- to coarse-meshed open reticula, enclosing 1 or more bulbs or soon distintegrating; fleshy scales 2 to 5, with mild to strong garlic flavor; leaves usually 3 or more per bulb, channeled, concave-convex in cross section, 1-5 mm. broad, usually with entire margins, shorter than the scape, green at anthesis; scape 1.5-5 dm. tall, terete, solitary; spathe membranaceous, caudate, breaking before anthesis into usually 3 separate or partially united 3- to 7-nerved bracts that are ovate to lanceolate and acuminate; umbel with few or no flowers, the pedicels being replaced (all or in part) by ovoid bulbils, some of which may in turn bear secondary umbels; pedicels (when present) 2 to several times the length of the perianth, elongating and becoming rigid when fruit is produced; perianth broadly campanulate; perianth segments 4-7 mm. long, elliptic-lanceolate, obtuse to acute, entire, spreading, white or pink, withering in fruit, the midribs somewhat thickened; stamens shorter than the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse to acute; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. *A. mutabile* Michx. Roadsides, meadows, woods and fields in the e. third of Tex., Mar.-May; generally distributed throughout e. N.A.

1b. *Allium canadense* var. *mobile* (Regel) M. Ownbey. Bulb ovoid, usually small, sometimes with 1 or 2 large basal bulblets, often one of a cluster; inner bulb coats whitish, cells of the inner epidermis sometimes contorted or with sinuous walls; outer bulb coats persisting as a series of grayish or brownish mostly fine-meshed open reticula, usually enclosing only a single bulb; leaves 2 or more per bulb, channeled, concave-convex in cross section, 1-2 mm. broad, usually with entire margins, shorter than the scape, green at anthesis; scape 1-5 (usually less than 3) dm. tall, terete, solitary; spathe membranaceous, caudate, breaking before anthesis into usually 3 separate or partially united 3- to 5-nerved bracts that are lanceolate and attenuate; umbel many-flowered, erect; pedicels very slender, subequal in length, mostly 2 to 4 times that of the perianth, elongating and becoming flexuous and rigid in fruit; perianth broadly campanulate; perianth segments 4-7 mm. long, elliptic-lanceolate, obtuse to acute, spreading, pink (rarely white), thin in texture, withering in fruit, the midribs somewhat thickened; stamens about two thirds the length of the perianth; filaments deltoid-subulate, broadly dilated and united into a cup at base; anthers short-oblong, obtuse or acute; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. *A. mobile* Regel, *A. Zenobiae* Cory. Usually in sandy or rocky soils, rarely on limestone or in clay, woods and prairies in e. fourth of Tex., Apr.-May; from Ga. and Fla. to Tex., Okla. and Mo.

1c. *Allium canadense* var. *hyacinthoides* (Bush) M. Ownbey. Bulb ovoid, without basal bulblets, often one of a cluster; inner bulb coats whitish, epidermal cells obscure, vertically elongate, regular or nearly so; outer bulb coats persisting as a series of grayish or brownish fibrous rather coarse-meshed open reticula, enclosing 1 or more bulbs; leaves several per bulb, channeled, concavo-convex in cross section, 2-7 mm. broad, entire or denticulate on the margins, shorter than the scape, green at anthesis; scape 1.5-3 dm. tall, terete, solitary; spathe membranaceous, acuminate, breaking before anthesis into 3 or 4 lanceolate and acuminate 3- to 7-nerved bracts that usually remain partially united at base; umbel many-flowered, erect; pedicels subequal in length, mostly 2 to 4 times that of the perianth, elongating and becoming flexuous and rigid in fruit; perianth urceolate-campanulate; perianth segments 5-7 mm. long, elliptic-lanceolate, obtuse to acute, entire, erect, pink, thin in texture, withering in fruit, the midribs somewhat thickened; stamens shorter than the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. *A. hyacinthoides* Bush. On calcareous prairies or more frequently in sandy soils in n.-cen. Tex., Mar.-Apr.; also adj. s. Okla.

1d. *Allium canadense* var. *ecristatum* (M. E. Jones) M. Ownbey. Bulb ovoid, without basal bulblets, often one of a cluster; inner bulb coats whitish, cells of inner epidermis vertically elongate, somewhat contorted; outer bulb coats persisting as a series of grayish

or brownish fibrous rather coarse-meshed open reticula, enclosing the bulb; leaves several per bulb, channeled, concavo-convex in cross section, 1-5 mm. broad, entire or denticulate on the margins, shorter than the scape, green at anthesis; scape 1-3 dm. tall, terete, solitary; spathe membranaceous, breaking before anthesis into 3 ovate acuminate 5- to 7-nerved bracts that remain partially united at base; umbel few- (5 to 25) flowered, erect; pedicels subequal in length, mostly less than twice that of the perianth, elongating and becoming flexuous and rigid in fruit; perianth urceolate-campanulate; perianth segments 5-7 mm. long, elliptic-lanceolate, obtuse to acute, entire, erect, deep-pink, rather thick in texture, withering in fruit, the midribs somewhat thickened; stamens shorter than the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. On prairies on the cen. Coastal Plain in Tex., Mar.-Apr.; endemic.

1e. *Allium canadense* var. *Fraseri* M. Ownbey. Bulb ovoid, without basal bulblets, often one of a cluster; inner bulb coats whitish, epidermal cells obscure, vertically elongate, regular or nearly so; outer bulb coats persisting as a series of grayish or brownish fibrous fine to coarse-meshed open reticula, enclosing 1 or more bulbs; leaves usually 3 or more per bulb, channeled, concavo-convex in cross section, 1-5 mm. broad, entire or denticulate on the margins, usually much shorter than the scape, green at anthesis; scape 2-5 dm. tall, terete, usually solitary; spathe membranaceous, caudate, breaking before anthesis into usually 3 ovate to lanceolate attenuate 3- to 7-nerved bracts that may remain partially united at base; umbel many-flowered, erect; pedicels becoming subequal in length, mostly 3 to 4 times that of the perianth, elongating and becoming flexuous and rigid in fruit; perianth broadly campanulate; perianth segments 4-7 mm. long, elliptic to lanceolate, acute to obtuse, entire, spreading, white (rarely pink), withering in fruit, the midribs somewhat thickened; stamens usually shorter than the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. *A. Fraseri* (M. Ownbey) Shinners, *A. lavendulare* var. *Fraseri* (M. Ownbey) Shinners, *A. acetabulum* (Raf.) Shinners var. *Fraseri* (M. Ownbey) Shinners. Generally in sandy or rocky soils in woods or plains in Tex., Apr.-May; from Tex. to S.D.

2. *Allium Runyonii* M. Ownbey. Bulb ovoid, bearing a cluster of short-stalked basal bulblets; innermost 2 bulb coats whitish, with the cells of the inner epidermis contorted with very sinuous walls; outer bulb coats persisting as a series of brownish fibrous very coarse-meshed open reticula, enclosing the bulb; fleshy bulb scale 1; leaves 3 or more per bulb, channeled, concavo-convex in cross section, 1-4 mm. broad, entire, usually equaling or exceeding the scape in length, green at anthesis; scape 1-3.5 dm. tall, terete or nearly so, often 2 or more successively produced from a single bulb; spathe membranaceous, acuminate, breaking before anthesis into 3 ovate acuminate 3- to 5-nerved bracts that usually remain partially united at base; umbel usually between 10- and 25-flowered, erect; pedicels about twice the length of the perianth at anthesis, elongating in fruit, becoming subequal in length and stiffly spreading, not flexuous; perianth urceolate-campanulate; perianth segments 5-7 mm. long, lanceolate, obtuse or even emarginate to acute, entire, erect, white with pinkish midribs, fading pink, becoming callous-keeled and permanently investing the fruit; stamens nearly equaling the perianth in length; filaments subulate, dilated below and united into a cup at base; anthers oblong, obtuse or umbonate; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli smooth. Sandy soils in Rio Grande Plains in s. Tex., Mar; endemic.

3a. *Allium perdulce* S. V. Fraser var. *perdulce*. Bulb ovoid, without basal bulblets, usually one of a cluster; inner bulb coats whitish, epidermal cells regular, vertically elongate; outer bulb coats persisting as a series of dark-brown fibrous coarse-meshed open reticula, enclosing 1 or more bulbs; fleshy bulb scales 1 or 2, with no evident onion or garlic flavor; leaves 3 or more per bulb, channeled, concavo-convex in cross section, 1-2 mm. broad, entire, usually equaling or exceeding the scape in length, green at anthesis; scape 1-2 dm. tall, terete or nearly so, solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 ovate acuminate mostly 5-nerved bracts that

usually remain partially united at base; umbel 5- to 25-flowered, erect; pedicels about the length of the perianth at anthesis, elongating in fruit and becoming flexuous and rigid; perianth urceolate; perianth segments 7-10 mm. long, lanceolate, obtuse to acute, entire, erect, deep-rose-color, fading to purple, becoming callous-keeled and permanently investing the fruit; stamens one half to two thirds the length of the perianth; filaments deltoid-subulate, united into a cup at the base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds dull-black, finely alveolate, the alveoli not pustuliferous. Generally in sandy soils in plains of n.-cen. Tex., Mar.-Apr.; from Tex. and e. N.M., n. to S.D. and adj. Ia.

3b. *Allium perdulce* var. *Sperryi* M. Ownbey. Bulb ovoid, without basal bulblets, sometimes one of a cluster; inner bulb coats whitish, epidermal cells regular, vertically elongate; outer bulb coats persisting as a series of dark-brown fibrous rather coarse-meshed open reticula, enclosing 1 or more bulbs; fleshy bulb scales 2, with no evident onion or garlic flavor; leaves 3 or more per bulb, channeled, concavo-convex in cross section, 1-3 mm. broad, entire, usually equaling or exceeding the scape in length, green at anthesis; scape 1-2 dm. tall, terete or nearly so, solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 ovate acuminate 5- to 7-nerved bracts that usually remain partially united at base; umbel 5- to 20-flowered, erect; pedicels about twice the length of the perianth at anthesis, elongating in fruit and becoming flexuous and rigid; perianth urceolate; perianth segments 7-10 mm. long, lanceolate, obtuse to acute, entire, erect, white or pale-pink with deep-pink midribs, fading to pink, becoming callous-keeled and permanently investing the fruit; stamens one half to two thirds the length of the perianth; filaments deltoid-subulate, united into a cup at base; anthers oblong, obtuse; ovary crestless; style stout, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; mature seeds not known. On rocky slopes in the Trans-Pecos, Mar.; endemic.

4. *Allium Drummondii* Regel. WILD ONION. Bulb ovoid, without basal bulblets, usually one of a cluster; innermost 2 bulb coats whitish or brownish, with the cells of the inner epidermis intricately contorted, their walls usually not sinuous; outer bulb coats enclosing 1 or more bulbs, persisting as a series of brown fibrous fine-meshed reticula whose interstices mostly remain closed; fleshy bulb scales 1 or 2, mildly garlic-flavored; leaves usually 3 or more per bulb, channeled, concavo-convex in cross section, 1-3 (or -5) mm. broad, entire, about equaling the scape in length, green at anthesis; scape 1-3 dm. tall, terete or nearly so, usually solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 ovate acuminate 1-nerved bracts; umbel 10- to 25-flowered, erect; pedicels unequal in length, 1 to 3 times that of the perianth, becoming flexuous and rigid in fruit, rarely replaced by bulbils; perianth rotate-campanulate; perianth segments 6-9 mm. long, ovate to lanceolate, obtuse to acute, entire, spreading, white, pink, or red, rarely greenish yellow, becoming papery and rigid in fruit, the midribs somewhat thickened; stamens two thirds to three fourths the length of the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, each alveoli usually with a minute pustule in the center. *A. Hellertii* Small, *A. Nuttallii* Wats. On plains, hills and prairies, particularly in limestone soils, throughout most of Tex., Mar.-May; from Tex. to w. Neb., N.M., and n. Mex.

Forma asexuale M. Ownbey with bulbils replacing the pedicels.

5. *Allium Coryi* M. E. Jones. YELLOW-FLOWERED ONION. Bulb ovoid, without basal bulblets usually one of a cluster; innermost 2 bulb coats whitish or brownish, with the cells of the inner epidermis intricately contorted, their walls not sinuous; outer bulb coats persisting as a series of brown fibrous fine-meshed open reticula, enclosing 1 or more bulbs; fleshy bulb scale 1, mildly garlic-flavored; leaves 3 or more per bulb, channeled, concavo-convex in cross section, 1-3 mm. broad, entire, about equaling the scape in length, green at anthesis; scape 1-3 dm. tall, terete or nearly so, usually solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 ovate acuminate 1-nerved bracts; umbel usually between 10- and 25-flowered, erect; pedicels unequal in length, 1 to 3 times that of the perianth, becoming flexuous and rigid in fruit; perianth rotate-campanulate; perianth segments 6-9 mm. long, ovate to lanceolate, obtuse to acute, entire, spreading, bright yellow, sometimes tinged with red, fading with age and sometimes upon drying becoming papery and rigid in fruit, the midribs somewhat thickened; stamens two thirds to three fourths the length of the perianth; filaments subulate, dilated and

united into a cup at base; anthers oblong, obtuse; ovary crestless or rarely crested with 6 low processes that may be distinct or united in pairs across the septa; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli not pustuliferous. Rocky slopes and plains in mts. of the Trans-Pecos, Apr.-May; endemic.

6. *Allium macropetalum* Rydb. Bulb ovoid, without basal bulblets, usually one of a cluster; inner bulb coats whitish, epidermal cells vertically elongate and regular or obscure; outer bulb coats persisting as a series of brown fibrous usually coarse-meshed open reticula, enclosing 1 or more bulbs; fleshy bulb scales about 3, mildly garlic-flavored; leaves usually 2 per scape, semiterete, scarcely channeled and concavo-convex in cross section, 1-3 mm. broad, entire, exceeding the scape in length, green at anthesis; scape 5-20 cm. tall, terete or somewhat angled, solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 separate or partially united ovate to lanceolate mostly 3- to 5-nerved bracts; umbel 10- to 20 (rarely fewer- or more-) flowered, erect; pedicels unequal in length, 2 to 3 times that of the perianth, becoming more or less flexuous and rigid in fruit; perianth broadly campanulate; perianth segments 8-12 mm. long, lanceolate, obtuse to acuminate, entire, spreading, pink with deeper pink or reddish midribs, becoming papery in fruit, the midribs scarcely thickened; stamens about two thirds the length of the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse; ovary usually conspicuously crested with 6 flattened processes that are mostly well-developed in fruit, often as much as 2 mm. high, usually united in pairs across the septa; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli not pustuliferous. *A. deserticola* (M. E. Jones) Woot. & Standl. Desert plains and hills in the Trans-Pecos, Mar.-May; from Tex. to Ariz., Ut. and w. Colo.

7. *Allium Geyeri* Wats. Bulb ovoid or more elongate, without basal bulblets, usually one of a cluster; inner bulb coats whitish, epidermal cells vertically elongate and regular or obscure; outer bulb coats persisting as a series of gray or brown fibrous rather coarse-meshed open reticula, enclosing 1 or more bulbs; fleshy bulb scales 3 or 4, strongly garlic-flavored; leaves ordinarily 3 or more per scape, channeled, concavo-convex in cross section, 1-5 mm. broad, entire or denticulate on the margins, usually shorter than the scape, green at anthesis; scape 1-5 dm. tall, terete or somewhat angled, solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 or 3 separate or partially united ovate to lanceolate acuminate mostly 1-nerved bracts; umbel 10- to 25- (sometimes more-) flowered, erect; pedicels nearly equal in length, often less than twice that of the perianth, becoming rigid and stiffly spreading in fruit, usually not flexuous; perianth urceolate-campanulate; perianth segments 4-10 (usually 6-8) mm. long, ovate to lanceolate, obtuse to acuminate, erect, pink or white, often obscurely toothed on the margins and papillose on the midribs, becoming callous-keeled and permanently investing the fruit; stamens usually shorter than the perianth; filaments subulate, dilated and united into a cup at base; anthers oblong, obtuse or umbonate; ovary inconspicuously crested with 6 low rounded knobs that are separate or united in pairs across the septa, becoming variously developed or obsolete in fruit, usually not more than 0.5 mm. high; style linear, about equaling the filaments in length; stigma capitate, entire or obscurely lobed; seeds black, shining, finely alveolate, the alveoli each with a minute pustule in the center. Moist open slopes, meadows or stream banks in the Guadalupe Mts., July; from Tex. to Ariz., Ida., Wash. and s. Alta.

8. *Allium cernuum* Roth. NODDING ONION. Bulb elongate, usually one of a cluster, often stipitate (short-rhizomatous) at base; inner bulb coats whitish to pinkish or reddish; outer bulb coats grayish or brownish, membranaceous, minutely striate with elongate cells in regular vertical rows; leaves several per bulb, channeled, concavo-convex to broadly V-shaped in cross-section or nearly plane, 1-6 mm. broad, entire or denticulate on the margins, shorter than the scape, green at anthesis; scape 1-5 dm. tall, terete or ridged (particularly above), sometimes flattened and narrowly winged, abruptly recurved near the apex, sometimes two or more produced successively from a single bulb; spathe membranaceous, acuminate, usually breaking irregularly and caducous at anthesis; umbel few- to many-flowered, cernuous; pedicels slender, 2 to 3 times the length of the perianth, in fruit becoming stouter, elongating and bending abruptly upward from near the point of attachment; perianth campanulate; perianth segments 4-6 mm. long, elliptic-ovate,

obtuse to obtusish, entire to nearly so, pink or white, at least the outer segments strongly incurved, withering in fruit, the midribs not thickened; stamens exerted; filaments subulate, united into a cup at base; anthers orbicular to oblong, obtuse; ovary conspicuously crested with 6 distinct flattened entire or toothed processes; style linear, exerted; stigma entire; seeds dull-black, finely alveolate, the alveoli smooth to minutely roughened or with a minute pustule in the center. In mts. of the Trans-Pecos, late summer; from Tex. and adj. Mex. to Ariz. and B.C., across continent then s. to Ga.

9. *Allium stellatum* Ker. PRAIRIE ONION. Bulb ovoid, usually one of a cluster, not stipitate at base; inner bulb coats whitish or pinkish; outer bulb coats grayish or brownish, membranaceous, minutely striate with elongate cells in regular vertical rows; leaves several per bulb, channeled, broadly V-shaped in cross section, 1-5 mm. broad, entire or nearly so, shorter than the scape, usually withering at or before anthesis; scape 2-5 dm. tall, terete or angled (particularly above), usually erect, solitary; spathe membranaceous, acuminate, breaking before anthesis into 2 separate or united lanceolate acuminate about 7-nerved ultimately reflexed bracts; umbel many-flowered, at first cernuous but later becoming erect; pedicels slender, 2 to 3 times the length of the perianth, in fruit becoming stouter and more or less curved; perianth stellate; perianth segments 5-8 mm. long, elliptic-lanceolate, acute, entire, deep pink, spreading, withering in fruit, the midribs not thickened; stamens exerted; filaments subulate, dilated below and united into a cup at base; anthers oblong, obtuse; ovary conspicuously crested with 6 distinct flattened entire or toothed processes; style linear, exerted; stigma entire; seeds dull-black, finely alveolate, the alveoli minutely roughened. Prairies, usually in calcareous soils in n.e. Tex., Oct.; from Tex. to Man. and Ill.

10. *Allium Elmendorffii* M. Ownbey. Bulb ovoid, bearing a few short-stalked basal bulblets; innermost 2 bulb coats whitish, with the cells of the inner epidermis vertically elongate or contorted, with very sinuous walls; outer bulb coats thin, membranaceous, without persistent fibers; fleshy bulb scale 1, mildly garlic-flavored; leaves 3 or more per bulb, channeled, concavo-convex in cross section, 1-2 mm. broad, entire, usually equaling or exceeding the scape in length, green at anthesis; scape 1.5-4 dm. tall, terete or nearly so, sometimes two produced successively from a single bulb; spathe membranaceous, acuminate, breaking before anthesis into 3 or 4 acuminate 3- to 5-nerved separate or partially united bracts; umbel 10- to 30-flowered, erect; pedicels usually more than twice the length of the perianth, elongating in fruit; becoming subequal in length, rigid and somewhat flexuous; perianth campanulate; perianth segments about 5 mm. long, lanceolate, obtuse, entire or nearly so, somewhat spreading, white or pinkish, withering away from the fruit, with the midribs slightly thickened; stamens shorter than the perianth; filaments subulate, dilated below and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, about equaling the filaments in length; stigma capitate, entire to distinctly lobed; seeds black, shining, finely alveolate, the alveoli smooth. In Carrizo sands of e. Bexar and adj. Wilson and Atascosa cos., Mar.-Apr.; endemic.

11. *Allium rhizomatum* Woot. & Standl. Bulb ovoid, solitary, 1-2.5 cm. long, about 1 cm. in diameter, arising from slender scaly rhizomes 2-3 cm. long; inner bulb coats white and hyaline, with a few indistinct longitudinal nerves but not reticulate; outer bulb coats grayish and opaque; leaves 2 or 3 per bulb, about as long as or longer than the scape, flat, 2-3 mm. wide; scape 2-3 dm. tall, terete; spathe 2-valved, the scarious ovate acute valves at first pinkish-veined but eventually reflexed and white; umbel erect, few-flowered; pedicels 1-2 cm. long; perianth segments oblong to lanceolate, acute to acuminate, 6-9 mm. long, pale with purplish or pinkish midvein, slightly carinate at the base; stamens about equaling the perianth, included; filaments dilated at the base and coalescent; ovary slightly crested; style linear, shorter than the perianth; stigma small, simple; seeds shiny black, finely alveolate, the alveoli not pustuliferous. *A. glandulosum* of auth. On grassy mt. slopes in the Trans-Pecos, July-Sept.; from w. Tex. to s. Ariz., s. through Mex. to Guat.

12. *Allium Kunthii* G. Don. Bulb ovoid, usually one of a cluster, about 2 cm. in diameter, sometimes stipitate (short-rhizomatous) at base but without long slender rhizomes; inner bulb coats whitish or pinkish; outer bulb coats grayish or brownish, membranaceous, with or without obscure cellular markings, sometimes striate with elongate cells in regular vertical rows; leaves several per bulb, channeled, concavo-convex in cross-section, 1-3 mm. broad, sometimes denticulate on margins and nerves, shorter

than the scape, green at anthesis; scape 1.5-3 dm. tall, terete or somewhat ridged, often 2 or more produced successively from a single bulb; spathe membranaceous, acuminate, breaking before anthesis into 2 separate or partially united lanceolate acuminate 3- to 5-nerved ultimately reflexed bracts; umbel few- to many-flowered, erect; pedicels unequal in length, mostly slender, about twice the length of the perianth, rarely arcuate or flexuous; perianth broadly campanulate; perianth segments 4-8 mm. long, lanceolate, acute to acuminate, entire, spreading, white or pink (particularly on the midribs), withering in fruit, the midribs scarcely thickened; stamens shorter than the perianth; filaments broadly dilated below and united into a cup at base; anthers oblong, obtuse; ovary crestless; style linear, shorter than the perianth; stigma capitate, entire; seeds dull-black, finely alveolate, the alveoli not or very obscurely pustuliferous. *A. scaposum* Benth. Dry rocky hills and mts., usually in limestone soils, in w. Tex., July-Sept.; from Tex. to Ariz. and Mex.

9. NOTHOSCORDUM KUNTH*

FALSE GARLIC

About 35 species in America.

1. *Nothoscordum bivalve* (L.) Britt. CROW-POISON. Scapose herb resembling the onion but odorless, with a membranous-coated bulb; scape 15-55 cm. high; bulb globose, to 25 mm. in diameter, often bulbiferous at base; leaves several, basal, narrowly linear, equal to or shorter than the scape, rarely to 8 mm. wide; umbel terminal, 6- to 12-flowered, the 2 subtending scarious bracts lanceolate; flowers with pedicels to 5 cm. long or more that become rather rigid in fruit; floral segments narrowly oblong to oblong-lanceolate, acute, whitish with a prominent reddish to purplish or sometimes greenish central dorsal stripe, 8-13 mm. long, withering-persistent; stamens 6, inserted on the bases of the floral segments; capsule 4-7 mm. long, obovoid, somewhat 3-angled, somewhat depressed and notched at apex, the style persistent; seeds angled or flattened, black. In low sandy woods, grasslands, prairies and disturbed soil, and on rocky open or wooded slopes throughout most of Tex., flowering intermittently throughout the year; from Fla. to Tex. and Mex., n. to Va., s. O., Ind., s. Ill. and Neb.

10. HEMEROCALLIS L.

DAY-LILY

About 20 species that are natives of Eurasia.

1. *Hemerocallis fulva* L. TAWNY DAY-LILY, YELLOW DAY-LILY. Showy perennial with fleshy-fibrous roots or tubers; leaves numerous, basal, linear, keeled, 1-2 cm. broad; scape to 2 m. high, 3- to 15-flowered; flowers self-sterile, about 12 cm. wide, tawny-orange, deeper-colored toward center, the 3 inner perianth segments (petals) wavy-margined and obtuse, collapsing and decaying after expanding for a single day; perianth funnel-form, lilylike, the short tube enclosing the ovary, the spreading limb 6-parted; stamens 6, inserted at the summit of the perianth tube; anthers as in *Lilium* but introrse; filaments and style long and filiform, declined and ascending; stigma simple; capsule (at first rather fleshy) 3-angled, loculicidally 3-valved, with several black spherical seeds in each cell. An Old World species that has escaped from cult. to roadsides and borders of fields and thickets, Apr.-July.

11. LILIUM L.

LILY

Bulbs scaly, producing simple stems with numerous alternate-scattered or whorled narrow sessile leaves and from one to several large and showy flowers; perianth funnel-form or campanulate, mostly red to orange-color, the 6 divisions spreading or recurved above, deciduous; anthers linear to oblong, extrorsely attached near the middle to the tapering apex of the long filament, at first usually included but at length versatile, the cells dehiscent by a lateral or slightly introrse line; style elongate or very short (dimorphic); stigma 3-lobed; capsule subcylindric to ovoid; seeds densely packed in 2 rows in each cell.

About 80 species that are widely distributed over the North Temperate Zone.

* See Appendix.

1. Flowers erect, their segments narrowed below into claws; bulbs not rhizomatous; in mountains of Trans-Pecos Texas 1. *L. philadelphicum*.
1. Flowers nodding, their segments sessile; buds erect, their peduncles arching before anthesis, then becoming erect in fruit; bulbs rhizomatous; in forests of east Texas 2. *L. Michauxii*.

1. *Lilium philadelphicum* L. WILD ORANGE-RED LILY, WOOD LILY. Stem to 1 m. high, usually much shorter, glabrous; leaves in 2 to 6 whorls or sometimes scattered, linear or lanceolate to linear-lanceolate or rarely elliptic-oblong; flowers 1 to 5, erect, open-campanulate, from faded orange to scarlet or deep orange-red, with oblong to roundish purple spots within; segments oblong-lanceolate to lanceolate or broadly elliptic, glabrous, blunt or merely short-acuminate at apex, rather abruptly tapering below into claws, 5-8 cm. long, about 2.5 cm. wide; capsule to 55 mm. long, broadly rounded-subtruncate at summit, slightly tapered at base. In canyons of Guadalupe Mts. in the Trans-Pecos, May-Aug.; from Que. to B.C., s. to Ark., Tex., N.M. and Ariz.

Our plant is referred to var. *andinum* (Nutt.) Ker (*L. umbellatum* Pursh), characterized by having its linear to lanceolate leaves mostly scattered or in whorls only at the upper nodes, and flowers intensely red to scarlet.

2. *Lilium Michauxii* Poir. CAROLINA-LILY. Stem to 12 dm. high, usually much smaller; leaves mostly in whorls of 3 to 7, with some scattered or opposite, coriaceous or fleshy, glaucous when fresh, obovate or oblanceolate, blunt to abruptly short-tipped, their lateral veins obscure beneath, the larger blades to 12 cm. long and 25 mm. wide; flowers 1 to 3, nodding; perianth segments orange-red, purple-spotted within and becoming yellow in the throat, recurved from about the middle, narrowly lanceolate, acuminate, to 1 dm. long and 1 cm. wide; stigma with low broad lobes. *L. carolinianum* Michx. Pine- and oak-woods in s.e. Tex., July-Aug.; from n. Fla. to e. Tex., n. to Va.

12. ERYTHRONIUM L.²⁷

DOG'S-TOOTH-VIOLET. FAWN-LILY

Nearly stemless herbs with two or one smooth and shining flat leaves tapering into petioles and sheathing the base of the commonly one-flowered scape, rising from a deep solid scaly bulb; flowers perfect, rather large, nodding, lilylike; floral segments 6, lanceolate, recurved or spreading, mostly 2-4 cm. long, deciduous, the 3 inner segments sometimes with a callous tooth on each side of the base and a groove in the middle; filaments 6, subulate; anthers oblong-linear, often dimorphic; style elongated; capsule obovoid, contracted at base, 3-valved, loculicidal; seeds rather numerous.

About 25 species, almost entirely North American with several in Eurasia.

1. Perianth segments yellow, auricles present; lower surface of leaves not glaucous ... 1. *E. rostratum*.
1. Perianth segments white, auricles absent; lower surface of leaves glaucous (2)
- 2(1). Perianth segments reflexed in full bloom; leaves mottled; mature fruits held above ground; in moist woods 2. *E. albidum*.
2. Perianth segments spreading to at most half-reflexed in full bloom; leaves not mottled; mature fruits resting on ground; in prairies, pastures and dry woods 3. *E. mesochoreum*.

1. *Erythronium rostratum* Wolf. Leaves 2 in flowering forms, 1 in immature forms, strongly mottled on adaxial side at anthesis with purplish-brown pigment, not glaucous; flowers with yellow segments, the outer 3 segments with intense purplish-brown specks on abaxial side, the inner 3 segments with well-developed auricles at base which clasp the opposite filaments; stamens 6; filaments opposite inner floral segments slightly longer than those opposite the outer segments; anthers yellow, those opposite the inner floral segments maturing before those opposite the outer segments; stigma lobes swollen, short, erect; style persistent, forming a prominent beak on the capsule; fruit ellipsoidal, beaked,

²⁷ Ref.: Kenneth R. Robertson in Ann. Missouri Bot. Gard. 53: 197-204. 1966.

held erect at maturity. *E. americanum* of auth. In rich moist woods, especially along creek or river banks in e. Tex., Feb.-Apr.; from Ala., Tenn., Kan., Mo., Okla. and Ark. to Tex.

2. *Erythronium albidum* Nutt. **WHITE DOG'S-TOOTH-VIOLET.** Plant vegetatively propagating by long offsets from the bulbs; leaves 2 in flowering forms, 1 in immature forms, elliptical-lanceolate to ovate-lanceolate, flat to half-folded, mottled on both sides with purplish-brown or light-green, glaucous on both sides; flowers with white segments, often tinged on abaxial side with pink, blue or lavender; perianth segments usually completely reflexed in full bloom; 3 inner segments without auricles, with a yellow spot present at base; stamens 6; filaments opposite the inner segments slightly longer than those opposite the outer segments; anthers yellow, those opposite the inner segments maturing before those opposite the outer segments; stigmas trifid, the long lobes divergent, slender, the style not persistent; fruit obovate, held erect at maturity, rounded, slightly apiculate or slightly umbilicate at distal end. In moist dense woods, especially along slopes or banks overlooking creeks, lakes and rivers in n.e. Tex., Mar.-May; from Ont. and Minn., s. to Ga., Ky., Mo. and Tex.

3. *Erythronium mesochoreum* Knerr. Leaves 2 in flowering forms, 1 in immature forms, lanceolate to linear-lanceolate, conduplicate or occasionally half-folded, usually not mottled, glaucous on both sides; flowers with white segments, often tinged on abaxial side with blue or lavender; perianth segments spreading or at most half-reflexed in full bloom; the 3 inner segments without auricles, with a yellow spot present at the base; stamens 6; filaments opposite the inner segments slightly longer than those opposite the outer segments; anthers yellow, those opposite the inner segments maturing before those opposite the outer segments; stigmas trifid, the long lobes divergent and slender; style not persistent on fruit; fruit obovate, resting on ground at maturity, umbilicate at distal end. *E. albidum* var. *mesochoreum* (Knerr) Rickett. In prairies, pastures and dry open woods, mostly in n.-cen. Tex., Mar.-Apr.; from Ia., Mo., Neb., Kan., Okla. and Tex.

13. IPHEION RAF. SPRING STAR-FLOWER

About 25 species that are natives of Latin America, especially Argentina.

1. *Ipheion uniflorum* (Lindl.) Raf. Scapose glabrous bulbous perennial with the odor of onion; bulbs with membranous tunic; leaves basal, linear, nearly flat, obtuse, to 3 dm. long and 7 mm. wide, slightly glaucous, with a long closed tubular scarious sheath; scapes to 2 dm. tall, bearing a 2-valved bractlike dry spathe above the middle and 1 or 2 flowers at the summit; flowers erect, salvershaped, 2-3 cm. broad; floral segments pointed, 1-1.3 cm. wide, more or less equal and basally connate into a tube, white with pale-blue tinge, with a darker central line and dorsally brownish-tinged; stamens 6, inserted on perianth tube. *Triteleia uniflora* Lindl., *Milla uniflora* (Lindl.) Grah., *Brodiaea uniflora* (Lindl.) Engl., *Beauverdia uniflora* (Lindl.) Herter. A nat. of Arg. that occurs as an escape from cult., increasing rapidly in sandy clay soils in lawns and yards, Feb.-Mar.

14. ANDROSTEPHIUM TORR.

Three species that are native of southwestern United States and Mexico.

1. *Androstephium coeruleum* (Scheele) Torr. Scapose herbs with a fibrous-coated corm, glabrous, gray-green; scape erect, to 25 cm. high, usually less than 15 cm.; leaves several, basal, arising from a broad loose scarious sheathing bract, slender-linear, to 3 dm. long; flowers 1 to 6 in umbels, 16-24 mm. long, fragrant, violet-purple, funnelliform, usually exceeding the stout pedicels; corolla tube nearly as long as the limb, the crown scarcely shorter than the limb, the 6 oblong lobes exceeding the 6 anthers, 1-nerved; capsule subglobose, 3-angled, about 15 mm. long, beaked; seeds large, black. *A. violaceum* Torr., *Milla coerulea* Scheele, *Brodiaea coerulea* (Scheele) Macbr. On grassy slopes, sandy hills, gypsum soils and similar areas, mostly in n.-cen. Tex., Feb.-May; from w. Kan. to Tex.

15. MILLA CAV. MEXICAN STAR

About 6 species from southern United States to Central America.

1. *Milla biflora* Cav. Low bulbous plant; leaves several, slender, terete, tubular, glaucous; scape slender, erect, with numerous small linear scarious bracts at the base of a terminal umbel, to about 5 dm. high; umbels 1- to 6-flowered; pedicels suberect, 5-15 cm. long; flowers white, fragrant, funnellform, the perianth tube about 13 mm. long; perianth segments oblong-lanceolate, fleshy, over 25 mm. long, with an external green keel; stamens 6, inserted at mouth of perianth tube; anthers lemon-yellow, about 7 mm. long; capsule elongate, 3-celled, with numerous seeds. In mts. of the Trans-Pecos, spring-summer; also Mex.

16. CAMASSIA LINDL. WILD HYACINTH

About 6 species in North America.

1. *Camassia scilloides* (Raf.) Cory. Perennial from a tunicated bulb; leaves crowded at base of scape, their bases clasping and surrounded by a sheathing scarious bract, keeled, elongate, grasslike, to about 15 mm. wide; scape to 8 dm. high, exceeding the leaves; raceme elongated and cylindrical; bracts setaceous, usually longer than the pedicels; flowers sweet-scented, lavender to pale-blue; floral segments distinct, 1-1.4 cm. long, 3-nerved, spreading or erect; capsule acutely triangular-globose, 3-valved, about 1 cm. long; seeds roundish, angled, black and shining. *Quamasia hyacinthina* (Raf.) Britt. In sandy or rocky soils in fields, meadows, prairies and open woodlands from cen. Tex. northw., Mar.-May; from Ala. to Tex., n.e. and n. to Pa., s. Ont., Mich., Wisc., Ia. and Kan.

A phase that blooms later and has small flowers with erect segments is sometimes referred to as *C. angustata* (Engelm. & Gray) Blank.

17. MUSCARI MILL. GRAPE-HYACINTH

About 60 species that are native of the Old World.

1. *Muscari racemosum* (L.) Mill. STARCH GRAPE-HYACINTH. Leaves and scape (in early spring) from a membranous-coated bulb; leaves linear-subterete, furrowed or slenderly channeled, 1.5-3 mm. broad, lax; scape erect, to about 2 dm. high; raceme dense, ovoid, many-flowered, to 65 mm. long; pedicels mostly shorter than the flowers; perianth blue, ellipsoid, somewhat constricted at the throat, with 6 pale teeth, heavily musky-odored; stamens 6, included; anthers short, introrse; style short; capsule 3-sided, loculicidal, with 2 black angular seeds in each cell. A nat. of the Medit. region that escapes from cult. to fields, roadsides, lawns, fallow ground in various parts of the state, Mar.-May.

18. HESPERALOE ENGELM.

A genus of 2 species in Mexico and Texas.

1. *Hesperaloë parviflora* (Torr.) Coult. RED-FLOWERED YUCCA. Caudex very short, sending up a slender sparingly bracteate flowering stem, usually cespitosely suckering; leaves numerous, crowded at base, linear, arcuately spreading, long-attenuate, to 12 dm. long and 25 mm. wide or more, thick and striate-ridged on the back, the margins filiferous; flowering stem to about 25 dm. high, the few branches of the inflorescence divaricate, glabrous and subglaucous; bracts broad and acuminate, rather large; flowers fascicled above the bracts, with soft articulated rosy pedicels to 35 mm. long, ephemeral, rosy-red or salmon-colored, tubular to oblong-campanulate, 25-35 mm. long; stamens shorter than corolla, with smooth subulate-filiform filaments and anthers 2 mm. long; style filiform, long-exserted or scarcely exceeding the perianth; capsule ovoid, 3-celled, to 3 cm. or more long; seed black, flattened, about 8 mm. in diameter. Prairies, rocky slopes and mesquite groves, mostly in cen. Tex., Mar.-July; also Mex.

The plant with more slender and flexuous branches, smaller bracts, flowers about 25 mm. long, longer anthers, and the stouter included style scarcely longer than the ovary has been segregated as var. *Engelmannii* (Krauskopf) Trel.

19. YUCCA L.²⁸

BEARGRASS. SPANISH-BAYONET

Usually large plants with a thick branching mainly subterranean caudex or a distinct woody trunk above ground; leaves numerous, clustered at the ends of the branches or main stem, narrow, elongate, thin and flaccid or thick and rigid, commonly spine-tipped, with corneous or filiferous margins; flowers rather large, usually numerous, perfect, in terminal racemes or panicles; perianth of 6 rather thick white to cream-color or greenish oval to oblong or lanceolate flattish or somewhat concave segments that are withering-persistent, the 3 inner segments (petals) broader than the 3 outer ones (sepals), longer than the 6 stamens; stigmas 3; fruit dry or fleshy, dehiscent or indehiscent; seeds numerous in each cell, flattened, commonly blackish.

An American genus of 30 or more species most frequent in arid regions. It is essentially impossible to construct a key for the identification of yucca species based solely upon limited material usually provided by most herbarium specimens. A habit photograph of the plant to accompany herbarium material would be extremely useful. Identification in the field is the only sure method.

According to Kearney and Peebles (1960), "The yuccas are an important resource of the Indians of the Southwest. The buds, flowers, and emerging flower stalks are eaten raw or boiled, or the flower stalks roasted like mescal. The large, pulpy fruits of the baccate species (*Y. baccata*, etc.) are eaten raw or roasted, dried for winter use, or ground into meal, and the seeds are also used for food. A fermented beverage was made from these fruits. Fiber from the leaves furnishes material for rope, mats, sandals, baskets, and cloth. The roots, known as amole, have saponifying properties and are used as a sort of soap and as a laxative. The seeds are the natural food of the larvae of small moths, which pollinate the flower by gathering the pollen into a mass that is pushed into the tube of the stigma."

1. Fruit indehiscent, fleshy, eventually pendent; leaf blade thickish, rigid and sword-like, 3 cm. wide or more (2)
1. Fruit dehiscent, capsular, dry or somewhat fleshy, not pendent; leaf blade mostly narrow and/or thinnish, rarely to 3 cm. wide (6)
- 2(1). Pistil 45 mm. long or more at anthesis; united portion of perianth extending perceptibly above base of ovary (3)
2. Pistil rarely as much as 40 mm. long; united portion of the perianth scarcely extending above the base of the ovary (5)
- 3(2). Perianth segments united into a short stoutish somewhat obconical or cup-shaped base 12 mm. long or less; fruit 12-17 cm. long, 4-6.5 cm. in diameter 1. *Y. baccata*.
3. Perianth segments united into a slender somewhat obconical or nearly tubular base 12-25 mm. long; fruit 7-10 cm. long, 2.5-4 cm. in diameter (4)
- 4(3). Peduncle exceeding the foliage; panicle ellipsoidal; perianth segments commonly united for 25 mm. 2. *Y. carnerosana*.
4. Peduncle not exceeding the foliage; panicle broadly conoid; perianth segments rarely united for more than 15 mm. 3. *Y. Faxoniana*.
- 5(2). Leaf margins without free fibers; ovary short, slender for its length, not exceeding 7 mm. in diameter at anthesis 4. *Y. Treculeana*.
5. Leaf margins with detachable fibers; ovary short, stout for its length, 7-12 mm. in diameter at anthesis 5. *Y. Torreji*.
- 6(1). Leaf margins corneous, smooth or usually denticulate, lemon-yellow to orange-red; pistils usually 3-2-4 cm. long (7)
6. Leaf margins filiferous; pistils 2-3.2 cm. long (11)

²⁸ Adapted mainly from Susan Delano McKelvey, *Yuccas of the Southwestern United States*. Part 1 (1938), Part 2 (1947), and John Milton Webber, *Yuccas of the Southwest*. U.S. Dept. Agric., Agric. Mon. No. 17. 1953.

- 7(6). Mature plants solitary, arborescent; leaves many in one head; inflorescence many-flowered, many-branched (8)
7. Mature plants forming clumps, acaulescent; inflorescence few-flowered, few-branched (9)
- 8(7). Mature plants 1-2 m. high (not including the inflorescence); inflorescence 1-1.5 m. in length overall; mature leaf blades short, mostly 3 dm. long or less, slender, about 7 mm. wide, widest at or above the middle, more or less scabrous on both surfaces 6. *Y. Thompsoniana*.
8. Mature plants 3-3.6 m. high (not including the inflorescence); inflorescence 1.5-2 m. long or more in overall length; leaf blades long, to 6 dm. long or more, 7-13 mm. wide, widest considerably above the middle, smooth on both surfaces 7. *Y. rostrata*.
- 9(7). Plants usually with 10 to 30 heads of leaves in one clump; mature leaf blades straight, flat except near tip (where sides inroll), with flat yellow margins; inflorescence with wide-spreading branchlets 8. *Y. pallida*.
9. Plants with a single head of leaves or in small clumps with 2 to 6 heads of leaves (10)
- 10(9). Mature leaf blades twisted, very concave (the sides turned inward for most of their length), with wavy dark-orange or red-brown margins, to about 40 mm. wide at greatest width; perianth segments 3.5-4 cm. long 9. *Y. rupicola*.
10. Mature leaf blades nearly flat, straight and rigid, the minutely denticulate margins somewhat reddish-yellow, to about 15 mm. wide at greatest width; perianth segments 5-6 cm. long 10. *Y. Reverchonii*.
- 11(6). Mature plant manifestly arborescent, with a thick long stem; head of leaves commonly large 11. *Y. elata*.
11. Mature plant acaulescent or rarely with a thin short stem to 1 m. high; head of leaves commonly small (12)
- 12(11). Leaves typically broad and thin, usually soft and limp, with some becoming bent over near the middle, to 50 mm. wide (13)
12. Leaves typically narrow and stiff, mostly straight or merely recurved, 22 mm. wide or less, very rarely with some leaves wider (14)
- 13(12). Panicle branches glabrous; perianth yellowish-green or greenish-white; panicle held well above the leaves; indigenous 12. *Y. Freemanii*.
13. Panicle branches pubescent; perianth bright-white; panicle held close to the leaves; cultivated 13. *Y. flaccida*.
- 14(12). Inflorescence held well above tips of leaves (separated from leaves by its own length or more when fully expanded), broadly paniced (usually more than half as broad as long) (15)
14. Inflorescence held just below to moderately above tips of leaves (separated from leaves by less than half its own length), spikelike or rather narrowly paniced (usually less than half as broad as long) (17)
- 15(14). Distribution in east Texas (east of prairies); panicle branches pubescent; at anthesis the ovary and style subequal 14. *Y. louisianensis*.
15. Distribution west of east Texas; panicle branches not pubescent; at anthesis the ovary and style commonly unequal (16)
- 16(15). Panicle branches glabrous; style pale green; distribution mainly in west and west-central Texas 15. *Y. constricta*.
16. Panicle branches puberulent to glabrescent; style white; distribution mainly in south-central Texas 16. *Y. tenuistyla*.
- 17(14). Distribution in the Plains Country and eastern Trans-Pecos region of west Texas; bracts under lowest flowers commonly 3-7 cm. long; leaves mostly 1 cm. wide or less (18)
17. Distribution east of the Plains Country and Trans-Pecos region; bracts under lowest flowers 1-1.3 cm. long; leaves mostly more than 1 cm. wide (19)

- 18(17). Pistil 30-37 mm. long; distribution mainly in northern High Plains 17. *Y. angustifolia*.
18. Pistil 25-28 mm. long; distribution in South Plains and eastern Trans-Pecos region ..
..... 18. *Y. campestris*.
- 19(17). Ovary about twice as long as the style and stigmas together; inflorescence varying from spikelike to paniced with ascending branches; rather local in north-central Texas 19. *Y. necopina*.
19. Ovary at first slightly shorter than the style and stigma together, becoming longer with age; inflorescence spikelike or with few short spreading branches near base; rather widespread 20. *Y. arkansana*.

1. *Yucca baccata* (Engelm.) Trel. BLUE YUCCA, BANANA YUCCA, DATIL. Plant commonly simple or clumped at ground level or rarely caulescent, with very short assurgent or procumbent stems toward center of clump; clumps 1-5 m. in diameter, with as many as 70 heads of leaves; leaves broadened toward middle, commonly straight or incurved, rarely outcurved, occasionally twisted, rather deeply concavo-convex, quite rigid, 3-7 dm. long, 3-5.5 cm. wide; leaf margin usually with coarse short recurved fibers, occasionally with long curly fibers; scape absent or as much as 13 cm. long; panicle entirely within the foliage or with only a fraction above it, obovoid to ellipsoidal, oblate to acute at apex, 3.5-6 dm. long; flowers campanulate, expanding but little, pendent, white or cream-color, commonly tinged with purple; perianth segments lanceolate to oblanceolate; sepals 4-10 cm. long, 15-28 mm. wide; petals 45-95 mm. long, 2-3 cm. wide; filaments 2.5-4 cm. long; pistil 4-7.5 cm. long; ovary narrowly ovoid and tapering into style at apex, with deep carpel sutures, 7-10 mm. in diameter; style 4-10 mm. long, tapered; fruit 7-24 cm. long, 25-55 mm. in diameter, symmetrical, broadly cylindrical or somewhat tapering, frequently weighing 425 to 500 gm.; seed to 11 mm. in greatest diameter, flat, thick, rough, dull-black, wingless. On rocky hill and mt. slopes and plains of grasslands, juniper and oak woodlands in the w. Edwards Plateau and Trans-Pecos, Apr.-June; from Tex. to Calif. and adj. Mex.

Apparent hybrids occur where this species and *Y. Torreyi* are admixed.

2. *Yucca carnerosana* (Trel.) McKelvey. SPANISH DAGGER. Plant arborescent, symmetrical, simple or rarely a tall rather dense clump of stem and heads of leaves, with stems contiguous at base and spreading toward top; stems commonly 1 or 2, of equal or unequal height, rarely as many as 8 of varying height, the older trunklike and to 5 m. high and 35 cm. in diameter, rarely once- or twice-branched toward top, the short branches assurgent; leaves large, in terminal head, 5-10 dm. long, 5-7.5 cm. wide, rigid, spreading; scape rather long, stout; panicle slightly above the foliage, ellipsoidal or oblately ellipsoidal, rather densely branched, with persistent white bracts; flowers white; sepals 7-9.5 cm. long, 13-21 mm. wide; petals 6.5-9 cm. long, 2-2.8 cm. wide; perianth tube 1.7-3 cm. long; filaments 2.2-3 cm. long; pistil 5-6.3 cm. long; ovary 6-9 mm. in diameter; style 6-10 mm. long; fruit oblong, to at least 1 dm. long and 4 cm. in diameter. On rocky brushy slopes in s.-cen. Brewster Co. and an isolated small colony near mouth of McKittrick Canyon in the Guadalupe Mts. in Culberson Co., Mar.-May; also n. Mex.

3. *Yucca Faxoniana* Sarg. Plant arborescent, symmetrical, simple or rarely a tall open clump of stems and heads of leaves, with stems contiguous at base and spreading toward top; stems commonly 1, rarely as many as 6, of varying height, the older trunklike and to 65 dm. high and 4 dm. in diameter, occasionally once or twice assurgently branched; leaves 5-8.5 dm. long, 4.5-7 cm. wide, rigid, spreading; scape rather short and stout; panicle with as much as one fourth of its length within the foliage, broadly conoid, rather openly branched, with white or occasional purple-tinged persistent bracts; flowers white; sepals 55-85 mm. long, 15-17 mm. wide; petals 55-85 mm. long, 1.9-2 cm. wide; perianth tube 1-1.8 cm. long; filaments 2-3.2 cm. long; pistil 4.5-6 cm. long; ovary 6-8 mm. in diameter, narrowly ovoid; style 5-7 mm. long; fruit 3-9 cm. long, 2.5-3 cm. in diameter, slightly tapered above and below with a long curved beak about 2 cm. long; thick and flat or occasionally hemispherical, to 1 cm. wide in greatest diameter, surface rough, dull-black, wingless. On sandy plains, rocky slopes and bluffs in the Trans-Pecos, Mar.-July; also n. Mex.

Apparent hybrids occur where this species and *Y. Torreyi* are admixed.

4. *Yucca Treculeana* Carr. SPANISH DAGGER, PALMA PITA. Plant arborescent, with 1 to few stems of varying height in rather open clumps; stems commonly 1 to 4, assurgently branched, 3-3.5 m. high; leaves commonly in large symmetrical head or occasionally entire shoots bearing fresh leaves, 5-10 dm. long, 4-8 cm. wide, thick, rigid, concavo-convex but frequently flattened; leaf margin thin, entire or with few fine straight fibers; scape short, glabrous; panicle sometimes with as much as three fourths of its length above the foliage, ellipsoidal, dense; flowers small, broadly globose or hemispherical, white or lightly tinged with purple; perianth segments somewhat thickened toward base; sepals 3-4.5 cm. long, 8-15 mm. wide; petals 3-4 cm. long, 1-2 cm. wide; filaments 15-24 mm. long; pistil 2-3 cm. long; ovary 4-6 mm. in diameter, the apex abruptly terminating (shouldered) in the style; style 1-5 mm. long; fruit 6.5-10 cm. long, 17-24 mm. in diameter, cylindrical, with abruptly tapered apex, symmetrical, rarely constricted; carpel suture U-shaped, deep or frequently broad and rather flat; seed to 6 mm. in greatest diameter, flat, thick, rough, dull-black, wingless. Thinly scattered in tall chaparral or brushland in s.-cen. Tex., Feb.-Apr.; also n. Mex.

Those plants with a fleshy inflorescence, succulent throughout, narrowed above and below, and much-thickened, brittle, canaliculate perianth segments are segregated as var. *succulenta* McKelvey. Apparent hybrids occur where this species and *Y. Torreyi* are admixed.

5. *Yucca Torreyi* Shafer. Plant caulescent, rather commonly arborescent, asymmetrical or of ragged appearance, simple to a rather tall narrow fairly dense clump of stems and heads of leaves; stems commonly 1 or 2, occasionally as many as 8, of varying height, the older trunklike, rarely to 43 dm. high and 3 dm. in diameter, unbranched or rarely with 2 or 3 ascending branches; leaf heads solitary or somewhat clustered; leaves few, in a small terminal head or numerous in a large elongated head or cluster, 3-10 dm. long, 3-5 cm. wide, commonly tapered from an enlarged base to the apex, moderately concavo-convex or rarely somewhat flattened, thick, rigid, scabrous on both surfaces, yellowish-green; leaf margin thick, with at first curly (later straight) tough fibers; scape absent or as much as 1 dm. long; panicle commonly with a fraction of its length above the foliage or rarely entirely within the foliage, 3.5-7 dm. long, ellipsoidal, dense; flowers commonly subglobose or campanulate, occasionally fully expanding, cream-color to deeply tinged with dark-purple; perianth segments very variable in shape and size, concave, thickened in the center from base to apex; sepals 35-75 mm. long, 8-18 mm. wide; petals 35-78 mm. long, 1-2.2 cm. wide; filaments 15-27 mm. long; pistil 22-35 mm. long; ovary 4-8 mm. in diameter, rather stout, apex tapering into the style; style 4-8 mm. long; fruit 7-10.5 cm. long, 25-38 mm. in diameter, cylindrical or ovoid, gradually tapered from base to apex, rarely constricted; carpel suture V-shaped, deep and narrow; seed to 9 mm. in greatest diameter, flat, thick, rough, dull-black, wingless. *Y. macrocarpa* of auth., *Y. Torreyi* f. *parviflora* McKelvey. Usually thinly scattered on grassy and chaparral mesas and slopes from the upper Rio Grande Plains and Edwards Plateau to the Trans-Pecos, Mar.-May; also N.M. and n. Mex.

Some forms occur that have bluish green, glaucous leaves.

6. *Yucca Thompsoniana* Trel. Plant arborescent, frequently asymmetrical or rarely symmetrical, with 1 to 3 shoots; stems 1-2.6 m. high, 12-15 cm. in diameter, trunklike, erect with comparatively long assurgent or diffused branches; leaf heads frequently asymmetrical, rather small and composed of comparatively few leaves; leaves 2-3 dm. long, 7-12 mm. wide, linear or somewhat broader toward center, flat or concavo-convex to plano-keeled, striate, thin and flexible; leaf margins corneous, yellow or brownish, minutely denticulate; scape 4-7 dm. long, stout, glabrous or evanescently pubescent; panicle 1-2 dm. above foliage, 5-8 dm. long, narrowly ellipsoidal to somewhat ovoid, densely flowered, with 20 to 34 branchlets that are to 22 cm. long; flowers white, globose to campanulate, spreading flat at anthesis, with an umbonate base; perianth segments narrowly oblong, sharply acuminate, conspicuously veined; sepals 35-67 mm. long, 12-26 mm. wide; petals 4-6.5 cm. long, 11-35 mm. wide; filaments 17-33 mm. long, with a somewhat erect clavate tip; pistil 25-38 mm. long; ovary 4-6 mm. in diameter, slender, usually tapering into style or rarely somewhat abruptly terminating in the style; style 6-18 mm. long, attenuate, white; capsule 3.5-7 cm. long, 2-2.5 cm. in diameter, ellipsoidal or somewhat ovoid, with a long-attenuate or rarely short-attenuate beak and obconical

pedicel, rarely constricted; beak of dry capsule flaring, with long reflexed often twisted valve points; seed to 7 mm. in greatest diameter, flat, thin, dull black, without a marginal wing. Thinly scattered on exposed rocky slopes and knolls in the Trans-Pecos, Apr.-May; also n. Mex.

According to Webber, hybrids between this species and *Y. Reverchonii* occur when they are admixed.

7. *Yucca rostrata* Engelm. Plant arborescent, rather symmetrical, with 1 to 5 shoots; stem 1-4.5 m. high, 18-32 cm. in diameter, trunklike, erect, with none to 3 short assurgent branches toward the top, both stem and branches covered with reflexed dead leaves; leaf head symmetrical, large and elongated; leaves numerous, 4.2-6 dm. long, 12-17 mm. wide, linear or somewhat broader toward center, flat, concavo-convex or keeled on both surfaces, striate, thin, flexible, glaucous, pungent; leaf margin corneous, yellow, hyaline, minutely denticulate; scape 3-7 dm. long, stout, glabrous or evanescently pubescent; panicle not or up to 2 dm. above foliage, 3.5-7 dm. long, narrowly ellipsoidal to somewhat ovoid, densely flowered, with 28 to 40 branchlets that are to 35 cm. long; flowers white, globose to campanulate, fully expanding at anthesis, with an umbonate base; perianth segments narrowly oblong, sharply acuminate, conspicuously veined; sepals 42-47 mm. long, 12-15 mm. wide; petals 4.2-5 cm. long, 1.1-2 cm. wide; filaments 1.7-2 cm. long, with a somewhat erect clavate tip; pistil 25-35 mm. long; ovary 4-6 mm. in diameter, usually tapering into style or rarely somewhat abruptly terminating in style; style 6-14 mm. long, attenuate, white; capsule 3.5-7 cm. long, 18-25 mm. in diameter, ellipsoidal to somewhat ovoid, with a long-attenuate or rarely short-attenuate beak and obconical pedicel, rarely constricted; beak of dry capsule flaring, with long valve points outcurved and twisted; seed to 7 mm. in greatest diameter, flat, thin, dull-black, without a marginal wing. On mt. slopes and in canyons in Brewster Co., Mar.-Apr.; also n. Mex.

8. *Yucca pallida* McKelvey. Plants acaulescent, forming small or moderately large open clumps with rather widely separated heads of few leaves; heads of leaves as many as 30 in one clump; leaves 18-35 cm. long, 1-3.2 cm. wide, usually flexible where not thickened, glaucous, finely striate, pale blue- to sage-green; leaf margins corneous, yellowish, about 1 mm. thick, usually very finely denticulate; flowering stem long-exserted, 13-25 dm. long; scape 6-13 dm. long; panicle 7-12 dm. long, branched from base to the racemose tip, the 10 to 20 branchlets 5-20 cm. long; flowers numerous, 5-6.5 cm. long; perianth segments pale-green with whiter margins, 2-3.2 cm. wide, ovate to elliptic or obovate; filaments 23-32 mm. long, long-pubescent; pistil 3.2-4 cm. long; ovary stout or slender, pale-blue-green to yellowish-green, the neck whitish; style oblong-cylindric to slightly ovoid, 1.3-2 cm. long, white; capsule 4.5-5 cm. long, 1.3-2 cm. in diameter, oblong-cylindric, usually symmetrical, at first tan, later black, the beak about 1 cm. long, the wall thickish; seeds small. Incl. var. *edentula* (Trel.) Cory. Mainly on the Blackland Prairies in n.-cen. Tex., Apr.-May; endemic.

9. *Yucca rupicola* Scheele. TWISTED-LEAF YUCCA. Plant acaulescent, solitary but soon becoming an open clump of as many as 15 scattered leaf heads; leaf heads large, spreading, with few leaves; leaves 3-6 dm. long, 2-4 cm. wide, very broad toward middle, concave or flat but oblique and undulate or twisted, slightly striate, flaccid, dark-green, pungent; leaf margin hyaline, reddish-brown or occasionally yellow, minutely denticulate; scape 3.5-15 dm. long, slender, 1.5-2 cm. in diameter, glabrous to lightly floccose; panicle 2.5-5 dm. above foliage, 3-10 dm. long, narrowly ovoid to narrowly pyramidal, few-flowered, with 8 to 16 branchlets; branchlets up to 1.3 dm. long; flowers mainly campanulate, pendent and expanding but little, rarely somewhat globose and open, white or greenish-white; perianth segments ovate, sharply acuminate; sepals 4-6.8 cm. long; 15-24 mm. wide; petals 4-7 cm. long, 2-3 cm. wide; filaments 18-32 mm. long; pistil 3-4.5 cm. long; ovary 4-6 mm. in diameter, tapering into or somewhat abruptly terminating in style; style 1.2-2 cm. long, attenuate, white or greenish; capsule 4-5.5 cm. long, 2-3 cm. in diameter, ellipsoidal or somewhat cylindrical with a long-attenuate or short-attenuate beak and obconical pedicel, rarely constricted; beak of dry capsule flaring with valve points generally outcurved and twisted; seed to 8 mm. in greatest diameter, flat, thin, dull-black, without or with a very narrow marginal wing. On limestone ledges and on grass-covered plains of dense brush and open woodlands centered on the Edwards Plateau, Apr.-June; endemic.

According to Webber, hybrids between this species and *Y. Reverchonii* occur when they are admixed.

10. *Yucca Reverchonii* Trel. SAN ANGELO YUCCA. Plant acaulescent, solitary but ultimately a dense small clump with as many as 25 heads of leaves; leaf head small, with few leaves; leaves 25-55 cm. long, 1-2 cm. wide, linear to somewhat broader toward the center, concavo-convex, quite rigid, straight, light glaucous green; leaf margin hyaline, yellow or occasionally red or brown, minutely denticulate; scape 4.5-11 dm. long, slender, glabrous to heavily floccose; panicle 25-42 cm. above the foliage, 3.5-10 dm. long, narrowly ovoid to narrowly pyramidal, with few branchlets and flowers; flowers pendent, campanulate to somewhat globose, expanding but little at anthesis, white or greenish-white; perianth segments ovate, sharply acuminate; sepals 4-6 cm. long, 1.5-2 cm. wide; petals 4-6 cm. long, 2-3 cm. wide; filaments 2-3.2 cm. long; pistil 3-4.5 cm. long; ovary 4-6 mm. in diameter, tapering into or rarely abruptly terminating in style; style 1-2 cm. long, attenuate, white or greenish; capsule 4-6 cm. long, 2-3 cm. in diameter, rarely constricted, ellipsoidal with a long-attenuate or short-attenuate beak and obconical pedicel; beak of dry capsule flaring, with long reflexed valve points; seed to 7 mm. in greatest diameter, flat, thin, dull-black, without a marginal wing. Thinly scattered on limestone ledges and gravelly brushy plains on the Edwards Plateau, Apr.-June; endemic.

Some authors consider this plant to be a hybrid of *Y. Thompsoniana* and *Y. rupicola*.

11. *Yucca elata* Engelm. PALMELLA, SOAP-TREE, SOAP-WEED. Plant caulescent or arborescent, solitary but soon clumped; stems mainly 1-4.5 m. high, trunklike, erect, with 1 to 5 short assurgent branches toward the top or rarely unbranched and to 78 dm. high; head of leaves large, symmetrical; leaves 3-9.5 dm. long, 4-25 mm. wide, linear, plano-convex or plano-keeled, striate, rigidly divergent, flexible, pale-green; leaf margin white or greenish-white, soon finely filiferous; flowering stalk 1-5.4 m. tall; scape 1-3 m. long, stout, mainly 25-65 mm. in diameter, rarely to 12 cm. in diameter, greatly exceeding the foliage; panicle 5-35 dm. long, 3-6 dm. in diameter, with 20 to 45 branchlets, ellipsoidal or broadest toward center; flowers many, campanulate or somewhat globose, white or cream-color, rarely greenish or tinged with pink; perianth segments narrow-elliptical to broad-elliptical or even ovate, acute; sepals 32-57 mm. long, 15-27 mm. wide; petals 35-57 mm. long, 2-3.5 cm. wide; filaments 1.6-3 cm. long, slender; pistil 22-32 mm. long; ovary 6-10 mm. in diameter, slender, white or pale-green, oblong-cylindrical, abruptly terminating in style, with deep carpel sutures and anther depressions prominent or wanting; style 6-11 mm. long, the shape variable, slender and oblong-cylindric or stoutish, white or pale-green; capsule 4-7 cm. long, 35-58 mm. in diameter, oblong-cylindric, mucronate, commonly symmetrical, rarely constricted; seed to 14 mm. in greatest diameter, thin, dull-black, with a broad marginal wing. On gently sloping desert hills, grasslands and in dry washes in the Trans-Pecos, May-July; from Tex. to Ariz. and n. Mex.

12. *Yucca Freemanii* Shinn. Acaulescent, with one or few heads of leaves; leaves narrowly to broadly lanceolate, 1.5-6 dm. long, 1-4 cm. wide, with narrow petiolelike section of 3-7 cm. above the short widely clasping base (base 1-2 cm. long, wider than long), soft and rather limp, the apex broadly acute to subacuminate (inrolled in drying and appearing narrowly acuminate), the margins with few and mostly long white threads; scape slender (4-5 mm. thick at base of inflorescence), 1-1.8 m. high, flower-bearing in terminal one fourth to one third; panicle 4-6 dm. long, rather narrowly ovoid, the branches spreading-ascending, 4-20 cm. long, glabrous; bracts of axis ovate-oblong, 9-15 mm. long; perianth apparently funnelform-globose, pendulous, on glabrous pedicels 5-12 mm. long; perianth segments rather thin, yellowish-green, about equal in length, 3-3.8 cm. long; outer segments elliptic-oblong, with medial vein dorsally thickened toward apex, mucronate, 11-13 mm. wide; inner segments broadly elliptic, obtuse or barely mucronate, 17-22 mm. wide; filaments thick, densely papillose-pubescent, 12-18 mm. long; anthers 2.5-3 mm. long; pistil about 25 mm. long; ovary narrowly ovoid to ovoid-cylindric, 11-18 mm. long, about 6 mm. thick; style 6-7 mm. long; capsule oblong-obpyriform (sometimes obpyramidal), rounded-trigonous, slightly constricted just below the middle, glabrous, about 35 mm. long, 15 mm. thick, tipped by the persistent style and with withered persistent reflexed segments at base; seeds flat, approximately deltoid, 8 mm. long, 5 mm. wide, black. In old fields, along railroad right-of-ways and roadsides in n.e. Tex., Apr.-May; also adj. La.

13. *Yucca flaccida* Haw. Acaulescent, cespitose; leaves thin, flexible, the outer ones almost always recurved, 1-4 cm. wide, lanceolate, elongated, very gradually long-attenuate, mostly plicate, with fine long and rather straight thin marginal fibers; panicle mostly pubescent; maturing capsule dull-grayish-green, the carpels variously and irregularly flattened in places as if shaved off with a knife, when ripe broad, usually constricted and mostly flaring above; seeds rather dull, about 1 cm. wide.

This species, which occurs naturally east of Texas, is sometimes cultivated. It has a tendency to persist when abandoned.

14. *Yucca louisianensis* Trel. Similar in aspect to *Y. arkansana*; leaves green, flaccid, 1-4 cm. wide, usually less than 3 cm. wide, white-bordered and sparingly filiferous; inflorescence an exerted glabrous or mostly pubescent panicle; inner perianth segments broad to attenuate; style variously tumid and deep-green to pale and oblong; capsule stout and short, angular in developing as in *Y. flaccida*; seeds about 1 cm. wide. *Y. arkansana* var. *paniculata* McKelvey.

According to some authors this is the common species of sandy areas in northeast Texas, east of the Blackland Prairies.

15. *Yucca constricta* Buckl. Plant acaulescent or with short procumbent stems to 4 dm. high; clump small to large, open, with up to 20 heads of leaves 2-9 dm. apart; head of leaves large, asymmetrical or rarely small and symmetrical; leaves 3-6.5 dm. long, 8-15 mm. wide, linear or somewhat broader toward center, nearly flat or plano-convex to occasionally triquetrous, striate, rigidly divergent, flexible, pale- to dark-green; leaf margin white or green, eventually filiferous, the fine fiber straight or curled and soon eroding away; flowering stalk 15-32 dm. long, slender and weak; scape 1-2 m. long; panicle 2-4.6 dm. above foliage, 4.5-12 dm. long, occasionally 7 dm. in diameter at base, ovoid to broadly conoid, open-flowered, with 8 to 15 branchlets; flowers small, hemispherical or cup-shaped, pale-greenish-white; perianth segments thin, acute, ellipsoidal; sepals 35-45 mm. long, 11-21 mm. wide; petals 37-48 mm. long, 17-26 mm. wide; filaments 17-22 mm. long; pistil 25-38 mm. long; ovary 5-6 mm. in diameter, slender, cylindrical with oblate apices, pale-green, the carpel sutures prominent, the anther depressions faint or wanting, abruptly terminating (shouldered) in style; style 8-11 mm. long, cylindrical with basal lobes extending slightly over ovary, whitish-green or pale-green (darker than ovary); capsule 46-63 mm. long, 36-43 mm. in diameter, oblong-cylindrical, mucronate, deeply constricted; seed to 15 mm. in greatest diameter, thin, glossy-black, with a broad marginal wing. Thinly scattered in brushwood and grasslands from s.-cen. Tex. to the Trans-Pecos, Apr.-June; also adj. Mex.

16. *Yucca tenuistyla* Trel. Acaulescent; leaves rather soft and mostly recurving, often a little scabrid on the back, about 5 dm. long and 1-1.5 cm. wide, dark-green, lanceolate, long-attenuate, scarcely pungent, white-margined, finely filiferous; inflorescence about 1 m. high, paniced at some distance above the leaves, glabrous or slightly puberulent; flowers with narrow pointed segments; style oblong, white, often deeply parted; capsule stout, even; seeds glossy, about 1 cm. wide. Brushlands from the s. Edwards Plateau to the coast of s.-cen. Tex., Feb.-May; endemic.

17. *Yucca angustifolia* Pursh. Plant acaulescent or with short stems to 3 dm. high, solitary but soon clumped; heads of leaves rather small; leaves 5-7 dm. long, 5-11 mm. wide, linear, plano-convex, occasionally triquetrous or nearly flat, striate, divergently spreading, flexible, pale-green or pallid; leaf margin white or greenish-white, soon finely filiferous; flowering stalk 9-12.5 dm. long; scape 25-53 cm. long; inflorescence extending 5-21 cm. into the foliage, usually simple or rarely with few abortive branchlets at base; flowers globose or campanulate, greenish-white, commonly tinged with purple and shiny; perianth segments thick, brittle, broad and acute; sepals 45-56 mm. long, 26-33 mm. wide; petals 5-6 cm. long, 31-42 mm. wide; filaments 2-3 cm. long; pistil 3-3.7 cm. long; ovary 9-13 mm. in diameter, obovoid, white or rarely greenish-white, the carpel sutures faint, the anther depressions prominent, abruptly terminating in the style; style 8-13 mm. long, very tumid or swollen, 6-10 mm. in diameter toward center, dark-green or rarely medium-green; capsule about 6 cm. long, 45-53 mm. in diameter, oblong-cylindrical, mucronate, with occasionally 1 or 2 valves slightly constricted; seed to 1 cm. in greatest diameter, thin, smooth, dull-black, with a broad marginal wing. *Y. glauca* of auth. Rather thinly scattered on rolling well-drained grassland plains in the Tex. Panhandle, May-June; from Tex., n. to Mo., Neb., S.D. and Wyo.

18. *Yucca campestris* McKelvey. Plants acaulescent or with stems to 1 m. high, forming small or large thicketlike clumps with many rather open heads of leaves; leaves slender, wiry, to 65 cm. long and 7 mm. wide, plano-convex or plano-keeled for half or more its length, blue-green, the acicular spine about 7 mm. long and easily broken; leaf margins at first white and finely filiferous, rather soon smooth; flowering stalk 1-2 m. long, slender; scape to 1 m. long; panicle ellipsoidal, 6-10 dm. long, starting among the leaves or less often above them, with numerous slender fragile erect-ascending branchlets to 13 cm. long; flowers dull-greenish, sometimes with a pinkish-tinge, often globose; perianth segments 10-11.5 cm. long; sepals 1.5-2 cm. wide; petals about 25 mm. wide; filaments flaccid, rather slender, reaching the base of style at maturity; pistil 25-28 mm. long; ovary 1.3-2 cm. long, ovoid to obovoid, often deeply marked by impress of anthers, rough-surfaced; style bright-green, unevenly papillose; capsule 45-53 mm. long, 3-5 cm. wide, sometimes subglobose, symmetrical or constricted, soon reddish-brown, eventually gray; seed to 13 mm. in greatest diameter, glossy. In deep sands and on dunes centered in the region of Ward, Midland, Howard and Ector cos. Apr.-June; endemic.

Webber considered this plant to be a hybrid of *Y. elata* and *Y. constricta*.

19. *Yucca necopina* Shinners. Similar to *Y. arkansana* but higher; plant 1-3 m. high; inflorescence an unbranched spike or a panicle; perianth greenish-white; inner band of leaves 18 to 30, the exterior leaves 45 to 70 and narrower; ovary twice as long as the style and stigma combined. In sandy soil along fencerow on Brazos River terrace near Glen Rose; endemic.

Shinners suggests that this plant may be a hybrid between *Y. pallida* and *Y. arkansana*.

20. *Yucca arkansana* Trel. Plant acaulescent or (at most) with a short nearly prostrate stem about 15 cm. long, with one or several somewhat asymmetrical heads of leaves in small open clumps; leaves 2-6 dm. long, 1-2.5 cm. wide, long-tapered above; leaf margins at first white, papery, with curly fibers; scape to about 1 m. long; inflorescence a raceme about 1 m. long, very rarely with a few branches, glabrous; flowers relatively few, globose, 32-65 mm. long, mostly greenish-white, with broad obtuse segments; style greener than the ovary at anthesis, very tumid below, 7-13 mm. long, coarsely and unevenly papillose; capsule 4-7 cm. long, stoutish, about twice as long as broad, oblong-cylindric to obovoid; seeds dull, about 1 cm. wide. *Y. glauca* Nutt. var. *mollis* Engelm. In prairies, on limestone outcrops and rocky soils from s.-cen. to n.-cen. Tex., Apr.-June; from Tex., n. to Okla. and Ark.

20. NOLINA MICHX.²⁹

Plants perennial, polygamo-dioecious, with a large woody caudex that is subterranean or forming a distinct trunk above ground; leaves numerous, clustered, narrowly linear, thin or rigid, the margins smooth or finely serrate; flowers numerous, borne on a short nearly naked flowering stem in a compound racemose panicle, the main branches subtended by foliaceous or scarious long-pointed or much-attenuated bracts; pedicels jointed about the middle or near base subtended by minute scarious bracts; perianth small, persistent; perianth segments 6, 1-nerved; stamens 6, usually abortive in the fertile flowers; filaments slender or stoutish, usually very short; ovary sessile, deeply 3-lobed; style very short, recurved; ovules 2 in each cell; fruit a capsule, with a thin often more or less inflated wall, usually bursting irregularly to expose the globose brown to blackish turgid seed.

About 30 species that are natives of southern United States and Mexico. It is reported that sheep and goats are sometimes poisoned by these plants. These animals are especially fond of the young inflorescences which may account for the scarcity of plants in some localities where they should be abundant.

1. Leaf margins serrulate with close-set cartilaginous teeth (2)
1. Leaf margins smooth or only slightly roughened with few distant or remote teeth (4)

²⁹ Ref.: William Trelease in Proc. Am. Philos. Soc. 50: 404-426. 1911.

- 2(1). Leaves thin, flat, usually 6 mm. wide or less, entire at apex; fruits about 10 mm. wide, with pedicels usually more than 4 mm. long; endemic to eastern half of Edwards Plateau1. *N. Lindheimeriana*.
2. Leaves thick, concavo-convex, usually more than 8 mm. wide, typically fibrous-lacerate at apex; fruits about 6 mm. wide; in Trans-Pecos Texas (3)
- 3(2). Fruiting pedicels 4 mm. or less long; seeds 3-4 mm. in diameter, bursting the cell of fruit before maturity to remain exposed2. *N. erumpens*.
3. Fruiting pedicels 4-6 mm. long; seeds 2-2.5 mm. in diameter, not bursting the fruit .
.....3. *N. microcarpa*.
- 4(1). Inflorescence usually conspicuously purple-tinged, its main rachis and divisions slender and flexible; perianth 2-2.5 mm. long; fruiting pedicels slender, typically 2-4 mm. long, articulate usually near the middle ...4. *N. micrantha*.
4. Inflorescence not pigmented as above or rarely so, its main rachis and divisions thick and rigid; perianth 2.5-3.5 mm. long; fruiting pedicels 4-7 mm. long, articulated near base, noticeably dilated into the fruit (5)
- 5(4). Leaves 2-4 mm. wide, concavo-convex below, triangular toward the apex; inflorescence rather compact with ascending lateral branches; seeds 3-4 mm. in diameter; plant usually in rocky habitats of limestone
.....5. *N. texana*.
5. Leaves about 5 mm. wide, flat or concavo-convex; inflorescence rather open with coarse spreading branches; seeds 4-6 mm. in diameter; plant in sandy soils or dunes6. *N. arenicola*.

1. *Nolina Lindheimeriana* (Scheele) Wats. **DEVIL'S-SHOESTRING**. Flowering stem stout, 6-18 dm. high (including the inflorescence), from a very short caudex; roots fleshy-thickened; leaves numerous, flat and thinnish, 3-9 dm. long, rarely longer, 4-8 mm. wide, the margins strongly serrulate with the teeth directed forward; panicle open, simple or sometimes compound; primary branches of inflorescence spreading-ascending, to about 13 cm. long, slender, somewhat flexible, simple or the lowermost with slender branchlets; bracts inconspicuous, usually much shorter than the floral branches; perianth 2-2.5 mm. long, the segments oblong-elliptic; fruit very thin, somewhat inflated, notched at both ends, usually purplish tinged, about 1 cm. wide, wider than long; fruiting pedicels slender, 3-8 mm. long, articulate well below the middle or near base, slightly dilated above the articulation; seeds not bursting the fruit, about 3 mm. in diameter. On limestone slopes and in ravines either in the open or in open-wooded areas on the e. half of Edwards Plateau, May-July; endemic.

2. *Nolina erumpens* (Torr.) Wats. **BEAR-GRASS**. Plant sometimes attaining a size of 25 dm. high and wide; flowering stem 6-25 dm. long (including the inflorescence), somewhat rough-scabrous; leaves as many as several hundred, thick, concavo-convex and somewhat carinate, 6-20 dm. long, 6-20 mm. wide near base, very strongly serrulate, commonly fibrous-lacerate at apex; panicle compound, to 12 dm. long and 4 dm. thick, rigid throughout, with pyramidal primary branches 1-2.5 dm. long, some of the lowermost branches with subdivaricate secondary branchlets 5-12 cm. long; bracts of lowermost primary floral branches about equal to or as much as 5 times as long as the branches; perianth white, about 4 mm. long; fruits rather depressed, 5-7 mm. wide; fruiting pedicels about 4 mm. long or less, articulated about the middle or near the base, somewhat dilated above the articulation and ribbed just below the fruit; mature seeds 3-4 mm. in diameter, bursting the cell of fruit before maturity to remain exposed. On limestone slopes, in clayey-rocky soils, along arroyos in brushlands and in igneous soils in the Trans-Pecos, May-July; also n. Mex.

3. *Nolina microcarpa* Wats. **SACAUISTA**. Flowering stem stout, about 18 dm. long, from a short caudex; leaves concavo-convex, rather thick and somewhat carinate, to about 1 m. long, 6-12 mm. wide, raggedly denticulate-scabrous to very strongly serrulate, fibrous-lacerate at the apex; panicle narrow, branched at base; primary floral branches slender, about 3 dm. long, with ascending branchlets 5-7.5 cm. long; bracts small; fruit very thin, inflated, notched at both ends, about 6 mm. wide; fruiting pedicels 4-6 mm.

long; seeds 2-2.5 mm. in diameter, not bursting the fruit. On rocky hills in the Trans-Pecos, spring-summer; from w. Tex. to Ariz. and n. Mex.

This species is included here solely on a report of its occurrence in the state. We have seen no specimen.

4. *Nolina micrantha* I. M. Johnst. Flowering stem 7-10 dm. high (including the inflorescence); leaves numerous, almost semiterete, channeled, to about 13 dm. long, 3-5 mm. wide, the margins smooth to slightly scabrous, typically fibrous-lacerate at apex; panicle about as long as or shorter than the leaves, compound, its various parts usually somewhat purplish-tinged, the central rachis and divisions slender and flexible; bracts of the primary floral branches inconspicuous, shorter than the branches; floral bracts (especially of staminate flowers) erose-laciniate; perianth 2-2.5 mm. long, the segments elliptic; fruits 4-6 mm. wide, 3-4 mm. long, deeply notched at apex, the style almost sessile; fruiting pedicels slender, 2-4 mm. long, very rarely longer, articulated usually near middle; seeds globose, 3-4 mm. in diameter. On rocky slopes and in open sandy soils and grasslands in the Trans-Pecos, June-Aug.; also in n. Mex.

The slenderly dissected and somewhat twiggy inflorescence, slender short pedicels, and the typically purplish or reddish-purple tinged main rachis, branches and branchlets, and bracts are distinguishing characteristics of this species.

5. *Nolina texana* Wats. SACAUISTA, BUNCH-GRASS. Flowering stem very short, 3-6 dm. long (including the inflorescence), often several from a very short caudex; leaves numerous, covering the ground, 6-12 dm. long, 2-4 mm. wide, concavo-convex below, triangular toward the apex, smooth or sparingly roughish with distant teeth on the margins; panicle congested, compound, with oblong primary branches often 15 cm. long; bracts of primary floral branches large and foliaceous, with dilated bases, usually much-exceeding the branches; perianth about 3.5 mm. long, the segments broadly elliptic; fruits somewhat inflated and depressed, 4-6 mm. broad before rupture, about 3 mm. long; fruiting pedicels 4-7 mm. long, articulate near base, noticeably dilated above the articulation and usually ridged just below the fruit; seeds globose, nearly smooth, 3-4 mm. in diameter. In rocky soils from cen. Tex. to the upper Rio Grande Plains and Trans-Pecos, recently reported from Garza Co. in the South Plains, Mar.-July; also n. Mex.

Those plants found in the Trans-Pecos whose inflorescences have very compact, ovoid divisions scarcely 6 cm. long and branchlets about 1 cm. long are segregated as var. *compacta* (Trel.) I. M. Johnst. (*N. erumpens* var. *compacta* Trel., *N. affinis* Trel.).

6. *Nolina arenicola* Correll. Flowering stem to 1 m. high (including the inflorescence); leaves numerous to form a large clump, about 13 dm. long and 5 mm. wide, flat or concavo-convex, with smooth margins; panicle compound, rather open with coarse spreading or spreading-ascending branches, the branches with short stubby branchlets; bracts not conspicuous, mostly about equal to or only slightly exceeding the primary branches; perianth 2.5-3.5 mm. long, the segments ovate-elliptic; fruits 4-7 mm. wide, deeply notched at apex, the style prominent; fruiting pedicels 5-7 mm. long, articulate near base, dilated into the fruit, with prominent ridges just under the fruits; seeds 4-6 mm. in diameter. In sandy soils in chaparral and brushlands, and on dunes in w. part of the Trans-Pecos, May-June; endemic.

21. DASYLIRION Zucc.

Plants dioecious, composed of a tall leafy flowering stem terminating a stout cylindrical stem or caudex; leaves numerous, crowded, with broad somewhat concave bases (spoons), narrowly linear, elongated, somewhat rigid and striate, usually armed with marginal hooked spines; flowers unisexual, in dense racemes forming a narrow compound panicle; pedicels articulate just beneath the flower or fruit; staminate flowers nearly sessile; perianth segments oblong-obovate, obtuse; stamens exerted; style short; fruit triangular and 3-winged, 1-celled and 1-seeded, coriaceous and indehiscent; seeds obtusely triangular.

About 20 species that are natives of southwestern United States and Mexico.

According to Standley (1920), the trunks of *Dasyilirion* are used for building houses and for fuel, and they are split open to permit cattle to eat the spongy interior because

they, as well as the leaf-bases, contain much sugar and are an excellent food for cattle. The head of the plant can be roasted or boiled and the sweet pith and leaf bases eaten by man. After being roasted the trunks are allowed to ferment and are then distilled to obtain a highly intoxicating beverage known as "sotol." This is a colorless liquor of penetrating odor and peculiar taste. The leaves are widely used for thatching, baskets, rough hats, mats and other such items. The leaf bases or "spoons" are frequently used in sophisticated artificial floral arrangements.

1. Spines of the leaves mostly recurved; leaves green1. *D. leiophyllum*.

1. Spines of the leaves directed forward or outward; leaves green or somewhat glaucous (2)

2(1). Floral branches slender, becoming pendent; mature fruits 6-8 mm. wide, deeply notched at apex2. *D. Wheeleri*.

2. Floral branches rather rigid, erect or erect-ascending; mature fruit 3-5 mm. wide, shallowly notched at apex (3)

3(2). Spines of the leaves stoutish, mainly directed forward; fruit broadly elliptic3. *D. texanum*.

3. Spines of the leaves slender, mainly directed outward; fruit obovate-elliptic4. *D. heteracanthium*.

1. *Dasyliirion leiophyllum* Engelm. Shortly caulescent; flowering stem to 37 dm. high; leaves scarcely 1 m. long, to 25 mm. wide near base, somewhat fibrous-lacerate at apex, green or at first somewhat glaucous, smooth, rather glossy; spines mostly recurved, usually 3-4 mm. long and 1-1.5 cm. apart, becoming orange or reddish; panicle to about 3 dm. long, the floral branches erect or erect-ascending and exceeding the subtending bracts; perianth greenish, the segments scarcely 2 mm. long; fruits broadly elliptic, 6-9 mm. long, 4-5 mm. wide, the thick style about equaling the moderately open and deep notch or prominently exerted if the wings have not fully developed; seeds about 3 mm. long. On limestone hills in the Trans-Pecos, May-July; also N.M. and adj. Mex.

2. *Dasyliirion Wheeleri* Wats. SOTOL, DESERT SPOON. Trunk to at least 1 m. high, bearing a dense rosette of leaves and a flowering stem 3-5 m. high; leaves about 1 m. long and to 4 cm. wide just above the spoon, rather glaucous, the serrulate margins armed with antrorse hooked reddish-brown teeth 1.5-3 mm. long and 1-2 cm. apart; panicle 15-25 dm. long, usually 2-3 dm. in greatest diameter; racemes 5-10 cm. long, flexuous and usually pendent; floral bracts cup-shaped, lacerate, 2-3 mm. long; perianth about 2 mm. long; fruit narrowly obcordate, 7-9 mm. long, 4-8 mm. wide, deeply notched at apex, with pedicels 2-4 mm. long; style shorter than to nearly equal to the wings; seeds 3-angled, about 4 mm. long. On limestone or granite slopes in the Trans-Pecos, May-July; from Tex. to Ariz. and n. Mex.

3. *Dasyliirion texanum* Scheele. SOTOL. Trunk 6-15 dm. high, bearing a dense rosette of leaves and a flowering stem 2-5 m. high; leaves light-green, 9-12 dm. long, 8-10 mm. wide below and attenuate upward, splitting into coarse fibers at apex, the serrulate (sometimes conspicuously so) margins armed with stout antrorse hooked spines to 2 mm. long and 6-12 mm. apart, the unarmed dilated base narrowed gradually into the blade; panicle 6-9 dm. long, very narrow; primary floral branches erect or suberect, about 75 mm. long, equaling the broad subtending bracts; racemes 2.5-5 cm. long, ascending; floral bracts broadly ovate, acute, lacerately toothed, about 2 mm. long; perianth 2 mm. long; fruit 6-7 mm. long, broadly elliptic, with pedicels 2 mm. long; style equaling or exceeding the notch or prominently exerted if the wings are not fully developed; seeds 3-angled, about 3 mm. long. On rocky slopes, flats and novaculite hills in the Trans-Pecos and on the Edwards Plateau, June-July; also adj. Mex.

4. *Dasyliirion heteracanthium* I. M. Johnst. SOTOL. Plant robust, obviously allied to *D. leiophyllum*; leaves 8-11 dm. long, 2-3 cm. wide just above the enlarged base, more or less dull-green, provided with marginal spines that are for the most part spreading straight out or with some curved upwards; spines slender, 2-4 mm. long and 5-15 mm. apart, often becoming yellow or rarely brown toward the apex; fruits obovate-elliptic, 6-7 mm. long, 4-5 mm. wide, the wide apical sinus not deep. On rocky slopes and flats in s. Trans-Pecos Tex., Mar.-July; also n. Mex.

22. ASPARAGUS L. ASPARAGUS

More than 300 species from Siberia to South Africa. Various species are grown for food or ornamentals.

1. *Asparagus officinalis* L. GARDEN ASPARAGUS. A much-branched finely dissected perennial to about 3 m. high, from strong rhizomes, with small greenish-yellow flowers and globular red berries about 1 cm. in diameter, the strong spring shoots bearing prominent scalelike leaves and forming the edible "asparagus" of commerce; leaves reduced to merely dry scales, the foliage represented by green branchlets or cladodes that are needlelike; pedicel jointed; perianth bell-shaped, the 6 separate segments more or less connivent; stamens 6, attached on base of perianth. Nat. of Euras. that escapes from cult. to sandy fields and dry open woods, May-July.

23. SMILACINA DESF. FALSE SOLOMON'S SEAL

Herbaceous perennials from creeping scaly rootstocks; aerial stems simple, leafy; leaves alternate, simple, entire, lanceolate to ovate or cordate, sessile or petioled; inflorescence terminal, racemose or paniculate; perianth segments distinct, 6; stamens 6, borne at the base of the perianth segments; anthers versatile, dehiscent inwardly; ovary 3-celled; styles thick, the stigmas 3; ovules 2 in each cell; fruit a round or 3-lobed berry, 1- to 6-seeded.

About 25 species mostly in temperate regions of both hemispheres.

- 1. Leaves abruptly long-acuminate, distinctly petioled, spreading 1. *S. racemosa* var. *racemosa*.
- 1. Leaves merely acute or very short-acuminate, usually somewhat clasping by the sessile or wing-petioled base, usually ascending 1. *S. racemosa* var. *amplexicaulis*.

1. *Smilacina racemosa* (L.) Desf. Rootstock stout; stem erect, arcuate or spreading, usually puberulent (at least in the inflorescence), occasionally essentially glabrous, more or less flexuous, 3-7 dm. high; leaves lanceolate to elliptic, usually broadest at the middle, acute to long-acuminate or tailed at the apex, somewhat clasping and ascending to distinctly petioled and spreading, distichous, 6-18 cm. long, 2-7 cm. wide, distinctly veined, puberulent to glabrous; inflorescence many-flowered, 3-13 cm. long, 1-8 cm. broad, with 5 to 20 branches; perianth segments white or greenish, 1-2 mm. long, about 0.5 mm. wide; stamens exceeding the perianth segments, 1.5-3 mm. long, the anthers yellow, the filaments more or less inflated; style to 1 mm. long; ovary 0.7-1.5 mm. long; berry globose, about 5 mm. in diameter, at first mottled red and green, later turning red or occasionally purple throughout. In shady woods in rather moist rich soil in mts. of the Trans-Pecos, June-Aug.; from Que. to B.C., s. to Ga., Mo., Tex. and Ariz.

Var. *amplexicaulis* (Nutt.) Wats. differences from var. *racemosa* have been pointed out in the key. It appears to be confined to the Davis Mts.; throughout most of the U.S. and Can. as well as Alas. and n. Mex.

24. POLYGONATUM MILL. SOLOMON'S SEAL

Perennial glabrous (in ours) herbs with horizontal creeping more or less knotty rhizomes and fibrous roots; stem simple, erect or arching, naked below, leafy above; leaves simple, alternate, amplexicaul to sessile or shortly petiolate, typically elliptic; inflorescence axillary, consisting of one to several pendulous flowers on deflexed or arcuate peduncles; calyx and corolla united into a cylindric tube, with 6 lobes that are usually shorter than the tube; stamens 6, included, inserted on the perianth tube; filaments filiform or flattened, smooth or roughly papillose; anthers linear-oblong to sagittate, bilobed at base, introrse; ovary 3-celled, with several ovules in each cell; fruit a dark-blue or black globose pulpy several-seeded berry.

About 50 species in the North Temperate Zone.

1. Distribution in mountain canyons of Trans-Pecos Texas; leaf scars (seals) on rhizome small and mostly inconspicuous, about 3 mm. across; cauline bract papery, caducous; peduncles stout, strongly and sharply deflexed 1. *P. cobrense*.
1. Distribution in moist rich woods of east and north-central Texas; leaf scars on rhizome large and conspicuous, 5 mm. or more across; cauline bract foliaceous, persistent; peduncles slender, arcuate, not strongly deflexed 2. *P. biflorum*.

1. *Polygonatum cobrense* (Woot. & Standl.) Gates. Rhizomes slender, about 5 mm. thick, only slightly knotty if at all; stems slender, somewhat flexuous, to 45 cm. tall; leaves essentially sessile or narrowed at the base into a broad petiole to 7 mm. long, elliptic to elliptic-lanceolate, narrowly obtuse to subacute at apex, to 95 mm. long and 38 mm. wide, glaucous on lower surface, very faintly nerved with only the midrib prominent; peduncles strongly and sharply deflexed, 7-15 mm. long, each dividing into 2 or 3 much shorter pedicels, all stout and strongly flattened laterally; flowers greenish-white, 1.2-2 cm. long, somewhat expanded toward mouth of tube, the lobes oblong and obtuse, twice as long as the tube; anthers 6 mm. long, acute, slightly exceeding the almost filiform somewhat roughened filaments; fruit 6 mm. or more in diameter. In humus under trees in canyons of mts. in the Trans-Pecos, Apr.-June; from w. Tex. to e. Ariz.

2. *Polygonatum biflorum* (Walt.) Ell. GREAT SOLOMON'S SEAL. Rhizome stout, about 7.5 mm. thick, conspicuously knotty; stem slender or stout, to 1 m. tall, arching or ascending; leaves sessile and often clasping, broadly elliptic to elliptic-lanceolate, narrowly obtuse to subacute at apex, to 15 cm. long and 7 cm. wide, somewhat glaucous beneath, prominently several-nerved; peduncles arcuate, slender, to 5 cm. long, the 1 to 5 pedicels much shorter than the peduncle; flowers greenish-white, 1.3-2 cm. long, the lobes (3-4 mm. long) much shorter than the tube; filaments usually papillate or granulose. *P. commutatum* (R. & S.) Dietr., *P. canaliculatum*, misapplied. On rich moist wooded slopes in e. and n.-cen. Tex., Mar.-May; from N.E. and Ont., w. to Neb., s. to Fla. and Tex.

25. TRILLIUM L.³⁰

TRILLIUM. WAKE-ROBIN

Perennial scapose herbs with subterranean or creeping tuberlike rhizomes, rarely producing rhizomatal leaves; scapes 1 or 2 (very rarely 3 or more), each with a whorl of 3 large foliaceous bracts subtending a solitary perfect flower at the summit; flowers pedicellate or sessile, 3-merous (occasionally 2-, 4-, or irregularly parted), with the perianth in two distinct series; sepals distinct, usually green, sometimes suffused with purple adaxially; petals distinct, white, pink, yellow, greenish or purple; anthers linear, adnate to the sides of connective or terminal; ovary sessile, 3- or 6-angled or -winged; stigmas 3, sessile or on a distinct style; berry 3-locular, few- to many-seeded, indehiscent.

About 40 species in temperate wooded regions of North America and eastern Asia. Segregated with three closely allied genera by some authors as the family Trilliaceae. The relationship of Texas species to those northward and eastward is in need of careful study.

1. Flowers pedicellate; corolla white or pink; gynoecium with a distinct style 1. *T. texanum*.
1. Flowers sessile; corolla purple, greenish or yellow; gynoecium with sessile stigmas (2)
- 2(1). Bracts petiolate; sepals basally reflexed; rhizome slender, the length of an internode about equal to the diameter 2. *T. recurvatum*.
2. Bracts sessile; sepals not basally reflexed; rhizome compact, the length of an internode less than one third the diameter (3)
- 3(2). Anther-position and dehiscence introrse; petals about twice as long as stamens; bracts about 3 to 5 times as long as sepals 3. *T. gracile*.
3. Anther-position and dehiscence lateral; petals about 3 times as long as stamens; bracts about 2 to 3 times as long as sepals 4. *T. viridescens*.

³⁰ Contributed by John D. Freeman.

1. *Trillium texanum* Buckl. Scapes 1-3 dm. tall; bracts sessile or abruptly narrowed into short petiolules, narrowly lanceolate to elliptic-lanceolate or oblong, obtuse to rounded, upper surface somewhat farinose by the presence of numerous stomates, (3-) 4-6 (-8) cm. long, (1-) 1.3-2 (-3) cm. wide; flowers on erect pedicels (2.5-) 3-4 (-4.5) cm. long; sepals spreading, lanceolate, green, usually larger than the petals; petals spreading, narrowly lanceolate to lanceolate, acute, often with a short claw, white, becoming pink and finally reddish with age, (1.5-) 2-2.5 (-3) cm. long, 7-10 (-14) mm. wide; stamens 10-14 mm. long, the anthers slightly longer than the white or pale-green filaments, the connectives often purple; gynoecium about as long as the stamens, with a distinct style about as long as the ovary and stigmas equal to or longer than the style; berry triangular-ovoid, sharply 6-ridged at base of persistent style, 8- to 15-seeded. Extremely rare in low moist woods, bogs and stream banks in Cass, Houston and Panola (type locality) cos., Mar.-May; replaced in Ark. and s.w. Mo. by *T. pusillum* Michx. var. *ozarkanum* (Palm. & Steyerl.) Steyerl., which lacks the upper epidermal stomates in the bracts, has thicker rhizomes, and grows in relatively dry rocky woods.

2. *Trillium recurvatum* Beck. Scapes (1.5-) 2-4 (-5) dm. tall; bracts with a petiole 1-3 cm. long, narrowly lanceolate to ovate, acute to slightly acuminate, obscurely mottled with dark-green, (5-) 7-11 (-18) cm. long, (2-) 4-8 (-12) cm. wide; flower sessile or subsessile (pedicel not more than 3 mm. long); sepals abruptly recurved, narrowly lanceolate, acute, (1.5-) 2-3 (-4) cm. long, 5-10 mm. wide; petals erect, lanceolate to oblanceolate, acute, distinctly clawed, purple or yellowish-green, (2-) 2.5-4 (-5) cm. long, (6-) 10-20 (-26) mm. wide; stamens erect, (8-) 10-15 (-20) mm. long, the filaments straight and almost as long as the strongly incurved anther connectives; gynoecium height about even with the bases of the anthers, the prominently 6-winged angular-ovoid ovary (3-) 4-6 (-8) mm. in height and the divergent-spreading stigmas about as long; fruit transversely angular-ovoid, distinctly winged, about 15 mm. in diameter. Rare on alluvial banks in rich woods in Nacogdoches and Rusk cos., Mar.-May; widespread n. into Ia. and Wis., n.e. into Ky. and Ind.

Forma *Shayi* Palm. & Steyerl. Flowers lacking purple pigments; petals yellow or greenish-yellow; stamens and carpels greenish; occurring with the typical form (but not known from Tex.).

3. *Trillium gracile* J. D. Freeman. Scapes (1.6-) 2-3 (-3.6) dm. tall; bracts sessile, elliptic-lanceolate to oblanceolate, rounded to obtuse or acute, broadly cuneate basally, dark-green, usually distinctly mottled with small darker spots, (6-) 7-10 (-13) cm. long, (2.5-) 3-6 (-8) cm. wide; flower sessile, with the odor of morel mushrooms; sepals narrowly oblong-lanceolate, slightly acuminate-blunt or obtuse, widely spreading, often somewhat reflexed distally, usually dark-purple on upper surface, (1.5-) 2-2.5 (-3.5) cm. long, 4.5-8 mm. wide; petals erect, linear-elliptic or linear-oblanceolate, acute to rounded, usually dark-purple (sometimes yellow), (1.5-) 2-3.5 (-4.5) cm. long, 3-7.5 mm. wide; stamens erect, (8-) 11-17 (-19) mm. long, the filaments about 2-3 mm. long, the introrse anthers on straight connectives; gynoecium just more than half as tall as the stamens, the ovoid ovary 3.5-7 (-11) mm. tall and the subulate divergent stigmas 1.5-4.5 (-6.5) mm. long, the stigma tips recurved; fruit ovoid, smooth. *T. ludovicianum* of auth., in part, not Harbison. Locally abundant in sandy loam of rich piney woods in s.e. Tex. and adj. La., especially along Sabine River, Apr.-May.

Forma *luteum* J. D. Freeman. Flowers lacking purple pigments; petals yellow or greenish-yellow; stamens and carpels greenish; occurring spontaneously with the typical form. Occurring with the species.

4. *Trillium viridescens* Nutt. Scapes (1.8-) 3-4.5 (-6) dm. tall, often scabrous distally; bracts sessile, elliptic-ovate to broadly ovate or elliptic, rounded to acute (in Tex.) or acuminate (n. of Tex.), very obscurely mottled or not mottled, (8-) 9-11 (-15) cm. long, 4-10 (-12) cm. wide; flowers sessile, with musty-spicy odor like spoiled fruit; sepals narrowly to linear-lanceolate, acute to acutish, divergent to spreading, sometimes purplish basally, (3.5-) 4-5.5 (-6.5) cm. long, 5.5-11 (-14) mm. wide; petals erect, linear-spatulate to very narrowly spatulate, acute-rounded or rounded, greenish or greenish-purple above a purple claw, sometimes purple or yellowish-green throughout, (4-) 5-7 (-8.5) cm. long, (5-) 7-10 (-14) mm. wide; stamens erect, (14-) 18-27 (-30) mm. long, the filaments 2.5-4.5 (-6) mm. long and the linear anthers lateral on the connective; gynoecium about half as tall as stamens, the ovoid sharply 6-angled ovary 5-9

(-12) mm. tall and the nearly linear divergent to spreading stigmas about as long as the ovary, the stigma tips often extending between stamens; fruit ovoid, usually 6-ridged or sharply angled. *Trillium stenanthos* Raf., *T. sessile* L. var. *Nuttallii* Wats., *T. sessile* var. *viridescens* (Nutt.) Trel., *T. viride* of auth., in part, not Beck. In rich woods on sandy or rocky soils in Harrison, Marion and Red River cos., Apr.-May; reaching s. extreme of range in n.e. Tex., more common in n.w. Ark. and e. Okla.

26. ALETRIS L. COLIC-ROOT. STAR-GRASS

Perennial and smooth stemless herbs, very bitter, with a short and thick rhizome and a spreading rosette of thin and flat lanceolate leaves; flowers small, in a spikelike raceme that terminates a slender nearly naked scape; perianth tubular to campanulate, wrinkled and roughened outside by thickly set points, the tube adhering to the base of the ovary, 6-cleft at the summit; stamens 6, inserted at the summit of the perianth tube; filaments and anthers short, included; style subulate, 3-cleft at the apex; stigmas minutely 2-lobed; capsule ovoid, beaked, enclosed in the persistent withered perianth; seeds numerous, minute, costate.

About 25 species in Asia and North America.

1. Perianth white, 8-9 mm. long, the lance-oblong lobes recurved-spreading 1. *A. farinosa*.
1. Perianth yellow, about 7 mm. long, the ovate lobes erect 2. *A. aurea*.

1. *Aletris farinosa* L. UNICORN-ROOT. Leaves firm, to 2 dm. long; scapes to 1 m. high, usually much smaller, with remote small bracts; raceme to 3 dm. long, densely to sub-remotely flowered; bracts linear or clavate; perianth tubular, 8-9 mm. long, whitish, with granulate surface, its lance-oblong lobes somewhat recurved-spreading, marcescent, shrinking at maturity and thus often exposing the long abrupt beaks that are about as long as the plump body of the capsule. Dry or moist peats, sands and gravels, rare in s.e. Tex., Mar.-May; from Fla. to Tex., n. to s.w. Me., s. N.H., cen. Mass., s.e. N.Y., s. Ont., Mich. and Wisc.

2. *Aletris aurea* Walt. YELLOW STAR-GRASS. Very similar to *A. farinosa*; leaves membranaceous, to 12 cm. long; scape to 8 dm. tall or more; raceme remotely flowered; perianth broadly campanulate, about 7 mm. long, orange-yellow, not so roughened, its short-ovate lobes erect; beaks of capsules included, about as long as the plump body. Damp pine-barrens, bogs and savannahs in e. Tex., May-July; from Fla. to Tex., n. to s.e. Va. and Md.

27. SMILAX L.³¹ GREEN-BRIER. CAT-BRIER

Shrubby or herbaceous dioecious plants usually climbing or supported by a pair of tendrils on the petiole of the broad-ribbed and netted-veined simple leaves; flowers unisexual, the staminate often the larger, in umbels in axillary peduncles, small, greenish, yellowish or bronze, regular; perianth segments distinct, similar, deciduous; stamens in the staminate flower 6; filaments slender or flattened, inserted on the very base of the perianth; the introrse anthers linear or oblong, fixed by the base, apparently 1-celled; ovary of fertile flowers 3-celled (1-cell with single stigma in *S. laurifolia*); stigmas thick and spreading, almost sessile; ovules 1 or 2 in each cell, pendulous, orthotropous; fruit a small berry.

About 350 species, mostly tropical with few in the Temperate Zone in North America and eastern Asia. Segregated by some authors as a separate family, Smilacaceae.

1. Stems herbaceous, annual, without prickles; flowers fetidly scented; ovules 2 in each carpel 1. *S. herbacea*.
1. Stems woody, perennial, usually prickly (at least near base); flowers not malodorous; ovules solitary in each carpel (2)

³¹ Adapted partly from W. C. Coker in Jour. Elisha Mitchell Sci. Soc. 60:27-69, Pls. 9-39, 1944, and W. H. Duncan in Sida 3:1-76, 1967.

- 2(1). Stems hairy; underside of leaves densely hairy; plants trailing, suberect or low climbing (to 7 dm.); berries red 2. *S. pumila*.
2. Stems glabrous (rarely with dark stellate hairs on some portions in *S. Bona-nox*); underside of leaves glabrous or rarely minutely hairy; plants sometimes erect but usually high-climbing; berries red or black (sometimes covered with a bloom) (3)
- 3(2). Leaves evergreen, thick-coriaceous, oblong to oblong-linear or oblong-lanceolate to rarely broadly linear, on the underside the midvein in its lower third more prominent than the laterals, a lateral vein closely and evenly submarginal (this is more easily seen in dried leaves), the veins indistinct on the upper surface; stigma one; berries black, 1-seeded, ripening late in the second season after flowering in the previous summer or fall 3. *S. laurifolia*.
3. Leaves deciduous or evergreen with leathery to firm-coriaceous but with neither thick nor oblong blades (if oblong, conspicuously veined on the underside), the midvein scarcely or no more prominent than the laterals, with no submarginal vein (unless irregularly spaced along part of the margin—in *S. auriculata*), the veins sometimes distinct on the upper surface; stigmas 2 or 3; berries black or red, 1- to 3-seeded, ripening the same year after flowering in the spring (or the summer of the second year in *S. Smallii*) (4)
- 4(3). Underside of leaves whitened, silvery or bluish-gray; the leaf margins thin though sometimes rolled when dry, not serrulate, without a rib; berries black or covered with a bloom and bluish; peduncles longer (usually much longer) than the petioles of the subtending leaves 4. *S. glauca*.
4. Underside of leaves about the same green color as the upperside; the leaf margins thin or in one species with a rib; berries black or red, rarely covered with a bloom; peduncles longer or shorter than the petioles of the subtending leaves (5)
- 5(4). Peduncles 1.5 or more times as long as petioles of the subtending leaves, sometimes to 7 cm. long; berries usually 1-seeded (6)
5. Peduncles less than 1.5 times as long as petioles of the subtending leaves or (if longer) the stems without dark slender prickles or leaves without a marginal rib; berries 1- to 3-seeded (8)
- 6(5). Stems with relatively weak somewhat bristlelike usually dark prickles; leaf margins minutely serrulate and not thickened, veins and veinlets slender; leaf drying and fading to a dull-ashy-green color 7. *S. hispida*.
6. Stems with rigid broad-based pale or merely dark-tipped prickles; leaf margins entire or sparsely spinulose-ciliate and thickened by a marginal rib (often poorly developed in young leaves and in some shade forms), veins and veinlets usually thickened; leaf drying and fading to a tan-color (7)
- 7(6). Leaves typically panduriform to broadly ovate, usually longer than broad; widespread in Texas 5. *S. Bona-nox*.
7. Leaves reniform or deltoid-reniform, mostly broader than long; endemic to Edwards Plateau 6. *S. renifolia*.
- 8(5). Leaves usually evergreen, thin-coriaceous, lanceolate to elliptic-lanceolate, smooth-margined (use 10× lens), the base broadly cuneate, the apex acute or short-acuminate; berries dull-red 8. *S. Smallii*.
8. Leaves deciduous, firm-membranous, ovate to triangular-lanceolate or suborbicular, the margin smooth or roughened (use 10× lens), rounded to subcordate at base, the apex notched to mucronulate or cuspidate to acute or obtuse; berries red or black (or bluish-black when glaucous) (9)
- 9(8). Berries black (bluish-black when glaucous); principal stems and main branches with stout flattened prickles; leaf blades usually ovate, abruptly acute to short-acuminate at apex; moist or more often dry habitats . 9. *S. rotundifolia*.
9. Berries bright-red; stems prickly mostly at the base, the prickles mostly subulate; leaf blades usually ovate-lanceolate to narrowly triangular-lanceolate, rounded to obtuse and mucronate at apex; wet habitats 10. *S. Walteri*.

1. *Smilax herbacea* L. CARRION-FLOWER. Stems high-climbing or widely spreading and trailing, to about 3 m. long, freely branched, with numerous tendrils; lower stem bracts ascending to somewhat spreading; leaves with petioles to 8 cm. long, triangular-ovate to narrowly ovate, cordate to rounded at base, broadly rounded to short-cuspidate or short-acuminate at apex, usually pale and puberulent on veins beneath; peduncles elongated, arising from the axils of the foliage leaves, somewhat flattened, with up to 35 flowers in a hemispherical umbel, becoming strongly divergent in fruit; perianth segments oblong to obovate, 3.5-6 mm. long; fruit blackish-blue, often glaucous, about 1 cm. in diameter, with 3 to 5 subglobose brown seeds that are about 4 mm. long. *Nemexia herbacea* (L.) Small. Moist soil in thickets, along roadsides and in woodlands; collected once in woods, San Augustine, summer; e. U.S. and Can., w. to Sask., Mont., Colo., Okla. and Tex.

Our plant is usually referred to var. *lasioneuron* (Hook.) A. DC. (*S. lasioneuron* Hook.) with leaves puberulent on the veins beneath.

2. *Smilax pumila* Walt. SARSAPARILLA-VINE. Stems and branches trailing or low-climbing, woolly, unarmed; leaves with thick petioles to 25 mm. long (usually 15 mm. or less long), ovate to ovate-elliptic or ovate-lanceolate, 5-10 cm. long, to 8 cm. wide, woolly on lower surface, cordate at base, bluntly pointed at apex; peduncles about as long as the petioles or shorter, woolly; segments of the staminate flowers linear to linear-oblong, about 3 mm. long or rarely longer; berry ovoid, persistent, 5-8 mm. long, red, acute; seeds about 3 mm. long, red. In sandy soil and duff of pinelands, sand hills, along stream, oak woods and sparsely wooded slopes in e. Tex., flowering in the fall and fruit ripens in the spring; from Fla. to Tex., n. to S.C.

3. *Smilax laurifolia* L. BAMBOO-VINE, BLASPHEME-VINE. Evergreen high-climbing rampant vine, often forming impenetrable entanglements, with knotty-thickened sub-ligneous rhizomes and with strong terete stems armed (especially below and on vigorous sprouts) with rigid terete prickles; tendrils intermittent, few or wanting on flowering branchlets; leaves heavily coriaceous, short-petioled, with the thick midrib much more prominent beneath than the 2 to 4 lateral ones, oblong to oblong-linear or -lanceolate, usually coarsely mucronate, provided with a prominent and evenly submarginal vein, 6-20 cm. long and 1-7.5 cm. broad; umbels short-stalked, often crowded and subpaniculate along the branchlets; stigma solitary, ovary 1-celled; berries becoming black, about 8 mm. in diameter. Swamps, seepage slopes and low ground in e. Tex., flowering in late summer and autumn of 1st season, lasting over winter; from Fla. to Tex., n. to N.J. and Tenn.; also W.I.

The leaf margin is often inrolled so that there appear to be 2 closely parallel veins at the margin.

4. *Smilax glauca* Walt. SAW-BRIER, CAT-BRIER. Lithe freely climbing and entangling shrub with thick and knotty rhizomes; stems slender, terete, often glaucous, with relatively scattered stiff slender prickles; leaves glaucous or whitened beneath (when fresh) and sometimes above, elliptic or ovate to reniform, with rounded or subcordate bases, to 13 cm. long and 1 dm. wide, the lower surface densely papillose to hirtellous-pulverulent or rarely glabrous; peduncles slender, arching to drooping, longer than subtending petioles; berries blue with bloom, sometimes blackish. Dry to moist sandy thickets, open woods, fields and along streams, in e. Tex., May-June; from Fla. to Tex., n. to N.J., W.Va., s. O., s. Ind., s. Ill. and s.e. Mo.

The terete, not 4-angled or 4-ridged, stems forming the youngest internodes distinguishes this species from *S. rotundifolia* when it loses its glaucousness. Those plants with the lower surface of their leaves glabrous are usually distinguished as var. *leurophylla* Blake.

5. *Smilax Bona-nox* L. CAT-BRIER, ZARZAPARRILLA. Often a rampant vine, straggling to climbing, from ligneous-thickened and knotty rhizomes and slender subterranean stolons, with 4-ridged stems and branches, the lower portion of stem and main branches scurfy and stiffly prickly, the branchlets with or without prickles; leaves very variable, from strongly panduriform to broadly ovate, with or without broadened bases, to 1 dm. long or more, mucronate, coarsely ciliate or eciliate, becoming stiffly coriaceous, strongly reticulate, with a thickened marginal rib; peduncles to 3 cm. long, ascending to divergent or slightly recurving, longer than subtending petioles; pedicels 3-6 mm. long, glaucous; berries black, with a bloom; seed usually solitary, ellipsoid-obovoid to subglobose, 4-5

mm. long, 3.5-4 mm. broad. *S. Bona-nox* var. *hederacfolia* (Beyr.) Fern. and var. *hastata* (Willd.) A. DC. In thickets, open woods, cedar brakes, floodplains and hillsides from e. Tex. w. to Cameron and Val Verde cos., Feb.-June; from Fla. to Tex. and Mex., n. to Va., Ind. and Mo.

6. *Smilax renifolia* Small. Perennial, shrubby, glabrous; stems elongated, climbing high over trees and shrubs, more or less distinctly angled; leaves numerous, with petioles 5-10 mm. long, reniform or deltoid-reniform, 3-7 cm. long, resembling those of *Celtis*, rounded and mucronate at the apex, entire, mostly broader than long, cordate to subcordate at base; stipular sheath fully as long as the petioles, usually provided with tendrils; peduncles of pistillate plants 1-2 cm. long, flattened, much longer than the adjacent petiole; pedicels 2-3 mm. long; perianth segments greenish, linear to linear-oblong, about 2 mm. long, acutish; berries black, subglobose. Climbing over bushes and small trees in open-wooded canyons and along creeks on the Edwards Plateau, Mar.-June; endemic.

This plant, which is endemic to the Edwards Plateau, centered in Gillespie Co., should probably be treated as a geographic variant of *S. Bona-nox*, its closest ally.

7. *Smilax hispida* Muhl. CHINA-ROOT, HELLFETTER, BRISTLY GREEN-BRIER. Stout-based high-climbing shrub from short knotty rhizomes, with lithe glabrous several- to many-ridged stems and branches, very prickly below and sparsely so above with blackish subulate relatively flexible unequal prickles; leaves submembranaceous, lustrous green, when dry light-olive-gray, ovate to elliptic or suborbicular, rounded to cordate at base, the veins slender, the reticulations delicate, the margins serrulate and not thickened, to 15 cm. long and broad, usually much smaller; peduncles divergent to drooping, slender, 15-65 mm. long, much longer than subtending petioles; pedicels very slender, 5-12 mm. long; perianth bronze to greenish; fruit black, mostly 1-seeded, the lustrous red-brown subglobose seed 5-6.5 mm. in diameter. *S. Pseudo-china* of auth., *S. tamnoides* of auth. and var. *hispida* (Muhl.) Fern. Low woods and thickets, along creeks, e. and n.-cen. Tex., Mar.-June; from Fla. to Tex., n. to e. Va. and Kan.

8. *Smilax Smallii* Morong. GREEN-BRIER. Plant glabrous, often evergreen; stem and branches terete, striate, armed only below, often high-climbing, to about 25 dm. long, with tendrils; leaves with petioles 4-10 mm. long, light-green, shining above, often somewhat glaucous beneath, thin-coriaceous, lanceolate to elliptic-lanceolate, slightly rounded to cuneate at base, narrowed into an obtuse to acute or short-acuminate apex, sparsely lineate, 5-nerved, to 11.5 cm. long and 4 cm. wide; stipular sheath with narrow membranous smooth-edged margins and two thirds as long as the petiole; peduncle about equal to petiole; pedicels very unequal, 2-8 mm. long; receptacle small, globular; bracteoles minute, triangular; perianth segments of male flowers narrowly oblanceolate, about 4 mm. long; stamens 6, about as long as the perianth; anthers one eighth the length of the filaments; fruits about 6 mm. in diameter, 2- or 3-seeded, ripening at end of first year. *S. lanceolata* of auth. Trailing over trees and shrubs along creeks and in rolling woodlands in e. Tex., May-June; from Fla. to Tex. and Ark., n. to Va.

9. *Smilax rotundifolia* L. COMMON GREEN-BRIER, BULL-BRIER, HORSE-BRIER. Tough woody high-climbing vine, from long slender rhizomes, with strong greenish subrigid terete to 4-angled stems and branches bearing stout flattened prickles; tendrils numerous; leaves shortly petioled, narrowly ovate to suborbicular or reniform, with rounded to cordate bases, bright-green on both sides, lustrous, thinnish, becoming subcoriaceous, mostly 4.5-10 cm. long, often muriculate on back near base; peduncles to 15 mm. long, ascending to divergent; pedicels 2-7 mm. long; flowers greenish to bronze; berries blue-black, with bloom, mostly 2- or 3-seeded. Incl. var. *quadrangularis* (Muhl.) Wood. Moist to dryish thickets and woods, evergreen shrub bogs, often a noxious pest in e. Tex., Mar.-June; from Fla. to Tex., n. to N.S., s. Me., s. N.H., N.Y., s. Ont., O., Ind., s. Ill., s.e. Mo. and Okla.

10. *Smilax Walteri* Pursh. CORAL GREEN-BRIER, RED-BERRIED BAMBOO. Slender and lithe woody vine, with widely creeping slender rhizomes, clambering over bushes; lower half of the stem with scattered subulate prickles, the terete branches nearly or quite without prickles; tendrils numerous; leaves submembranaceous, smooth, green on both sides, when dried very lightly orange-tinged with brown, ovate to ovate-oblong or triangular-ovate, with rounded bases, rounded to obtuse and mucronate at apex, mostly 6-12 cm. long and 3-7 cm. broad; peduncles mostly shorter than petioles; flowers greenish to bronze; berries bright-red, handsome, persistent over the winter. Swampy or boggy thickets, low pinelands, rare in e. Tex., Mar.-June; from Fla. to Tex., n. to N.J.

A rather large and apparently quite old colony of the Old World Aloe *barbadensis* Mill., the aloe of commerce, is established along the highway between Rio Grande City and Guerra in Starr County. It is characterized by its tumid swordlike leaves with broad marginal spines about 1 cm. apart and its slender, dense racemes of prominently bracteate yellowish flowers. It may eventually become widespread in south Texas.

FAM. 39. AMARYLLIDACEAE ST.-HILL.

AMARYLLIS FAMILY

Mostly perennial herbs, herbaceous or sometimes with a woody base or with somewhat woody stems; flowering stems scapose, from a bulb or corm, a short rootstock or a large woody caudex; leaves of a linear type and entire; flowers perfect, regular or nearly so; perianth segments 6, distinct or mostly united below into a tube that is adnate to the ovary; stamens 6, rarely more or only 3, inserted on the perianth, the filaments free or united in a cup; anthers basifixed or versatile, dehiscing usually by introrse longitudinal slits; ovary inferior, 3-celled; style 3-lobed; fruit usually a 3-valved capsule with loculicidal dehiscence or sometimes indehiscent; seeds usually numerous.

Broadly interpreted the family probably has nearly 2,000 species in about 100 genera, rather cosmopolitan but mostly in tropical and subtropical regions of both hemispheres. Some of the species are highly ornamental while others, such as Agaves, are important economically.

The commonly cultivated *Amaryllis Belladonna* L., a native of Latin America, occasionally escapes. It is abundantly spread in and along a slough on the west edge of Edna in Jackson County, where it is well-established. It is readily distinguished by its umbellate cluster of large (to 15 cm. long) reddish to salmon-color bell-shaped flowers, and its basal cluster of broad, fleshy, strap-shaped leaves.

1. Flowers with a conspicuous corona above the perianth (2)
 1. Flowers without a corona (3)
 - 2(1). Corona between the perianth segments and the stamens 1. *Narcissus*, p. 413.
 2. Corona united to the filaments and connecting them .. 2. *Hymenocallis*, p. 414.
 - 3(1). Flowers solitary or paired, rarely umbellate (4)
 3. Flowers numerous in spicate racemes or panicles (8)
 - 4(3). Perianth segments pilose on the outer surface; foliage grasslike, herbaceous, usually villous or pilose 3. *Hypoxis*, p. 415.
 4. Perianth segments glabrous; foliage mostly broad and fleshy-thickened, rarley grass-like, glabrous or essentially so (5)
 - 5(4). Flowers several in an umbel; spathes 2, large and broad 7. *Crinum*, p. 419.
 5. Flower solitary; spathe solitary, narrow (6)
 - 6(5). Anthers basally dorsifixed; filaments very short ... 4. *Cooperia*, p. 416.
 6. Anthers medially dorsifixed; filaments well-developed (7)
 - 7(6). Perianth erect; stamens of 2 lengths 5. *Zephyranthes*, p. 418.
 7. Perianth oblique or declinate; stamens of 4 lengths ... 6. *Habranthus*, p. 418.
 - 8(3). Flowers regular; leaves minutely scabrous-dentate to spiny-margined; flowering stems with much-reduced bracts; inflorescence paniculate or racemose with the flowers in clusters 8. *Agave*, p. 419.
 8. Flowers somewhat irregular; leaves serrulate or entire, passing gradually into leafy bracts on the flowering stem; inflorescence always a simple spicate raceme 9. *Polyanthes*, p. 423.

1. NARCISSUS L.

Bulbous plants with linear flat or narrow rushlike leaves that appear with (and are about equal to) the flower scape; flowers yellow or sometimes white, mostly nodding; perianth salverform, with a rather short cylindrical or funnelform tube, the usually equal

segments spreading to reflexed from the base of the tubular or cup-shaped crown; stamens inserted in the tube.

Several of the 30 or more entirely Eurasian species, and some of their hybrids, are commonly cultivated for their early spring flowers. Three of the more frequently cultivated species that tend to escape cultivation or occur as waifs are included here.

- 1. Leaves terete or semiterete and narrowly channeled on the face, green 1. *N. Jonquilla*.
- 1. Leaves flat or essentially so, mostly glaucous (2)
- 2(1). Crown half as long as to longer than the perianth segments 2. *N. Pseudo-Narcissus*.
- 2. Crown much less than half as long as the perianth segments 3. *N. Tazetta*.

1. *Narcissus Jonquilla* L. JONQUIL. Plant low and slender; leaves and scape 25-45 cm. high; flowers 2 to 6, fragrant; perianth yellow with a darker crown; tube slender, about 25 mm. long; crown about 3 mm. long, crenate, much shorter than the obovate spreading segments.

2. *Narcissus Pseudo-Narcissus* L. DAFFODIL. Plant stout; leaves to about 5 dm. long, 8-20 mm. wide, usually exceeding the scape; flowers solitary, horizontal or ascending, 5-6.5 cm. long; perianth yellow with a darker crown; tube broad, about 13 mm. long; crown 3.5-5 cm. long, with more or less frilled edges, about as long as the oblong to ovate segments.

3. *Narcissus Tazetta* L. POLYANTHUS NARCISSUS. Plant stout; leaves to about 45 cm. long, about as long as the flattened scape, 1-2 cm. wide; flowers usually 4 to 8, sometimes fewer, fragrant; perianth whitish, with a light-yellow crown; tube slender, to 25 mm. long; crown cup-shaped, much shorter than the obovate overlapping segments.

2. HYMENOCALLIS SALISB. SPIDER-LILY

Herbs with scapes and leaves from a rather large tunicated bulb; flowers white (in ours), showy, essentially sessile in a terminal umbel subtended by 2 or more usually scarious bracts; perianth tube very slender, elongate, the limb with linear to narrowly lanceolate spreading segments; crown showy, forming a large conspicuous cup that connects the bases of elongate filaments; anthers versatile; capsule firm, few-seeded.

Forty or more species in the warmer parts of the Western Hemisphere. *H. caymanensis* Herb. has been reported from coastal Texas but no material has been seen. The long (12-16 cm.) perianth tube is characteristic of this species.

- 1. Flowering from July to September after the leaves begin to wither 1. *H. Eulae*.
- 1. Flowering from March to May or sporadically to July, with the leaves (2)
- 2(1). Free part of filaments 20 mm. long or less; larger perianth segments usually 5 mm. wide or less; crown 25-35 mm. long; leaves commonly less than 20 mm. wide 2. *H. Liriosme*.
- 2. Free part of filaments 23-35 mm. long; larger perianth segments usually more than 5 mm. wide; crown 33-40 mm. long; leaves 18-42 mm. wide 3. *H. caroliniana*.

1. *Hymenocallis Eulae* Shinn. Bulb about 5 cm. in diameter, to 75 mm. long (including neck); scape 6-9 dm. high; leaves glaucous-green, oblanceolate, to 6 dm. long and 5 cm. wide, slightly recurved, appearing in late winter and dying off in late spring; spathes lanceolate, to 4 cm. long; umbel mostly 6- to 9-flowered; flowers snow-white, about 2 dm. across, fragrant (especially at night); perianth tube 8-12 cm. long, the segments to 1 dm. long; staminal cup about 65 mm. in diameter, the edges somewhat lacerate, with sharp points; ovary sessile, about 1 cm. long; filaments 3-4 cm. long; anthers introrse. In heavy soils near streams that periodically overflow and seepage slopes in s.e. Tex., July-Sept.; also La.

2. *Hymenocallis Liriosme* (Raf.) Shinn. Bulb with black outer and white inner coat; scape sharply 2-edged, biconvex, spongy, shriveling to less than half its original

width and less than a fourth its thickness in drying; leaves shining, light-green, to about 4 cm. wide, appearing in the spring; flowers snowy-white (tinged lemon-yellow in the center and greenish or yellowish on perianth tube), blooming simultaneously with appearance of leaves, about 2 dm. in diameter; perianth tube 6-8 cm. long *H. galvestonensis* of auth. Common on stream banks, in ditches and wet places in e. Tex., w. to Red River, Van Zandt, Kaufman and Victoria cos., Mar.-May; from La. and Tex. to Ark. and Okla.

3. *Hymenocallis caroliniana* (L.) Herb. Scape 35-53 cm. high; leaves narrowly oblanceolate to elliptic-ligulate, 1.8-4 cm. wide; umbel 3- to 9-flowered; spathe bracts lanceolate, acute to obtusely acute, to 6 cm. long; flowers sweetly fragrant; perianth segments greenish-white below, to 1 dm. long; crown 3.3-4 cm. long, the margins irregularly incised; filaments 23-35 mm. long; style exceeding the stamens; fruit globose, usually with 2 ovules in each cell. *H. occidentalis* of auth. In wet sandy areas in e. and s.-cen. Tex., Mar.-May or sporadically to July; from Ga. to Tex., n. to Ky., Mo. and Ark.

3. HYPOXIS L.³² STAR-GRASS

Stemless small herbs with grasslike usually hairy linear or narrowly lanceolate leaves and slender 1- to several-flowered peduncles from a cormlike short vertical rhizome; perianth mostly pilose without, its tube completely coherent with the ovary; perianth segments yellow to whitish within, usually green on the back, connivent at least after anthesis, usually forming a beaklike crown to the fruit or rarely deciduous; anthers versatile or rarely basifixed; capsule indehiscent or longitudinally dehiscent; seeds globular to ellipsoid, with pebbled to muricate or variously sculptured testa.

More than 100 species, mostly in the Southern Hemisphere.

- 1. Seeds sharply muricate, the projections somewhat awl-shaped and acute (2)
- 1. Seeds reticulate, covered with low smooth rounded pebbling or blunt murications (3)
- 2(1). Seeds black, beset with conspicuous sharp projections; principal leaves 5- to 9-nerved1. *H. hirsuta*.
- 2. Seeds brown, the acute projections minute; principal leaves 3-nerved 2. *H. micrantha*.
- 3(1). Leaves thin and flaccid, glabrous, narrowly linear-lanceolate, usually more than 5 mm. wide at about the middle; peduncles mostly 2-flowered; perianth segments 5-7 mm. long3. *H. leptocarpa*.
- 3. Leaves firm, linear, pilose, 1-4 mm. wide; peduncles usually 1-flowered; perianth segments 7-12 mm. long (4)
- 4(3). Leaf bases (corm scales) breaking down into fibrous bristles; anthers versatile; seeds opaque or slightly lustrous4. *H. rigida*.
- 4. Leaf bases not disintegrating into bristles; anthers basifixed; seeds iridescent 5. *H. sessilis*.

1. *Hypoxis hirsuta* (L.) Cov. Corm subglobose to ellipsoid, 5-20 mm. thick, covered with membranaceous pale or brown-tinged sheaths that do not become fibrillous; leaves linear, rather firm, 1-6 dm. long, 1-8 mm. wide; peduncles filiform, stiffish or spreading, 4-35 cm. long, 2- to 7-flowered; pedicels elongate; ovary and capsule densely pilose; perianth segments lanceolate to elliptic or narrowly ovate, 5-15 mm. long; capsule ellipsoid, 2-6 mm. long; seeds 0.8-1.3 mm. in diameter, black, lustrous, the outer coat closely covered with sharp murications. *H. erecta* L. In open woods, meadows, prairies and pastures in e. Tex., w. to Wise and Bastrop cos., Mar.-May; from s. N.H. to Man., s. to Fla. and Tex.

2. *Hypoxis micrantha* Pollard. Corm subglobose to subcylindric, 4-12 mm. thick, covered with the dark membranaceous bases of the old leaves rarely disintegrating into bristly fibers; leaves linear-lanceolate, 1-4 dm. long, 1-6 mm. wide, pilose; peduncles pilose, 5-18 cm. long; ovary and capsule pilose; perianth segments 3.5-15 mm. long, rather acute at the apex; capsule subglobose to subcylindric, 4-9 mm. long; seeds brown, covered with very numerous minute awl-shaped murications. Sandy soil in open pinelands in n.e. Tex.; in s. U.S. and the W.I.

³² Adapted from A. Brackett in *Rhodora* 25:120-147. 1923.

3. *Hypoxis leptocarpa* Engelm. Corm ovoid-cylindric, 10-15 cm. thick; leaves very thin and flaccid, narrowly linear-lanceolate, tapering below, acuminate and long-attenuate at apex, often quite glabrous, 2-9 dm. long, about 12 mm. broad; peduncles very slender and lax, mostly 1- to 3- (rarely 4-) flowered; perianth segments 5-7 mm. long, subglabrous to dorsally pilose; mature capsules 4-10 mm. long, slightly pubescent to glabrate; seeds black, with blunt murications. *H. hirsuta* var. *leptocarpa* (Engelm.) Brackett. Wet woods, swamps and bottomlands, often along streams, in s.e. Tex., May-Aug.; from N.C. to Fla. and Tex.

4. *Hypoxis rigida* Chapm. Corm subcylindric to ellipsoid, 6-15 mm. thick, covered with the stiff bristly bases of the old sheaths or rarely with membranous slightly disintegrating leaf bases; leaves rather rigid, linear, 1-4 dm. long, 1-4 mm. wide; peduncles glabrate, to 3 dm. long, 1- or rarely more-flowered; ovary and capsule pilose; perianth segments 7-12 mm. long, oblong to lanceolate, acutish, densely pubescent without; capsule narrowly obovoid, 1-9 mm. long; seeds about 1 mm. in diameter, black, opaque or slightly lustrous, covered with short rounded approximate pebbling. *H. humilis* Tharp. Low pine barrens, sandy soil in prairies and on edge of bogs in s.e. Tex., Apr.-July; from Fla. to Tex., n. to N.C.

5. *Hypoxis sessilis* L. Corm cylindric to slenderly ovoid, 5-10 mm. thick, covered with membranous but scarcely fibrillous brown sheaths; leaves linear, 1-3 dm. long, 1-4 mm. wide, firm; peduncles essentially wanting or to 8 cm. long, filiform, pilose; ovary and capsule densely pilose; perianth segments lanceolate, rather acute, 7-12 mm. long; anthers basifixed; capsule pyriform, 3-4 mm. long; seeds black, ellipsoid, 1-4 mm. in diameter, the low flat pebbling almost completely covered with a closely granular film or coating of a golden-brown iridescent substance, the short beak and rostrate hilum black. Dry pine barrens and sandy openings in s.e. Tex., Mar.-May; throughout s. U.S.

4. COOPERIA HERB.³³

RAIN-LILY

Bulb globose or subglobose, tunicated, black or brown; leaves linear, smooth, usually glaucous, erect or recumbent; scape hollow, erect, usually single-flowered; spathe long, tubular below, free upwards, entire, fenestrate or bifid (usually unilaterally); flower erect, salverform, night-blooming, opening in the afternoon or evening, scented, white or light-yellow; stamens inserted in the throat of the tepal tube; filaments very short; anthers erect, fasciculate, pale-yellow, affixed one fourth distance from base; stigma tripartite; capsule trilocular; seeds flat, black, D-shaped.

About 6 or 7 species, one in South America, the others from northern Mexico, through Texas to Kansas, west to New Mexico and east to southwestern Louisiana.

1. Flowers white (2)

1. Flowers yellow (4)

2(1). Style less than 35 mm. long; stigma in tube with lobes linear; leaves broad (over 5 mm. wide); ovary pedicellate; perianth tube short (2.2-4 cm. long) 1. *C. pedunculata*.

2. Style more than 40 mm. long; stigmatic lobes globose; leaves narrow (to 5 mm. wide); pedicel rarely present; perianth tube greatly elongate (3.4-18 cm. long) (3)

3(2). Plant of delicate appearance; known only from the Texas Gulf Coast north of the Coastal Bend 2. *C. Traubii*.

3. Plants larger, not delicate-appearing; widely spread over Texas and beyond 3. *C. Drummondii*.

4(1). Length of perianth tube usually less than that of spathe (Cameron Co.) 4. *C. Smallii*.

4. Length of perianth tube usually markedly greater than length of the spathe (Texas Coastal Bend) 5. *C. Jonesii*.

³³ Contributed by Walter S Flory.

1. *Cooperia pedunculata* Herb. Bulb large, usually black, conical when young, flattened-globose when old, 2.5 × 4 cm., the often long neck to 8 cm.; leaves glaucous, linear, 6 mm. wide but broadening to about 12 mm. at base; scape 2 dm. high; spathe bifid at tip, at first covering the ovary, later disclosing it on one side; stipe short, 5-33 mm. long; flowers appear in the spring, white, sometimes flushed pink without; perianth tube cylindric, 3-4 cm. long; limb broadly funnellform, expanding to 5 cm. wide; anthers 6 mm. long, the petaline slightly exceeding the sepaline in position by a quarter of their length; style 16 mm. long or shorter, erect; stigma white, suberect, rounded, included in the tube. *Zephyranthes Drummondii* D. Don. In e. and s.w. Tex. and adj. parts of Mex., Mar.-Aug.

2. *Cooperia Traubii* Hayward. Bulb globose, 16 mm. in diameter, the neck 28 mm. long; leaves 3 or 4, linear, glaucous, recumbent, to 23 cm. long; scape to 19 cm. high; spathe cylindric, about one third the length of the perianth tube, the slender tips 14 mm. long and acute; stipe none; flowers opening in the evening, white, often with tinge of reddish-pink on reverse of the three sepals; perianth tube very slender, (6-) 10-13 (-14) cm. long; limb often stellate, 3.3-7 cm. or more in diameter at full expansion; anthers 6-10 mm. long; filaments very short, 0.5-3 mm. long; style slender, both it and the stigma white, the latter with globose lobes and usually exserted (often to 1 cm. above the anthers). *Zephyranthes Traubii* (Hayward) Moldenke. From Brazoria, Refugio, Victoria and Calhoun cos., probably occurring also on grassy plains of Jackson, Matagorda, and perhaps of other counties near the Tex. Gulf Coast and n. of the Coastal Bend; endemic.

While most like *C. Drummondii*, it is more delicate in appearance, with the scape and perianth tube being more slender, the bulbs usually smaller, the filaments shorter, and the leaves generally narrower.

3. *Cooperia Drummondii* Herb. **CEBOLLETA**. Quite variable; bulb large, subglobose, 2 × 3 cm., the neck 2-9 cm. long, the tunics black; leaves 2 to 5, narrow-linear, gray-green, tending to be glaucous, erect or declinate, 3 dm. long; scape 10-33 cm. high; spathe about 4 cm. long, slit or looped at the tip, with its tube about 11 cm. long and greenish, often fading red; stipe none; flowers most frequently in the fall, sometimes in the summer, less frequently in the spring, white, the very slender tube 8-18 cm. long; perianth limb opening flat, white, pink-tinted on the outer surface; calyx lobes ovate to lanceolate, 24 mm. long, 13 mm. wide, with blunt tips, the corolla lobes just slightly smaller; flower expanding in the evening, sometimes lasting up to 4 days before it withers; anthers erect, creamy-yellow, 9 mm. long, attached one-third of length from base, filaments 4-8 mm. long; style white, sometimes shorter than the tube, sometimes exceeding the stamens. *Zephyranthes Herbertiana* D. Dietr., *Z. brazosensis* (Herb.) Traub. The most widely distributed *Cooperia* known, with its greatest frequency in Tex., but occurring from n. Mex. to Kan., N.M. and La., May-Sept.

4. *Cooperia Smallii* Alex. Bulb globose, with brown tunics, 25 mm. in diameter; leaves narrowly linear, bright-green, acute, channeled on upper side, 15 cm. long, to 3 mm. wide; scape greenish-tan, erect, 15-20 cm. tall; spathe 22-46 mm. long, tubular for 1.5-3 cm.; pedicel variable, from practically none to 35 mm. long; flowers usually appearing in profusion following heavy autumn rains; buds open in the afternoon; perianth tube green, 11-44 mm. long; perianth limb lemon-yellow, stellate or full; stamens erect; filaments 4-9 mm. long, subulate, fleshy or somewhat flattened, pure-white or with green bases; anthers linear, pale-yellow, about 8 mm. long; stigma (which is either exserted or among the anthers) with 3 globular whitish lobes. *Zephyranthes Smallii* (Alex.) Traub. Considerable evidence indicates this to be a natural first-generation hybrid between *Z. pulchella* and an unusual clone of *C. Drummondii*. Known only from Cameron Co., Tex.

5. *Cooperia Jonesii* Cory. Bulb subglobose, 2.5-3 cm. in diameter; leaves gray-green, narrowly linear, not acute, to 35 cm. long and 45 mm. wide; scape to 3 dm. tall; spathe 2-4 cm. long, tubular for 12-23 mm.; pedicel varying from none to 6 mm. in length; perianth tube 23-72 mm. long; perianth limb yellow, stellate or full, 2-5 cm. in diameter when fully expanded; buds open in the afternoon; filaments 1.5-7 mm. long, subulate, fleshy or flattened, pure-white or with green bases; style white, 6-7.5 mm. long; globose-lobed stigma sometimes below the anthers but more often exceeding them sometimes by as much as 5 mm. *Zephyranthes Jonesii* (Cory) Traub. Primary distribution in Refugio and San Patricio cos. but also extending into Victoria, Goliad, Nueces and Bee cos. Con-

siderable evidence indicates this to be a natural hybrid between *Z. pulchella* and *C. Drummondii*.

5. ZEPHYRANTHES HERB.³⁴

RAIN-LILY. ZEPHYR-LILY

Bulb globose or subglobose, tunicated, usually dark-brown; leaves linear, grasslike, with margins essentially parallel; scape hollow, slender, single-flowered, from a tubular spathe that is sometimes fenestrate but usually is 2-notched at apex; flower regular, erect to suberect, funnelform with short to long tube, the limb segments about equal; anthers erect to suberect, becoming versatile after anthesis, orange, affixed below the middle; stigma trifid, the lobes filiform to globose; capsule trilocular, rarely 4-celled; seeds few or many per cell, black, flat, D-shaped.

About 50 species in the warmer parts of the Western Hemisphere. The South American *Z. candida* Herb. escapes from cultivation and tends to become naturalized in southeast Texas (Liberty, Orange and Jefferson cos.). It has white flowers that are usually tinged rose on the outside, and leaves that are slightly thickened or raised on the edges.

1. Found in alkaline soils of west Texas; leaves narrow, not over 3 mm. in width and usually less; stigma deeply trifid1. *Z. longifolia*.
1. Found in less alkaline soils of south Texas coastal prairies; mature leaves more than 3 mm. wide (2)
- 2(1). Flowers bright (buttercup)-yellow, unscented; perianth tube 5 mm. long; stigma capitate and distinctly 3-lobed2. *Z. pulchella*.
2. Flowers a lighter yellow, with decided fragrance; perianth tube 15-24 mm. long; stigma shortly 3-lobed3. *Z. refugiensis*.

1. *Zephyranthes longifolia* Hemsl. Bulbs ovoid, 2-2.5 cm. in diameter; leaves very narrow, 15-23 cm. long, contemporary with the flowers in summer; flowers bright-yellow, coppery outside; spathe 2-2.5 cm. long; pedicel much shorter than the spathe; perianth 2-2.5 cm. long; tube short; stamens much shorter than the limb; stigma deeply trifid. *Atamosco longifolia* (Hemsl.) Cockll. On alkaline soils in Trans-Pecos and High Plains of w. Tex., Apr.-July; from Tex. to Ariz. and the highlands of cen. Mex.

2. *Zephyranthes pulchella* J. G. Sm. Bulbs globose, 1-2 cm. in diameter; leaves 3 or 4, appearing with flower, usually 2 dm. long or less, but occasionally to 3 dm. long, to 3.5 mm. wide; flowers yellow, usually appearing after heavy rains, unscented; perianth erect, 2 cm. long; tube 5 mm. long; stamens inserted at the throat, about 1 cm. long; suberect anthers curved; filaments diverse at anthesis; style equal to the stamens; stigma capitate, 3-lobed. *Atamosco pulchella* (J. G. Sm.) Greene, *Z. chrysantha* Greenm. & Thomps. Most often in swales and roadside ditches, throughout s. Tex. Coastal Prairies from Corpus Christi to Brownsville and westw., May-Oct.; endemic.

3. *Zephyranthes refugiensis* F. B. Jones. Bulb subglobose, 2-2.5 cm. in diameter, slightly broader than high, the neck 4-5 cm. long; leaves to 25 cm. long, 2-3 mm. wide at base and to 4 mm. at widest point; flowers dark-lemon-yellow (but lighter in color than those of *Z. pulchella*), appearing after heavy rains from July to Nov., reported to be fragrant; perianth erect, to 45 mm. long, the limb funnelform, the yellowish-green tube 15-23 mm. long; anthers suberect and curved, the filaments semipatent; stigma shortly 3-lobed. In open swales on prairies or in brushy pastures over a 200 square mile area mostly in Refugio Co., but to some extent in adjoining Goliad Co. A hybrid close to *Z. pulchella* with some introgression from *Cooperia Drummondii*; endemic.

6. HABRANTHUS HERB.

COPPER LILY

About 20 species in subtropical and warm temperate regions, mostly South America; we have one species.

1. *Habranthus texanus* (Herb.) Steud. Bulb ovoid, about 2 cm. in diameter; leaves basal, following the flower, short, narrowly linear; scape slender, to about 3 dm. tall, 1-flowered; spathe bifid, about 25 mm. long; perianth orange-yellow, sometimes tinged

³⁴ Contributed by Walter S Flory.

reddish on outer surface, 25-30 mm. long, broadly infundibuliform, somewhat zygomorphic and declinate, the subequal linear-oblong segments to 1 cm. wide and rounded-apiculate at apex; stamens fasciculate, unequal, of 4 different lengths; capsule subglobose, 3-lobed and -angled, about 15 mm. wide. *Zephyranthes texana* Herb., *Atamosco texana* (Herb.) Greene. In water among grasses, swales, moist pasturelands and other such places in e. Tex., w. to the Edwards Plateau and along the coast to the Rio Grande Plains, Aug.-Oct.; endemic.

7. CRINUM L.

Bulbous, the neck of the bulb often columnar like a caudex; leaves basal, often persistent, broad and thick, strap-shaped, not narrowed at base; flowers white or whitish, in some species striped or tinged with red, few or many in an umbel subtended by 2 large broad spathe valves, the pedicels short or none, the scape solid; perianth tube equaling or exceeding the essentially equal segments; stamens inserted at throat; filaments long and usually declinate; ovary inferior, globose to oblong or oval, with few ovules in each cell; style long, slender; stigma small, capitate; capsules bursting irregularly; seeds large, green.

About 100 species in warm temperate or tropical regions in both hemispheres.

1. Perianth segments much shorter than the tube 1. *C. americanum*.
 1. Perianth segments longer than the tube 2. *C. strictum*.

1. *Crinum americanum* L. SOUTHERN SWAMP LILY. Bulbs stoloniferous, 5-12 cm. in diameter, the neck short; scape to 9 dm. tall or more; leaves narrowly liguliform, to 15 dm. long and 5 cm. wide, sparingly denticulate; flowers white, sometimes marked with pink, fragrant, salverform, 2 to 6 in an umbel, essentially sessile; spathe valves broadly lanceolate, acuminate, 5-9 cm. long; perianth tube very slender, greenish, 10-12 cm. long; perianth segments much shorter than the tube, to about 15 mm. wide; stamens spreading, prominent; capsule globose, about 3 cm. in diameter, strongly beaked. In swamps, marshes, edge of water in ditches and lakes, in s.e. and s.-coastal Tex., May-Nov.; from Fla. and Ga. to Tex.

2. *Crinum strictum* Herb. Bulb small, ovoid, without a distinct neck; leaves 6, evergreen, suberect, to about 4 dm. long and 5 cm. wide, narrowly linear-lanceolate, bluntly acute at apex, with hyaline margins that are minutely toothed at varying intervals to 8 mm. apart; scape flattish, with rounded edges, rusty-reddish in lower third, to 3 dm. long; spathe valves lanceolate, the margins infolded, streaked reddish over moderate yellow-green, to 9 cm. long and 25 mm. wide at base, tapering to a bluntly acute to truncately notched apex; umbel 3- or 4-flowered; buds creamy-white streaked reddish for the most part on outside, upright at first then nodding slightly below; flowers fragrant, on pedicels 3-4 mm. long; perianth tube permanently slightly curved in upper fourth, 85 mm. long, 5-7 mm. in diameter; perianth segments white and streaked reddish on outer surface, narrowly lanceolate, acute-apiculate, about 11 cm. long and 15 mm. wide; stamens and styles red in upper three-fourths, prominently exerted; stamens 65 mm. long; anthers 13 mm. long; ovary oblong, 14 cm. long, about 9 mm. in diameter; style 32 mm. longer than the stamens; stigma minute. In wet soils, rare in s.e. Tex.

Var. *Traubii* Moldenke differs from var. *strictum* in its 7-flowered umbel, longer foliage that is deeper green in color, and flowers not so erect. Occurring with the species.

Crinum bulbispermum (Burm.) Milne-Redhead & Schweickerdt has been reported from Texas but no material has been seen of this plant. This species, a native of South Africa, is commonly cultivated. It may be distinguished by its outward-curved or even drooping flowers with contiguous and often declinate stamens and styles.

8. AGAVE L.³⁵ CENTURY-PLANT

Succulent rosette plants with long-lived leaves, flowering but once after 8 to 20 years, frequently suckering at base and occasionally bulbiferous in the inflorescence; roots

³⁵ Contributed by Howard Scott Gentry.

hard-fibrous, radiately and shallowly deployed; stems thick, very short, usually shorter than the terminal bud; leaves large, generally succulent, armed or unarmed on the margins, tipped with a hard sharp spine; inflorescence tall-scapose, spicate to racemose or paniculate with the flowers in umbellate clusters, bracteate; flowers mostly large, many, proterandrous; perianth tubular to shallowly funnelform, the six segments similar or dimorphic, imbricate in the bud; stamens six; filaments long-exserted, inserted in tube or on tepal base; anthers versatile; ovary inferior, 3-celled, succulent, thick-walled; ovules numerous, axile, in 2 rows; pistil elongate, filiform, tubular; stigma 3-lobate, papillate-glandular; fruit a dehiscent loculicidal capsule; seeds flattened, black (fertile).

Two hundred to two hundred fifty species all native to the Americas, many now world-wide in cultivation for fiber, food and ornamentals. Several species in the succulent collections of private and public gardens of Texas are not included here.

Several extra-Texas species have been reported from the state, including *A. applanata* Koch, *A. heterocantha* Zucc., *A. neglecta* Small and *A. scabra* Salm-Dyck. These reports are probably based upon misdetermined indigenous plants.

1. Inflorescence spicate or racemose; plants relatively small; flower tube shallow and open. (subg. *Littaea*) (2)
1. Inflorescence paniculate, the flowers borne in umbellate clusters on lateral branches; plants mostly large to medium size; flower tube deep. (subg. *Euagave*) (4)
- 2(1). Leaves with a firm gray to brownish sinuate horny border, the teeth 20 to 30 or more on each side; terminal spine weak, 1-1.5 cm. long 1. *A. lophantha*.
2. Leaves with a detachable white to gray nearly straight horny border, the teeth 10 to 20 on each side; terminal spine strong, 2-4.5 cm. long (3)
- 3(2). Leaves 2-3 cm. wide, light-green to yellowish, the lower surface (when fresh) checked with green lines 2. *A. lecheguilla*.
3. Leaves 5-7 cm. wide, dark-green to glaucous-green, the lower surface not checked with green lines 3. *A. chisosensis*.
- 4(1). Leaves large, 12-18 cm. broad; panicles large and broad with lateral branches sigmoid (5)
4. Leaves smaller, usually less than 10 cm. broad; panicles smaller, narrower, the lateral branches straight (8)
- 5(4). Leaves without teeth or with a few small teeth irregularly along the margins (cultivated) 4. *A. Weberi*.
5. Leaves always armed with prominent teeth along the margins (6)
- 6(5). Leaves asperous, the bases very broadly clasping the broad stem; teeth of leaves generally large and deflexed, the larger over 1 cm. long (native) 5. *A. asperrima*.
6. Leaves smooth, the bases less broadly clasping; teeth of leaves usually smaller, less than 1 cm. long, straight or flexed (7)
- 7(6). Leaves elongate, 10-17.5 dm. long, rarely shorter, always 7 to 9 times longer than wide (cultivated and native) 6. *A. americana*.
7. Leaves short and broad, 4-7.5 dm. long, only 3 or 4 times longer than broad (native) 7. *A. Havardiana*.
- 8(4). Leaves relatively broad, mostly 3 to 5 times longer than broad; panicles broad with the lateral peduncles 20-30 cm. long; flower tube deep, one half to two thirds as long as the tepals (9)
8. Leaves narrower, mostly 4 to 6 times longer than broad; panicles narrow, with short lateral peduncles only 5-15 cm. long; flower tube shallow, about one third as long as the tepals 8. *A. gracilipes*.
- 9(8). Large compact rosettes with many leaves 30-40 cm. long; teeth of leaves remote but little flexed 9. *A. Parryi*.
9. Small rather open rosettes with rather few leaves only 15-25 cm. long; teeth of leaves proximal and variously flexed 10. *A. neomexicana*.

1. *Agave lophantha* Schiede. THORN-CRESTED AGAVE. Small rather open light-green widely suckering rosettes, ours only 3-4 dm. tall; leaves 3-4 dm. long, 3-4.5 cm. wide, linear-lanceolate, spreading, usually straight, the horny margins continuous, firm, sinuate; teeth 4-6 mm. long, variously curved but not generally downflexed, usually with 1 to 3 secondary teeth along the midblade; terminal spine weak, 1-1.5 cm. long; spikes 3-5 m. tall, with acicular bracts conspicuously longer on the lower part of shaft; flowers short-pedicellate, in twos and threes, pale-green to yellowish-green, 3.5-4 cm. long, the ovary longer than tepals; tepals 15-20 mm. long, spreading, clasping the filaments after anthesis; filaments inserted on orifice of tube. Rare in Tex., on sandy soils in Starr and Zapata cos.; from s. Tex. s. along the Gulf Coast to Ver.

2. *Agave lecheguilla* Torr. LECHUGUILLA. Small widely suckering yellow-green rosettes 2.5-4 dm. tall; leaves 3-5 dm. long, 2-3 cm. wide, linear, straight to falcate or upcurving, when fresh checked with short green lines on lower surface, the narrow detachable margins usually with 8 to 12 downflexed teeth 4-7 mm. long and 2-4 cm. apart; terminal spine strong, 2-3.5 cm. long, brown and graying; spikes 2-3 m. tall; flowers in clusters of 1 to 3, 2.5-4 cm. long (base of ovary to tepal tips); ovary greenish-yellow, fusiform, 12-14 mm. long; tube shallow, open, 2-4 mm. deep; tepals 12-18 mm. long, spreading, linear, yellow to red or purplish, clasping filaments after anthesis; filaments yellow or red, 2.5-4 cm. long, inserted in tube; anthers yellow, 11-16 mm. long; capsules mostly oblong, 2-3 cm. long. Open arid calcareous rocky slopes in w. Tex., May-July; from s. N.M., s.e. across the Mex. highlands to State of Mexico.

Plants with irregular compound inflorescences occur at random in some Texas populations. These may be designated as *f. glomeruliflora* (Engelm.) Trel.

3. *Agave chisosensis* C. H. Mull. CHISOS AGAVE. Small to medium dark-green compact surculose rosettes 4-6 dm. tall, 5-8 dm. broad; leaves linear-lanceolate, long-acuminate, 4-5.5 dm. long, 6-7 cm. wide, spreading, thin, concave above, smooth, glaucous-green, the margins with a narrow horny detachable border adorned with rather regular remote light-gray upflexed teeth 4-6 mm. long; terminal spine 35-45 mm. long, grayish, openly grooved above, aciculate; inflorescence racemose, 5-6 m. tall; flowers short-pedicellate, borne in compact clusters of 10 to 12, "golden-yellow," about 45 mm. long; ovary about 15 mm. long; tube funnellform, 7-8 mm. long; tepals 2-2.2 cm. long, 7 mm. wide; filaments 4-5 cm. long, "inserted at the bases of the segments; capsules cylindrical, 3.5-4 cm. long, about 17 mm. thick, prominently longitudinally veined." Mts. in the Big Bend country of w. Tex., July; endemic.

This *Agave* shows a combination of the characters found in *A. lecheguilla* and *A. gracilipes* and appears to be of hybrid origin.

4. *Agave Weberi* Cels. WEBER AGAVE, MAGUEY LISO. Large green single thick-stemmed rosettes, 15-18 dm. tall and 2 m. broad; leaves 14-16 dm. long, 12-15 cm. wide, smooth, channeled, gracefully arching, linear-lanceolate, recumbent with drought or at maturity, the margins smooth or with a few minute to small teeth; terminal spine about 5 cm. long, acicular but flattened above; panicles 7-8 m. tall, with 12 to 18 wide-spreading umbels of bright-yellow flowers; flowers 7-8 cm. long, the tube and neck deeply furrowed; ovary 3.5-4 cm. long, green; tube 1.8-2 cm. deep; tepals 21-24 mm. long, involute, persisting erect in wilting; filaments 5.5-6 cm. long at anthesis, inserted 11-13 mm. above bottom of tube; anthers 3 cm. long, Cult. along Route 83, Webb County, known only in cult., summer; described originally as from Moctezuma, S. L. P., Mex.

Bulbils have been reported to form in the inflorescence.

5. *Agave asperrima* Jacobi. ROUGH AGAVE, MAGUEY CENIZO. Medium to large gray-glaucous suckering rather open rosettes with very broad short stems; leaves asperous, 7-11 dm. long, 12-18 cm. wide, lanceolate, long-acuminate, deeply channeled, sometimes narrowed below midblade but very broadly clasping at the base, thick, the margins teated and heavily armed with downflexed teeth, brown and asperous-graying in age; terminal spine strong, 3-6 cm. long, mostly dark-brown; panicles 5-7 m. tall, broad and open, with 10 to 14 lateral branches in upper third of shaft with densely flowered umbels; flowers yellow, 6-8 cm. long; ovary green, 3-4 cm. long; tube 13-18 mm. deep, 14-16 mm. broad; tepals 18-26 mm. long, wilting at anthesis; filaments 55-65 mm. long, inserted 9-12 mm. above bottom of tube; anthers 2.5-3 cm. long. Sandy and calcareous soils in Starr, Webb and Zapata cos.; s. Tex. and throughout the desert of n. Mex. to S. L. P.

6. *Agave americana* L. CENTURY PLANT, MAGUEY. Medium to large glaucous-gray freely suckering rosettes, 1.5-2 m. tall, 2 m. broad, the wild forms in Texas much smaller;

leaves 12-17 dm. long, 1.4-2 dm. wide, lanceolate, acuminate, somewhat channeled and frequently some leaves reflexed, smooth, the margins repand with moderate teeth and broad-based teeth (the latter brown and graying) mostly 5-8 mm. long; terminal spine 2.5-5 cm. long, subulate, brown aging grayish; panicle 5-7 m. tall, long-oval in outline, with 18 to 30 sigmoid lateral branches in upper half of shaft, the large umbels of greenish-yellow flowers loosely spreading; ovary (at anthesis) small and tapering to base, 32-35 mm. long; tube 8-15 mm. deep, 16-20 mm. broad; tepals 25-32 mm. long, wilting and curling after anthesis, unequal; filaments 6-9 cm. long, inserted 6-12 mm. above bottom of tube; anthers 28-35 mm. long. June-July in s. Tex.

This is a polymorphic species with many varieties cultivated throughout the warmer regions of both hemispheres. A rather typical variety of the Linnean species occurs in cultivation about Laredo. A small wild form occurs also in south Texas as an outlyer of the many wild forms in adjacent Mexico. Horticultural varieties with yellow-striped leaves are also cultivated in Texas. They are also large plants with leaves even more flaccid than in typical *A. americana*. Trelease has designated these colored forms as: var. *marginata*, yellow or white margins; var. *striata*, variously lined leaves; var. *medio-picta*, broad median yellow band.

7. *Agave Havardiana* Trel. HAVARD AGAVE. Medium-sized stiff-leaved glaucous-green depressed-globose mostly single rosettes, 4-6 dm. tall, 5-8 dm. broad, sparingly surculose; leaves mostly 4-7 dm. long, 15-17 cm. wide, broadly lanceolate to almost triangular-lanceolate, thick, rather smooth, gray-green, roundly channeled, the upper teeth larger and mostly 5-10 mm. long and deflexed, the lower teeth ever smaller downwards, teeth sometimes lacking on lower third of margins; terminal spine strong, subulate, 4-5 cm. long, brown to gray; panicles 3-5 m. tall, broad, massive, open, with 12 to 15 large umbels; flowers mostly greenish-yellow, the tepals frequently tinged red or ferruginous, 7-8 cm. long; ovary 3-3.6 cm. long, thick, with a short neck; tube 16-22 mm. deep, 14-18 mm. broad; tepals fleshy, unequal, 18-24 mm. long, rather narrow and wilting inward; filaments 5-6.5 cm. long, inserted in mid-tube; anthers 2.8-3 cm. long; capsules oblong to obovoid, 45-55 mm. long, 15-18 mm. thick, abruptly beaked; seeds 5 × 6-7 mm. Endemic to the rocky mt. slopes in the Big Bend country of Tex., June-July.

8. *Agave gracilipes* Trel. SLIM-FOOTED AGAVE. Small compact yellow-green to gray-green surculose rosettes 3-4 dm. tall, 7-8 dm. broad; leaves numerous, 1.8-3 dm. long, 5-7 cm. wide, patulous, lanceolate, rather short-acuminate, stiff, smooth, the margins well-armed with proximal or remote teeth 5-6 mm. long; terminal spine 15-35 mm. long, stout, flattened above, dark-brown to gray, decurrent, sometimes to midblade; panicle 4-5 m. tall, usually narrow and closely branched with 20 to 30 lateral branches in upper half to third of shaft; flowers yellow, in small umbels, 4-5.8 cm. long; ovary 2.2-3 cm. long, fusiform, green; tube 5-7 mm. deep, openly funnelform; tepals 15-17 mm. long, narrow, involute, yellow, sometimes flushed russet; filaments slender, 28-43 mm. long, inserted on orifice of tube; anthers 1.6-2 cm. long, yellow; capsules 3.5-4 cm. long, 15-17 mm. thick, oblong, short and broadly stipitate; seeds 6 × 4-4.5 mm., shiny black. Open rocky piedmonts of the Big Bend country in w. Tex. and in adj. N.M., latter June-Oct.

North of Allamore, in Hudspeth Co., this species appears to hybridize with *A. lecheguilla*.

9. *Agave Parryi* Engelm. PARRY AGAVE. Compact depressed-globose medium-sized gray-green multileaved widely suckering rosettes 3-5 dm. tall, 5-7.5 dm. broad; leaves 3-4.5 dm. long, 7-10 cm. wide, short-lanceolate, thick, rigid, concave above, nearly smooth, ashy-gray to light-green; teeth few, remote, the larger towards apex and 4-6 mm. long, slender; terminal spine 25-35 mm. long, subulate, flattened above and decurrent on leaf edge for several cm.; panicles 3.5-4.5 m. tall, stout, with 18 to 24 strong lateral branches with large umbels of yellow flowers in upper half of shaft; flowers 5.5-6 cm. long; ovary about 3 cm. long; tube 1-1.2 cm. deep, openly conical; tepals 15-18 mm. long, 5 mm. wide; filaments 5.5-6 cm. long, inserted near upper edge of tube; capsules 3.5-4 cm. long, about 2 cm. thick, oblong or pyriform, little-stipitate, beaked. Slopes of the Guadalupe Mts. in Trans-Pecos Tex., summer; from cen. Ariz. n. of the Gila River, e. to w. Tex. and n. Chih.

10. *Agave neomexicana* Woot. & Standl. NEW MEXICO AGAVE. Small rather open sometimes depressed closely suckering light-green to glaucous rosettes, 2.5-4 dm. tall, 3-7 dm. broad; leaves 1.8-3 dm. long, 5-8 cm. wide, lanceolate to triangular, short- or long-

acuminate, thick, rigid, concave above, smooth, the margin repand with larger teeth above the midblade 3-8 mm. long, merely curved; terminal spine 1.5-5 cm. long, slender, grooved or flattened above, brown to gray; panicle 2.5-3.5 m. tall, with 9 to 14 ascending lateral branches in upper third of shaft, many-flowered; flowers reddish in bud, 5-6 cm. long when open; ovary 3-3.5 cm. long, light-green; tube broadly funnelform, 8-12 mm. deep; tepals 1.4-2 cm. long, 5 mm. wide, thin, yellow to orange; filaments 35-40 mm. long, inserted 6-10 mm. above bottom of tube; anthers 2-2.3 cm. long, light-orange; capsules light-brown, 2.5-3.5 cm. long, 1.5-2 cm. thick. In mts. of w. Tex. and s.e. N.M., June-July.

9. POLIANTHES L.³⁶

AMERICAN ALOE

Glabrous perennial with a thick fibrous-rooted crown and usually somewhat bulbous; leaves soft, thick-herbaceous, somewhat fleshy, their margins entire to scabrous or minutely toothed, clustered at the base of the many-flowered scape; flowers in spikelike racemes; perianth tubular-funnelform, persistent, 6-parted, the narrow divisions nearly equal; stamens 6; anthers linear, versatile; capsule coriaceous, 3-celled, with numerous flattened seeds.

About a dozen species in southwestern United States, Mexico and the West Indies.

- 1. Filaments very short or absent, the anthers slightly or not exerted 1. *P. Runyonii*.
- 1. Filaments moderately to very long, the anthers well-exserted (2)
- 2(1). Perianth lobes 3-8 mm. long; in north-central and eastern Texas (3)
- 2. Perianth lobes 10-15 mm. long; in south-central and far south Texas (4)
- 3(2). Perianth (including ovary) 20-23 mm. long; anthers 8-10 mm. long 2. *P. virginica*.
- 3. Perianth (including ovary) 26-35 mm. long; anthers 13-15 mm. long 3. *P. lata*.
- 4(2). Filaments exerted to less than twice the length of the perianth lobes; capsule distinctly stipitate 4. *P. maculosa*.
- 4. Filaments exerted to 3 to 6 times the length of the perianth lobes; capsule essentially sessile 5. *P. variegata*.

1. *Polianthes Runyonii* Shinn. RUNYON'S HUACO. Stems bulbous, crowning a short thick rootstock; roots thickened, fleshy, in clusters; basal leaves 5 to 7, linear, elongate, spreading, serrulate, 1-2 dm. long, spotted; stem leaves 2 or 3, small, bractlike; flowering stem slender, erect, greenish-purple, 3-10 dm. long, simple, terminated by a very open spike; flowers relatively few, solitary in the axils of small bracts; perianth slender, salverform, greenish-white at first, brick-red in age, the tube about 35 mm. long, the segments oblong and spreading; stamens 6; anthers sessile, inserted at the top of the tube, exerted; fruit small, nearly globular, about 35 mm. in diameter; seeds black, flattened. *Runyonia longiflora* Rose. Open areas in the Rio Grande Valley, summer; endemic.

Polianthes tuberosa L. ("nardo"), a species closely allied to *P. Runyonii*, is often cultivated in Texas. It is distinguished from *P. Runyonii* by its entire, smooth leaf margins and white perianth.

2. *Polianthes virginica* (L.) Shinn. FALSE ALOE, RATTLESNAKE-MASTER. Leaves all from the base, about 10, at first erect then spreading, nearly flat, lanceolate to somewhat oblong-spatulate, about 2 dm. long and 3 cm. wide above the middle, gradually tapered to the narrow base, at apex tapered rather abruptly into a slender acumination with a weak point, green but somewhat mealy, not at all spotted to somewhat spotted or mottled, the margins slightly serrulate; scape 7-8 dm. high or more, about 7-bracteate, glaucous; spike about 6 dm. long and 30-flowered; flowers solitary and distant, the lower ones on pedicels 6-8 mm. long, the upper ones short-pedicelled; ovary 14 mm. long, somewhat constricted above; perianth greenish, less than 25 mm. long; perianth segments about 8 mm. long, erect, the margins involute, hairy at tip; stamens shortly exerted; filaments dark-purple, inserted near base of the tube; anthers whitish, spotted with brown; style shorter than the stamens; capsule globose, 1.4-2 cm. in diameter. *Agave virginica* L.,

³⁶ Adapted from Lloyd H. Shinn in *Sida* 2(4): 333-338. 1966.

Manfreda virginica (L.) Salisb. In pine and mixed forests, open woods and gravelly slopes and old fields in e. Tex., June-Aug.; from Fla. to Tex., n. to Va., W.Va., O., Ind., Ill. and Mo.

Those plants with spotted or mottled leaves that occur with plants with green leaves are designated as *f. tigrina* (Engelm.) Shinners.

3. *Polianthes lata* (Shinners) Shinners. Plant from a pithy corm 2-3.5 cm. long and 1-2 cm. thick, with numerous thick fleshy-fibrous roots from the lower part; leaves 4 to 10, bluish-gray-green, herbaceous, fleshy, mostly basal, elliptic to broadly lanceolate, 10-18 cm. long, 3-7 cm. wide, short-acuminate, glabrous, spinulose-serrulate, rather stiffly ascending, deeply concave, of nearly uniform thickness; leafy bracts of scape narrowly ovate-lanceolate to triangular-lanceolate, clasping by a very asymmetrical base, those at base of inflorescence to 18 mm. long; scape 6-10 dm. high, erect, glabrous, rather stout; raceme spikelike, the spicy-scented flowers rather crowded on upper fourth; pedicels shorter than their subtending bracts; perianth (including the ovary) 26-35 mm. long, yellowish, strongly flecked or suffused with red-brown upward, the tip wholly red-brown, the lanceolate lobes 5-7 mm. long and 2.5-3 mm. wide at base; filaments strongly clavate, flattened, ultimately exerted 15-25 mm. beyond the perianth, attached about 5 mm. above base of tube; anthers linear, 13-15 mm. long, deciduous from the persistent filaments; immature capsule oblong- to ovoid-globose, glabrous, about 15 mm. long (exclusive of the abrupt necklike base about 2 mm. long), crowned by the persistent perianth. *Agave lata* Shinners. In oak woods and prairies in n.-cen. Tex., June-July; also Okla.

4. *Polianthes maculosa* (Hook.) Shinners. Basal leaves 6 to 10, narrowly lanceolate, recurved, blotched with brown or sometimes green, the margins serrulate; scape 3-6 dm. high or more, with about 6 small bracts, purplish; flowers as many as 25, nearly sessile, almost 5 cm. long (including the ovary); tube narrowly funnel-shaped, a little longer than the purplish or greenish-white somewhat spreading lobes; filaments a little shorter than the perianth lobes; anther cells exerted, brownish; stigmas 3-lobed; capsule globose-oval to globose-subquadrate, 20-25 mm. long, slightly pointed. *Agave maculosa* Hook., *Manfreda maculosa* (Hook.) Rose. In thickets in sandy-clayey soils in s.-cen. Tex., Apr.-July; endemic.

5. *Polianthes variegata* (Jacobi) Shinners. HUACO, TEXAS TUBEROSE. Basal leaves few, 3-4 dm. long, 25-50 mm. wide, mainly lanceolate, deeply channeled, finely toothed, spotted; scape 9-12 dm. high, loosely flowered; perianth greenish-brown, glaucous without, the tube broadly funnel-shaped, 8-10 mm. long, the oblong lobes about 12 mm. long; stamens about 5 cm. long, inserted near top of tube; ovary (including slender beak) 4 mm. long; capsule oblong-ellipsoid, cuspidate, 15-22 mm. long. *Agave variegata* (Jacobi) Rose, *Manfreda variegata* (Jacobi) Rose. On prairies and chaparral-covered hills in the Rio Grande Valley and Plains, May-July; also adj. Mex.

FAM. 40. DIOSCOREACEAE R. BR.

YAM FAMILY

Herbaceous or woody twining vines, from slender or thickened rhizomes or tubers, with whorled to opposite or alternate mostly cordate net-veined petioled leaves and axillary panicles, racemes or spikes of minute flowers; flowers regular, perfect or unisexual; perianth 6-parted with the sepals and petals similar; stamens 6 or 3, with short filaments and ovoid to globose anthers whose sacs often become divergent; ovary inferior, 3-celled; ovules 1 or 2 in each cell; styles 3, simple or with each branched; fruit a 3-angled or -winged capsule or berry.

Comprising about 750 species in 5 genera, mostly tropical and warm temperate.

1. DIOSCOREA L.

YAM

Plants dioecious; aerial stems slender or stoutish and more or less twining; flowers very small, unisexual, in axillary panicles or racemes; capsule loculicidally 3-valved by splitting through the winged angles; seeds flat, with a membranaceous wing.

About 600 species, mostly tropical and subtropical. The large storage roots of *D. alata* L. provide one of the chief foods in tropical regions, and those of some Mexican species are the source of the drug cortisone.

1. Leaves of one or more lower nodes in whorls of 4 to 7; petioles rarely less than 7 cm. long, usually densely pubescent at base and at juncture with leaf blade 1. *D. quaternata*.
1. Leaves of lower nodes at most opposite or with 3 approximate; petioles rarely more than 6 cm. long, glabrous 2. *D. villosa*.

1. *Dioscorea quaternata* (Walt.) J. F. Gmel. Aerial stems to 3 m. long or more, usually erect below and leaning or twining above, from a somewhat irregularly contorted more or less branched rhizome that is 10-15 mm. thick; leaves in whorls of 4 to 7 at one or more of lower nodes, becoming opposite or alternate above; mature petioles rarely less than 7 cm. long, typically pubescent at base and at juncture with leaf blade; capsules 2.5-3 cm. long; seeds 18 mm. broad. Moist rich woods in n.e. Tex., Apr.-June; from n.e. Pa., s. to n.w. Fla., w. to Ill., Mo., Okla. and n.e. Tex.

2. *Dioscorea villosa* L. Aerial stems to 5 m. long, twining, from a rather straight slender rhizome that is 5-10 mm. thick; leaves all alternate or with only the lower opposite or approximate; mature petioles rarely more than 6 cm. long, typically glabrous; capsules 12-25 mm. long; seeds to 12 mm. broad. *D. paniculata* Michx. Low moist woods and thickets of e. Tex., Apr.-June; from s. N.E. to Minn., s. to s.e. Va., O., Tenn., Ark. and e. Tex.

FAM. 41. IRIDACEAE JUSS. IRIS FAMILY

Perennial or annual mostly caulescent herbs with short or long rootstocks; leaves equitant, mostly elongate; flowers perfect, mostly regular, arising from spathe-like bracts; perianth composed of an outer and inner series of 3 segments each; stamens 3, the filaments partially adnate to the perianth; carpels 3, united; ovary inferior; styles entire or variously divided, sometimes petal-like; ovules few to many; fruit a loculicidal 3-valved capsule.

About 1,000 species in nearly 60 genera of wide geographic distribution.

1. Rootstock neither a bulb nor a corm (2)
 1. Rootstock a bulb or corm (4)
 - 2(1). Roots clustered at base of plant, fibrous or tuberous-thickened; plants delicate, mostly less than 4 dm. high; leaves grasslike; perianth tube absent 1. *Sisyrinchium*, p. 425.
 2. Rootstock a rhizome; plants coarse, usually more than 4 dm. high; leaves broad; perianth tube present (3)
 - 3(2). Style branches expanded and petal-like, concealing the stamens; perianth usually bluish, reddish or yellow, not noticeably spotted, the tube well-developed 2. *Iris*, p. 428.
 3. Style branches neither expanded nor petal-like, the stamens clearly visible; perianth orange-color with conspicuous crimson or purple spots, the tube much-abbreviated 3. *Belamcanda*, p. 430.
 - 4(1). Style arms only briefly bifid at the apex; capsule narrowly cylindrical, about 1 cm. long 4. *Alophia*, p. 430.
 4. Style arms deeply divided (5)
 - 5(4). All perianth segments subequal; capsule commonly obovoid, usually less than 1 cm. long; style divided to near base 5. *Nemastylis*, p. 431.
 5. Inner perianth segments markedly larger than the outer ones, spreading; capsule ellipsoid; style forming a tube about 5 mm. long before dividing 6. *Eustylis*, p. 432.

1. SISYRINCHIUM L.³⁷ BLUE-EYED GRASS

Annual or perennial herbs; roots fibrous to tuberlike; leaves grasslike; flowers single or in small clusters; perianth regular; tepals similar, often alternating wide and narrow; stamens united into a column or free to the base.

³⁷ Contributed by Royce L. Oliver.

About 125 species in the Western Hemisphere. In addition to the following species, *Sisyrinchium occidentale* Bickn. has been reported from west Texas but the status of this plant has yet to be clarified.

1. Plants annual; flowers variously colored, not blue (2)
1. Plants perennial; flowers blue to blue-purple, white in blue population or white, with simple stems or sessile spathes (4)
- 2(1). Ovaries and capsules 1.5 times as long as broad ... 1. *S. minus*.
2. Ovaries and capsules subglobose to broadly oblong (3)
- 3(2). Flowers variously colored, not yellow; tepals 9-16 mm. long; capsules 3-4.2 mm. wide 2. *S. rosulatum*.
3. Flowers yellow with red-brown eye ring; tepals 5-10 mm. long; capsules 2.7-3.5 mm. wide 3. *S. exile*.
- 4(1). Stems without leafy bracts (5)
4. Stems with leafy bracts (9)
- 5(4). Spathes dry and brown, often tinged violet 4. *S. sagittiferum*.
5. Spathes dark-green to yellow-green, sometimes purple at nodes (6)
- 6(5). Floral bracts about the same length 11. *S. biforme*.
6. Outer floral bract much longer than the inner (7)
- 7(6). Outer floral bract connected for 4-7 mm. at base (8)
7. Outer floral bract connected for 3 mm. or less at base .. 6. *S. campestre*.
- 8(7). Plants of central and south Texas, drying olive-green 12. *S. dimorphum*.
8. Plants of north Texas, drying light-green 5. *S. montanum*.
- 9(4). Spathes peduncled 4 mm. or less from a leafy bract or sessile and peduncled on the same plant 7. *S. albidum*.
9. Spathes peduncled more than 4 mm. from a leafy bract (10)
- 10(9). Stems broadly winged with each wing as broad as the stem and at least 1 mm. wide 8. *S. angustifolium*.
10. Stems not broadly winged (11)
- 11(10). Plants very erect; stems 5 to 7 times as long as the peduncles 9. *S. atlanticum*.
11. Plants spreading to erect; stems shorter to 3 times as long as the peduncles (12)
- 12(11). Spathes dry and brown, usually tinged violet 4. *S. sagittiferum*.
12. Spathes green, sometimes purple at nodes (13)
- 13(12). Pedicels 6-11 mm. longer than the spathes; capsules upright; plants erect; stems few or solitary 10. *S. demissum*.
13. Pedicels shorter, to 4-5 (-10) mm. longer than the spathes; capsules spreading to pendent; plants spreading to erect; stems often numerous (14)
- 14(13). Pedicels shorter than the spathes; stems (1.5 to) 2 to 6 times as long as the more robust leafy bracts, usually with and without leafy bracts on the same plant (15)
14. Pedicels usually longer than the spathes; stems shorter, to 1.5 times longer than the more robust leafy bracts, always with leafy bracts (16)
- 15(14). Mature capsules broadly oblong, 5-7 mm. high; tepals 7-13 mm. long; wings and stems drying about the same color 11. *S. biforme*.
15. Capsules globose to subglobose, 4-5 mm. high; tepals 5-8 mm. long; wings drying dark, the stems light 12. *S. dimorphum*.
- 16(14). Ovaries usually glabrous; plants drying medium- to olive-green; in central Texas 13. *S. pruinatum*.
16. Ovaries minutely pubescent; plants usually drying light-green to glaucous; in east or west Texas (17)

- 17(16). Narrower tepals 1.3 to 3.3 times longer than broad; bracts 6 to 12.5 times longer than broad; leaves 2-4 mm. wide; plants of central and west Texas 14. *S. ensigerum*.
17. Narrower tepals (2.5 to) 3 to 5 times longer than broad; outer bracts 7.5 to 18 times longer than broad; leaves 1-2 mm. wide; plants of east Texas 15. *S. Langloisii*.

1. *Sisyrinchium minus* Engelm. & Gray. Plants prostrate to erect, 4-22 cm. tall, often forming rosettes; stems with 1 or 2 leafy nodes and a leafy bract; spathes often broad and foliaceous; outer floral bract 5-10 mm. longer than inner; pedicels usually shorter than floral bracts; flowers usually lavender-pink to purple-rose, occasionally white, rarely yellow; capsule 4-5 mm. high, recurving to pendent. *S. Thurowii* Coult. & Fish. In sandy or silty soil in s. Coastal Plains to cen. Tex., Mar.-May; also La., introd. elsewhere.

2. *Sisyrinchium rosulatum* Bickn. Plants usually erect, 13-36 cm. tall; leaves 2-4 mm. wide, one fourth to one half the height of plant; flowers vary from white to lavender-rose, with rose-purple eye ring; filaments free about 0.5 mm.; base of staminal column urn-shaped. *S. laxum* of auth. Weedy along roadsides and old fields from Gulf Coast to s.e. Tex., Apr.-May; Fla. to Tex., n. to N.C., Ark.; nat. of S.A.

Hybridizes with *S. exile* giving flower colors of mauve, scarlet or yellow, with or without variously colored eye ring and stripes along veins.

3. *Sisyrinchium exile* Bickn. Plants 5-19 cm. tall, usually erect; stems sometimes simple; leaves 0.5-3 mm. wide; filaments free about 0.5 mm.; staminal column urn-shaped at base. *S. Brownii* Small, *S. micranthum* of auth. Sandy roadsides and old fields from Gulf Coast to s.e. Tex., Apr.-May; Fla. to Tex.; nat. to S.A.

Hybridizes with *S. rosulatum*.

4. *Sisyrinchium sagittiferum* Bickn. Plants 1-3 dm. tall; fibrillose fibers at base; leaves erect, one half to three fourths height of plant; floral bracts equal or outer to 3 cm. longer than inner; flowers blue-purple; capsules 3-4 mm. high, on spreading pedicels. *S. texanum* Bickn. (hybrid form). In low wet areas in e. Tex., occurs mostly in hybrid form n. of Gulf Coast, Mar.-Apr.; also La.

Hybridizes with *S. Langloisii* and with *S. pruinatum* giving plants with branched stems; and with *S. albidum* giving *albidum*-like plants with chartaceous bracts.

5. *Sisyrinchium montanum* Greene. Plants 20-35 cm. tall; leaves 2-3 mm. wide and one third to as tall as the plant; flowers blue; tepals 8-10 mm. long; capsules 6-7 mm. high. River bottoms in e. Panhandle of Tex., Apr.-June; Nfld. to n. B.C., s. to Que., s. Ont., N.Y., n. Ind., n. Ill., Neb. and Tex.

6. *Sisyrinchium campestre* Bickn. Plants 15-28 cm. tall; stems narrow, broadly winged; leaves about same width as the scapes and one half to three fourths the height of plant; outer floral bract about twice as long as the inner; flowers white to light-blue; capsules 3-4 mm. high, on spreading pedicels. Prairies in n.e. Tex., Apr.-May; Wisc. to Man., s. to Tex. and La.

Hybridizes occasionally with *S. pruinatum*.

7. *Sisyrinchium albidum* Raf. Plants 23-40 cm. tall; usually with heavy fibers at base; stems narrow, broadly winged; leafy bract 3.5-13 mm. long; spathes 1 to 4, sessile or with peduncles to 4 mm. long; flowers white to light-blue. In open woods and exposed areas of e. Tex., Mar.-Apr.; Ala. to Tex., n. to N.C., s. Ont., s. Mich., s. Wisc. and Mo.

Hybridizes with *S. Langloisii* to produce very elongated leafy bracts and peduncles 5-10 mm. long; and with *S. sagittiferum* to produce brown chartaceous bracts. Most plants in Texas are atypical for the species.

8. *Sisyrinchium angustifolium* Mill. Plants 15-30 cm. tall, erect to slightly spreading, branched or simple and branched on same plant, drying olive-green, darkening with age; basal leaves erect, one fourth to three fourths as high as the plant; peduncles 1 to 3, 1-5 mm. longer than the subtending leafy bract; outer floral bract longer than inner; flowers blue to blue-violet, rarely white; capsules 4-5.5 mm. high, on erect or recurving pedicels. *S. bermudianum* of auth., *S. graminoides* Bickn., *S. gramineum* Curt. Differs somewhat from plants of e. U.S. In low wet areas in e. Tex., Apr.-May; Fla. to Tex., n. to s.e. Nfld., s. Que., s. Ont., O., Ind., Ill., Mo. and e. Kan.

9. *Sisyrinchium atlanticum* Bickn. Plants erect from coarse roots, 23-57 cm. tall, drying light-green; fibers present or absent at base; stems 17-43 cm. long; peduncles 3-7

cm. long; flowers blue, occasionally white; tepals 8-11 mm. long; capsules 4-5 mm. high, drying dark. In wet areas of s.e. corner of Tex., Apr.-May; Fla. to Tex., n. to n. N.S., N.Y., n. O., s. Mich. and Ark.

10. *Sisyrinchium demissum* Greene. Plants 22-72 cm. tall, drying light-green; stems erect, 1-3 mm. wide, the wings about one half the width of stems; leaves 2-3 mm. wide, less than one half the height of plant; peduncles to 17 cm. long; tepals blue, 1 cm. long; capsules 6-7 mm. high. *S. longipedunculatum* Bickn. Along streams in Guadalupe Mts. of Tex., June-Aug.; from Tex. to Calif., n. to Ore., Colo.; also n. Mex.

11. *Sisyrinchium bifforme* Bickn. Plants erect, 14-38 cm. tall; roots coarse; stems very narrowly winged; leaves 1-3 mm. wide; capsules 6-7 mm. high. In sandy soil of beaches and offshore islands of Tex., Dec.-June; also La.?, Mex.

12. *Sisyrinchium dimorphum* R. Oliv. Plants 9-32 cm. tall, drying olive-green; roots coarse; stems with or without leafy bracts, the wings less than one half the width of stem; leaves one half to three fourths the height of plant; flowers blue, sometimes white; tepals 5-9 mm. long, 1.5-3 mm. wide; capsules about 5 mm. high. Along streams in Edwards Plateau and Trans-Pecos, Apr.-July; also n. Mex.

13. *Sisyrinchium pruinatum* Bickn. Plants 9-30 cm. tall, spreading to erect; stems usually numerous; leaves 1-3 mm. wide; flowers violet-purple to purple-blue, rarely white; capsules 4-6 mm. high. *S. amoenum* Bickn., *S. Brayi* Bickn., *S. Bushii* Bickn., *S. colubri-ferum* Bickn., *S. Helli* Bickn., *S. varians* Bickn. Clay and sandy clay on roadsides and open areas in prairies and oak belts to Coastal Prairies of Tex., Apr.-May; also Okla. and Ark.

Hybridizes with *S. ensigerum*, *S. Langloisii* and *S. sagittiferum* where their ranges overlap.

14. *Sisyrinchium ensigerum* Bickn. Plants 15-47 cm. tall, usually erect; stems few to numerous; flowers purple-blue; capsules 4-7 mm. high. Clay, limestone or sandy soil in Grand Prairie, Edwards Plateau and s. Texas plains westw., Apr.-May; also Okla. and n. Mex.

Hybridizes with *S. pruinatum*, and shows similarities to the Mexican species *S. scabrum* Schlecht. & Cham. in the Trans-Pecos.

15. *Sisyrinchium Langloisii* Greene. Plants 9-35 cm. tall, mostly erect; stems usually numerous; leaves narrow; flowers light violet-blue to purple-blue; capsules 3.5-4.5 mm. high. *S. Canbyi* Bickn., *S. flaccidum* Bickn., *S. furcatum* Bickn. Roadsides and open areas of e. Oak Belt and Pine Belt of Tex., Apr.-May; also La., Miss. and Ark.

Hybridizes with *S. pruinatum*, *S. albidum* and *S. sagittiferum* where their ranges overlap.

2. IRIS L. IRIS. FLEUR-DE-LIS

Perennials from a creeping more or less tuberous rhizome; leaves ensiform or lanceolate, commonly grasslike; flowers large and showy, mostly purplish or bluish (in ours); tube of the perianth commonly extended beyond the ovary; stamens distinct, the linear or oblong anthers sheltered under the over-arching petal-like branches of the style that bear the stigma in the form of a thin lip or plate under the apex; most of the style connate with the perianth segments to form a tube; capsule 3- or 6-angled, usually coriaceous; seeds depressed-flattened or plump, usually in 2 rows in each cell.

More than 200 species in the Northern Hemisphere, most frequent in Asia. Cultivated *Iris* tend to maintain themselves about abandoned farms and homesteads, the most common of these are *I. pallida* Lam., *I. tingitana* Boiss. & Reut. and *I. xiphium* L.

1. Flowers bright- to golden-yellow throughout or dark-red to reddish-brown (2)

1. Flowers in shades of blue to purplish-blue or rarely whitish (3)

2(1). Flowers bright- to golden-yellow throughout; tepals entire at apex; capsule 3-angled; introduced species1. *I. Pseudacorus*.

2. Flowers dark-red to reddish- or coppery-brown; tepals notched at apex; capsule 6-angled; native species2. *I. fulva*.

- 3(1). Leafy bract subtending spathes less than or slightly longer than the spathes, or absent; ovary and capsule 3-angled 3. *I. virginica*.
3. Leafy bract subtending spathes usually more than twice as long as the spathes; ovary and capsule 6-angled (4)
- 4(3). Largest leaves mostly about 15 mm. wide, essentially erect; inner 3 perianth segments usually notched at apex 4. *I. hexagona* var. *flexicaulis*.
4. Largest leaves more than 20 mm. wide, arcuate-spreading; inner 3 perianth segments rounded to subacute at apex 5. *I. brevicaulis*.

1. *Iris Pseudacorus* L. **YELLOW-FLAG**. Rhizome stout and extensively spreading; leaves erect, somewhat arched and nodding at tip, linear-attenuate, about 2 cm. wide, forming clumps to about 1 m. tall; flowering stalk stout, erect, about as tall as clump of leaves, with 1 or 2 short leafy bracts; flowers 1 or 2 together at apex of flower stalk, also often in the axil of the upper leaf; involucral bracts 2, shorter than flower; the 3 outer perianth segments 5-8 cm. long and arching, clear-yellow or sometimes with flecks of brown at base and on claw, with suborbicular to ovate blade and a broad claw with involute edges; the 3 inner perianth segments yellow, linear to linear-pandurate, obtuse, to about 25 mm. long; capsule cylindric-prismatic to ellipsoid, 5-8 cm. long, bright-green, often lustrous, turgid, bluntly 3-angled; seeds suborbicular or somewhat angular from pressure, corky, about 7 mm. in diameter. Usually standing in 1 to 3 feet of water in ponds, in open woods, rare in s.e. Tex. (known only from Hardin Co.), Apr.-May; introd. from Euras. and Afr., rather aggressive as an escape from cult.

2. *Iris fulva* Ker. **RED-FLAG**. Rhizome rather stout, widely spreading, with scars or fibers of decayed leaves; leaves erect, linear-attenuate, to about 9 dm. long; flower stalk rather slender, erect, slightly zigzag, often overtopping the leaves; flowers 1 or 2 at summit of flower stalk, often also in axils of 1 or 2 upper stem leaves; involucral bracts 2, the longer attenuate one exceeding the flower; the 3 outer perianth segments red to copper-colored, spreading-arching, 45-55 mm. long, with oval to obovate-oval apically notched blade and a short paler claw; the 3 inner perianth segments red to copper-colored, narrowly obovate to elliptic-obovate, cuneate at base and notched at apex, about two thirds as long as outer perianth segments; capsule ellipsoid to oval, 45-55 mm. long, green, not beaked but sometimes constricted near apex, 6-angled, rather thick-walled; seeds orbicular to semiorbicular, about 7 mm. in diameter. In marshes and wet meadows, ditches and on stream banks, reported from e. Tex. but no specimen seen, spring; Ga: to e. Tex. (?), Mo. and Ky.

3. *Iris virginica* L. **SOUTHERN BLUE-FLAG**. Rhizome stout; leaves rather flaccid; basal leaves buff or pale-brown at base, soon arched-recurving or falling to ground; flowering stem weak, to 1 m. high, simple or somewhat branched in the inflorescence, soon low-arching and maturing fruit on the ground or in water; spathe bracts firm, usually subherbaceous, to 14 cm. long; the 3 outer perianth segments with obovate to oval-obovate blade 3-4 cm. wide, with prominent yellow midrib expanding to a broad bright-yellow pubescent patch at base (the elongate hairs as long as thickness of blade); the 3 inner perianth segments obovate to obovate-spatulate, two thirds to four fifths as large as sepals; capsule ovoid to ellipsoid or thick-cylindric, 3-11 cm. long, 13-25 mm. thick, 3-angled, often asymmetrical, brittle-walled, dull or scarcely lustrous on inner surface, early disintegrating; seeds rounded to irregularly D-shaped, 3-6 mm. thick at back, 5-8 mm. wide, with an irregularly deep-pitted brittle corky coat. *I. caroliniana* Wats., *I. versicolor* of auth. In marshes, wet savannahs and pinelands, shallow water in ditches and in soggy meadows in e. Tex., Apr.-June; from Fla. to Tex., n. to e. Va.

Those plants with a branched, not simple, inflorescence and with capsules 7-11 cm. long have been segregated as var. *Shrevei* (Small) Anders. (*I. Shrevei* Small).

4. *Iris hexagona* Walt. var. *flexicaulis* (Small) Foster. Rhizome rather stout; leaves erect, mostly 3 to 5 together, pale-green and more or less glaucous, linear-attenuate, mostly 1-2 cm. wide; flower stalk erect, rather stout or slender, shorter than the basal leaves, exceptionally leafy, zigzag, glaucescent; flowers paired or 3 together at top of stem or sometimes solitary and 1 or 2 together in the axils of the stem leaves; involucral

bracts 2, not foliaceous, exceeded by the flowers; perianth tube cylindrical-prismatic, almost 13 mm. long; the 3 outer perianth segments broadly spatulate, obovate, 5-7 cm. long, about 25 mm. wide, spreading or recurved at tip, bright-violet except basal part which is yellowish-green; inner 3 perianth segments shorter than the outer ones, narrowly spatulate, notched at apex, somewhat spreading, deep-violet, the claw somewhat brownish; style branches nearly 5 cm. long, broadly linear, reddish-violet except the paler margins; anthers shorter than filaments; capsule ellipsoid to oval or somewhat obovoid, 5-7.5 cm. long, 6-angled, somewhat glaucous, the walls thick; seeds brown, corky. Lowlands in s.e. Tex., Mar.-May; also La.

5. *Iris brevicaulis* Raf. Rhizomes rather slender, 10-25 mm. in diameter; stem zigzag, loosely ascending to depressed, compressed, 15-53 cm. high; basal leaves lax, 3-6 dm. long or more, 15-35 mm. wide; spathes terminal and sessile or short-peduncled from all but lowest axils, subtended by broad and very prolonged leafy bracts 2-6 dm. long or more; spathe bracts subequal, to 5 cm. long, the outer pair green, the inner pair scarious-margined; flower deep-blue or blue-purple; ovary prominently 6-angled; the 3 outer perianth segments 7-9.5 cm. long, 2.5-3 cm. wide, the ovate blade slightly longer than the greenish-yellow dark-striped claw, the latter with a yellowish-white summit; the 3 inner perianth segments oblanceolate, slightly shorter than the sepals; style branches greenish, with entire or toothed subquadrate to semiovate crests; capsule 6-angled, ovoid to ellipsoid, 3-5 cm. long; seeds irregularly circular, with thick coat. *I. foliosa* Mack. & Bush. Swamps, wet meadows, damp woods, marshes and bottomlands in e. Tex., Apr.-June; from Ala. to Tex., n. to O., Ind., Ill., Mo. and Kan.

3. BELAMCANDA ADANS.

BLACKBERRY LILY

Two species, native to eastern Asia.

1. *Belamcanda chinensis* (L.) DC. Perennial herb with horizontal rhizomes and ensiform leaves; stem 3-6 dm. high; inflorescence cymose-paniculate, widely branched; flowers lasting but a day; perianth orange with crimson or purple spots and markings, 3-5 cm. across, the widely spreading segments nearly equal; filaments distinct, inserted on the base of the perianth segments; style clavate, 3-cleft; capsule 2.5-3 cm. long, 1-2 cm. in diameter, oblong to pyriform, 3-lobed, its 3 valves recurving sharply at maturity and soon deciduous to expose the mass of round black fleshy seeds attached to the central column, the whole resembling a large blackberry. Established as an escape in pastures, along roadsides and in thickets and on hillsides, mostly in e. Tex., Apr.-July; from Ga. to Tex., Kan. and Conn.; nat. of Asia.

4. ALOPHIA HERB.

A small American genus.

1. *Alophia Drummondii* (Grah.) Foster. Scapose herb with a deep-seated brown-coated bulb; bulb ovoid to subglobose, when mature about 2 cm. long and 25 mm. in diameter; leaves with sheathing bases and plicate, narrowly linear, to about 3 dm. long; scape to about 3 dm. high, erect, more or less sheathed by the leaf bases, slender, usually simple, supporting 1 or 2 erect flowers from a spathe; perianth about 5 cm. across; hypanthium tube very short or wanting; the 3 outer perianth segments crestless, cuneate-obovate to cuneate, spreading, broadly acute, pale- or dark-lavender, with a violet halo outlining the white base that is violet-spotted or the whole segment may be white in albino forms; the 3 inner perianth segments very much smaller than the outer ones, short-acuminate, the upper part violet, the blackish-violet lower part more or less channeled and sometimes with white spots near the base; anthers narrow, lying against the style branches; style branches ascending, each tipped with 2 subulate stigmas that are toothed at the apex; capsule erect, thin-walled, cylindrical to somewhat narrowly clavate, 25 mm. long or less, stramineous in age. *Herbertia Drummondii* (Grah.) Small, *H. caerulea* (Herb.) Herb. In clayey or sandy soils mostly in grasslands and prairies in s. Tex., Mar.-May; endemic.

5. NEMASTYLIS Nutt.³⁸

SHELL-FLOWER

Herbaceous perennials with an ovoid to subglobose bulb; leaves linear to lance-attenuate or lance-ensiform, often plicately nerved; stems simple or branched; spathes herbaceous, 1- to several-flowered; flowers erect or somewhat nutant, rotate, regular, fugacious, the segments very briefly united at the base, equal or subequal; stamens inserted on the segments at the base; filaments free to more or less united; anthers longer than the filaments, with a narrow connective, coiling downward from the apex with maturity; style equal to or usually shorter than the style arms, the 3 style arms bifid almost to the base and opposite the stamens; ovary small, oblong-ellipsoid to subclavate or subturbinate; stigmas apical, subcapitate to tufted or sometimes 2-parted; capsule more or less oblong-ellipsoid to obovoid, opening by 6 deltoid teeth at the apex; seeds yellow- or dark-brown, irregularly closely pitted, angular, about 2 mm. long.

A small genus that is confined to the New World.

1. Cauline leaves well-developed, 5-11 mm. wide; filaments free or only slightly connate at the base 1. *N. geminiflora*.
1. Cauline leaves reduced or (if developed) narrow, 1-4 mm. wide; filaments wholly or partially united (2)
- 2(1). Filaments united in a column; in east Texas 2. *N. Nuttallii*.
2. Filaments united for 3-4 mm. (over half their length); in Trans-Pecos Texas 3. *N. tenuis* var. *Pringlei*.

1. *Nemastylis geminiflora* Nutt. CELESTIAL LILY, PRAIRIE PLEAT-LEAF. Bulb broadly ovoid to subglobose, 20-25 mm. high, the brittle membranous brown tunics prolonged upward into a collar around the base of the stem and leaves; basal leaves 2 or 3, 2-4 dm. long or longer, 3-6 mm. wide, glabrous, plicate, lance-linear or narrowly linear-ensiform; cauline leaves 2 or 3, 15-35 cm. long, 5-11 mm. wide, at least one of them usually much-exceeding the inflorescence, the upper one somewhat reduced; stem 12-46 cm. high, glabrous, terete, sometimes branched near the base, usually several-branched above the middle; spathes herbaceous, unequal, the outer 20-42 mm. long, the inner 35-47 mm. long, 1- or 2-flowered, the filiform pedicels glabrous and not well-exserted at anthesis; perianth segments subequal, to 3 cm. long, 17 mm. wide, ovate-obovate, obtuse to acutish, blue (lighter at the base, giving the effect of an "eye"); filaments free or only slightly connate at the base, to 2.5 mm. long; anthers to 15 mm. long; ovary ovoid-turbinate, glabrous, to 4 mm. long; style to 3 mm. long; style arms to 5 mm. long; capsule 15-20 mm. long, well-exserted, oblong-turbinate; seeds angular, brown. *N. acuta* (Bart.) Herb., *Calydorea texana* (Herb.) Baker. In clayey soils and limestone areas from n.-cen. Tex., s. through the Edwards Plateau to s.-cen. Tex., Mar.-May; from Tex., n. to Mo. and Kan.

2. *Nemastylis Nuttallii* Pick. Bulb ovoid to subglobose, 15-20 mm. high, the tunics dark-brown to chestnut-brown; basal leaves 2 or 3, the lowest the shortest, 15-40 cm. long, 1-3.5 (-5) mm. wide, linear-ensiform, long-acute, glabrous, the wider ones somewhat plicate, rarely equaling or exceeding the inflorescence; cauline leaves 2, the lower 9-23 cm. long, to 4 mm. wide, sometimes exceeding the inflorescence, the upper reduced, 1.5-8 cm. long, rarely with a branch in its axil; stem simple, 2-4 dm. high, very infrequently 1-branched above the middle, terete, glabrous, with the axis terminated by a 1- (rarely 2-) flowered pair of spathes; spathes closely convolute, equaling or somewhat exceeding the pedicel at anthesis, glabrous, the outer 2-3 cm. long, the inner 3-5 cm. long; perianth segments subequal, to 2 cm. long, 4-5 mm. wide, ovate to obovate, rather obtuse or subacute, blue, concolorous (?); filaments 1-2 mm. long, united in a column; anthers about 5 mm. long; ovary 4-5 mm. long, glabrous, turbinate to subclavate; style 2 mm. long, usually slightly longer than the staminal column; style arms 2 mm. long; capsule more or less oblong-clavate, trigonous, 2 cm. long; seeds dark-red-brown, closely pitted, angular, to 2 mm. long. *N. coelestina* of auth. Mostly along streams, probably to be found in n.e. Tex.; also Ark. and Mo. No specimen has been seen from Texas.

³⁸ Adapted from R. C. Foster in Contr. Gray Herb. 155: 26-44. 1945.

3. *Nemastylis tenuis* (Herb.) Baker var. *Pringlei* (Wats.) Foster. Bulb ovoid to subglobose, about 15 mm. wide and 20-25 mm. high, the tunics dark-brown; basal leaves 2 or 3, 6-28 cm. long, 1-2.5 mm. wide, linear, acute, coarsely scabrous on the midrib and margins (especially near the base); cauline leaf 1, 6-15 cm. long, 1-2 (-3) mm. wide, scabrous like the basal leaves; stem simple or occasionally 1-branched, 12-30 cm. high, terete, glabrous; spathes unequal, the outer to 25 mm. long, the inner to 4 cm. long, glabrous, 1- (rarely 2-) flowered, the pedicels shorter than the spathes at anthesis; perianth segments subequal, to 3 cm. long but usually about 2 cm., to 9 mm. wide, the inner ones slightly shorter and narrower, oblong-ovate to oblanceolate, obtuse, pale-blue; filaments 3-4.5 mm. long, united at the base for 2-3 mm.; anthers 8-10 mm. long; style usually shorter than the staminal column; style arms to 3.5 mm. long; capsule oblong-ellipsoid, to 25 mm. long; mature seeds not seen. In open grassy pine woods in mts. of the Trans-Pecos, May-July; from Tex. to Ariz., s. to Guat.

6. EUSTYLIS ENGELM. & GRAY

A small genus mostly in South America.

1. *Eustylis purpurea* (Herb.) Engelm. & Gray. PURPLE PLEAT-LEAF. Perennial herb from a shallow-rooted tunicated bulb; bulb ovoid to narrowly or broadly ellipsoid, to 2 cm. in diameter, coated with chocolate-brown scales; flowering stem wiry, often zigzag, to 75 cm. high, mostly somewhat shorter than the leaves, more or less branched with convolute attenuate flower spathes terminating the branches; leaves linear-lanceolate, pleated, sheathing the stem below, acuminate-attenuate at apex, to about 2 cm. wide; flowers emerging from spathes for several days in succession, fugacious; perianth with the outer 3 segments somewhat larger than the 3 inner ones and depressed at base to form a cup in center of blossom; perianth segments velvety-purple to rose-purple or very rarely whitish, spotted reddish-brown over yellow toward the base; outer perianth segments obovate, broadly rounded at apex, about 25 mm. long; inner perianth segments shorter and narrower than the outer ones, longitudinally cupped and crimped near apex; filaments and anthers about equal in length; style forming a tube about 5 mm. long before dividing into slender recurved arms at apex; capsule ellipsoid, about 2 cm. long; seeds brown, rugose, about 2 mm. in diameter. *Nemastylis purpurea* Herb., *Tigridia purpurea* (Herb.) Shinn. In sandy soils in open woods and in grassy areas throughout most of e. and s. Tex., May-Oct.; probably also in Ark., La., Okla. and n.e. Mex.

FAM. 42. CANNACEAE JUSS.

CANNA FAMILY

Perennial erect herbs with branched or unbranched stems and large alternate leaves with sheathing petioles; flowers perfect, zygomorphic, mostly showy, borne in terminal thyrsoid panicles; sepals 3, erect, greenish and bractlike; petals 3, more or less united to form a tube; stamens more or less adnate to the corolla, with one filament anther-bearing, the others becoming showy staminodia; ovary inferior, 3-celled, with the placentae parietal; style petaloid, the stigma marginal.

A solitary genus of about 55 species, mostly in tropical America.

1. CANNA L.

CANNA. INDIAN-SHOT

Characters of the family.

1. Flowers red; plant not glaucous; leaves rounded at base 1. *C. indica*.
1. Flowers yellow; leaves tapered at base (2)
- 2(1). Petals becoming reflexed; tube about 5 cm. long, prominent; plant green; leaves oblong-lanceolate 2. *C. flaccida*.
2. Petals remaining erect or strongly ascending; tube about 2 cm. long; plant glaucous; leaves narrowly lanceolate 3. *C. glauca*.

1. *Canna indica* L. INDIAN-SHOT. Plant slender, to about 12 dm. tall, the herbage deep-green and glabrous; leaves oblong-elliptic, 2-4 dm. long, to about 2 dm. wide; flowers small, usually in pairs, red or reddish, not especially showy; floral bracts suborbicular; sepals 1-1.5 cm. long, exceeding the perianth tube; corolla lobes 3-3.5 cm. long, much longer than the tube; staminodia linear to narrowly spatulate or oblanceolate, flat, about 5 cm. long; capsule 25-35 mm. long. Commonly cult. and escaped to low grounds along the Gulf Coastal Plain from Fla. to Tex., summer-fall; nat. of E.I.

2. *Canna flaccida* Salisb. Plant to 75 cm. high, the herbage green throughout; leaves oblong-lanceolate, to 6 dm. long and 13 cm. wide; raceme simple, loose and few-flowered, with very small bracts, erect; flowers yellow, showy, soft or flaccid in texture; sepals about 25 mm. long; corolla tube about 5 cm. long; petals yellow, strongly reflexed, nearly as long as the tube; upper staminodia 3, rounded, 5-7.5 cm. long, the lip orbicular. About lakes and in marshes and swamps along the coast in s. Tex., Apr.-June; from S.C. to Fla. and Tex.

3. *Canna glauca* L. Plant to 9 dm. high, the herbage green and glaucous; leaves narrowly lanceolate, to at least 6 dm. long and usually 1 dm. or less wide, tapering both to the base and to the long-acuminate apex, typically white hyaline-edged; raceme rather loose, erect, simple or forked, little-exceeding the leaves; floral bracts orbicular; flowers clear-yellow, narrow and erect; sepals green, about 12 mm. long; petals 4-5 cm. long, the tube about 2 cm. long; upper staminodia 3, entire, to 75 mm. long and 2 cm. broad; lip narrow, emarginate. In marshes and swamps along the coast in s. Tex., Apr.-July; from s. Tex. and Mex. s. to S.A. and W.I.

FAM. 43. MARANTACEAE PETERS.

ARROWROOT FAMILY

Herbs with alternate or basal sheathing leaves provided with a joint at the summit of the petiole; flowers perfect, typically 3-merous; sepals separate, usually green and similar or only slightly dissimilar; petals 3, separate or united at base, forming an irregular corolla; stamens of the outer circle reduced to 2 or 1, these modified into staminodia and often petaloid; stamens of the inner circle 3, 2 staminodes, the third only half-staminode and half-fertile; ovary inferior, 3-celled or by abortion 1-celled; ovule solitary and erect in each cell; fruit fleshy or capsular; seeds arillate.

About 26 genera and 400 species, all tropical except ours.

1. THALIA L.

Characteristics of the family. About a dozen species found in America and Africa.

1. *Thalia dealbata* Roscoe. POWDERY-THALIA. Erect scapose herbs from strong rhizomes, with large basal long-petioled leaves; leaves 3, the blades ovate-lanceolate or elliptic-lanceolate and 2-4 dm. long; scapes 1-2 dm. tall; inflorescence more or less white-powdery; flowers purplish, in paniced spikes, each surrounded by several coriaceous bracts; corolla tube short; staminodia petaloid, somewhat connate, the largest deflexed and liplike; ovary 1-celled; fruit a capsule. *T. barbata* Small. In water of ditches, edge of ponds and in swamps in e. and s.e. Tex., Oct.-Nov.; from Fla. to Tex., n. to S.C. and s.e. Mo.

FAM. 44. BURMANNIACEAE BL.

BURMANNIA FAMILY

Small annual or perennial herbs, commonly with grasslike basal leaves and/or alternate minute bractlike leaves on the stem, saprophytic or autophytic; flowers solitary or several in a terminal cluster or cyme, or racemosely scattered on upper part of stem, perfect, with a 6-cleft perianth whose tube adheres to the 1- or 3-celled ovary; stamens 3 or 6, attached to the perianth tube about the middle or near its summit; anthers with broad connectives; capsule usually irregularly dehiscent, with numerous minute seeds.

About 17 genera comprising more than 125 species, mostly tropical and subtropical.

1. Hypanthium 3-angled or 3-winged; ovary 3-celled; capsule 3-valved from the apex or irregularly rupturing 1. *Burmannia*, p. 434.
1. Hypanthium terete; ovary 1-celled; capsule 3-valved from the base 2. *Apteria*, p. 434.

1. BURMANNIA L.

Mostly small herbs with linear or scalelike leaves and solitary, capitate, racemose or cymose flowers; perianth 3-angled or 3-winged, with the outer 3 lobes much larger than the minute or essentially lacking 3 inner lobes; stamens 3, sessile in the throat of perianth; ovary 3-celled; capsule crowned by the persistent perianth.

A genus of nearly 60 species, mainly in the tropics of both hemispheres.

1. Flowers 1 or several in a raceme; hypanthium broadly 3-winged 1. *B. biflora*.
1. Flowers several in a terminal cluster; hypanthium merely 3-angled 2. *B. capitata*.

1. *Burmannia biflora* L. Stem threadlike, to 15 cm. tall; scalelike stem leaves to 3 mm. long; perianth about 5 mm. long, bright-blue, the lobes narrow; capsule 4-5 mm. long. In moist woodlands and bogs in e. Tex., Aug.-Oct.; Fla., n. to Va. and w. to Tex.

2. *Burmannia capitata* (Walt.) Mart. Stem threadlike, to 2 dm. tall; scalelike stem leaves to 5 mm. long; perianth about 5 mm. long, whitish or bluish-white, the lobes minute to obsolescent; capsule 2-3 mm. long. In moist woodlands and bog areas in e. Tex., Aug.-Nov.; Fla., n. to N.C. and w. to Tex.

2. APTERIA NUTT.

Several species in tropical and warm regions of America.

1. *Apteria aphylla* (Nutt.) Barnh. NODDING-NIXIE. Stem slender, threadlike, to 2 dm. tall, simple or branched; scalelike stem leaves to 3 mm. long; flowers small, nodding, with long pedicels; perianth 1-1.5 cm. long, whitish or purple; outer 3 perianth lobes much larger than the 3 narrow inner lobes, the lobes 2-3 mm. long; stamens attached deep in throat of perianth; filaments with winglike appendages; connective not prolonged beyond the anther sacs; capsule 3-4 mm. long. *A. setacea* Nutt. In decaying leaves of moist woods and on edge of bogs in e. Tex., Aug.-Oct.; Fla. and Ga., w. to Tex.

FAM. 45. ORCHIDACEAE JUSS.³⁹

ORCHID FAMILY

Perennial herbs of various habits and habitats, terrestrial, semiaquatic or epiphytic, autophytic or saprophytic, hermaphroditic, produced from a short or elongated or (rarely) coralloid rhizome; roots subterranean or aerial, fibrous, fleshy or tuberous, fasciculate or adventitious and scattered on the rhizome or stem; stems terete, much-abbreviated to elongated, slender to very stout, naked, bracteate or leafy; leaves simple, radical or cauline or both, persistent, deciduous or fugacious, occasionally altogether lacking, varying from sheathing bracts to a broad or narrow lamina; lamina linear to broadly elliptic, membranaceous to somewhat fleshy; inflorescence terminal, supported by an abbreviated to greatly elongated peduncle, composed of one or more flowers, commonly a spike or simple raceme; flowers small and inconspicuous to rather showy, zygomorphic, perfect; perianth composed of three outer segments (sepals) and three inner segments (petals), the segments free or more or less united, adnate to the 1- or 3-celled inferior ovary, one petal (the lip or labellum) usually complex in structure and differing only slightly or greatly in form, size and coloration from the other segments; lip often extended to form a spur or nectary; stamens and pistils (including the filaments and styles) united to form an organ (the column) in the center of the flower; column various, bearing at or near its summit or laterally 1 or 2 mobile or rigidly attached

³⁹ Cf. D. S. Correll in C. L. Lundell, *Flora of Texas* III: 151-196. 1944 for a more detailed treatment.

anthers, producing in front on the ventral surface the somewhat confluent stigmas, with one stigma usually modified to form the rostellum; anthers situated behind the rostellum, resting in a bed or clinandrium, perfectly or abortively 2-celled, containing a mass of pollen or 2 to 8 distinct pollen masses or pollinia; pollen powdery, granular-mealy, waxy or cartilaginous; fruit a dry capsule or fleshy pod, commonly ovoid, ellipsoid or cylindrical, dehiscing along 1, 2 or 3 longitudinal sutures; seeds numerous, scobicular.

A cosmopolitan family that attains its highest development in the tropics of both hemispheres and is one of the largest families of flowering plants in the world, consisting of several hundred genera and 15,000 or more species. It is also considered to be among the most advanced families in the Monocotyledoneae. The column, formed by the united stamens and pistils, is distinctive of the family.

1. Lip an inflated yellow pouch; fertile anthers 2, borne laterally on the column 1. *Cypripedium*, p. 436.
1. Lip simple or complex, sometimes broadly saccate or cymbiform but never pouch-shaped; fertile anther 1, borne at or near the apex of the column (2)
- 2(1). Flowers with a distinct saccate or elongated spur (3)
2. Flowers without a conspicuous spur, at most producing a short mentum (5)
- 3(2). Leaves absent at time of flowering; naked scape produced from a corm 14. *Tipularia*, p. 445.
3. Leaves or foliaceous bracts present at time of flowering; stem produced from an abbreviated or elongated rhizome (4)
- 4(3). Leaves with a distinct slender petiole; rhizome elongated, repent 12. *Erythroides*, p. 444.
4. Leaves with the basal part sheathing the stem, epetiolate; rhizome abbreviated, not repent 2. *Habenaria*, p. 436.
- 5(2). Plants not green, saprophytic; stem usually yellowish-brown; leaves reduced to sheathing scales; rhizomes coralloid (6)
5. Plants green, autophytic; leaves one to many, sometimes absent or inconspicuous at time of flowering (in *Spiranthes*); rhizome not coralloid (7)
- 6(5). Lip with 3 to 6 longitudinal ridges or crests on face; perianth about 20 mm. long; pollinia 8 15. *Hexalectris*, p. 446.
6. Lip not ridged or crested, at most with a pair of short lamellae; perianth usually less than 15 mm. long; pollinia 4 16. *Corallorhiza*, p. 447.
- 7(5). Lip broadly saccate or cymbiform; leaves rather large (8)
7. Lip not saccate; leaves small, often grasslike (9)
- 8(7). Leaves forming a basal rosette, shining and fleshy; lip uppermost in flower 10. *Ponthieva*, p. 441.
8. Leaves scattered on the stem, plicate; lip lowermost in flower 4. *Epipactis*, p. 439.
- 9(7). Lip crested or bearded on the face (10)
9. Lip not crested or bearded on the face (14)
- 10(9). Leaf linear to linear-lanceolate, grasslike, plicate, sheathing the scape near the base; column broadly winged at the apex; lip forming the uppermost segment of the perianth 9. *Calopogon*, p. 440.
10. Leaf ovate to ovate-elliptic, fleshy; column not winged, clavate; lip forming the lowermost segment of the perianth (11)
- 11(10). Leaves 5 or 6 in a whorl at summit of stem 6. *Isotria*, p. 439.
11. Leaves 1 to several, alternate, not whorled (12)
- 12(11). Plant weak, ascending; stem leafy; leaves broadly ovate, clasping the stem, less than 2 cm. long; flowers several 5. *Triphora*, p. 439.
12. Plant rigidly erect; leaf solitary or rarely 2, arising near middle of stem, more than 2 cm. long; flowers 1 or rarely 2 (13)
- 13(12). Lip 25 mm. long or less, bearded on the face 7. *Pogonia*, p. 440.
13. Lip more than 30 mm. long, with a central crest 8. *Cleistis*, p. 440.

- 14(9). Leaves several, basal or cauline, narrow and grasslike or (if broad) basal 11. *Spiranthes*, p. 441.
14. Leaf solitary or 2 oppositely placed on the stem, attached to or spreading near middle of stem, broad and short (15)
- 15(14). Stem produced from a small bulbous corm; leaves 1 or 2; lip broad and short, obliquely tridentate or acutish at the apex 13. *Malaxis*, p. 445.
15. Stem produced from a slender rhizome; leaves always 2, opposite; lip narrow and elongated, deeply bilobed 3. *Listera*, p. 438.

1. CYPRIPIEDIUM L.

A genus of 100 or more species widespread in boreal, temperate and tropical regions of Europe, Asia, Oceania and America.

1. *Cypripedium Calceolus* L. var. *pubescens* (Willd.) Correll. **YELLOW LADY'S-SLIPPER.** Terrestrial herbs to 7 dm. high, with fibrous roots rising from a short or elongated rhizome; leaves several on the stem, broadly elliptic-lanceolate, plicate, prominently ribbed, to 2 dm. long and 1 dm. wide, sheathing the stem; flowers one or two, showy, subtended by foliaceous bracts; sepals spreading, free or with the lateral pair partially or wholly united; petals spreading, free, narrower than the sepals; lip sessile, dull-cream-color to golden-yellow, inflated, saccate or pouch-shaped, horizontally placed, about 5 cm. long; column declined, with two laterally placed fertile stamens (each bearing a 2-celled anther) and a dorsally placed sterile petal-like staminode; pollen granular; stigma terminal and somewhat 3-lobed; ovary 1-celled; capsule obovoid to ellipsoid. *C. parviflorum* Salisb., *C. pubescens* Willd., *C. veganum* Cockll. & Barker, *C. parviflorum* var. *pubescens* (Willd.) Knight. On hardwood slopes in e. Tex. and pockets of dunes in the Plains Country, Apr.-June; Que. and Nfld., s. to Ga., w. to N.M., Wash., B.C. and the Yuk.

2. HABENARIA WILLD.

Terrestrial or semiaquatic herbs with fleshy or tuberous roots; roots ovoid to fusiform-elongated or rarely palmate; plants erect, simple, glabrous; stem leafy or merely bracted; leaves one or more, basal or cauline, essentially sessile, with the basal part sheathing the stem; flowers usually small, in showy or inconspicuous racemes; sepals free, similar or dissimilar; dorsal sepal erect or incurved to form a hood over the column; lateral sepals spreading or deflexed; petals free, erect, usually connivent with the dorsal sepal, simple or bipartite; lip lowermost or occasionally uppermost, simple or tripartite (the divisions cuneate to filiform-setaceous, entire or variously toothed or fringed), entire, toothed or fringed, extended at the base to form a spur; spur elongated and filiform or filiform-clavellate, shorter to much longer than the pedicellate ovary; column short; stigmas with or without papillose processes; anther cells two, separate, relatively distant; pollen granular, attached to exposed glands (not contained in a pouch); capsules narrowly cylindrical to ellipsoid.

A polymorphic genus of approximately 500 species native mainly to the warmer regions of the world.

1. Lip deeply 3-parted, that is divided at least halfway to the base of the lamina (2)
 1. Lip simple, not 3-parted, linguiform, ligulate, linear or lanceolate, at most fringed, notched or lobulate (4)
- 2(1). Divisions of the lip fringed; petals entire, not 2-lobed 3. *H. lacera*.
2. Divisions of the lip not fringed; petals 2-lobed (3)
- 3(2). Spur more than 4 cm. long, much longer than the pedicellate ovary (often as much as 6 times as long); lateral lobes of lip 15 mm. or more long 1. *H. quinquieseta*.
3. Spur less than 2 cm. long, about as long as the pedicellate ovary; lateral lobes of lip less than 13 mm. long 2. *H. repens*.

- 4(1). Lip copiously ciliate-fringed (5)
- 4. Lip not fringed, at most coarsely erose (8)
- 5(4). Flowers white, occasionally tinged with cream-color; lamina of lip narrowly ovate-oblong 4. *H. Blephariglottis*.
- 5. Flowers yellow or orange-color; lamina of lip ovate to oblong (6)
- 6(5). Lip oblong-elliptic, more than 8 mm. long; spur longer than the pedicellate ovary 5. *H. ciliaris*.
- 6. Lip ovate, less than 6 mm. long; spur shorter than the pedicellate ovary (7)
- 7(6). Spur less than 10 mm. long 7. *H. cristata*.
- 7. Spur more than 11 mm. long 6. *H. × Chapmanii*.
- 8(4). Lip lobed at the base or tridentate at the apex (9)
- 8. Lip not obviously lobed or notched, entire to crenate (10)
- 9(8). Lip with a lobe or prominent tooth on each side at the base, adorned with a tubercle or cushionlike callus in the center near or at the base 9. *H. flava*.
- 9. Lip shallowly notched at the apex to form 3 short blunt teeth, ecallose 10. *H. clavellata*.
- 10(8). Flowers yellow 8. *H. integra*.
- 10. Flowers whitish or greenish (11)
- 11(10). Lip forming the uppermost segment of the perianth, ecallose; flowers snowy-white 11. *H. nivea*.
- 11. Lip forming the lowermost segment of the perianth, with a small tubercle or cushionlike callus in the center near or at the base; flowers greenish 9. *H. flava*.

1. *Habenaria quinqueseta* (Michx.) Sw. LONG-HORNED HABENARIA. Plant 2-9 dm. tall; stem leafy; raceme elongated, with few to many greenish-white flowers; midlobe of lip linear, 8-20 mm. long. Represented in Tex. by a collection by Charles Wright, without a definite locality but doubtless in the Coastal Prairies in the s.e. part of the state. It should be looked for in swamps, margin of ponds, and similar wet places; locally distributed from Fla., n. to S.C. and w. to Tex., also in the W.I. and Latin Am., July-Nov.

2. *Habenaria repens* Nutt. WATER-SPIDER ORCHID. Similar to *H. quinqueseta* but with narrower leaves and smaller greenish flowers; midlobe of lip 4-7 mm. long, linear. *H. Nuttallii* Small. In streams, ditches, swamps, on the margins of ponds and lakes, often floating on mats of other vegetation on surface of water in cen., s. and e. Tex., May-Nov.; from Fla., n. to N.C. and Va. (?), w. to Tex.; also throughout the W.I. and Latin Am.

3. *Habenaria lacera* (Michx.) Lodd. RAGGED FRINGED ORCHID. The fringed deeply 3-lobed lip of the yellowish-green flowers is distinctive. Plant 25-75 cm. tall, slender; raceme elongate and laxly flowered; petals linear-oblong to narrowly oblong-spatulate, mostly entire at the truncated apex, 5-7 mm. long, mostly less than 2 mm. wide; lip 10-16 mm. long, 13-17 mm. wide across lateral lobes; spur curved, to 23 mm. long. In open woods along streams, in open sedge marshes and meadows in n.e. Tex., rare, May-Aug.; from Nfld., s. to Ga., w. to Tex., Ark., Mo., Ill., Wisc., Minn.

4. *Habenaria Blephariglottis* (Willd.) Hook. WHITE FRINGED ORCHID. The white flowers with coarsely fringed linguiform lip are distinctive. Plant leafy below, bracted above, to 11 dm. tall; raceme mostly densely flowered; petals linear to oblanceolate, 3-8 mm. long; lip to 1 cm. long or more; spur slender, 1.5-5 cm. long. *Blephariglottis Blephariglottis* (Willd.) Rydb. In marshes, meadows, edge of swamps and depressions in savannahs and prairies in s.e. Tex., June-Sept.; widely distributed and locally abundant from Nfld., s. to Fla., w. to O., Mich. and Tex.

5. *Habenaria ciliaris* (L.) R. Br. YELLOW FRINGED ORCHID. Similar to *H. Blephariglottis* except for its bright- to deep-orange-color flowers with more copiously and finely fringed lips. Plant to 1 m. tall; petals linear-oblong to linear-cuneate, 6-7 mm. long, 1-2 mm. wide; lip 8-12 mm. long; spur 2-3.3 cm. long. *Blephariglottis ciliaris* (L.) Rydb. In

moist woodlands, along streams, seepage slopes in forests and open areas, bogs, savannahs and prairies in e. and s.e. Tex., June-Oct.; from Ont., s. to Fla., w. to Ill., Mo., Ark. and Tex.

6. *Habenaria* × *Chapmanii* (Small) Ames. The size of the lemon-yellow to orange-color flowers of this plant are intermediate between *H. cristata* and *H. Blephariglottis*, its putative parents. The spur is usually about 12 mm. long. *Blephariglottis Chapmanii* Small. In habitats similar to those of *H. ciliaris* in s.e. Tex., July-Aug.; from N.J. and Del., s. to n. Fla., w. to Tex.

7. *Habenaria cristata* (Michx.) R. Br. CRESTED FRINGED ORCHID. Except for their smaller size and usually deeper color the flowers of this species are similar to those of *H. ciliaris*. The short spur averages 6 mm. in length. Plant usually about 5 dm. tall; petals oblong-elliptic to narrowly cuneate, fringed at apex, 2-4 mm. long; lip 4-6 mm. long. *Blephariglottis cristata* (Michx.) Raf. In habitats similar to those of *H. ciliaris* in e. and s.e. Tex., June-Sept.; from e. Mass. (rare), s. to cen. Fla., w. to Tex., Ark. and Tenn.

8. *Habenaria integra* (Nutt.) Spreng. YELLOW FRINGELESS ORCHID. Except for its lack of fringes on the lip the flowers of this species are quite similar in color, size and appearance to those of *H. cristata*. Plant usually less than 5 dm. tall; petals narrowly oblong, obtuse, 3-4 mm. long, about 2 mm. wide; lip ovate-elliptic to obovate, usually marginally crenulate, 4-5 mm. long, 3-4 mm. wide; spur about 5 mm. long. *Gymnadeniopsis integra* (Nutt.) Rydb. Represented in Tex. by a collection of Thomas Drummond without a definite locality but doubtless in boggy savannahs or prairies in the s.e. part of the state. Along the coast from N.J., s. to n.-cen. Fla., w. to Tex.; also e.-cen. Tenn., July-Sept.

9. *Habenaria flava* (L.) R. Br. SOUTHERN REIN-ORCHID. The tubercle or callus on the disk of the lip near its base is characteristic of this species. Plant with one to three leaves below, bracted above, to 6 dm. tall; petals ovate to oblong or suborbicular, 2-5 mm. long, to 3.5 mm. wide; lip variable in shape, broadly oblong to suborbicular, 2.5-6 mm. long, to 4.5 mm. wide across the basal teeth or lobules; spur slender, rarely clavellate, to 11 mm. long. *Perularia bidentata* (Ell.) Small, *P. scutellata* (Nutt.) Small. In mud of densely wooded floodplain swamplands, thickets, wet savannahs, prairies and marshes in e. and s.e. Tex., Apr.-Aug.; primarily in the coastal regions and lowlands from Md., s. to cen. Fla., w. to Tex., Ark., Mo., Ill. and Ind.

10. *Habenaria clavellata* (Michx.) Spreng. GREEN REIN-ORCHID, SMALL WOOD ORCHID. The narrowly oblong-cuneate lip that is truncate and sinuately tridentate at the apex is characteristic of this species. Plant to 45 cm. tall; leaves one or rarely two, obovate-oblong, obtuse, to 18 cm. long; flowers greenish or yellowish-white; petals ovate, 3-5 mm. long, about 2 mm. wide; lip 3-7 mm. long; spur slender-clavate, 8-12 mm. long. *Gymnadeniopsis clavellata* (Michx.) Rydb. In water or at edge of water along streams in forests, swamps, on wooded seepage slopes and in ravines in e. Tex., June-Aug.; from Nfld., s. to n. Fla., w. to Tex., Ark., Mo., and Minn.

11. *Habenaria nivea* (Nutt.) Spreng. SNOWY ORCHID. The small white flowers with lip uppermost distinguishes this species. Plant slender, rigidly erect, glabrous, to 9 dm. tall, with basal ellipsoid tubers to 3 cm. long; petals linear-oblong to elliptic, somewhat falcate, 2-5 mm. long; lip 3-8 mm. long; spur slender, almost horizontal, curved upward, 1-1.5 cm. long. *Gymnadeniopsis nivea* (Nutt.) Rydb. In wet prairies, savannahs and bogs, mainly in s.e. Tex., May-Aug.; locally distributed from N.J. and Del., s. along the coast to Fla., w. to Tex. and Ark.

3. LISTERA R. BR.

A small genus of about 20 species widely distributed in boreal and temperate regions of the Northern Hemisphere.

1. *Listera australis* Lindl. SOUTHERN TWAYBLADE. Small inconspicuous terrestrial herb with fibrous matted roots; stem slender, rarely more than 15 cm. high, more or less glandular-pubescent above the two opposite or subopposite leaves; leaves sessile, inserted above the middle of the stem, typically ovate-elliptic, to 4 cm. long; inflorescence a terminal raceme composed of small reddish-purple or greenish flowers; sepals and petals

free, similar and subequal, to 2 mm. long and 1 mm. wide; lip longer than the sepals and petals, linear, deeply 2-cleft, auricled on each side at the base; column wingless; capsule small, slender, pedicellate. In humus and on mosses of low moist woods and in ravines along streams in s.e. Tex., Feb.-May; locally from Que. and Ont., s. to cen. Fla. and w. to Tex.

4. EPIPACTIS Sw.

A genus of about 20 species mainly in temperate and mountainous regions of Europe and Asia, with 2 species in North America.

1. *Epipactis gigantea* Hook. GIANT HELLEBORINE. Plant terrestrial or saxicolous, usually 5 dm. tall or more; stem simple, leafy, from a short creeping rhizome with fibrous roots; leaves clasping stem, plicate-venose, broadly elliptic to linear-lanceolate, 6-20 cm. long, 2-7 cm. wide; inflorescence a few- to many-flowered prominently bracteose more or less secund raceme; floral bracts foliaceous, conspicuously exceeding the flowers; flowers greenish, marked with purplish or reddish nerves; sepals free, lanceolate, subequal, spreading or loosely connivent, 15-25 mm. long, 7-9 mm. wide; petals similar to the sepals but smaller; lip sessile on the base of the column, fleshy, saccate at the base, flattened above, distinctly 3-lobed with the lateral lobes erect to form a sac, about as long as sepals; column short, broadened above; capsule obovoid to ellipsoid, pendent, 2-2.5 cm. long. *Serapias gigantea* (Hook.) A. A. Eat. On seepage slopes, wet limestone bluffs and ledges in cen. and w. Tex., Apr.-July; scattered from Mont., S.D., Colo., Okla. and Tex., w. to B.C., Wash., Ore. and Calif.; also Mex.

5. TRIPHORA Nutt.

A small genus of about 10 species closely allied to *Pogonia*, in which some of the species are difficult to define; widely distributed in the Americas.

1. *Triphora trianthophora* (Sw.) Rydb. THREE BIRDS ORCHID, NODDING POGONIA. Inconspicuous terrestrial delicate succulent herb, stoloniferous and bearing fleshy tubers; stems slender, rarely more than 15 cm. high; leaves alternate, usually 2, clasping stem, ovate, less than 2 cm. long; flowers 2 or 3, nodding, borne in the axils of the upper leaves, about 15 mm. long; perianth parts distinct; lip 3-crested; column free, entire at the apex; capsule erect or pendent, ellipsoid to ellipsoid-obovoid, 1.5-2 cm. long. *Pogonia trianthophora* (Sw.) B.S.P. In leafmold of hardwood forests in e. Tex., Aug.-Oct.; from Can. and N.E., s. to cen. Fla., w. to Wisc., Ia., Mo., Ark. and Tex.

A rather distinctive variant, var. *Schaffneri* Camp, is exceedingly abundant in moist woodlands in Smith County. It is distinguished from var. *trianthophora* by its smaller flowers and erect, not pendent, fruits.

6. ISOTRIA Raf.

A genus closely allied to *Pogonia*, composed of 2 species, both of which are apparently confined to the United States.

1. *Isotria verticillata* (Willd.) Raf. WHORLED POGONIA. Terrestrial herb with long slender hairy roots, usually about 2 dm. tall; leaves 5 or 6 in verticil at top of stem, oblong-lanceolate to elliptic, to 9 cm. long and 5 cm. wide; flowers one or rarely 2 just above the leaves; perianth parts distinct; sepals 3.5-6 cm. long, about 3 mm. wide; petals elliptic-obovate to elliptic-lanceolate, about 2 cm. long and 5 mm. wide; lip yellowish-green, streaked with purple, oblong-cuneate, tuberculate-crested, 3-lobed near apex, to 25 mm. long and about 1 cm. wide; capsule erect, cylindrical or ellipsoid, 2-3.5 cm. long. *Pogonia verticillata* (Willd.) Nutt. Along streams and on slopes in hardwood forests in e. Tex., Apr.-July; from N.E., s. to Fla., w. to Mich., Mo., Ark. and Tex.

The long linear-lanceolate madder-purple sepals that greatly exceed the lip and petals are distinctive.

7. POGONIA Juss.

A genus of about 20 species widely dispersed over the world.

1. *Pogonia ophioglossoides* (L.) Ker. ROSE POGONIA. Terrestrial herb with slender fibrous roots, rigidly erect, usually about 4 dm. tall; leaf solitary, inserted about halfway up the stem, ovate to ovate-lanceolate, to 12 cm. long and 3 cm. wide; flowers one or 2 terminating the stem, rose-color to white, 15-25 mm. long; perianth parts distinct; lip bearded; column free, coarsely toothed at the apex; capsule ellipsoid, erect. In swamps, bogs, marshes, wet savannahs, prairies and seepage slopes in e. and s.e. Tex., Apr.-July; from Nfld., s. to Fla., w. to Minn., Ill. and Tex.

The heavily bearded lip, which forms the lower segment of the flower, is distinctive.

8. CLEISTES RICH.

A genus of about 40 species in the Western Hemisphere, mainly in South America.

1. *Cleistes divaricata* (L.) Ames. SPREADING POGONIA. Terrestrial herb with slender fibrous root, rigidly erect, to 75 cm. tall; leaf solitary, inserted above the middle of the stem, oblong-lanceolate, to 15 cm. long and 2 cm. wide; flowers one to rarely 3 that terminate the stem; perianth parts distinct; sepals to 65 mm. long, about 5 mm. wide; petals magenta-pink to white, to 45 mm. long and 12 mm. wide; lip crested, about as long as petals; column free, eroded at apex; capsule erect, cylindrical. *Pogonia divaricata* (L.) R. Br. This species is represented in Tex. by a collection made by E. J. Palmer, but the exact locality is unknown. It doubtlessly occurs in the s.e. part of the state and is to be looked for in low grassy pine barrens, savannahs, prairies, flatwoods, bogs, swamps and along stream banks; rare and of local occurrence from N.J. and Del. s. to cen. Fla., w. to Tenn., Ky. and Tex.; Apr.-July.

The ascending and often recurved linear-lanceolate brownish sepals are distinctive.

9. CALOPOGON R. BR.

Terrestrial scapose herbs arising from orbicular or ellipsoid corms, with a solitary (rarely more) grasslike leaf sheathing the stem near the base; inflorescence a dense or lax few- to several-flowered terminal raceme; flowers conspicuous, showy, varying in color from white to deep-crimson or magenta; sepals and petals free, spreading; lip forming the upper segment of the perianth, with a minute lateral lobe on each side near the base, strongly dilated and bearded above with numerous clavellate hairs and papillae at the apex; column free, slender and somewhat incurved, winged on each side at the apex; anther terminal, operculate; pollinia four, two in each anther cell, the grains connected by filaments; capsule erect, cylindrical or ellipsoid.

A small New World genus of 4 species, chiefly occurring in southeastern United States with one species widespread in eastern Canada and the United States. The bearded lip, which forms the uppermost segment of the flower, is distinctive.

1. Flowers usually 2 to 5, opening almost simultaneously; leaves grasslike, about 2 mm. wide 1. *C. barbatus*.

1. Flowers usually more than 8, opening in slow succession up the raceme to extend over a prolonged period; leaves usually much more than 5 mm. wide 2. *C. pulchellus*.

1. *Calopogon barbatus* (Walt.) Ames. BEARDED GRASS-PINK. Plant usually about 3 dm. tall; leaf less than 2 dm. long and about 2 mm. wide; flowers rarely more than 5; sepals and petals to about 17 mm. long; lip about 11 mm. long. In moist acid sandy soils on edge of bogs, swamps and marshes, and in moist open woodlands, rare in e. Tex. (Henderson Co.), Apr.-May; from N.C. along the Atl. seaboard to Fla., w. along the Gulf Coast to e. Tex.

2. *Calopogon pulchellus* (Salisb.) R. Br. GRASS-PINK. Plant rigidly erect, usually about 5 dm. tall; leaf to 5 dm. long and 5 cm. wide; flowers 8 or more; sepals and petals similar,

typically elliptic, to about 25 mm. long; lip usually more than 12 mm. long. In depressions in savannahs and prairies, marshes, swamps and bogs in e. and s.e. Tex., Apr.-June; from Nfld., s. to s. Fla., w. to Minn., Ia., Mo., Okla. and Tex.

10. PONTHEIVA R. BR.

In this genus there are 25 species that are found in the warmer regions of the Western Hemisphere from southeastern Virginia to Chile, including Mexico, Central America, the West Indies and South America.

1. *Ponthieva racemosa* (Walt.) Mohr. SHADOW-WITCH. Terrestrial scapose herb with fleshy or somewhat fibrous roots, usually about 3 dm. tall; leaves in basal rosette, oblong-elliptic to oblanceolate, obtuse, to 15 cm. long and 5 cm. wide; flowers white-green, fragrant, nonresupinate in a lax terminal raceme; sepals ovate to elliptic-lanceolate, spreading, to 8 mm. long and 3.5 mm. wide; petals attached to the column above its base, oblique, often adherent to the dorsal sepal at the apex; lip on the upper part of the flower, with its claw grown to the column above its base, abruptly dilated and ascending, suborbicular, saccate-concave, to 7 mm. long; capsule suberect, ellipsoid to obovoid-ellipsoid. Along streams in woods or about muddy sloughs and ponds in e. and s.e. Tex., Sept.-Nov.; from s.e. Va., s. to Fla., w. to Tex.; also the W.I. and Latin Am.

The noticeably oblique petals and lip forming the uppermost segment of the flower are characteristic.

11. SPIRANTHES RICH.

LADIES' TRESSES

Coarse or delicate terrestrial herbs with clustered tuberous or rarely fibrous roots; leaves various, mostly basal, broadly ovate to elliptic or narrowly linear to semiterete, persistent or fugacious, reduced above to persistent sheathing bracts; flowers variously colored, usually white and variously tinged or marked with green, yellow, brown or lavender, sometimes brick-red, deep-crimson, yellow-orange or yellow-scarlet, in a more or less spirally twisted showy or inconspicuous terminal spike; sepals free; dorsal sepal and petals coherent; lateral sepals usually somewhat decurrent on the ovary and gibbous at the base or extended to form a mentum; lip sessile or with a short claw, with the basal portion concave and embracing the column, spreading or arcuate-recurved at the apex, crisped, wavy or toothed, with a minute or conspicuous callosity on each side at the base, sometimes ecallose; column short, terete to clavate, essentially footless or extended into a long foot at the base; anther erect on the back of the column, 2-celled; pollinia two, powdery-granular, narrowly obovoid, their filaments coherent to the narrow viscid gland which is set in the thin beak (rostellum) terminating the column (after the removal of the gland the beak is left as a 2-toothed or forked tip); capsule erect, ellipsoid to ovoid or obovoid, sometimes 3-keeled.

A polymorphic genus of about 200 species widely dispersed throughout the North Temperate Zone and tropical Asia and America, south to Chile.

- 1. Flowers forming a dense cylindrical spike, apparently in several ranks; basal leaves (when present) with linear, lanceolate, oblong-elliptic or oblanceolate blades, never with a distinct petiole, the lower part sheathing the stem (2)
- 1. Flowers forming a loose or dense usually spiral spike, single-ranked, often secund; basal leaves (when present) with ovate, oblong-elliptic, lanceolate or semiterete blades, with a distinct petiole or with the lower part sheathing the stem (6)
- 2(1). Plant small, slender; spike ovoid to narrowly cylindrical, more or less tapering at each end, 15 mm. or less in diameter; lip 5.5 mm. or less long 7. *S. ovalis*.
- 2. Plants usually large, stout; spike cylindrical-elongated to pyramidal, usually much more than 15 mm. in diameter; lip more than 6 mm. long (3)
- 3(2). Spike large, showy, 3-6 cm. in diameter; flowers colorful, varying from greenish-white to yellow-scarlet or deep-crimson; lateral sepals long-decurrent on the ovary; column foot elongated and about as long as the column; rostellum a long awl-shaped bristlelike point 2. *S. cinnabarina*.

3. Spike comparatively slender, mostly inconspicuous, 3 cm. or less in diameter; flowers usually white, rarely orange-yellow; lateral sepals only shortly decurrent on the ovary; column foot short or indistinct; rostellum not awl-shaped (4)
- 4(3). Flowers varying in color from nearly white to greenish-white or orange-yellow, suffused or striped with bluish-green; lamina of lip ecallose 3. *S. michuacana*.
4. Flowers white, sometimes tinged or marked with yellow; lamina of lip with a prominent or small callosity on each side at the base (5)
- 5(4). Lip ovate-oblong, usually slightly constricted about the middle and then dilated at the apex, mostly less than 10 mm. long; leaves basal or only on the lower part of the stem 6. *S. cernua* var. *cernua*.
5. Lip with the basal half dilated, broadly rhombic-ovate, tapering to the obtuse to subacute apex, often as much as 14 mm. long; leaves often extending up the stem 6. *S. cernua* var. *odorata*.
- 6(1). Lip prominently panduriform, with a narrow isthmus or constriction separating the basal half from the more or less expanded apical lobe or lobule (7)
6. Lip not prominently panduriform, essentially simple and entire, at most fringed or crenulate, ovate to oblong (8)
- 7(6). Basal half of lip oblong-quadrate, adorned with a spongy cinnabar-red tissue ... 13. *S. parasitica*.
7. Basal half of lip orbicular, concave, not provided with a cinnabar-red tissue 1. *S. durangensis*.
- 8(6). Lip oval (5-5.5 mm. long); petals oval to obovate or suborbicular, with the anterior margin more or less erose; leaves absent at time of flowering 12. *S. Parksii*.
8. Lip ovate to oblong, if oval more than 5.5 mm. long; petals linear to elliptic-oblong or oblanceolate; leaves absent or present at time of flowering (9)
- 9(8). Basal leaves spreading, with the relatively short and broad blades having a distinct petiole, ovate to narrowly oblong-elliptic, persistent or fugacious (10)
9. Basal leaves erect, ascending, linear, narrowly lanceolate or oblong-elliptic, epetiolate, with the lower portion sheathing the stem, persistent or fugacious (13)
- 10(9). Lip quadrate to oblong-quadrate, white, less than 4 mm. long 9. *S. Grayi*.
10. Lip ovate, oblong-quadrate or oblong-elliptic, 4-6 mm. long (rarely 3.5 mm. long in var. *brevilabris*) (11)
- 11(10). Plant with a densely pubescent spike; lip deeply fringed and with a prominent tuft of hairs on the disk near the apex; leaves usually persistent; flowering in the spring 8. *S. gracilis* var. *brevilabris*.
11. Plant essentially glabrous throughout (12)
- 12(11). Lip with a broad green stripe on the central portion of the disk; leaves fugacious; usually flowering in the fall 8. *S. gracilis* var. *gracilis*.
12. Lip with a broad yellow stripe on the central portion of the disk, often also flecked with green; leaves mostly persistent; usually flowering in the spring 8. *S. gracilis* var. *floridana*.
- 13(9). Flowers secund (rarely slightly spiraled); lip from a broad base tapering to obtuse apex, 6-9.5 mm. long; basal leaves fugacious .11. *S. longilabris*.
13. Flowers strongly spiraled; lip ovate, orbicular-quadrate, oblong or oblong-quadrate; basal leaves persistent or fugacious (14)
- 14(13). Lip oblong-elliptic to oblong, membranaceous, with parallel lateral margins or often broadest at or near the distal end, veined with green; spike glabrous or very sparsely pubescent 10. *S. praecox*.
14. Lip ovate to ovate-oblong or ovate-elliptic, usually fleshy-thickened, broadest at or near the base (15)

- 15(14). Lip ovate to ovate-elliptic; spike densely pubescent; ovaries usually covered by a thick mat of reddish-brown hairs4. *S. vernalis*.
 15. Lip ovate-oblong, often from a suborbicular base, conspicuously laciniate along the apical margins; spike more or less pubescent5. *S. × laciniata*.

1. *Spiranthes durangensis* Ames & C. Schweinf. Plant scapose, erect, 2.5-5 dm. tall; flowers fragrant; sepals and petals dull-brownish-pink to purplish, often with green nerves, about 15 mm. long; lip whitish-pink with green nerves, with a short arcuate claw, only slightly longer than the sepals. In grassy pockets of rimrocks, on rocky bluffs and seepage slopes in the mts. of the Trans-Pecos, May-July; also Mex.

The lip strongly constricted about the middle is distinctive.

2. *Spiranthes cinnabarina* (La Llave & Lex.) Hemsl. SCARLET LADIES' TRESSES. Plant stout, glabrous below, pubescent above with articulated hairs; floral segments typically lanceolate, to 25 mm. long. On rocky mt. slopes, canyons, grassy hills and in meadows, often on limestone hills, in the Chisos Mts. in the Trans-Pecos, Aug.-Oct.; from w. Tex. through Mex. to n.w. Guat.

The relatively large yellowish-orange to yellow-scarlet flowers are distinctive in this genus.

3. *Spiranthes michuacana* (La Llave & Lex.) Hemsl. Plant erect, to 8 dm. tall; rachis more or less covered by a white tomentum; flowers fragrant, about 17 mm. long. In clayey soil of scrub forests, on rocky grassy slopes and in fields in the mts. of the Trans-Pecos, Oct.-Nov.; also Ariz. and Mex.

The large glandular-pilose floral bracts that about equal the length of the flowers are distinctive.

4. *Spiranthes vernalis* Engelm. & Gray. SPRING LADIES' TRESSES. Plant slender or stout, usually about 5 dm. tall; leaves linear to narrowly lanceolate, acuminate; spike densely spiraled; flowers 5-10 mm. long, yellowish or sometimes marked with green, fragrant. *Ibidium vernale* (Engelm. & Gray) House. In wet prairies, savannahs and meadows, fresh and coastal salt marshes, swamps, beaches and dune areas in the e. third of Tex., Apr.-July; from Que. and Mass., s. to s. Fla., w. to Mo., Kan., Okla., and N.M.; also Mex. and Guat.

Characterized by its copiously pubescent rachis and ovaries that are provided with articulated, brownish, sharp-pointed hairs.

5. *Spiranthes × laciniata* (Small) Ames. LACE-LIP SPIRAL-ORCHID. Rather coarse plants that have intermediate characters between *S. praecox* and *S. vernalis*. *Ibidium laciniatum* (Small) House. In marshes and shallow water of cypress swamps and in boggy depressions in savannahs and prairies in s.e. Tex., May-July; from N.J., s. to Fla., w. along the Gulf Coast to Tex.

6. *Spiranthes cernua* (L.) Rich. var. *cernua*. NODDING LADIES' TRESSES. *Ibidium cernuum* (L.) House. Plant erect, glabrous below, downy-pubescent above, usually about 4 dm. tall; flowers 6-11 mm. long, usually fragrant; lip ovate-oblong to oblong. In swamps, wet woods, stream bottoms, grassy seepage slopes in cen. and e. Tex., July-Dec.; from N.S. and Ont., s. to s. Fla., w. to Minn., S.D., Neb., Kan., Okla. and N.M.

Var. *odorata* (Nutt.) Correll. FRAGRANT LADIES' TRESSES. The thickish lip of var. *odorata* is broadly ovate instead of being oblongish as in var. *cernua*. *Gyrostachys odorata* (Nutt.) O. Ktze. This variety occurs sparingly throughout the area of distribution of var. *cernua*. It attains its maximum development in the southeastern states where it is commonly found in stoloniferous colonies in water and mud of swamps, marshes, and along wooded rivers and streams.

7. *Spiranthes ovalis* Lindl. OVAL LADIES' TRESSES. Plant slender, rarely more than 35 cm. tall; leaves 2 to 4 at the base, gradually reduced above to sheathing bracts, elliptic to lanceolate, to 15 cm. long and 15 mm. wide; spike 2-10 cm. long, 1-1.3 cm. in diameter; flowers white, less than 5 mm. long. *Ibidium ovale* (Lindl.) House. In moist shady woods and on the edge of thickets, on wooded hills, along streams and sometimes in floodplain woods in n.-cen. and e. Tex., Aug.-Oct.; from W.Va. and Va., s. to n.-cen. Fla., w. to Ind., Mo., Okla. and Tex., rare.

The slender, compact, more or less fusiform, spike of small flowers is distinctive.

8. *Spiranthes gracilis* (Bigel.) Beck var. *gracilis*. GREEN-LIP LADIES' TRESSES. Plants slender, essentially glabrous throughout, about 5 dm. tall, with fasciculate fleshy roots; leaves (when present) to 65 mm. long and 23 mm. wide; flowers white with the lip

marked with green, 4-6 mm. long. *Gyrostachys gracilis* (Bigel.) O. Ktze., *Ibidium gracile* (Bigel.) House. In sandy post oak woods, gravelly soils, on open-wooded slopes, in fields, meadows and prairies of n.-cen., e. and s.e. Tex., July-Oct.; from N.S. and N.B., s. to s.-cen. Fla., w. to Minn., Ia., Mo., Okla. and Tex.

The broad green stripe in the center of the lip, which is rarely more than 5 mm. long, is distinctive. Also, the usually fugacious basal leaves are ovate to ovate-lanceolate instead of being grasslike as in most of our species.

Var. *brevilabris* (Lindl.) Correll. TEXAS LADIES' TRESSES. Similar to var. *gracilis* except for the densely pubescent spike, persistent basal leaves, and earlier flowering period in March and May. *Spiranthes brevilabris* Lindl. Originally described from Tex., this variety is rare from s. Tex. e. to Fla. in habitats similar to those of var. *gracilis*.

Var. *floridana* (Wherry) Correll. FLORIDA LADIES' TRESSES. Similar to var. *gracilis* except for the lip having a yellow instead of green center and the much narrower and elongated basal leaves being persistent; also flowering earlier, from April to June. *Ibidium floridanum* Wherry. Occurring in habitats similar to var. *gracilis* from N.C., s. to cen. Fla. and w. to Tex.

9. *Spiranthes Grayi* Ames. LITTLE LADIES' TRESSES. Plants very slender, rarely more than 4 dm. tall, produced from a single tuberous root; leaves similar to those of *S. gracilis*. *S. Beckii* Lindl., *Gyrostachys simplex* (Gray) O. Ktze., *Ibidium Beckii* (Lindl.) House. In damp sandy soil of shady forests, well-drained wooded slopes, along wooded stream-banks in e. and s.e. Tex., June-Aug., rarely earlier; from Mass., s. to s.-cen. Fla., w. to Ky., Ark. and Tex.

The extremely slender spike of tiny white flowers, with segments 2-4 mm. long, is characteristic.

10. *Spiranthes praecox* (Walt.) Wats. GRASS-LEAVED LADIES' TRESSES. Plant usually slender, essentially glabrous throughout, to 75 cm. tall; spike loosely to densely flowered; perianth 5.5-11 mm. long. *Gyrostachys praecox* (Walt.) O. Ktze., *Ibidium praecox* (Walt.) House. In low wet grassy pinelands and flatwoods, wet prairies, savannahs and meadows, in bogs and coastal marshes in e. and s.e. Tex., Mar.-June; from N.J., s. to s. Fla., w. to Ark. and Tex.

The thin green-veined oblong lip, which is 5.5-10 mm. long, is distinctive.

11. *Spiranthes longilabris* Lindl. GIANT SPIRAL-ORCHID. Plant erect, slender, essentially glabrous throughout, to 6 dm. tall; flowers white or white tinged with cream-color, conspicuously ringent, 6-10 mm. long. Commonly in wet grassy pine barrens and flatwoods, swamps, marshes, wet savannahs and prairies, and sandy bogs in s.e. Tex., Oct.-Dec.; from e. N.C., s. to Fla., and w. to Tex.

The characteristically secund inflorescence of horizontally projecting flowers separates this species from all other Texas *Spiranthes*. Its nearest ally, *S. praecox*, with which it may be confused, has flowers whose lips are marked or veined with green, a character lacking in *S. longilabris*.

12. *Spiranthes Parksii* Correll. Plant small, erect, 2-3 dm. tall; spike few-flowered, about 5 cm. long; flowers 5-7 mm. long. The characteristically obovate petals and oval lip are distinctive and conveniently separate this species from all other species of *Spiranthes* found in Texas. Endemic in Tex. along the Navasota River in Brazos Co., Oct.

13. *Spiranthes parasitica* A. Rich. & Gal. Plant slender, to about 3 dm. tall; spike slender, few-flowered; sepals and petals pink, 5-8 mm. long; lip 6-9 mm. long, white with 3 green stripes extending almost to the apex, with cinnabar-red tissue on the basal portion. In moist shaded soil along creeks, on dry slopes and forests in the mts. of the Trans-Pecos, June; also in Ariz., Mex. and C.A.

The persistent spongy cinnabar-red blotch on the disk of the lip is distinctive.

12. ERYTHRODES BL.

A complex genus of about 100 species found in the tropics and subtropics of both hemispheres.

1. *Erythroides querceticola* (Lindl.) Ames. Plant slender, leafy, glabrous, erect from a geniculate-prostrate stoloniferous base, rooting at the nodes, usually about 3 dm. tall;

leaves with short petioles that surround the stem at the base, ovate to lanceolate or elliptic-lanceolate, usually reticulate-veined, to 8 cm. long and 3 cm. wide; flowers yellowish-green or white, subsessile in a spicate raceme; sepals and petals 3-4.5 mm. long; lip 3-lobed above, 5-7 mm. long (including the basal spur), usually provided with 4 or more mammillate calli or calluslike structures on the interior near the base. Reported from Texas but no material has been seen. It should be looked for in moist partially shaded woodlands in e. Tex., often associated with the grass, *Oplismenus hirtellus*; from Fla., w. to La. and Tex. (?); also Bah. I., W.I., Mex. and C.A.

13. MALAXIS Sw.

Inconspicuous terrestrial scapose herbs arising from a swollen or cormlike base; scape bearing one or two leaves about the middle or occasionally just below the inflorescence; inflorescence a many-flowered elongated spike or raceme of small flowers terminating the stem; sepals free or with the lateral sepals connate, spreading; petals narrowly linear or filiform, usually strongly recurved; lip sessile, the uppermost segment of the perianth, erect, tridentate at the apex, usually auriculate and concave; column short, terete, often toothed at the apex; anther terminal, erect or incumbent; pollinia four, waxy; capsule small, ovoid to ellipsoid or subglobose.

A genus of about 250 species which attains its greatest development in Asia and Oceania; also widely distributed in the Western Hemisphere and sparsely in Europe.

1. Flowers deep-maroon to rarely greenish; lip acuminate at apex1. *M. Ehrenbergii*.
1. Flowers green or yellowish-green; lip unequally tridentate at apex with the middle tooth minute (2)
- 2(1). Flowers subsessile; pedicels less than 2 mm. long; raceme spicate, narrowly cylindrical, densely many-flowered, usually much less than 10 mm. in diameter ..
.....2. *M. Soulei*.
2. Flowers on slender pedicels more than 3 mm. long; raceme subcorymbose to slender-elongated, laxly few- to many-flowered, usually more than 15 mm. in diameter ...
.....3. *M. unifolia*.

1. *Malaxis Ehrenbergii* (Reichb. f.) O. Ktze. Plant slender, glabrous, to nearly 5 dm. tall; leaf solitary, suborbicular to oblong-elliptic, to 1 dm. long and 6 cm. wide; pedicels 2-3 mm. long; flowers deep-maroon to rarely greenish; lip triangular-lanceolate and more or less hastate, 2-2.5 mm. long. In humus of open forests and about igneous rocks in Chisos Mts. of the Big Bend, rare, summer-fall; from w. Tex. to Ariz., s. through Mex. to Guat.

2. *Malaxis Soulei* L. O. Wms. MOUNTAIN MALAXIS. Plant slender, glabrous, to 5 dm. tall; leaf solitary, cordate-ovate to oblong-lanceolate, to 15 cm. long and 6 cm. wide; pedicels stout, to 2 mm. long; flowers minute, yellowish-green; lip uppermost in the flower, 1.5-2.8 mm. long. In humus in moist canyons and ravines, and on wooded slopes in the mts. of the Trans-Pecos, July-Oct., from w. Tex. to Ariz., s. through Mex. to C.A.

3. *Malaxis unifolia* Michx. GREEN ADDER'S MOUTH. Plant bright-green, to 55 cm. tall; leaf solitary, orbicular-ovate to ovate-lanceolate, to 9 cm. long and 65 mm. wide; pedicels filiform, 3-10 mm. long; flowers green; lip lowermost in the flower, 2-4 mm. long. *Achroanthes unifolia* (Michx.) Raf. On moist wooded slopes along streams, ravines, and in mixed pine-hardwood forests in e. Tex., Mar.-July; from Nfld., s. to n. Fla., w. to Minn., Mo., Ark. and Tex.; also Cuba, Jam. and Mex.

14. TIPULARIA NUTT.

A genus represented by only one other species which occurs in Japan.

1. *Tipularia discolor* (Pursh) Nutt. CRIPPLED CRANE-FLY. Inconspicuous terrestrial scapose herb to 65 cm. high, arising from a horizontal series of corms which alternately produce a leaf in autumn and a slender scape in summer, the stem brownish-green, suffused with purple or bronze; leaf solitary, fugacious with the arrival of the scape

inflorescence, cordate-ovate, green above, purplish beneath, to 1 dm. long and 7 cm. wide; perianth segments similar, typically oblong-elliptic, 4-8 mm. long; lip 3-lobed, with a slender spur produced at the base; spur horizontal or ascending, 1.5-2 cm. long; capsule ovoid, pendent. *T. unifolia* (Muhl.) B.S.P. In humus of rich damp woods, along streams, on pine-hardwood slopes, and in floodplain areas of e. and s.e. Tex., July-Aug.; from N.Y. and Pa., s. to n. Fla., w. to O., Ind., Ky., Ark. and Tex.

This is apparently the only species in the Orchidaceae known to have an asymmetrically arranged perianth in which one of the petals distinctly overlaps the dorsal sepal for about half its width. Another interesting characteristic of this species is the fact that during the winter a solitary ovate leaf, purplish beneath, remains above ground, usually lying on or among fallen leaves. The leaf withers away in summer before or just as the slender flowering scape arises from the series of underground corms.

15. HEXALECTRIS RAF.

Terrestrial scapose saprophytic herbs arising from slender or stout coralloid and annulated rhizomes; stem flesh-colored or purplish, apparently lacking chlorophyll, simple or occasionally branched; leaves reduced to buff or purplish sheathing scales; inflorescence a lax terminal few-flowered raceme; flowers showy, rose-lavender, purplish, red or yellowish, often variously striped or mottled with purple, rarely nearly white; sepals and petals free, spreading or somewhat revolute; lip 3-lobed, crested on the disk with several longitudinal central lamellae or ridges; column slender, shallowly winged on each side at the summit; pollinia eight, four in each cell of the anther, waxy, fasciculate.

A small genus of only 6 species in the United States and Mexico.

1. Midlobe of lip adorned with three irregularly scalloped and broken lamellae 1. *H. Warnockii*.
1. Midlobe of lip not as above, without prominent lamellae (2)
- 2(1). Lateral lobes of lip free for 3 mm. or more (3)
2. Lateral lobes of lip free for 2 mm. or less (4)
- 3(2). Lateral lobes of lip oblong, obtuse; lip broadly elliptic in outline, 14 mm. or more long 4. *H. revoluta*.
3. Lateral lobes of lip subquadrate to suborbicular-obovate, broad at the apex; lip obovate in outline, 13 mm. or less long 2. *H. grandiflora*.
- 4(2). Lip less than 10 mm. long 5. *H. nitida*.
4. Lip more than 12 mm. long 3. *H. spicata*.

1. *Hexalectris Warnockii* Ames & Correll. TEXAS PURPLE-SPIKE. Plant 1.5-3 dm. tall; raceme 3- to 8-flowered; sepals and petals maroon or deep-purple, 1.5-2 cm. long; petals oblanceolate to linear-spatulate; lip white with the lateral lobes veined with purple, adorned with orange-yellow lamellae and purple at the apex, about as long as the petals. In humus beneath oaks or in cedar-oak groves on the Edwards Plateau and in the Trans-Pecos, June-Aug.; also in the Chiricahua National Monument, Ariz.

The slender maroon or deep-purple stem and the rather large nodding flowers are characteristics of this species.

2. *Hexalectris grandiflora* (A. Rich. & Gal.) L. O. Wms. GREENMAN'S HEXALECTRIS. Plant purplish, to 6 dm. tall; flowers deep-rose-lavender to purplish-red, sometimes nearly white; petals oblong-ob lanceolate, 12-23 mm. long; lip 1-1.3 cm. long. *H. mexicana* Greenm. In rich humus of woods in ravines, moist canyons, and on stream banks in the mts. of the Trans-Pecos, June-Aug.; also Mex.

3. *Hexalectris spicata* (Walt.) Barnh. CRESTED CORAL-ROOT. Plant often stout, to 8 dm. tall; sepals and petals yellowish with purplish-brown striations, strongly 5-nerved; petals oblong-elliptic to narrowly oblong-spatulate, 1.8-2 cm. long; lip yellowish-white, with purple striations, 14-17 mm. long. *H. aphylla* (Nutt.) Raf. In moist shady soil on stream banks, in creek basins, grassy woodlands, canyons, cedar thickets, usually associated with limestone, in cen. and Trans-Pecos Tex., May-July; from W.Va. and Md., s. to cen. Fla., w. to Ind., Ky., Mo., Ark. and N.M.; also Mex.

4. *Hexalectris revoluta* Correll. Closely allied to *H. spicata*; plant 3-4.5 dm. tall; sepals and petals 1.5-2 cm. long; petals elliptic to elliptic-obovate; lip about as long as

the petals. In moist or dry open oak woods in canyons in the mts. in the Trans-Pecos, June-July; also n. Mex.

When the flowers are fully expanded the sepals and petals are usually conspicuously revolute, often being tightly rolled back a third or more their length.

5. *Hexalectris nitida* L. O. Wms. Plant to about 3 dm. tall; flowers deep-purple and vernicose; petals narrowly obovate to oblanceolate. Among rocks in shaded canyons in the mts. of the Trans-Pecos, July-Aug.; also n. Mex.

This is the smallest flowered species in the genus, with all the segments usually less than 1 cm. long.

16. CORALLORHIZA CHÂT.

Inconspicuous terrestrial saprophytic scapose herbs with short or somewhat elongated rhizomes that are much-branched, toothed and coralloid; stem brownish, yellowish or purplish, destitute of green foliage, clothed with several membranaceous sheaths; inflorescence terminating the simple naked scape, consisting of a lax raceme of yellowish, brownish or purplish flowers, the flowers sometimes greenish or whitish; sepals subequal, ascending, spreading or connivent; lateral sepals united at the base to form a short mentum which is more or less adnate to the ovary; lip simple to 3-lobed, slightly adherent to the base of the column; column compressed; anther terminal; pollinia four, waxy, free; capsule ovoid to ellipsoid, pendent.

A small complex genus of about 12 species, mainly in North and Central America, with the greatest number of species in Mexico and its greatest development in the United States and Canada; one species in Eurasia.

- 1. Lip unequally 3-lobed, with the lateral lobes smaller than the midlobe 1. *C. maculata*.
- 1. Lip not 3-lobed, at most notched, erose-denticulate or undulate on the margins (2)
- 2(1). Lip not linguiform, with flat margins which are not thickened at the base; disk with a pair of separate lamellae on the lower half; perianth segments without prominent striations 2. *C. Wisteriana*.
- 2. Lip linguiform, with conspicuously involute margins which are much-thickened at the base; disk of lip with fleshy bilobed callus in the middle near the base; perianth segments usually conspicuously striate-veined 3. *C. striata*.

1. *Corallorhiza maculata* Raf. SPOTTED CORAL-ROOT. Plant madder-purple or yellowish, to 75 cm. tall; sepals and petals crimson-purple or rarely greenish, 3-nerved; petals oblong-lanceolate to oblanceolate, 5.5-7.5 mm. long; lip nearly pure-white or white and spotted with magenta-crimson, about as long as the petals. *C. multiflora* Nutt. In rich decaying humus in pine-hardwood forests in the mts. of the Trans-Pecos, July-Aug.; from Nfld. and N.S., s. to w. N.C., w. to Wash., Ore. and Calif., s.w. to Tex., N.M. and Ariz.; also Mex. and Guat.

2. *Corallorhiza Wisteriana* Conrad. SPRING CORAL-ROOT. Plant yellowish or sometimes madder-purple, to about 4 dm. tall; sepals and petals greenish-yellow, tinged with brown-purple; petals linear to narrowly ovate-elliptic, 5.5-7.5 mm. long; lip white, spotted with magenta-purple, about as long as the petals. On upland forested slopes, in cedar brakes, canyons, on river bluffs, in the e. half of Tex., Feb.-May; found sparingly from Pa., W.Va. and Va., s. to cen. Fla., w. to Wash., Wyo., Ut., Colo. and Ariz.; also Mex.

3. *Corallorhiza striata* Lindl. STRIPED CORAL-ROOT. Plant madder-purple to brownish-purple, to 5 dm. tall; flowers rather large for the genus, pinkish-yellow or whitish, tinged and conspicuously striped with reddish-purple, the segments to 15 mm. long. In moist soil in dense damp forests, canyons and on shaded banks along streams in the Trans-Pecos, May-July; from Que. and Ont., w. to Wash., Ore. and Calif., s.w. to Tex. and N.M.; also n. Mex.

SUBCLASS 2. DICOTYLEDONEAE

Stem exogenous, of pith, wood and bark, the wood in one or more layers surrounding a central pith, traversed by medullary rays, and covered by the bark (endogenous in

structure in Nymphaeaceae). Leaves usually pinnately or palmately veined, the veinlets forming a network. Parts of the flower usually in fours or fives, rarely in threes or sixes. Embryo of the seed with two cotyledons (one only in Nymphaeaceae and some species of Ranunculaceae; in *Quercus* and a few other genera 3 sometimes occur, and in some species of *Amsinckia* 4), the first leaves of the germinating plantlet opposite.

Dicotyledonous plants are first definitely known in Cretaceous time. They include more than 160,000 species and constitute nearly four fifths of all flowering plants.

FAM. 46. SAURURACEAE E. MEY.
LIZARD'S-TAIL FAMILY

Erect or ascending more or less aromatic perennial herbs, usually rhizomatous and stoloniferous; stems jointed; leaves alternate, simple, usually petioled; stipules adnate to petiole; flowers perfect, in congested or lax elongated spikes that may or may not be subtended by an involucre; perianth none; pistils 3 or 4, indehiscent, 1-seeded, free or united at the base; stamens as many as 8, free or adnate to ovary at base or epigynous, the 2-celled anthers longitudinally dehiscent; fruit a somewhat succulent capsule, in ours dehiscing apically through the central-apical portion of the folliclelike capsule.

A small family comprised of 5 genera and about 7 species in North America and Asia.

- 1. Leaves mostly basal; spike subtended by an involucre; west and southwest Texas . . .
 1. *Anemopsis*, p. 448.
- 1. Leaves all cauline; spike naked, not subtended by an involucre; east and southeast Texas 2. *Saururus*, p. 448.

1. ANEMOPSIS H. & A.

A monotypic genus.

1. *Anemopsis californica* (Nutt.) H. & A. YERBA MANSÁ. Plant forming colonies, usually about 3 dm. tall; stems nodose, scapelike, from aromatic creeping rootstocks; leaves mostly basal, those on the stem subtended by a sheathing bracteose leaf, elliptic-oblong, truncate or cordate at base, to 15 cm. long, with the petiole about as long as the blade; spike conical, 1.5-4 cm. long, subtended by a whorl of white or reddish bracts; most of the flowers subtended by a white obovate clawed bract; ovary sunk in the rachis of spike; fruit a capsule. In alkaline or saline soils of meadows, flats, and along streams in w. and s.w. Tex., recently reported from Hemphill and Lubbock cos. in the Panhandle, May-July; from Calif. and Ariz., n.e. to cen. Colo. and e. to w. Tex.; also n. Mex.

2. SAURURUS L.

Another species occurs in eastern Asia.

1. *Saururus cernuus* L. LIZARD'S-TAIL. Plant forming colonies, to about 9 dm. tall; stem naked below, leafy above, simple or branched; leaves cauline, cordate-ovate, the veins converging, to 15 cm. long, much longer than the petiole; stipules indistinct; spike to 3 dm. long and 15 mm. in diameter, peduncled, wandlike, naked, pubescent, curved-nodding at tip; flowers white, crowded, provided with a small bract that is adnate to or borne on the pedicel; stamens with long slender filaments; pistils (carpels) united at base; stigmas recurved; fruit somewhat fleshy, wrinkled. In water or muddy soils of lakes, swamps and streams in e. and s.e. Tex., May-Aug.; from s.w. Que. and s. Ont., s. to Fla., w. to Minn., Ill., Mo., Kan. and Tex.

FAM. 47. SALICACEAE MIRR. WILLOW FAMILY

Shrubs or trees with soft light wood, bitter bark and simple alternate deciduous stipulate leaves; stipules deciduous or persistent; dioecious (sexes on separate plants); flowers in aments (catkins) which fall off as a unit (the staminate after shedding pollen,

the pistillate after ripening and dispersal of seeds); flowers subtended by a single scale-like bract; stamens 2 to many; fruit a 1-celled capsule, 2- to 4-valved, containing numerous seeds that are surrounded by a tuft of long silky white or tawny hairs that arise from the base; style 1, rarely wanting; stigmas 2 to 4, sometimes 2-lobed.

A family containing only the following two genera, both of which are widely distributed but most abundant in North Temperate and Alpine-Arctic regions.

1. Buds with a single scale; floral bracts entire or merely toothed, tardily deciduous or persistent; flowers with a ventral and sometimes a dorsal gland; disk none; stamens 2 to 7 or 8; capsule 2-valved 1. *Salix*, p. 449.
1. Buds with several imbricated scales, often resinous; floral bracts lacerate, caducous; flowers borne on a shallow or cup-shaped disk; stamens 6 to 60; capsule 2- to 4-valved 2. *Populus*, p. 453.

1. SALIX L.⁴⁰ WILLOW

Prostrate to ascending or erect shrubs to large trees, to 36 m. or more in height; bud-scale one, with an adhering inner membrane; leaf blades variable, linear, lanceolate, oblanceolate, elliptic or oblong, petiolate, often persistently stipulate, green or glaucous on the lower surface, hairy to glabrous, the margins entire or somewhat revolute, denticulate, serrulate, crenate, undulate, or undulate-serrulate; aments precocious, coetaneous or serotinous, ascending, divaricate or somewhat recurved (never pendulous), 1-10 cm. or more long, slender and flexuous to stout and dense; flower scales entire to erose-toothed, yellowish to black, mostly hairy, tardily deciduous or persistent; stamens 2 (sometimes united) to 7 or 8, with 1 ventral and sometimes 1 dorsal gland; capsules with 2 valves recurving at maturity, lanceolate to ovoid, 2-9 mm. long, hairy to glabrous, sessile or pedicelled (0.5-3 mm. long), with 1 ventral gland and sometimes 1 dorsal gland; style 1 (sometimes wanting), entire or more or less divided; stigmas 2, entire or more or less divided; without a disk; seeds numerous, minute, 0.8-1.2 mm. long, oblong, bearing a tuft of silky hairs at base.

A genus of about 500 species, widely distributed throughout the North Temperate and Arctic zones, a few in the American tropics and Southern Hemisphere.

KEY BASED ON VEGETATIVE CHARACTERS

- A. Leaves narrowly lanceolate to lanceolate, acuminate to long-acuminate, 5-10 or 12 cm. long, finely serrulate, the vein islets beneath very small (1)
- B. Leaves linear or linear-oblong, acute, almost sessile, subentire to remotely and irregularly denticulate (sect. *Longifoliae*) (8)
- C. Leaves linear-oblong or linear-oblanceolate, 5-10 cm. long, distinctly petioled, entire to undulate-serrate, glaucous on lower surface, more or less pubescent (14)
 - 1(A). Leaves green beneath, linear-lanceolate, acuminate (sect. *Nigrae*) (2)
 1. Leaves glaucescent to glaucous beneath (4)
 - 2(1). Twigs all yellowish; blades narrowly lanceolate 2. *S. Gooddingii* var. *variabilis*.
 2. Twigs brown to blackish (seasonal somewhat yellowish) (3)
 - 3(2). Petioles short, averaging about 6 mm. long, brownish, pubescent; blades broader, less narrowed at base 1. *S. nigra* var. *nigra*.
 3. Petioles longer, averaging about 8 mm. long, yellowish, glabrous; blades narrower, more narrowed at base 1a. *S. nigra* var. *Lindheimeri*.
 - 4(1). Petioles with glands near leaf base; blades lanceolate, coarsely crenate-serrate, dark-green above, glabrous 11. *S. fragilis*.
 4. Petioles without glands near leaf base (5)

⁴⁰ Adapted from Carleton R. Ball in C. L. Lundell, Flora of Texas III: 369-392. 1961.

- 5(4). Twigs brownish, often pubescent; blades linear- to narrowly lanceolate, long-acuminate, often pubescent, dark-green above (sect. *Bonplandianae*) (*S. longipes* var. *Wardii*) 4. *S. caroliniana*.
5. Twigs yellow or yellowish, glabrous; blades yellowish-green above, glabrous (6)
- 6(5). Twigs enormously elongated and pendulous (weeping); blades linear-lanceolate, falcate 10. *S. babylonica*.
6. Twigs slender but not greatly elongated or pendulous (7)
- 7(6). Blades lanceolate or somewhat ovate-lanceolate; aments lax 3. *S. amygdaloides* var. *amygdaloides*.
7. Blades linear-lanceolate or lingulate-lanceolate; aments denser 3a. *S. amygdaloides* var. *Wrightii*.
- 8(B). Blades yellowish-green, somewhat translucent, glabrous (more or less thinly hairy while developing) (9)
8. Blades green, more opaque, silvery-silky or more or less gray-pubescent (10)
- 9(8). Blades 5-10 or 12 cm. long, 5-10 mm. wide 5. *S. interior* var. *interior*.
9. Blades 5-8 or 10 cm. long, 2-5 mm. wide 5a. *S. interior* var. *pedicellata*.
- 10(8). Blades silvery-silky, at least until full-size (11)
10. Blades more or less gray-puberulent or gray-pubescent (12)
- 11(10). Blades 6-10 or 12 cm. long, usually sharply denticulate, the hairs persisting beneath (especially on midrib) 5b. *S. interior* var. *angustissima*.
11. Blades 5-8 cm. long, mostly subentire, the hairs persisting on both surfaces 6b. *S. exigua* var. *stenophylla*.
- 12(10). Blades only occasionally more than 4 cm. long and 4 mm. wide, usually crowded, yewlike, pubescent, often becoming glabrate 7. *S. taxifolia*.
12. Blades only occasionally less than 5 cm. long, 5 mm. wide, not yewlike, pubescent or glabrous (13)
- 13(12). Blades 5-8 or 10 cm. long, 5-10 or 12 mm. wide, permanently more or less pubescent 6. *S. exigua* var. *exigua*.
13. Blades 4-6 or 8 cm. long, 3-5 or 6 mm. wide, soon glabrate to glabrous and yellowish green 6a. *S. exigua* var. *nevadensis*.
- 14(C). Blades mostly linear-oblongate, pubescent while young, becoming glabrous, densely glaucous and veiny; distribution mostly in mountain canyons (sect. *Lasiolepes*) 8. *S. lasiolepis* var. *Bracelinae*.
14. Blades narrowly elliptic to oblongate, densely pubescent while young, more thinly so and somewhat rugose in age; distribution in low or upland prairies or open wasteland eastward (sect. *Capreae*) 9. *S. humilis* var. *rigidiuscula*.

KEY BASED ON FLORAL CHARACTERS

1. Flower scales yellowish, slowly deciduous; aments leafy-pedunculate (2)
1. Flower scales blackish, persistent; aments precocious, sessile or subsessile (10)
- 2(1). Aments only one per peduncle, mostly coetaneous, occasionally subprecocious; capsules always glabrous (in Texas) (3)
2. Aments (especially staminate) 2 to 4 per peduncle, the supernumerary later, at base of the first, serotinous; stamens 2; ovaries (sometime) and capsules (less frequently) more or less hairy while developing (sect. *Longifoliae*) (7)

on the lower surface; outer branchlets of the lower limbs often somewhat drooping under favorable conditions. In alluvial soils along streams and near bodies of water in the Plains Country and Trans-Pecos, spring; from Que., w. to s.e. B.C., s. to Pa., s.w. Ky., w. Tex., N.M., n.e. Ariz. and n.w. Nev.

3a. *Salix amygdaloides* var. *Wrightii* (Anderss.) Schneid. Var. *Wrightii* differs from var. *amygdaloides* only in its very narrowly lanceolate leaf blades that are 7-10 or rarely 15 mm. wide and 6-8 or 10 cm. long, tapering gradually to the acuminate or long-acuminate apex and with the bases always sharply acute. *S. Wrightii* Anderss., *S. nigra* var. *Wrightii* (Anderss.) DC. Along streams and near bodies of water in w. and s.w. Tex.; also in adj. N.M. and (?) Mex.

4. *Salix caroliniana* Michx. LONG-PEDICELLED WILLOW. Shrubs or trees to 12 m. tall. *S. longipes* Shuttlew., *S. Wardii* Bebb. Along rocky water courses and in coastal sands in s.-cen. Tex., spring; W.I. and Fla., w. Tex., n. to the Potomac Valley, the Ohio River in w. Pa., s. Ind. and s.w. to e. Okla.

5. *Salix interior* Rowlee var. *interior*. SANDBAR WILLOW, TARAY. Shrub with clustered stems, usually to 4 or rarely to 5.5 m. tall. In alluvial soils, mostly along ditches and about bodies of water in n. Tex., s. to the Rio Grande Valley, spring; Potomac and Ohio valleys, n. to s. Can., w. from the Miss. River across the Great Plains, s. to La. and Tex., n.w. to Alas. and Yuk.

5a. *Salix interior* var. *pedicellata* (Anderss.) Ball. NARROW-LEAVED SANDBAR WILLOW. Differs from var. *interior* in the narrowly linear leaves, 2-4 mm. wide, and in the ovaries nearly always glabrous. *S. linearifolia* Rydb. In the drier and higher w. part of the range of var. *interior* from w. Tex. to Mackenzie, Yuk. and Alas., less common in the Miss. Valley.

5b. *Salix interior* var. *angustissima* (Anderss.) Dayton. SILVERY-FRUITED SANDBAR WILLOW. This variety differs from var. *interior* principally in the ovaries being densely white pilose-pubescent and the capsules remaining gray pilose-pubescent even in age. Along streams and near bodies of water in s. and w. Tex.; also adj. N.M. and Mex.

6. *Salix exigua* Nutt. var. *exigua*. GRAY SANDBAR WILLOW. Grayish, leafy, several-stemmed shrubs 2-4 m. tall. Along streams and near bodies of water, usually at high elevations, in the Edwards Plateau, Plains Country and Trans-Pecos, spring; from Calif., n. to B.C. and e. to the w. Great Plains.

6a. *Salix exigua* var. *nevadensis* (Wats.) Schneid. Differs (in part) from var. *exigua* in having browner and more glabrate branchlets, narrower glabrate and yellowish-green leaves, and somewhat more glabrate flower scales. Along streams and near bodies of water, in canyons, in the w. Plains Country and Trans-Pecos; from Calif., Ida. and Ut., e. to s. Colo. and w. Tex.

6b. *Salix exigua* var. *stenophylla* (Rydb.) Schneid. SILVERY DESERT WILLOW. Variety *stenophylla* differs from var. *exigua* in having narrower leaves and in the much more dense silvery-pubescence of all vegetal parts, and branchlets and bud scales more densely pilose-pubescent. From var. *nevadensis* it differs in its densely silvery-pubescent leaves that never become glabrate or yellowish-green in age, except on some vigorous shoots. Along streams and near bodies of water in the Plains Country and Trans-Pecos; from Tex. and n. Mex. to Calif., n. to Colo. and Ida.

7. *Salix taxifolia* Kunth. YEW-LEAF WILLOW. Shrubs or trees to 12 m. tall. Along streams, about springs, and bodies of water in w. Tex., spring; from Tex. to s. Ariz. and n. Mex.

8. *Salix lasiolepis* Benth. var. *Bracelinae* Ball. NARROW-LEAVED ARROYO WILLOW. Shrubs or small trees usually less than 8 m. tall. Along streams in w. Tex., spring; from s. Calif., e. to Tex. and n. Mex.

9. *Salix humilis* Marsh. var. *rigidiuscula* (Anderss.) Robins. & Fern. NARROW-LEAVED PRAIRIE WILLOW. Shrubs with clustered stems, usually less than 25 dm. tall. In dry barrens, fields, open woods and swampy areas in n.e. Tex., spring; from the Appalachian Plateau to the e. edge of the Great Plains, w. to cen. N.D. and Tex.

10. *Salix babylonica* L. WEEPING WILLOW. Trees to 12 m. tall; branchlets extremely slender and greatly elongated, pendulous, yellowish or brownish, glabrous, brittle at base (falling in wind-storms).

A north-China plant, long cultivated in Europe as an emblem of mourning, and early introduced into America as an ornamental. Now widely planted and sparingly escaped, especially in e. U.S.

11. *Salix fragilis* L. BRITTLE or CRACK WILLOW. Large trees to 20 m. tall. Introd. from Eur. in Colonial times for ornament, sentiment, pasture shade, and charcoal for making gunpowder; commonly established along streams as an escape in Can. and e. and cen. U.S. No specimen has been seen from Tex. but it undoubtedly occurs as an escape in the state.

2. POPULUS L.⁴¹ COTTONWOOD. ALAMO

Fast-growing and often short-lived dioecious trees with soft wood, fissured bark and mostly stout branches; branchlets slender or stout, terete or angled, pale-olive-brown or grayish- to lustrous reddish-brown, glabrous to tomentose; buds terminal and lateral, resinous or nonresinous, covered by several imbricated membranaceous scales; leaves alternate, stipulate, varying in shape from deltoid to rhombic or lanceolate, with the margins entire to variously crenate or serrate with the teeth often glandular, rarely lobulate, often bearing glands on upper surface at junction of leaf blade with petiole; petioles stout and much-abbreviated to elongate and slender, more or less terete to laterally compressed, sometimes channeled on upper side; stipules caducous; leaf scars deltoid to elliptic in shape, with 3 bundle scars; flowers without a perianth, in pendulous stalked unisexual aments, appearing before the leaves, borne singly, inserted on a shallow or cup-shaped symmetrical or oblique persistent disk and subtended by a bract; bracts stipitate, mostly cuneate or obovate, entire to variously lacerate or divided above, glabrous to villous, caducous; stamens 6 to 60, the slender filaments free on the disk and the small yellowish-red to purplish anthers ellipsoid to ovoid; ovary sessile on the disk, with 2 to 4 parietal placentae; styles short; stigmas 2 to 4, divided into filiform lobes or broadly dilated and more or less irregularly erose; pistillate aments mostly becoming elongated with age; fruit usually maturing before the leaves are mature, a 2- to 4-valved dehiscent capsule, globose to ellipsoid-conic, pale- to dark-brown; seeds abundant, minute, surrounded at the base by a tuft of long silky white or tawny hairs that are directed upward parallel with and encompassing the seed.

This is a genus of about 35 species, all native of the Northern Hemisphere in both the Old and New World. Many species are widely grown as ornamental shade and street trees, especially because of their rapid growth and ease of propagation from cuttings.

According to some historians, the Alamo of Texas fame received its name from a grove of *Populus* that grew on the banks of the *acequia*, "alamo" being the Spanish word for cottonwood.

1. Leaf blades permanently whitish-tomentose on lower surface; buds tomentose 1. *P. alba*.
1. Leaf blades and buds at most pubescent (2)
 - 2(1). Petioles nearly terete, usually prominently channeled or somewhat flattened on the upper side; leaf blades suborbicular-ovate to rhombic-ovate or lanceolate, the margins mostly finely serrate or crenate-serrate (3)
 2. Petioles conspicuously laterally compressed (especially just below the leaf blades), rarely channeled on the upper side; leaf blades typically deltoid to rhombic-ovate or suborbicular, the margins coarsely or finely crenate-serrate (5)
 - 3(2). Leaf blades more than 3 times as long as wide, pale-green on the lower surface, mostly obtuse to acute; petioles rarely more than 20 mm. long 3. *P. angustifolia*.
 3. Leaf blades rarely as much as twice as long as wide, not conspicuously paler on the lower surface, mostly acuminate; petioles usually more than 25 mm. long (4)
 - 4(3). Pistillate disk sessile; fruit orbicular, 2-3 mm. in diameter; leaf blade suborbicular-ovate to broadly deltoid-ovate, truncate to broadly rounded at the base, the margins sharply and unevenly serrate 4. *P. Hinckleyana*.
 4. Pistillate disk on a pedicel 3-5 mm. long; fruit ellipsoid-ovoid, about 10 mm. long; leaf blade more or less rhombic, commonly rounded-cuneate at base, the margins mostly crenate-serrate 2. *P. acuminata*.

⁴¹ Cf. D. S. Correll in C. L. Lundell, *Flora of Texas* III. 393-407. 1961 for a more detailed treatment.

- 5(2). Leaf blades suborbicular to broadly ovate, abruptly apiculate to shortly acuminate at apex, the margins finely crenate-serrate; found only at high elevations in the mountains of the Trans-Pecos 10. *P. tremuloides*.
- 5. Leaf blades deltoid to broadly rhombic-ovate, coarsely or finely crenate-serrate; not confined to high elevations (6)
- 6(5). Bud scales glabrous; leaf blades finely or coarsely crenate-serrate with usually 10 to 20 teeth on each side (7)
- 6. Bud scales pubescent to puberulent or very rarely subglabrous; leaf blades usually coarsely crenate-serrate with mostly no more than 10 teeth on each side (8)
- 7(6). Leaf blades with 2 or more prominent glands on upper surface at juncture with petioles, typically truncate or cordate at base; fruiting pedicels 8 mm. or more long 7. *P. deltoides*.
- 7. Leaf blades without glands on upper surface at juncture with petioles, typically widely cuneate at base; fruiting pedicels less than 6 mm. long 9. *P. nigra*.
- 8(6). Trees of the Trans-Pecos and along the Rio Grande (9)
- 8. Trees of the Plains Country and eastward (10)
- 9(8). Branchlets (except buds) and petioles essentially glabrous; fruiting pedicels 7 mm. or more long; leaf blades more or less cordate to rarely truncate at base 6. *P. Wislizenii*.
- 9. Branchlets and petioles usually conspicuously pubescent or puberulent; fruiting pedicels rarely more than 3 mm. long; leaf blades usually broadly cuneate or sometimes truncate or rarely cordate at base 5. *P. arizonica*.
- 10(8). Leaf blades with a pair of glands on upper surface at juncture with petioles 8. *P. Sargentii* var. *Sargentii*.
- 10. Leaf blades without basal glands or rarely with rudimentary glands 8. *P. Sargentii* var. *texana*.

1. *Populus alba* L. WHITE POPLAR, ÁLAMO BLANCO. Tree to about 30 m. tall, spreading by rootsprouts, with a wide rounded crown; leaves deltoid-ovate in outline, usually lobulate or coarsely and sinuately toothed, 6-12 cm. long, usually narrower than long; petioles terete, tomentose, 2-4 cm. long; staminate aments 8 cm. long or more; pistillate aments 4-7 cm. long; fruits ovoid, 3-5 mm. long. A commonly cult. tree (nat. of Eur. and Asia) that escapes and becomes naturalized along roadsides and on borders of fields, often becoming a pest, Mar.-May.

2. *Populus acuminata* Rydb. LANCELEAF COTTONWOOD. Tree to 18 m. tall, with a compact pyramidal or domelike crown; petioles 25-75 mm. long; aments 5-12 cm. long; fruits ovoid-ellipsoid, somewhat pitted, about 1 cm. long. In canyons and valleys, about springs and water tanks, and along streams in s. and w. Trans-Pecos, Apr.-June; from s. Alta., s. to Colo., Tex. and N.M.

Our specimens have narrow tapering leaves with petioles that are nearly terete and which are conspicuously channeled on the upper side. The leaf blade is 5-12 cm. long.

3. *Populus angustifolia* James. NARROWLEAF COTTONWOOD. Tree to 20 m. tall, with a narrow pyramidal crown; leaves 4.5-15 cm. long, 2-3.5 cm. wide; aments densely flowered, narrowly cylindrical, 4-7 cm. long; fruits broadly ovoid to subglobose, 5-7.5 mm. long. In its area of distribution this species is found along streams usually above 3,500 ft. alt., rare in the Trans-Pecos, Mar.-June; from s. Sask. and s. Alta., w. to Wash. and Ore., s. to Tex. and N.M.; also n. Mex.

This willowlike tree is characterized by its lanceolate to narrowly ovate-lanceolate leaf blades that are noticeably paler on their lower than their upper surface, and are provided with short petioles that are rarely as much as 15 mm. long.

4. *Populus Hinckleyana* Correll. Tree to 20 m. tall, with a cylindrical crown; leaves rather finely and irregularly (almost doubly) serrate on the margins; fruit globose, pitted-rugose, 2-3 mm. in diameter. In canyons and floodplain areas in the Davis Mts. in the Trans-Pecos where it is apparently endemic, Mar.-Apr.

The small (to 7 cm. long) suborbicular-ovate to broadly deltoid-ovate leaf blades and

much-abbreviated pistillate aments, with their sessile floral disks, are characteristics that distinguish this species from the allied *P. angustifolia* and *P. acuminata*.

5. *Populus arizonica* Sarg. ARIZONA COTTONWOOD, CHOPO. Tree to 25 m. tall, with a broad spreading crown; leaves 5-14 cm. long, mostly about as wide as long; petioles 2.5-9 cm. long; aments 6-10 cm. long; fruits globose to globose-ovoid, deeply pitted, 3-8 mm. long. On banks and sand-gravel bars of rivers and streams in canyons and valleys, about springs and water tanks in s.w. Trans-Pecos, Feb.-Apr.; from w. Tex. to s.e. Ariz. and n. Mex.

The typically rhombic leaf blade with its cuneate base and somewhat attenuated apex, and the usually puberulous to densely hirsute bud scales and puberulent twigs, are distinctive.

6. *Populus Wislizenii* (Wats.) Sarg. RIO GRANDE COTTONWOOD, ÁLAMILLO. Tree to 25 m. tall, with a broad somewhat flat-topped open crown; leaves coriaceous, broadly deltoid to deltoid-ovate, rather abruptly triangular-acuminate at apex, 5-14 cm. long, usually as broad as or broader than long; aments 8-15 cm. long; fruits broadly ovoid-ellipsoid to ovoid-conic or subglobose, pitted, 8-18 mm. long. Along rivers, streams and irrigation canals in valleys and canyons, in rocky or deep alluvial soils, in the Trans-Pecos, Mar.-July; from s. Colo. and s. Ut., s. to w. Tex., N.M. and n. Mex.

This is the common cottonwood along the Rio Grande in extreme west Texas.

7. *Populus deltoides* Marsh. EASTERN COTTONWOOD, ÁLAMO. Tree to 30 m. tall or more, with a wide open crown; leaves thick and coriaceous, deltoid to deltoid-ovate or sub-orbicular-ovate, triangular-acuminate to acute-apiculate at apex, 7-15 cm. long, usually about as wide as long; petioles 2.5-9 cm. long; aments 6-10 cm. long; fruits globose to globose-ovoid, deeply pitted, 3-8 mm. long. Occurring naturally in Tex. as far n.w. as the s. Plains Country and s.w. to Uvalde Co. in the Rio Grande Plains, Mar.-July; from N.H. s. to n.w. Fla., w. to s. Sask., N.D., w. Kan., w. Okla. and Tex.

This species may be found along practically every watercourse of any size and about most of the springs and waterholes in the eastern third of Texas, commonly planted along roadways and about dwellings, growing especially well in deep alluvial soils.

8. *Populus Sargentii* Dode var. *Sargentii*. PLAINS COTTONWOOD. Tree to 27 m. tall, with a broad open crown; leaves deltoid to deltoid-ovate or deltoid-subreniform, 7-11 cm. long, usually about as broad as or broader than long; pistillate aments 6-13 cm. long; fruits ovoid to ovoid-ellipsoid, pitted, 1-1.5 cm. long. *P. deltoides* [var.] *occidentalis* Rydb. In sandy alluvial soils along rivers and streams, about stock tanks and along roadside banks scattered over the Plains Country from Nolan Co. northw., and extending over into Cooke and Montague cos. in n.-cen. Tex., Mar.-June; from s. Sask., s. Alta. and S.D., s. to w. Okla., n. Tex. and n.e. N.M.

When in fruit, var. *Sargentii* is readily distinguished from both *P. deltoides* and *P. Wislizenii* by its short pedicels which are shorter than the fruits and usually less than 5 mm. long. From *P. deltoides* it is also distinguished by its pubescent, not glabrous, buds, and from *P. Wislizenii* by the glands that are developed at the junction of the leaf blades and petioles. The glands are smaller and of a different shape than those of *P. deltoides*.

Var. *texana* (Sarg.) Correll. TEXAS COTTONWOOD. *P. texana* Sarg. Variety *texana* occurs in the same types of habitat and, in Texas, occupies approximately the same area of distribution as var. *Sargentii*.

Except for the fact that var. *texana* rarely, if ever, has glands at the junction of the leaf blades and petioles it could be referred to var. *Sargentii*. This lack of well-developed glands is apparently the only characteristic that separates these two entities. Sterile specimens of var. *texana* resemble *P. Wislizenii* so closely that if it were not for a difference in their area of distribution it would practically be impossible to distinguish one from the other. The leaves of var. *texana*, however, usually have a more abruptly acuminate-attenuate apex, and some of the leaves occasionally have one or two abortive glands, a characteristic that is not evident in *P. Wislizenii*. In fruit, however, the stout pedicels of var. *texana*, which rarely exceed 5 mm. in length, conveniently separate it from the longer, more slender pedicels of *P. Wislizenii*.

9. *Populus nigra* L. BLACK POPLAR, SAUCE. Tree to 30 m. tall, spreading by root-sprouts, the brittle branches spreading or strongly ascending to form a columnar crown;

leaves 5-10 cm. long; petioles 3-5 cm. long; staminate aments 3-6 cm. long; pistillate aments 7-15 cm. long; fruits ovoid to ellipsoid, 7-9 mm. long. A commonly cult. tree (nat. of Eur. and Asia) that escapes and becomes naturalized. The widespread sterile horticultural form, var. *italica* Muenchh., commonly known as "Lombardy poplar," is propagated by sprouts and, accordingly, often spreads from cultivation. Its strongly ascending brittle branches form a narrowly columnar crown.

10. *Populus tremuloides* Michx. QUAKING ASPEN, ÁLAMO TEMBLÓN. Tree (in our area) rarely more than 15 m. tall, with a narrow symmetrical domelike crown; bark smooth, grayish-white to brownish; leaves to 75 mm. long, frequently wider than long; petiole slender, weak, 4-6.5 cm. long; aments 4-6 cm. long; fruits ellipsoid-conic, thin-walled, 6-9 mm. long. Incl. [var.] *aurea* (Tidestr.) Daniels. In Tex., apparently confined to the highest mts. in the Trans-Pecos where it grows in ravines and on talus slopes above 7,000 ft. alt.

This species is probably the most widespread tree in North America. It occurs in most of Canada and Alaska and throughout the United States, except in the southeast, and southward into northern Mexico it is found only in the high mountains. The leaves turn an intense bright yellow or orange-yellow in autumn. No fruiting material has been seen from Texas. It flowers and fruits in the spring in its range. The slightest breeze causes movement of the leaves, hence the common name, "quaking aspen."

FAM. 48. MYRICACEAE BL.

WAX-MYRTLE OR BAYBERRY FAMILY

Monoecious or dioecious shrubs or small trees with both kinds of flowers in short scaly erect aments and with resinous-dotted usually fragrant alternate leaves; involucre and perianth none.

A family of about 50 species in several genera of worldwide distribution.

I. MYRICA L. WAX-MYRTLE

Leaves coriaceous and evergreen (in ours) or tardily deciduous, entire or toothed to lobulate above the middle, without stipules; flowers typically unisexual, in the axils of small scalelike bracts and with or without 2 to 4 short entire basal bracteoles not overlapping the fruit; pistillate aments ovoid or cylindrical; staminate aments ellipsoid or thick-cylindrical, these from axillary scaly buds; stamens 2 to many; filaments somewhat united below; anthers 2-celled; ovary 1-celled; ovule 1, basal; stigmas 2, linear-elongate; fruit globose or ovoid, warty, commonly with a waxy coat or resinous dots.

About 35 cosmopolitan species.

1. Leaves of flowering branches typically elliptic to broadly oblanceolate, mostly 2 cm. wide or more, their upper surface with resinous dots remote or wanting 1. *M. heterophylla*.
1. Leaves of flowering branches typically narrowly oblanceolate to narrowly cuneate-oblanceolate, rarely to 2 cm. wide, their upper surface densely covered with resinous dots (2)
- 2(1). Coarse shrub or small tree, noncolonial, usually much more than 3 m. tall; leaves of fruiting branches mostly 5 cm. long or more; fruits mostly 2-3 mm. in diameter 2. *M. cerifera*.
2. Dwarf freely stoloniferous colonial shrub, to about 2 m. tall; leaves of fruiting branches rarely more than 4 cm. long; fruits 3-4 mm. in diameter 3. *M. pusilla*.

1. *Myrica heterophylla* Raf. Mostly small shrubs to about 3 m. tall; branches blackish or dark-grayish-black, the pubescence of leafy branchlets becoming dark with age; leaves elliptic to oblanceolate or occasionally obovate, tapering at base into a short petiole, broadly rounded to acute and minutely apiculate at apex, opaque, essentially glabrous and sometimes somewhat glaucous on upper surface, to 14 cm. long and 4 cm. wide;

inflorescence either below or in the axils of the leaves; staminate aments to 15 mm. long; fruit 3-3.5 mm. in diameter. In bogs and along streams in woods and thickets in e. Tex., Mar.-Apr.; from Fla., w. to Tex. and n. on inner Coastal Plain to N.J.

2. *Myrica cerifera* L. WAX-MYRTLE, CANDLE-BERRY. Shrub or small tree to 12 m. tall, rarely with a trunk to 2 dm. in diameter; young branchlets waxy, glabrous or sometimes pilose; leaves narrowly oblanceolate to cuneate-oblanceolate, tapering at base to short petiole, acute at apex, mostly less than 7 cm. long and to 25 mm. wide, fulvous or yellowish-green, heavily coated on both surfaces with resinous dots; fruit 2-3 mm. in diameter. *Cerothamnus ceriferus* (L.) Small. Along streams, about lakes and in boggy grasslands and wet woodlands in e. Tex., Mar.-Apr.; from Fla., w. to Tex. and n. to N.J. and Ark.

3. *Myrica pusilla* Raf. Low stoloniferous shrub forming colonies to 2 m. tall; young branchlets waxy, glabrous or nearly so; leaves oblanceolate to obovate or linear-spatulate, tapering at base to short petiole, obtuse to acutish at apex, heavily coated on both surfaces with resinous dots, mostly 5 cm. or less long; fruits 3-4 mm. in diameter. *Cerothamnus pumilus* (Michx.) Small. Sandy soils in moist or dry pine-hardwoods in e. Tex., Mar.-Apr.; from Fla., w. to Tex. and n. to s. Del. and Ark.

FAM. 49. LEITNERIACEAE BENTH. & HOOK. F.

CORKWOOD FAMILY

Shrub or small tree to 6.5 m. tall, with very light wood; bark brown and smooth when young, fissured with age; leaves alternate, deciduous, more or less scattered, petiole; leaf blades entire, thick and firm, prominently veiny, narrowly elliptic to elliptic-lanceolate, acute to acuminate, bright green and shining on upper surface, pubescent on lower surface; stipules wanting; flowers unisexual, male and female flowers borne on separate plants, in few- to many-flowered aments or spikes that appear before the leaves from the axils of last year's leaves; staminate flowers in a conspicuously bracted compound ament, composed of 3 to 12 stamens and without a perianth, the distinct filaments short and the anthers 2-celled; pistillate flowers in a few-flowered spike, solitary in the axils of primary bracts each of which is accompanied by 2 secondary bracts, composed of a single sessile 1-ovuled pistil and 3 to 8 diminutive bractlets; fruits a drupe, subtended by a bract, elongate, glabrous, the flesh leathery.

Represented only by the following American genus.

1. LEITNERIA CHAPM.

Characters same as those of the family. A monotypic genus of the southern United States.

1. *Leitneria floridana* Chapm. CORKWOOD. Leaf blades to 2 dm. long; staminate aments 3-4 cm. long; drupe elliptic, to 25 mm. long. In brackish or fresh water swamps and thickets in s.e. and s.-cen. Tex., spring; from n. Fla., w. to Tex. and n. to Ga. and Mo.

FAM. 50. JUGLANDACEAE KUNTH WALNUT FAMILY

Trees, monoecious, with alternate pinnate leaves and no stipules; leaflets usually glandular-dotted beneath; flowers unisexual; *staminate flowers* in aments with or without a calyx adnate to the bract and the two bractlets; *pistillate flowers* solitary or in a small cluster or spike, with a bract, 2 or 3 bractlets and a regular 4-lobed calyx (when present) adherent to the incompletely 2- to 4-celled but only 1-ovulate ovary; ovule orthotropous, erect, at the apex of the incomplete primary partition; fruit similar to a dry drupe, the fibrous-fleshy or woody husk or exocarp (ripened bract and bractlets or involucre and calyx) fused at least until maturity with the crustaceous or bony endocarp or nutshell (ripened carpels), containing a 2- to 4-lobed seed.

A small family of important trees, about 50 species in 7 genera. A number of species

in the family produce edible nuts, including the pecans, the Persian or "English" and black walnuts.

- 1. Pith of branchlets separating into thin plates; staminate aments separate, sessile, on last year's branchlets, in the axils of the fallen leaves of the previous season; stamens 8 to 40; staminate and pistillate flowers with 4 small sepals; style branches (stigmas) elongate; nut with indehiscent husk and irregularly furrowed shell 1. *Juglans*, p. 458.
- 1. Pith continuous; staminate aments in fascicles of 3, the fascicles subsessile to long-stalked in the axils of bud scales on new growth; stamens 3 to 8; staminate and pistillate flowers usually without sepals; stigmas short; husk of fruit splitting or partially splitting into valves, the nutshell smooth or merely reticulate 2. *Carya*, p. 459.

I. JUGLANS L. WALNUT. NOGAL

Trees with furrowed scaly bark and durable dark-colored wood; branchlets stout, with laminate pith; leaves pinnate, with numerous serrate leaflets; flowers greenish, produced in spring; *staminate aments* sessile, separate though often superposed, near the apex of the preceding year's growth; stamens 8 to 40, the floral receptacle adnate to the bract; bractlets 2; sepals usually 4, with some occasionally reduced to minute teeth; filaments free, very short; *pistillate flowers* solitary or several together in a cluster or short spike on a peduncle at the end of the branch, with a bract and 2 often irregularly toothed bractlets; sepals 4, small; style short, with 2 or rarely 3 elongate style branches that have their inner surfaces deeply fringed and stigmatic; style branches carinal (above the center of the carpel); fruit with a fibrous-fleshy indehiscent husk (exocarp) and a mostly rough irregularly furrowed nutshell or endocarp.

About 20 species in both hemispheres. The timber of some species is extremely valuable for cabinet and furniture making. The fruits of most species are also edible.

- 1. Fruit 35 mm. or more in diameter; distribution in eastern third of Texas 1. *J. nigra*.
- 1. Fruit 35 mm. or less in diameter; distribution in western two thirds of Texas (2)
- 2(1). Fruit 25 mm. or more in diameter; leaflets usually 15 or fewer, with dentate-serrate margins, mostly 15 mm. or more wide 2. *J. major*.
- 2. Fruit rarely more than 20 mm. in diameter; leaflets more than 15, with subentire to serrulate margins, rarely more than 15 mm. wide . . 3. *J. microcarpa*.

1. *Juglans nigra* L. BLACK WALNUT. A large tree to about 50 m. high, with trunk to 12 dm. in diameter, the brown to blackish thick bark in deep furrows and narrow forking ridges; branches widely spreading to form a massive crown; branchlets stout, brown to orange-brown; leaves to 6 dm. long; leaflets 11 to 23, sessile, ovate-lanceolate, long-acuminate, somewhat obliquely cordate at base, to 1 dm. long and 25 mm. wide, glabrous above, minutely downy beneath, the margins serrate; leaf scars on branchlets notched; fruit spherical, roughly dotted, yellowish-green; nut corrugated, to 6 cm. in diameter, the edible kernel sweet and oily. *Wallia nigra* (L.) Alef. In fields and rich woodlands in e. Tex.; from N.E. s. to Fla. and w. to Minn. and Tex.

2. *Juglans major* (Torr.) Heller. ARIZONA WALNUT, NOGAL SILVESTRE. Tree to about 15 m. high, with trunk to 12 dm. in diameter, the bark deeply furrowed and ridged on older trees; branches widely spreading to form a rounded crown; twigs reddish-brown, densely hairy when young, with age becoming ashy-gray; leaves to 35 cm. long; leaflets usually 9 to 13, rarely more, essentially sessile, lanceolate, acuminate at apex, more or less falcate, to 1 dm. long and 35 mm. wide below the middle, coarsely dentate-serrate on margins, thin, yellowish-green, scurfy-hairy when young, essentially hairless with age; fruit spherical, 25-35 mm. in diameter; husk brown, thin, densely hairy; nut with a thick hard shell and a small edible kernel. Scattered along streams and in canyons in the Edwards Plateau and Trans-Pecos; from Tex. to s.w. N.M. and cen. Ariz. and n. Mex.

The durable wood is used locally for fence posts.

3. *Juglans microcarpa* Berl. RIVER WALNUT, LITTLE WALNUT. Large shrub or small tree to about 6 m. high, rarely with trunk to 45 cm. in diameter, the bark smoothish or

lightly furrowed; branches usually arising near the ground to form a broad rounded crown; twigs reddish-brown, densely hairy when young, with age becoming ashy-gray; leaves to about 3 dm. long; leaflets usually 17 to 23, sometimes fewer, essentially sessile, narrowly lanceolate, tapering to an acuminate apex, more or less falcate, to 75 mm. long and 12 mm. wide below middle, subentire to serrulate on margins, thin, yellowish-green, with age becoming essentially hairless; fruit spherical, 1.2-2 cm. in diameter; husk brownish, thin, hairy; nut with a thick hard shell and a small edible kernel. *J. rupestris* Engelm. Scattered along streams and arroyos in s. and w. Tex.; from w. Okla. and Tex. to s.e. N.M. and n. Mex.

The var. *Stewartii* (I. M. Johnst.) W. Manning with broader leaflets and larger fruits on the average, is reported to occur in the Chisos Mts.

2. CARYA NUTT. HICKORY

Trees with hard and very tough wood, and scaly buds from which in spring are produced usually both kinds of flowers with the staminate flowers below the leaves and the pistillate flowers above; leaves petiolate, odd-pinnate, often glandular-dotted; leaflets 5 to 25; *staminate aments* usually in fascicles of 3 in the axils of bud scales; stamens 3 to 8, adnate to the bract and 2 bractlets; filaments short or none, free; *pistillate flowers* 2 to 10 in a cluster or short spike on a peduncle terminating the shoot of the season; bract and typically 3 bractlets sepal-like in flower, a true calyx absent; stigmas sessile, 2 and sometimes divided, with a stigmatic disk at their base, papillose, commisural (above the lines connecting the carpels), usually persistent; fruit with a 4-valved firm and (at length) dry husk that consists of the exocarp or involucre which usually falls away from the smooth and crustaceous or bony nutshell or endocarp; nut incompletely 2-celled and (at the base) mostly 4-celled.

Probably about 15 species in eastern North America and eastern Asia. Because of their tough, resilient wood some species are used for such purposes as the making of tool handles.

In order to identify with some certainty most species in this difficult genus one needs to have a tree growing in one's own yard so as to be able to study it at all seasons of the year! Even so, its identity will not be easily determined.

- 1. Bud scales valvate; bud scale scars wide, separate, not in a distinct ring; husk sutures winged or keeled (2)
- 1. Bud scales imbricate; bud scale scars in a distinct ring; husk sutures not winged or keeled (5)
- 2(1). Shell smooth; kernel sweet; cotyledons not deeply 2-cleft (3)
- 2. Shell uneven; kernel bitter; cotyledons deeply 2-cleft (4)
- 3(2). Leaflets 5 to 9; fascicles of staminate aments peduncled1. *C. myristicaeformis*.
- 3. Leaflets more than 9; fascicles of staminate aments sessile or nearly so2. *C. illinoensis*.
- 4(2). Bud sulphur-yellow; husk wingless at base, at maturity splitting only to just below middle; nut gray, smooth; leaflets usually fewer than 9, the lower surface pubescent and with ferruginous scales; terminal leaflet essentially sessile3. *C. cordiformis*.
- 4. Bud brownish; husk winged to the base, at maturity the valves completely separating; nut reddish-brown, furrowed or wrinkled; leaflets usually more than 9, the lower surface glabrous; terminal leaflet stalked4. *C. aquatica*.
- 5(1). Margins of young leaflet densely ciliate, the older leaflet serrations with persistent tufts of hairs; bark shaggy5. *C. ovata*.
- 5. Margins of young leaflet not densely ciliate, the older leaf serrations without tufts of hairs; bark usually not shaggy (6)
- 6(5). Husk more than 4 mm. thick; bark shaggy6. *C. laciniosa*.
- 6. Husk 4 mm. or less thick (rarely more); bark not shaggy (7)

- 7(6). Twigs stout; leaves with a strong spicy odor, woolly beneath; rachis woolly ...
7. *C. tomentosa*.
7. Twigs slender; leaves fragrant or odorless, smooth to somewhat hairy or dotted with
 minute scales beneath; rachis smooth or hairy (8)
- 8(7). Twigs smooth; husk usually about 7 mm. thick; leaflets mostly 7
8. *C. leioderms*.
8. Twigs hairy; husks about 3 mm. thick; leaflets 5 and 7
9. *C. texana*.

1. *Carya myristicaeformis* (Michx. f.) Nutt. NUTMEG HICKORY, NOGAL. Tree to about 30 m. high, with a trunk to 6 dm. in diameter, the bark dark-brown tinged with red and broken irregularly into small thin appressed scales; branches stout and somewhat spreading to form a rather narrow open crown; branchlets at first with lustrous scales, eventually dark-reddish-brown; leaves to 35 cm. long; leaflets 7 or 9, occasionally 5, short-stalked or essentially sessile, ovate-lanceolate to broadly obovate, acute at apex, cuneate or somewhat rounded at the narrow base, the margins serrate, to 12.5 cm. long and 37 mm. wide, thin and firm, dark-green above, more or less pubescent or nearly glabrous and silvery-white and lustrous beneath, becoming golden-bronze in the fall; fruit usually solitary, ellipsoid to somewhat obovoid, about 35 mm. long; husk broadly 4-ridged to base, coated with a yellow-brown scurfy pubescence, not more than 1 mm. thick, splitting nearly to the base; nut with a thick hard and bony shell, rounded and apiculate at the ends, smooth, dark-reddish-brown and marked by longitudinal small broken bands of gray covering the entire surface, the dark-brown kernel sweet. *Hicoria myristicaeformis* (Michx. f.) Britt. Along banks of rivers and in swamps of e. Tex.; from e. S.C. to s.e. Okla. and e. Tex.; (?) also in mts. of n.e. Mex.

2. *Carya illinoensis* (Wang.) K. Koch. PECAN, NOGAL MORADO, NUEZ ENCARCELADA. Tree to about 50 m. high, with a massive trunk to 2 m. in diameter that is often enlarged and buttressed at the base, the thick bark light-brown tinged with red and deeply divided into irregular furrows and ridges; overwintering buds flattened, with paired and valvate narrow scales covered with articulated hairs; branches stout and spreading to form a round-topped crown; branchlets at first red-tinged and coated with a loose pale tomentum, eventually glabrous or merely puberulent; leaves to 5 dm. long; leaflets 9 to 17, sessile, oblong-lanceolate to lanceolate, more or less falcate, acuminate at apex, cuneate to rounded at the asymmetric base, the margin coarsely and often doubly serrate, to 2 dm. long and 75 mm. wide, dark-yellow-green and glabrous or pilose above, pale and glabrous or pubescent beneath, terminal leaflet only slightly broader than upper lateral ones; fascicles of staminate aments sessile or nearly so; fruit in clusters of 3 to 11, ovoid to more or less ellipsoid, pointed at apex, rounded at the narrowed base, 4-winged and -keeled along the sutures, 25-65 mm. long, 12-25 mm. thick, dark-brown and more or less thickly covered with yellow scales; husk thin, brittle, at maturity splitting nearly to the base and often persistent on the branch during the winter after dropping the nut; nut usually thin-shelled, pointed at both ends, somewhat bright-reddish-brown, the reddish-brown kernel sweet. *Carya Pecan* (Marsh.) Engl. & Graebon., *Hicoria Pecan* (Marsh.) Britt. In low rich grounds along streams, bottomlands and moist open woodlands, mostly in cen. and n.w. Tex.; from Tex., n. to Ind. and Ia., e. to Ala.

The species, in many selected varieties, is widely cultivated in the southern states. The nuts, which vary in size and shape and in the thickness of their shells, and in the quality of the kernels, are an important article of commerce. The pecan is the State Tree of Texas.

Specimens have been seen that apparently represent *Carya* × *Lecontei* Little, a hybrid that combines the compressed fruit and bitter kernel of *C. aquatica* and the sessile male catkins, hairy yellowish winter buds, and elongate nut of *C. illinoensis*.

3. *Carya cordiformis* (Wang.) K. Koch. BITTERNUT HICKORY, FIGNUT HICKORY. Tree often to 30 m. high, with a trunk to 9 dm. in diameter, the light-brown red-tinged bark about 15 mm. thick and broken into thin platelike scales that separate on the surface into small thin flakes; branches stout and spreading to form a broad crown; branchlets slender, marked by oblong pale lenticels, at first bright-green and covered more or less with rusty hairs, ultimately becoming light gray; leaves to 25 cm. long; leaflets usually 7 or 9, sessile, ovate-lanceolate to lanceolate or obovate, acuminate at apex, coarsely serrate except at the cuneate to subcordate base, thin and firm, to 15 cm. long and 3 cm.

or more wide, dark-yellow-green and glabrous above, light-green and pubescent beneath; overwintering bud-scales lanceolate, sulphur-yellow with persistent scurf; fruit usually obovoid to subglobose, 4-winged from the apex to about the middle; husk thin, puberulous, more or less covered with small yellow scales, splitting only to below the middle; nut with a thin brittle shell, often broader than long, depressed or obcordate at apex, the bright-reddish-brown kernel very bitter. *Hicoria cordiformis* (Wang.) Britt., *H. minima* (Marsh.) Britt. In low wet woods near the borders of streams and swamps or on high rolling uplands in e. Tex.; from Fla. to Tex. n. to N.E., Minn. and Neb.

4. *Carya aquatica* (Michx. f.) Nutt. WATER HICKORY, BITTER PECAN. Tree sometimes to 30 m. in height, with a trunk rarely exceeding 6 dm. in diameter, the bark to 15 mm. thick and separating freely into long loose platelike light-brown scales tinged with red; overwintering buds reddish-brown, adorned with caducous yellow glands; branches slender, upright to form a narrow crown; branchlets slender, at first reddish-brown or ashy-gray and slightly glandular and coated with a loose pale tomentum, eventually gray and essentially glabrous; leaves to 33 cm. long; leaflets 7 to 13, sessile or stalked, ovate-lanceolate to lanceolate, falcate, acuminate at apex, rounded to cuneate at the more or less oblique base, glabrous, to 75 mm. long and 4 cm. wide, finely or coarsely serrate; fascicled staminate aments peduncled; fruit often in clusters of 3 or 4, subglobose to obovoid, much-compressed, usually broadest above the middle, rounded at the slightly narrowed base, conspicuously 4-winged, dark-brown or nearly black, provided with bright-yellow scales, to 4 cm. long and 32 mm. wide; husk thin, brittle, splitting tardily and usually only to below the middle; nut flattened, somewhat obovoid, with a thin dark-reddish-brown somewhat wrinkled shell, rounded and abruptly short-pointed at apex, the dark-brown kernel very bitter. *Hicoria aquatica* (Michx. f.) Britt. In river swamps that are periodically inundated, in e. Tex.; from Fla. to Tex., n. to Va., s.w. Ill. and s.e. Mo.

5. *Carya ovata* (Mill.) K. Koch. SHAGBARK HICKORY, SHELLBARK. Tree to 20 m. or more high, with a trunk to about 1 m. in diameter, the light-gray bark to 25 mm. thick and separating into thick plates often 3 dm. or more long and 2 dm. wide that are attached to the trunk by the middle; branches stout and slightly spreading to form a conic round-topped crown; branchlets at first covered with caducous brown scurf and pale glandular pubescence, soon bright-reddish-brown and lustrous, glabrous or pubescent; leaves to 35 cm. long; leaflets 5 or rarely 7, slender-stalked, ovate to ovate-lanceolate or obovate, somewhat rounded to acuminate at apex, ciliate on the margins that are finely serrate except toward the usually cuneate base, most of the serrations with a dense tuft of persistent hairs on one or both sides near their apex, to 17 cm. long and 75 mm. wide above the middle, dark-yellow-green and glabrous above, paler and shiny-glabrous or puberulous beneath, the terminal leaflet largest; fascicles of staminate aments peduncled, the floral bracts much-elongated; overwintering terminal buds ovoid, to 25 mm. long and 1 cm. thick; fruit solitary or in pairs, subglobose to somewhat obovoid, depressed at apex, dark-reddish-brown or nearly black at maturity, glabrous or pilose, to 6 cm. long; husk to 15 mm. thick and splitting freely to the base; nut with a usually thin shell, more or less 4-ridged or -angled, pale or whitish, the light-brown kernel sweet and aromatic. *Hicoria ovata* (Mill.) Britt. In rich woodlands, bottoms and slopes, commonly near streams and swamps in e. Tex.; from Fla. to Tex., n. to Me., Ont., Wisc., Minn. and Neb.

6. *Carya laciniosa* (Michx. f.) Loud. BIG SHELLBARK HICKORY, KING-NUT. Tree sometimes more than 30 m. high, with a trunk to 9 dm. in diameter, the light-gray bark to 5 cm. thick and separating into broad thick long-persistent plates to 12 dm. long; branches small and spreading to form a narrow cylindrical crown; branchlets orange-brown or tan, at first pilose or covered with a pale or rufous pubescence or tomentum, eventually glabrous or puberulous; leaves to 55 cm. long; leaflets 5 to 9, sessile or short-stalked, ovate to oblong-lanceolate or broadly obovate, acute to acuminate at apex, asymmetrically cuneate or rounded at base, to 22 cm. long and 12 cm. wide, the margins finely serrate, dark-green and lustrous above, pale-yellow-green or bronze-brown and covered with soft pubescence beneath; overwintering bud short and blunt; fruit solitary or in pairs, ellipsoid to ovoid or subglobose, depressed at apex, downy or glabrous, light-orange-color or chestnut-brown at maturity, to 63 mm. long and 5 cm. broad; husk pale, hard and woody, about 12 mm. thick; nut with a hard bony shell to 7 mm. thick, more or less

compressed, prominently 4-ridged or -angled, light yellow or reddish-brown, the light-chestnut-brown kernel very sweet. *Hicoria laciniosa* (Michx. f.) Sarg. In rich bottomlands that are usually periodically inundated, reported from n.e. Tex.; from N.Y., w. to Ia. and Neb., s. to Ala., La. and (probably) Tex.

7. *Carya tomentosa* Nutt. MOCKERNUT. Tree rarely to 30 m. high, with a trunk to 9 dm. in diameter, the close bark to 2 cm. thick and slightly ridged by shallow irregular interrupted fissures and covered by dark-gray closely appressed scales; branches small, spreading to form a narrow or broad round-topped crown; branchlets stout, tomentose at first with pale fascicled hairs, rather light-brown, eventually becoming grayish and glabrous to pubescent; leaves to 3 dm. long, glandular, resinous, fragrant; leaflets 5 to 9, sessile or short-stalked, oblong-lanceolate to obovate-lanceolate, gradually or abruptly acuminate at apex, rounded to cuneate at the often oblique base, the margins minutely or coarsely serrate, to 2 dm. long and 12.5 cm. wide, dark-yellow-green and rather lustrous above, paler or light-orange-colored or brownish beneath; overwintering terminal bud to 2 cm. long; fruit ellipsoid or obovoid, gradually narrowed at the ends, dark-reddish-brown, pilose or nearly glabrous, to 5 cm. long; husk about 3 mm. thick, splitting to the middle or nearly to the base; nut with a very thick hard shell that often cracks transversely upon drying, light-reddish-brown, becoming darker with age, the lustrous dark-brown kernel small and sweet. *Carya alba* (Mill.) K. Koch. In dry to moist woodlands in e. Tex.; from Fla. to Tex., n. to N.E., Ont. and Neb.

8. *Carya leiodermis* Sarg. SWAMP HICKORY. Tree to about 20 m. high, with trunk to 9 dm. in diameter, the pale bark tight and only slightly ridged; branches stout and somewhat pendulous to form a narrow round-topped crown; branchlets slender, reddish-brown and lustrous, at first puberulous or pubescent, becoming glabrous with age; leaves to 35 cm. long; leaflets 7 or rarely 5, short-stalked or nearly sessile, elliptic-lanceolate to narrowly obovate, thin, acuminate at apex, asymmetrically cuneate at base, at first hoary-tomentose beneath and pubescent above, with age becoming dark-green and lustrous above and pale or slightly pubescent beneath, to 12.5 cm. long and 65 mm. wide, the lower pair of leaflets much-reduced; fruit broadly obovoid, smooth, glabrous or puberulous and adorned with scattered white scales, to 45 mm. long and 3 cm. in diameter; husk to 7 mm. thick, opening freely to the base usually only by 2 sutures; nut with a thick hard shell, rounded at the ends, slightly compressed, tinged with red, the small kernel sweet. *Hicoria leiodermis* (Sarg.) Sudw. In low wet woods and swamps of s.e. Tex.; from Tex. and Ark. to Miss.

9. *Carya texana* Buckl. BLACK HICKORY. Tree to 30 m. high, usually much smaller, with a trunk to 9 dm. in diameter, the dark-brown to blackish and deeply furrowed bark about 2 cm. thick and roughened by closely appressed platelike scales; branches ascending or spreading to form a narrow round-topped crown; branchlets slender, at first coated with a thick rusty hoary tomentum that eventually wears off; overwintering terminal buds to about 1 cm. long, the scales hairy-tufted at apex; leaves to 3 dm. long; leaflets 7 to 13, subsessile or short-stalked, lanceolate, acuminate at apex, asymmetrically cuneate at base, to 12.5 cm. long and 4 cm. wide, thin and firm, hoary-tomentose when they unfold, more or less villous in fall, the margin serrate, dark-green and nearly glabrous above, pale-yellow-green and puberulous beneath; fruit subglobose to oblong or oblong-obovoid, apiculate at apex, slightly 4-winged at base, dark-brown, more or less covered with yellow scales, to 5 cm. long; husk thin, about 3 mm. thick, splitting to middle or nearly to base; nut acute at both ends, compressed, rough and pitted, with a thin brittle shell, the bright-reddish-brown kernel very bitter. *Carya Buckleyi* Durand, *C. arkansana* Sarg., *C. Buckleyi* var. *arkansana* (Sarg.) Sarg. In dry sandy woods or on rocky slopes in e. Tex.; from La. and Tex., n. to Ind., Ill., Mo. and e. Okla.

FAM. 51. BETULACEAE S. F. GRAY

BIRCH OR HAZEL-NUT FAMILY

Monoecious trees or shrubs with alternate simple pinnately straight-veined deciduous leaves and deciduous stipules; flowers unisexual; *staminate flowers* in spreading or drooping catkins, subtended by scaly bracts, with 2- to 4-parted "perianth" (or bracteoles) and 2 to many stamens; *pistillate flowers* in clusters, spikes or in a scaly catkin,

with minute perianth or none; ovary 2-celled, with 2 pendulous anatropous ovules in each cell; styles 2; fruit a 1-celled and 1-seeded nutlet, with or without a foliaceous involucre.

A family of 4 to 6 genera and about 140 species, mostly in the Northern Hemisphere. Sometimes divided so that *Carpinus* and *Ostrya* constitute a separate family, the Carpinaceae.

1. Staminate flowers solitary in the axil of each bract, without a calyx or bracteoles; pistillate flowers with a calyx or bracteoles; bracts of the pistillate ament deciduous; nutlets wingless, more or less enveloped by an involucre formed by the enlargement of the bract and bractlets of the flower (2)
1. Staminate flowers 2 or more in the axil of each bract, with a calyx or bracteoles; pistillate flowers without a calyx or bracteoles; bracts of the pistillate ament persistent or eventually deciduous; nutlets winged or with a coriaceous margin, without an involucre, borne in an ovoid to oblong-ellipsoid strobile (3)
- 2(1). Staminate aments covered by bud scales during the winter, usually solitary; involucre of nutlet flat, foliaceous, usually 3-lobed; bark grayish and smooth; trunk and branches fluted, sinewy1. *Carpinus*, p. 463.
2. Staminate aments naked during the winter, mostly clustered; involucre of nutlet saclike, bladderly, closed; bark brown, rough and flaky; trunk and branches terete2. *Ostrya*, p. 463.
- 3(1). Pistillate aments solitary; fruiting aments not persistent, the bracts thin, 3-lobed, deciduous with or soon after the nutlet; stamens 2, bifid; buds not stalked; trees with exfoliating bark3. *Betula*, p. 464.
3. Pistillate aments racemose; fruiting aments persistent, the bracts thick and semi-woody, not deeply lobed, persistent; stamens 4, not bifid; buds stalked; shrubs with smooth or somewhat scaly bark4. *Alnus*, p. 465.

1. CARPINUS L.

HORNBEAM. IRONWOOD

An Old World genus of about 35 species, with one in America.

1. *Carpinus caroliniana* Walt. AMERICAN HORNBEAM, BLUE-BEECH, LECHILLO. Small tree to 10 m. tall, with somewhat flattened and twisted trunk and smooth grayish bark; leaves oblong to narrowly oblong-ovate or elliptic-lanceolate, rounded at base, subobtusely to acuminate at apex, to 9 cm. long and 45 mm. wide, more or less doubly serrate; *staminate aments* pendulous, the ovate scales each subtending a solitary naked flower that is composed of several divided filaments each bearing 2 apically pilose half-anthers; *fruiting aments* ovoid to short-cylindric, to 5 cm. long; bracts about 2 cm. long, ovate, subtending 2 flowers, chartaceous, halberd-shaped, with 1 or 2 divergent basal lobes, entire or with a few blunt teeth along one side of the midlobe; nutlet ovoid, several-nerved. Rich woods and bottomlands along streams in e. Tex., Mar.-May; from Fla. and Tex., n. to Md., Tenn. and s. Ill.

2. OSTRYA SCOP.

HOP-HORNBEAM. IRONWOOD

Slender trees with very hard wood and brownish furrowed and more or less flaky bark and elongate acute buds; leaves open and concave in the bud, when expanded with a petiole less than 5 mm. long; flowers appearing before or with the leaves; *staminate aments* 1 to 3 together from scaly buds at the branchlets of the preceding year; staminate flowers consisting of several stamens in the axil of each bract, the short filaments often forked and each bearing an apically pilose half-anther; *pistillate aments* single, lax, terminating short leafy shoots of the season, each caducous bract subtending a pair of flowers; pistillate flowers composed of an incompletely 2-celled 2-ovuled ovary, crowned with the short-bearded border of the adherent calyx, tipped with 2 long linear stigmas and enclosed in a tubular union of bract and bractlets which in fruit becomes a closed somewhat compressed bladderly involucre that is very much larger than the small smooth or ribbed nutlet; the inflated involucre ovoid to ellipsoid or obovoid, bristly-hirsute at

base and more or less pubescent throughout (especially at the tip), loosely imbricated to form a strobile resembling that of the Hop.

A genus of about 10 species in the Northern Hemisphere.

1. Confined to woodlands and stream banks of east Texas .1. *O. virginiana*.
1. Confined to the mountains of west Texas (2)
- 2(1). Stipitate glands present especially on twigs and leaf petioles; leaf blades typically ovate; staminate aments 2-3 cm. long, the bracts merely short-apiculate and with glandular-ciliate margins; in Guadalupe Mts.2. *O. Knowltonii*.
2. Stipitate glands not present; leaf blades typically elliptic; staminate aments 3.5 cm. long or more, the bracts with a cusp about as long as the body and with long-fimbriate margins; in Chisos Mts.3. *O. chisosensis*.

1. *Ostrya virginiana* (Mill.) K. Koch. AMERICAN HOP-HORNBEAM, EASTERN HOP-HORNBEAM. Tree to 20 m. tall; leaves ovate-oblong to elliptic-lanceolate, rounded to slightly cordate at base, taper-pointed at apex, to 1 dm. long and 45 mm. wide, sharply doubly serrate, somewhat downy and with tufts of pale hairs in the axils of the veins on the lower surface; staminate aments 3-5 cm. long at anthesis; staminate scales broadly triangular-ovate to ovate-subquadrate, about 2.5 mm. long, rounded and abruptly contracted at the apex into an elongate point, ciliate on margin; fruiting aments on slender stems about 25 mm. long, short-cylindric, to 5 cm. long, each sac about 2 cm. long; nutlet ellipsoid, compressed, tan-color, 4-5 mm. long. Rich moist or dry woods in e. Tex., Mar.-Apr.; from Fla. and Tex., n. to s.e. Mass., Tenn., s. Ill., Ia. and S.D.

Our plant is represented by var. *lasia* Fern., distinguished by its densely and sub-persistently villous branchlets.

2. *Ostrya Knowltonii* Cov. WESTERN HOP-HORNBEAM. Small tree about 12 m. tall and a trunk 15 cm. in diameter, with the branchlets, leaves and floral parts more or less pubescent and with stipitate glands throughout; leaves suborbicular-ovate to ovate-elliptic, broadly rounded to slightly cordate at base, rounded to acute at apex, to 65 mm. long and 55 mm. wide, usually much smaller, always widest below the middle, sharply doubly serrate; staminate aments 2-3 cm. long at anthesis; staminate scales suborbicular to transversely elliptic, merely apiculate at the broadly rounded apex, glandular-ciliate on the margin, about 2 mm. long, usually wider than long; fruiting aments on stems to 2 cm. long, to 4 cm. long, each sac about 15 mm. long; nutlet ovoid, compressed, tan-color, about 6 mm. long. *O. Baileyi* Rose. In mt. canyons of w. Tex., Mar.-May; also in s.e. N.M., n. Ariz., and s.e. Ut.

3. *Ostrya chisosensis* Correll. BIG BEND HOP-HORNBEAM. Tree to 14 m. tall, with the branchlets, leaves and floral parts more or less pubescent but without stipitate glands; leaves elliptic to elliptic-lanceolate, rounded and slightly cordate at base, obtuse to acute at apex, to 6 cm. long and 3 cm. wide, sometimes widest above the middle, finely doubly serrate; staminate aments 3.5-4 cm. long at anthesis; staminate scales broadly triangular-ovate, tapered into a long-cuspidate apex, 2.5-3 mm. long, with the cusp at least 1 mm. long and usually about as long as the body, the margins and cusp long-fimbriate; fruiting aments still immature, on stout stems about 1 cm. long, about 2 cm. long, densely hirsute. Apparently endemic in the Chisos Mountains of the Big Bend National Park, May-June.

3. BETULA L. BIRCH

About 60 species that are widely scattered in the Northern Hemisphere.

1. *Betula nigra* L. RIVER BIRCH. Tree to 30 m. tall and a trunk to 8 dm. in diameter, with soft shaggy and freely exfoliating salmon-pink bark and reddish-dotted twigs; leaves with a tomentose petiole to 15 mm. long, rhombic-ovate, broadly cuneate to subtruncate at base, acute at apex, to 1 dm. long and 8 cm. wide below middle, conspicuously and often deeply doubly serrate, bright-green on upper surface, grayish-white on lower surface and when young downy; aments formed in the fall and expanding in early spring; *staminate aments* mostly 2 or 3 clustered, sessile, elongate, each of the ovate to suborbicular bracts subtending 3 flowers; staminate flowers consisting of 4 stamens adnate

to a 4-parted calyx, with two bractlets; the pedunculate thick-cylindric pistillate aments tomentose, solitary, 25-35 mm. long, the bracts 6-8 mm. long, nearly equally divided into 3 oblong-linear lobes, subtending 2 or 3 flowers; pistillate flowers naked, without bractlets or calyx; fruit an erect or pendent ovoid to oblong-ellipsoid strobile, the scales deciduous from the persistent cone axis at maturity to release the compressed laterally winged nutlets. Along streams and in bottomlands in e. Tex., Mar.-Apr.; from Fla. and Tex., n. to N.E., Pa., W.Va., O., s. Mich., s. Wisc., s. Minn. and e. Kan.

4. ALNUS MILL. ALDER

About 35 species, mostly in cool temperate regions.

1. *Alnus serrulata* (Ait.) Willd. SMOOTH ALDER. Spreading or laxly ascending deciduous shrubs or small trees to 5 m. or more tall, the main stem to 15 cm. in diameter; bark of trunk smooth, light grayish-brown to reddish-brown or blackish-gray, with dark lenticels; leaves with petioles to 15 mm. long, obovate to obovate-elliptic or elliptic, narrowly to broadly cuneate at base, rounded to acute at the apex, to 1 dm. long and 6 cm. wide, the margins simply serrulate or rarely somewhat undulate, the expanding leaves glutinous and aromatic; aments usually formed in the fall and expanding in early spring; staminate aments pendulous, in clusters of 3 to 5, each of the bracts subtending 3 flowers; staminate flowers with a minute 4-parted calyx and 4 stamens with undivided filaments; pistillate aments in clusters of 2 or 3, ovoid to ellipsoid, 1.5-2 cm. long, the fleshy cuneate bracts 3-4 mm. long, each subtending 2 flowers and a group of 4 tiny scalelets adherent to the bracts of the aments; fruit a persistent semiwoody strobile, each cuneate to cuneate-obovate truncate or lobulate scale bearing 2 to 4 compressed laterally winged nutlets. Along streams and in swamps and boggy situations, mainly in e. Tex., Mar.-Apr.; from N.E., s. to Fla. and Tex., Okla., Mo., Ind. and O.

Often confused with the eastern *A. rugosa* (Du Roi) Spreng., whose bark has linear, whitish lenticels.

FAM. 52. FAGACEAE DUM. BEECH FAMILY

Monoecious trees or shrubs with alternate simple straight-veined deciduous or evergreen leaves and deciduous stipules; staminate flowers in aments or capitate clusters; pistillate flowers solitary or slightly clustered; the 1-celled and 1-seeded nut entirely to partly enclosed in a cupule formed by the more or less consolidated bracts that become indurated; ovary 3- to 7-celled; ovules 1 or 2 in each cell, usually with only one ripening; styles 3; seed with no albumen, filled by the embryo and with 2 integuments.

About 900 species in 8 genera mostly cosmopolitan but most abundant in the Northern Hemisphere.

- 1. Involucre a saucerlike, cup-shaped or turbinate cupule, made up of prickleless imbricated scales not entirely covering the nut; nut circular in cross section; leaves lobed or unlobed3. *Quercus*, p. 467.
- 1. Involucre of pistillate flower and fruit 2- to 4-valved, prickly, covering the nut; nut compressed or triangular; leaves unlobed (2)
- 2(1). Staminate flowers in globose-stalked heads that are pendulous on slender peduncles; involucre with recurved single spines; nuts sharply triangular; bark smooth1. *Fagus*, p. 465.
- 2. Staminate flowers in a stiff moniliform ament; involucre with straight clustered spines; nuts lenticular or compressed, not triangular; bark very rough 2. *Castanea*, p. 466.

1. FAGUS L. BEECH

About 10 species in the North Temperate Zone.

1. *Fagus grandifolia* Ehrh. BEECH-NUT TREE. Large deciduous tree to 35 m. or more tall, with a trunk to 1 m. or more in diameter, with close and smooth ash-gray bark and

horizontally spreading branches and branchlets; leaves with a petiole to 1 cm. long, ovate-elliptic to oblong-elliptic, cuneate to rounded and sometimes slightly cordate at base, acuminate at apex, dark-green, strongly straight-veined, distinctly and often coarsely serrate, essentially glabrous or silky-pubescent on lower surface (f. *pubescens* Fern. & Rehd.), to 13 cm. long and 7 cm. wide; flowers appearing with the leaves; *staminate flowers* yellow, in pendulous heads from the lower axils of the leaves of the season, with deciduous scalelike bracts, the campanulate calyx 5- to 7-cleft; stamens 8 to 16, with slender filaments bearing 2-celled anthers; *pistillate flowers* from the upper axils of the leaves of the season, usually in pairs at the apex of a short peduncle, invested by numerous subulate bractlets with the inner bractlets coherent at base to form the 4-lobed involucre, the subulate calyx lobes 6; ovary 3-celled with 2 ovules in each cell; styles filiform, stigmatic along the inner surface; prickles of the mature rufous-tomentose involucre subulate-filiform, recurving or spreading, mostly less than 3 mm. long; nutlets usually 2, triangular, thin-shelled, edible, about 15 mm. long. In rich hardwood forests, especially on slopes along streams, in e. Tex., Mar.-Apr.; from Fla., w. to Tex. and n. to s.e. Mass., O., Ind., s. Ill. and Mo.

Our plant is represented by the more southern var. *caroliniana* (Loud.) Fern. & Rehd., with darker green, more firm-textured, less coarsely toothed ovate to obovate leaves and rufous-tomentose involucre with fewer and shorter prickles.

2. CASTANEA MILL.

CHINQUAPIN. CHESTNUT

Trees or shrubs; leaves conspicuously straight-veined, undivided, dentate or serrate; flowers appearing after the leaves in axillary aments near the ends of branches; aments wholly staminate or the upper ones androgynous with the pistillate flowers at the base; staminate flowers in long somewhat interrupted naked cylindrical aments, the calyx mostly 6-parted, the up to 20 stamens with 2-celled anthers on slender filaments; pistillate flowers usually 3 together in an ovoid scaly prickly involucre, the calyx with a 6-lobed border crowning the 3- to 7-celled ovary; nuts as many as 3 together, enclosed in the spiny involucre.

A small genus of very complicated plants in the Northern Hemisphere. Of necessity, our treatment of Texas material is most tenuous and tentative. The genus is in great need of a monograph.

- 1. Rather large trees or shrubs; branchlets more or less pubescent; leaves densely tomentose beneath (2)
- 1. Small shrubs or somewhat arborescent shrubs; branchlets typically smooth; leaves thinly tomentose beneath to essentially glabrous, often less than 10 cm. long (3)
- 2(1). Bur closely covered by scales bearing short erect crowded slender bristles, glabrate or sparingly pubescent; leaf blades velvety-pubescent beneath 1. *C. pumila* var. *pumila*.
- 2. Bur with broad open areas and somewhat remote scales that bear horizontally divergent short stout bristles which are canescent well to the tip; leaf blades mostly 10 cm. long or more, feltlike beneath 1. *C. pumila* var. *Ashei* Sudw.
- 3(1). A dwarf erect shrub that spreads by underground rootstocks, colonial 2. *C. alnifolia* var. *alnifolia*.
- 3. An arborescent shrub, noncolonial 2. *C. alnifolia* var. *floridana* Sarg.

1. *Castanea pumila* (L.) Mill. Trees or large spreading shrubs with furrowed bark; leaves elliptic to oblong-obovate, obtuse to acute at apex, to 15 cm. long and 5 cm. wide, usually smaller, green and glabrous above, whitish-downy to white-glabrate beneath, the lateral veins extending straight and parallel from the midrib to terminate in the sharp teeth of the coarsely serrate margins; staminate flowers fragrant, borne in profusion in long yellowish-white erect aments; pistillate flowers inconspicuous, mostly borne on separate interrupted catkins near tip of branchlets; burs 1 to 7 per stalk, about 25 mm. in diameter, tawny- to brown-tomentose and bearing close-set or somewhat distant

spine-bearing scales on their outer surface, when mature each split into 2 to 4 valves and bearing 1 to 3 nuts; nuts ovoid, pointed, sweet-meat, about 1 cm. in diameter. In sandy open woodlands and thickets in e. Tex., Mar.-June; from e. Mass., s. to Fla., w. to Tenn., Ark. and Tex.

We have two variants that are distinguished in the key.

2. *Castanea alnifolia* Nutt. DOWNY CHINQUAPIN. Shrub or small tree, with or without horizontal underground rootstocks, mostly less than 15 dm. high; leaves narrowly elliptic to oblong-obovate, to 12.5 cm. long and 5 cm. wide, green and smooth above, finely tomentose to green and essentially glabrate beneath, their venation and serrate margins similar to *C. pumila*; staminate flowers slightly fragrant, borne in interrupted clusters on erect-ascending slender greenish-yellow catkins; pistillate flowers and burs similar to those in *C. pumilla*. *C. pumila* var. *Margaretta* Ashe. On rolling hills and open woodlands and thickets in e. Tex., Mar.-June; from Va., s. to Fla. and w. to Ark. and Tex.

We have two variants that are distinguished in the key.

3. QUERCUS L.⁴² OAK

Shrubs to large trees, monoecious; pith star-shaped, continuous; wood usually hard with both uniseriate and multiseriate rays, the vessels grouped in a matrix of wood-parenchyma, either diffuse-porous or ring-porous, often plugged by tyloses; buds crowded toward the ends of the usually fluted twigs; stipules associated with the buds rather than the leaves, subulate to ligulate, promptly caducous or sometimes persistent; leaves alternate, usually distinctly petioled, never quite sessile, simple, entire or toothed or pinnately lobed, pinnately veined; *staminate flowers* in elongate flaccid catkins, apetalous, the calyx of 5 lobes fused into a more or less bowl-shaped perianth enclosing 5 to 10 free stamens with short anthers and slender filaments; *pistillate flowers* in a reduced catkin with a stiff woody rachis either short or long and 1- to several-flowered, the calyx of 6 sepals adherent to the bases of the styles and fused into a tube, the pistil of three carpels comprising a single 3-celled ovary (each cell containing 2 ovules) and three free styles which are ventrally stigmatic toward the dilated apex; fruit 1-celled and 1-seeded, the 5 remaining ovules aborted and adhering to the developed seed, the seed enclosed in a shell (forming a nut or acorn) and seated in a cup or involucre formed (in our species) of scales (each with a more or less aborted bud in its axil), developing from a compressed inflorescence, the cup enveloping the whole nut or covering it only at the base.

A genus of some 500 or so recognized species in the Northern Hemisphere, exclusive of the Arctic; about 250 in the New World centering in central Mexico and reaching Canada and Colombia.

1. Bark rather soft, gray and scaly (rarely black and deeply furrowed, e.g., *Q. virginiana* and *Q. fusiformis*); leaves (if toothed) only mucronate-tipped or rounded, rarely spinose and never aristate-tipped; stigmas abruptly dilated on short styles; fruit annual; cup scales usually prominently thickened basally and loosely appressed apically; acorns with the shell glabrous on the inner surface; abortive ovules basal (White Oaks) (2)
1. Bark rather hard, black and furrowed but scarcely scaly; leaves (if toothed) aristate-tipped, never round-lobed or if so these aristate from the veins; stigmas gradually or rarely abruptly dilated, on long styles; fruit biennial or annual; cup scales scarcely thickened basally (or if so the leaf characters definitely as here described) and usually tightly appressed apically; acorns with the shell tomentose on the inner surface; abortive ovules usually apical (Black Oaks) (33)
- 2(1). Mature acorns nearly enclosed in the thin shell-like cups, the orifice usually less than half the diameter of the acorn 2. *Q. lyrata*.
2. Mature acorns rarely more than half-enclosed in the cups, with the orifice as great as the diameter of the acorn (3)

⁴² Contributed by Cornelius H. Muller; also in Contr. Tex. Res. Found. Bot. 1: 21-309. 1951 (in which most of these species are illustrated).

- 3(2). Cups large (3-6 cm. in diameter, cf. *Q. Prinus* below), fringed about the lip with coarsely attenuated apices of the uppermost scales, these sometimes nearly closing the orifice over immature acorns 1. *Q. macrocarpa*.
3. Cups smaller (0.5-3 cm. in diameter), the apices of the uppermost scales not greatly attenuated nor forming a fringe about the lip (4)
- 4(3). Leaves glabrous beneath or nearly so at maturity (5)
4. Leaves pubescent beneath at maturity (sometimes minutely so) (11)
- 5(4). Leaves very small, markedly crisped and spinose-toothed, completely glabrous and glaucous 8. *Q. Hinckleyi*.
5. Leaves various but not spinose-toothed (6)
- 6(5). Leaves green beneath at maturity (7)
6. Leaves with a glaucous bloom beneath at maturity (9)
- 7(6). Leaves thin, yellow-green; petioles not pruinose; twigs glabrous or variously stellate-pubescent 23a. *Q. sinuata* var. *breviloba*.
7. Leaves thick, blue-green or gray-green; petioles pruinose; twigs glabrous (8)
- 8(7). Leaves 5-10 cm. long or more, the veins very prominent beneath; petioles more than 5 mm. long 6. *Q. glaucoides*.
8. Leaves 1-3 cm. long, the veins not very prominent beneath; petioles less than 5 mm. long 7. *Q. depressipes*.
- 9(6). Leaves deeply or shallowly round-lobed, obovate .. 3. *Q. alba*.
9. Leaves all shallowly lobed or repandly round-lobed (10)
- 10(9). Leaves from lanceolate to obovate, evenly repand, usually acute 5. *Q. Muehlenbergii*.
10. Leaves oblong to obovate, broadly shallow-lobed, not repand, obtuse 23a. *Q. sinuata* var. *breviloba*.
- 11(4). Leaves evenly round-repand; cups 2-4 cm. broad .. 4. *Q. Prinus*.
11. Leaves variously lobed or entire but not repand (12)
- 12(11). Leaves deeply lobed (13)
12. Leaves shallowly lobed, toothed or entire (18)
- 13(12). Twigs glabrous or nearly so (14)
13. Twigs persistently densely fulvous-tomentulose or velvety (16)
- 14(13). Lower leaf surface sparsely spreading stellate-villous or glabrate; distribution west of the Pecos River 9. *Q. Gambelii*.
14. Lower leaf surface densely spreading stellate-villous or at length nearly glabrate; distribution east of the Pecos River (15)
- 15(14). Shrubs or small trees; twigs usually about 2 mm. in diameter; leaf blades very thin, the margins flat or minutely revolute 14. *Q. Margaretta*.
15. Moderate-sized trees; twigs usually more than 3 mm. in diameter; leaf blades quite thick and leathery, the margins strongly revolute ... 15. *Q. Drummondii*.
- 16(13). Shrubs; leaves spreading-stellate on lower surface, usually apically 3-lobed and basally strongly attenuate-cuneate 13. *Q. Boyntonii*.
16. Trees; leaves glabrate beneath or at most sparsely appressed-stellate or puberulent (17)
- 17(16). Leaves strongly cruciform, the apical pair of lobes clavate; leaf blades quite thick and leathery; distribution on dry uplands 11. *Q. stellata*.
17. Leaves seldom cruciform, the lobes narrow; leaf blades thin; distribution in wet bottomland forests 12. *Q. similis*.
- 18(12). Leaves glaucous and glabrous above, noticeably fulvous-puberulent beneath, the margins heavily cartilaginous, the teeth strongly mucronate or even spinose .. 21. *Q. turbinella*.
18. Leaves various but not as above (19)

- 19(18). Leaves prominently reticulate beneath, the veins impressed above (20)
19. Leaves **not** markedly reticulate beneath, the veins not strikingly impressed above (21)
- 20(19). Leaves **not over twice** as long as broad, the broadly rounded apex abruptly mucronately several-toothed; fruit borne on prominent peduncles
.....22. *Q. rugosa*.
20. Leaves twice as long as broad or more, the apex acute to obtuse or entire to toothed but not abruptly mucronate; fruit sessile or short-stalked
.....19. *Q. arizonica*.
- 21(19). Leaves toothed, undulately crisped, the stellate pubescence very harsh to the touch24. *Q. pungens*.
21. Leaves variously toothed or entire but not undulate-crisped or if so the pubescence not harsh to the touch (22)
- 22(21). Leaves very small and thick, coarsely revolute, densely woolly-tomentose beneath20. *Q. intricata*.
22. Leaves small or moderate-sized, not coarsely revolute, if tomentose beneath not strikingly woolly (23)
- 23(22). Leaves spreading-pubescent beneath (24)
23. Leaves pubescent beneath with tightly appressed minute stellate hairs, often appearing glabrous and glaucous to the naked eye (27)
- 24(23). Leaves dark-green above, white-tomentose beneath (25)
24. Leaves usually similar in coloration above and beneath, at least not strikingly dissimilar (26)
- 25(24). Leaves oblong, uniformly white-tomentose beneath; cups about 15 mm. broad or rarely broader18. *Q. Mohriana*.
25. Leaves ovate to oblong, the veins visible through the white tomentum beneath; cups usually more than 15 mm. broad16. *Q. Havararii*.
- 26(24). Leaves shallowly lobed10. *Q. undulata*.
26. Leaves variously entire to toothed but not lobed17. *Q. grisea*.
- 27(23). Leaves green beneath in spite of minute pubescence; shrubs with slender pliable twigs24a. *Q. pungens* var.
Vaseyana.
27. Leaves creamy-canescens beneath with dense appressed stellate hairs (28)
- 28(27). Bark black or at least dark-gray, hard and deeply furrowed (29)
28. Bark light-gray, scaling off in thin plates, not furrowed (31)
- 29(28). Cups narrowed basally; fruit subfusiform, pedunculate; leaf blades broadest toward the base; shrubs or trees of limestone uplands; central and west Texas ..
.....26. *Q. fusiformis*.
29. Cups broadly rounded basally; fruit ovate or narrow but not fusiform, sessile (30)
- 30(29). Leaves 2-4 cm. broad or more, the blades broadest toward the apex; large trees in east and south Texas near the coast25. *Q. virginiana*.
30. Leaves 1-2.5 cm. broad; low shrubs on sand dunes easterly along the coast
.....27. *Q. minima*.
- 31(28). Leaves mucronately toothed, shiny beneath in spite of pubescence
.....24a. *Q. pungens* var.
Vaseyana.
31. Leaves lobed or toothed but not mucronate, dull-white beneath (32)
- 32(31). Shrubs or small trees of limestone uplands; central and west Texas
.....23a. *Q. sinuata* var.
breviloba.
32. Large trees in moist river bottom forests; south and east Texas
.....23. *Q. sinuata*.
- 33(1). Petioles usually not over 1 cm. long (34)
33. Petioles usually more than 1 cm. long (40)

- 34(33). Leaves densely white-tomentose beneath, the veins impressed above and the margins revolute29. *Q. hypoleucoides*.
34. Leaves variously pubescent or glabrous but not as above (35)
- 35(34). Fruit annual; leaves commonly glabrous below except for a tuft of stellate hairs on each side of the base of the midrib; west of the Pecos River28. *Q. Emoryi*.
35. Fruit biennial; leaves variously pubescent or glabrous but not as above; east of the Pecos River (36)
- 36(35). Leaves narrowly elliptic to linear-lanceolate, fully 5 times as long as broad, markedly revolute and awl-shaped upon issuing from the buds33. *Q. Phellos*.
36. Leaves elliptic to oblanceolate or clavate, scarcely more than 3 times as long as broad, flat when issuing from the buds, never awl-shaped (37)
- 37(36). Leaves elliptic to oblanceolate or oblong (38)
37. Leaves clavate or cuneate, often 3-lobed at the apex, the base usually entire but occasionally lobed (39)
- 38(37). Twigs and lower leaf surfaces persistently gray-tomentose30. *Q. incana*.
38. Twigs and lower leaf surfaces glabrate or nearly so, at least not tomentose31. *Q. laurifolia*.
- 39(37). Twigs and petioles glabrous or nearly so; leaves glabrous beneath except for axillary tufts of stellate hairs; cups saucer-shaped ...34. *Q. nigra*.
39. Twigs and petioles fulvous-pubescent; leaves variously pubescent beneath, especially about the base of the midrib; cups cup-shaped41. *Q. marilandica*.
- 40(33). Leaves entire (41)
40. Leaves variously toothed or lobed (48)
- 41(40). Leaves densely white-tomentose beneath, the veins impressed above and the margins revolute29. *Q. hypoleucoides*.
41. Leaves variously pubescent or glabrous but not as above (42)
- 42(41). Fruit annual; leaves commonly glabrous below except for a tuft of stellate hairs on each side of the base of the midrib; west of the Pecos River28. *Q. Emoryi*.
42. Fruit biennial; leaves variously pubescent or glabrous but not as above; east of the Pecos River (except *Q. graciliformis*) (43)
- 43(42). Leaves narrowly elliptic to linear-lanceolate, fully 5 times as long as broad, markedly revolute and awl-shaped when issuing from the buds33. *Q. Phellos*.
43. Leaves elliptic to oblanceolate or clavate, scarcely more than 3 times as long as broad, flat when issuing from the buds, never awl-shaped (44)
- 44(43). Leaves elliptic to oblanceolate or oblong (45)
44. Leaves clavate or cuneate, often obscurely 3-lobed at the apex (47)
- 45(44). Twigs and lower leaf surfaces persistently gray-tomentose30. *Q. incana*.
45. Twigs and lower leaf surfaces glabrate or nearly so, at least not tomentose (46)
- 46(45). Petioles slender, over 1 cm. long; leaf blades thin, attenuately acute; west of the Pecos River35. *Q. graciliformis*.
46. Petioles thick and stiff, less than 1 cm. long; leaf blades thick, obtuse or at most merely acute; coastal Texas on sand32. *Q. hemisphaerica*.
- 47(44). Twigs and petioles glabrous or nearly so; leaves glabrous beneath except for axillary tufts of stellate hairs; cups saucer-shaped ...34. *Q. nigra*.
47. Twigs and petioles fulvous-pubescent; leaves variously pubescent beneath, especially about the base of the midrib; cups cup-shaped41. *Q. marilandica*.

- 48(40). Leaves densely white-tomentose beneath, the margins revolute
29. *Q. hypoleucoides*.
48. Leaves variously pubescent or glabrous but not as above (49)
- 49(48). Fruit annual; leaves commonly glabrous below except for a tuft of stellate hairs
 on each side of the base of the midrib28. *Q. Emoryi*.
49. Fruit biennial; leaves variously pubescent or glabrous but not as above (50)
- 50(49). Leaves at most irregularly toothed or shallowly lobed (51)
50. Leaves regularly toothed or lobed (55)
- 51(50). Leaves not 3-lobed nor so much broader apically than basally as to be distinctly
 club-shaped (52)
51. Leaves apically 3-lobed or obscurely so, much broader apically than basally and
 distinctly club-shaped (53)
- 52(51). Twigs and lower leaf surfaces persistently gray-tomentose
30. *Q. incana*.
52. Twigs and lower leaf surfaces glabrate or nearly so, at least not tomentose
32. *Q. hemisphaerica*.
- 53(51). Twigs and petioles glabrous or nearly so; leaves glabrous except for axillary
 tufts of stellate hairs34. *Q. nigra*.
53. Twigs and petioles fulvous-pubescent; leaves variously pubescent beneath (54)
- 54(53). Leaves densely fulvous-tomentulose beneath40. *Q. falcata*.
54. Leaves variously pubescent beneath (especially about the base of the petiole) but
 never tomentulose41. *Q. marilandica*.
- 55(50). Leaves at most only coarsely toothed, 4 or 5 times longer than broad, narrowly
 lanceolate35. *Q. graciliformis*.
55. Leaves definitely lobed, at most only 2 or 3 times longer than broad, broadly lanceo-
 late to ovate (56)
- 56(55). Lateral lobes simple, cuneate (57)
56. Lateral lobes few- or several-toothed, aristate (61)
- 57(56). Terminal lobe elongate, oblong, truncate apically with usually 2 lateral teeth
 (58)
57. Terminal lobe scarcely more prominent than the lateral lobes or distinctly obscure,
 variously acute or rounded but not oblong (59)
- 58(57). Lower leaf surface glabrate or with axillary tufts or even scattered pubescence;
 distribution west of the Pecos River38. *Q. Gravesii*.
58. Lower leaf surface densely fulvous-tomentulose; distribution east of the Pecos River .
40. *Q. falcata*.
- 59(57). Leaves and twigs persistently fulvous-tomentulose or tardily glabrescent
39. *Q. tardifolia*.
59. Leaves and twigs glabrate or nearly so (60)
- 60(59). Leaves somewhat broader basally than apically, usually distinctly toothed as
 well as lobed38. *Q. Gravesii*.
60. Leaves distinctly broader apically than basally, clavate by expansion of three apical
 lobes and a narrow entire base41. *Q. marilandica*.
- 61(56). Leaves densely fulvous-tomentulose beneath40. *Q. falcata*.
61. Leaves variously pubescent or glabrate but not densely tomentulose (62)
- 62(61). Leaf bases broadly U-shaped40. *Q. falcata*.
62. Leaf bases variously obtuse to rounded or cordate but not U-shaped (63)
- 63(62). Buds large (6-10 mm. long), often quadrangular, densely fulvous- or gray-
 tomentose or strigose42. *Q. velutina*.
63. Buds not over 5 mm. long, sparsely pubescent or glabrous (64)

- 64(63). Acorn cups flat, at most shallowly goblet-shaped; acorns subrotund to broadly elliptic36. *Q. Shumardii*.
 64. Acorn cups deeply cup-shaped; acorns narrowly ovoid or narrowly elliptic (65)
 65(64). Leaves ovate to subrotund in outline; central Texas east of the Pecos River ...
37. *Q. texana*.
 65. Leaves narrowly ovate to broadly lanceolate in outline; west of the Pecos River
38. *Q. Gravesii*.

1. *Quercus macrocarpa* Michx. BUR OAK. Large trees; twigs very coarse, 3-5 mm. thick or rarely somewhat more slender, fluted, yellowish or gray, from villous or pubescent or both becoming glabrate, with few very inconspicuous lenticels; buds 4-5 mm. long, ovoid or narrowly so, obtuse to acute, grayish-brown, sparsely pubescent to tomentose; stipules persistent or sometimes deciduous, about 1 cm. long, awl-shaped or the lateral ones longer and obviously spatulate-dilated, the terminal ones coarsely thickened and gray-tomentose; leaves deciduous, rather thin, to 20 cm. long and 15 cm. broad, obovate in outline, the apices broadly rounded, the bases rounded to cuneate, rather deeply incised, with 3 or 4 sinuses on each side, these acute or narrowly rounded, usually reaching nearly to the midrib (especially below), the lobes clavate, undulate distally, the basal ones often much-shortened, margins minutely revolute, upper surfaces glabrate, dull or slightly lustrous, lower surfaces villous and gray-puberulent with a mixture of long spreading and short appressed stellate hairs or the appressed hairs rarely absent and the surface then green; petioles to 25 mm. long, densely or sparsely pubescent; *staminate catkins* 3-4 cm. long, the rachis yellow-tomentose, at length rather loosely flowered, the perianth deeply incised with narrow oblong lobes, the anthers scarcely exerted; *pistillate catkins* about 2 cm. long, about 4-flowered near the end; fruit annual, solitary or paired on a peduncle 1-2 cm. long and 2-3 mm. thick; cups 3-6 cm. broad, 2-5 cm. deep, moderately or deeply cup-shaped, margins woolly with attenuate apices of the uppermost scales, these sometimes closing the orifice of the cup; cup scales broad-based, the apices of the basal scales not elongate, the dorsal surface keeled (thickened), the bases broad, often appearing to be fused to adjacent scales, the whole gray-pubescent; acorns 3-5 cm. long, 2-4 cm. broad, ovoid, broadly rounded, usually one half or three fourths included, sometimes wholly or only one fourth included. In moist forests along streams in e. and cen. Tex.; e. to the Atl. and n. to N.B. and Sask.

2. *Quercus lyrata* Walt. OVERCUP OAK. Moderate trees; twigs rather coarse, to 4 mm. thick, finely fluted, from minutely villous becoming glabrate and gray or yellowish with few inconspicuous lenticels; buds about 3 mm. long, ovoid, obtuse, gray-puberulent; stipules tardily deciduous from about the terminal bud, about 5 mm. long, very finely subulate, pubescent; leaves deciduous, thin-membranous, to 20 cm. long and 12 cm. broad, usually smaller, narrowly obovate in outline or broadly so, apices acute or sometimes rounded, bases cuneate or attenuately acute; blades twice or thrice incised on each side, the lobes obtuse, acuminate-tipped, progressively shortened downward, the uppermost clavate and coarsely toothed, the sinuses deep, broadly rounded or angularly flattened along a line parallel to the midrib, margins minutely revolute, upper surfaces glabrous and lustrous, lower surfaces minutely villous and dull-green or glaucous-appressed-tomentose; petioles to 2 cm. long, sparsely pubescent; *staminate catkins* 4-6 cm. long, densely or loosely flowered, sparsely stellate-pubescent, the perianth irregularly lobed, the anthers scarcely exerted; *pistillate catkins* 1-2 cm. long, 2- or 3-flowered distally, densely short-tomentose; fruit annual, solitary or rarely paired on a tomentose or glabrate peduncle to 4 cm. long and 1-1.5 mm. thick; cups to 3 cm. broad and 2 cm. deep, hemispheric or spheroid, the base usually broadly flattened, the mouth much-constricted, sometimes forming a minute orifice and sometimes rather open, the lower scales coarse and much-thickened, those about the margin small, thin and appressed; acorns hemispheric or rarely ovoid, usually wholly contained in the cup but rarely only half-included. In moist forests along streams in the timber region of e. Tex.; e. to the Atl., n. to Md. and Mo.

3. *Quercus alba* L. WHITE OAK. Large or sometimes small trees; twigs to 3.5 mm. thick, from sparsely or densely loose-tomentose soon becoming glabrous and grayish-brown with few inconspicuous lenticels; buds 3-4 mm. long, subglobose to ovoid, sparsely

pubescent or glabrate, reddish-brown; stipules 8-12 mm. long, ligulate, pubescent dorsally, early caducous; leaves deciduous (dead leaves remaining on the tree late in winter), thin but firm and subcoriaceous, to 15 cm. long and 10 cm. broad, obovate in outline, apices broadly rounded, bases cuneate or obtusely cuneate; blade 4- or 5-lobed on each side, the lobes either long and narrow or short and broad but always rounded, entire or rarely again toothed or shallowly lobed, sinuses deep or rarely shallow, usually narrow but rounded at bottom, upper surfaces from sparsely stellate-pubescent or densely tomentose promptly glabrate and slightly lustrous, lower surfaces similarly glabrate and minutely white-punctate by persistence of hair bases, densely tomentose leaves therefore obviously glaucous beneath upon glabrescence; petioles to 18 mm. long, glabrate; *staminate catkins* to 10 cm. long, loosely or rather closely flowered, loosely tomentose, the perianth deeply incised with very narrow lobes, anthers little-exserted; *pistillate catkins* to 15 mm. long, 2- or 3-flowered distally, from tomentose glabrate with the twigs; fruit annual, solitary, paired or ternate, subsessile or on a glabrate peduncle to 25 mm. long and 2.5 mm. thick; cups 1.5-3 cm. broad, to about 1 cm. deep, deeply cut-shaped to saucer-shaped, margins smooth, the scales coarsely thickened and short-fulvous-tomentose; acorns to 25 mm. long and 17 mm. broad, narrowly ovoid, usually narrowed toward the apex, one fourth or one third enclosed or included at the base only. In moist forests in the timber region of e. Tex.; e. to the Atl. and n. to Can.

4. *Quercus Prinus* L. CHESTNUT OAK. Large trees; twigs to 4 mm. thick, shallowly fluted, from very sparsely villous becoming glabrate and reddish- or grayish-brown; buds 5-7 mm. long, 2.5-4.5 mm. broad, acutely ovoid, brown, noticeably short-pubescent; stipules about 8 mm. long, ligulate, pubescent, very promptly caducous; leaves deciduous, to 20 cm. long and 10 cm. broad, obovate in outline, apices usually acute, rarely rounded, bases rounded or cuneate; blade repandly coarsely toothed or finely lobed, upper surfaces glabrous or sparsely pubescent along the midrib, somewhat lustrous, lower surfaces dull, finely villous-short-tomentose or sparsely so, white-punctate, appearing glaucous in sparsely pubescent forms; veins 12 to 15 on each side, each passing into a tooth or lobe; petioles 2-3 cm. long, villous but usually glabrate in age; *pistillate catkins* 5-10 mm. long, 1- to 3-flowered, tomentose; fruit annual, large, solitary, paired or ternate, subsessile or on a peduncle to 2 cm. long and 4 mm. thick; cups 2-4 cm. broad, 1.5-2 cm. deep, cup-shaped or hemispheric, the base round, margins thin, slightly roughened by projecting scale apices; cup scales very coarse, obviously thickened, triangular but the uppermost with narrowed apices, very loosely appressed, arranged rather distinctly in diagonal rows, densely fulvous-puberulent all over; acorns to 3 cm. long and 2.75 cm. broad, broadly ovoid, basally flat, apically rounded, puberulent, about one half included. *Q. Houstoniana* C. H. Mull., *Q. Muehlenbergii* of Cory & Parks, non Engelm. In moist forests of the timber region of e. Tex.; e. to the Atl. and n. to Del. and Mo.

5. *Quercus Muehlenbergii* Engelm. ЧИМКАРИН OAK. Moderate-sized or large trees; twigs from sparsely fine-pubescent soon becoming glabrate and brown, graying the second year, fluted, the few lenticels pale and rather conspicuous; buds 3-3.5 mm. long, 2-2.5 mm. broad, subrotund to broadly ovoid, apex rounded, brown or reddish-brown, very sparsely pubescent; stipules 3-4 mm. long, ligulate, delicate, very early caducous; leaves deciduous, coriaceous, to 20 cm. long and 10 cm. broad, usually much smaller, lanceolate to oblanceolate or usually obovate in outline, only rarely broadest at or below the middle, apices from short-acute to acuminate, bases truncate to cuneate, margins quite regularly repandly toothed or shallow-lobed, the teeth or lobes mucronate-tipped, upper surfaces glabrate and lustrous-dark-green, lower surfaces glaucous, the apparently glabrate surfaces liberally sprinkled with minute appressed stellate hairs; veins about 8 to 12 on each side, regularly passing into the teeth; petioles 1-3 cm. long, sparsely pubescent or glabrate; *staminate catkins* 4-6 cm. long, rather loosely flowered, sparsely pubescent; anthers well-exserted; *pistillate catkins* to 2 cm. long, 1- to 3-flowered; fruit annual, solitary or paired, subsessile or short-pedunculate; cups to 22 mm. broad and 12 mm. high, deeply or shallowly cup-shaped, base rounded, margins either rather coarse and thick or tending to be thin and flaring; cup scales broadly triangular, moderately thickened, rather loosely appressed short-gray-pubescent; acorns to 25 mm. long and 2 cm. thick, oblong to ovoid, light brown, glabrate except about the apex, about one fourth or one third included. *Q. prinoides* Coult., non Willd., *Q. Prinus* Coult., non L., *Q.*

Brayi Small. In calcareous upland forests of n.e., cen. and w. Tex.; e. to the Atl., n. to Me. and Wisc., w. into s. N.M. and n. Mex.

6. *Quercus glaucoides* Mart. & Gal. Shrubs to moderate-sized trees; twigs to 3 mm. thick, fluted, glabrous or from loosely stellate-tomentose becoming glabrate or more or less persistently pubescent, brown or grayish-brown, with few prominent light lenticels; buds very variable, about 2 mm. long and ovoid or as much as 6 mm. long and conic, in either case acute or subacute, sparsely pubescent, dark-brown; stipules promptly or tardily caducous, about 5 mm. long, the terminal ones subulate, the lateral ones ligulate, dorsally pubescent; leaves deciduous, rather thick and coriaceous or hard, to 12 cm. long and 6 cm. broad, usually much smaller, oblong or elliptic to obovate or ovate, the apices broadly rounded, bases usually rounded but ranging from cordate to cuneate, irregularly sinuate or few-lobed or rarely entire, margins cartilaginously thickened but not revolute, upper surfaces glabrous, dull bluish- or grayish-green, rarely darker, lower surfaces from stellate-floccose to promptly glabrate or with patches of hairs persistent in protected places, lighter, usually quite glaucous from microscopic wax particles; petioles to 15 mm. long, rather slender, glabrate, the pulvinus usually pruinose; *staminate catkins* 3-6 cm. long, very loosely flowered, sparsely tomentose, the subglobose anthers moderately exerted from the deeply cleft perianth; *pistillate catkins* about 5 mm. long, 1- to 3-flowered distally; fruit annual, small, solitary or paired, subsessile or on a peduncle to 1 cm. long; cups to 18 mm. broad, 4-6 mm. high, from shallowly cup-shaped to usually saucer-shaped, basally rounded or flat, the margins often thickened (as though woody) or normally thin; cup scales broadly ovate, apically rounded, often coarsely thickened (including even the apex) or only moderately thickened at the minutely tomentose base and the thin apex closely appressed, nearly glabrous, dark-reddish-brown; acorns to 2 cm. long and 14 mm. broad, conic to ovoid or subcylindric, glabrous except the apex, light-brown, one fourth included or enclosed at the base only. *Q. Laceyi* Small, *Q. glaucophylla* v. Seem., *Q. porphyrogenita* Trel. On limestone escarpment and canyons of the Edwards Plateau in cen. Tex.; also n.e. Mex.

7. *Quercus depressipes* Trel. Low shrubs to about 1 m. tall, often forming dense thickets by stolons or growing singly; twigs 1-1.5 mm. thick, shallowly fluted, tan-brown becoming reddish-gray with few inconspicuous lenticels, glabrate or fulvous-tomentose; buds 1-1.5 mm. long, subglobose, tan-brown, glabrate or the scales inconspicuously ciliate; stipules early-caducous, 3-5 mm. long, ligulate, rose- or straw-colored, ciliate above the middle; leaves subevergreen, thick and coriaceous, to 3 cm. long and 12 mm. broad, oblong to elliptic, broadly rounded to subacute at apices, moderately or deeply cordate at bases, margins entire to usually inconspicuously few-toothed above the middle, somewhat revolute, both surfaces dull gray-green or glaucous, completely glabrous or a few stellate hairs on the midrib; petioles 1-2 mm. long or rarely longer, strongly depressed in the cordate leaf bases, rose-colored with a glaucous bloom, glabrous or sparsely stellate-hairy like the twigs; *staminate catkins* to 2 cm. long, somewhat pubescent, rather closely flowered, the glabrous roundish anthers little-exserted; *pistillate catkins* rather consistently 2-flowered on a short stellately pubescent or glabrous peduncle; fruit annual, paired on a stellate or glabrous peduncle 7-15 mm. long; cups 8-10 mm. broad, 4-6 mm. high, goblet-shaped, the base somewhat constricted or rounded; cup scales moderately thickened and densely gray-tomentose at base, the apices reddish-brown, dorsally glabrous and ciliate, rather closely appressed; acorns to 15 mm. long and 1 cm. broad, elliptic to ovoid, apically rounded, tan-brown, transiently glaucous, glabrous, one fourth to one half included. On openly wooded grassland, usually at high elev. in the Davis Mts. of the Trans-Pecos; also n. Mex.

8. *Quercus Hinckleyi* C. H. Mull. Intricately branched shrubs forming coarse thickets to 7.5 dm. tall; twigs 1-1.5 mm. thick, glabrous or only an occasional minute stellate hair, light-brown and pruinose, becoming glaucous-waxy the second season, lenticels very obscure; buds minute, less than 1 mm. long, subrotund, the scales glabrous and reddish-brown except for the strikingly ciliate margins; stipules tardily deciduous, about 2 mm. long, ligulate, loosely hairy; leaves persistent at least 2 seasons, thick and coriaceous, very small, to 15 mm. long and about as broad, subrotund in outline, occasionally broader than long, cordate or auriculate at bases, acute or obtuse but spine-tipped at apices, glabrous and glaucous on both surfaces, margins markedly crisped, coarsely 2- or

3-toothed on each side (the teeth markedly spinescent), scarcely revolute but strikingly cartilaginous-thickened; veins very obscure, the principal ones passing into the teeth; petioles to 2 mm. long, glabrous and pruinose, rose-tinted; staminate catkins very small, usually 3-5 mm. long, few-flowered on a loosely tomentose peduncle, the rounded anthers moderately exerted from the lanate calyx; fruit annual, solitary, sessile or on peduncles scarcely 4 mm. long; cups to 15 mm. broad, 1-3 mm. deep, very shallowly saucer-shaped, margins irregularly undulate; cup scales very small, basally much-thickened and pubescent, apically tightly appressed and glabrous except for the ciliate margins; acorns ovoid, 8-12 mm. broad, glabrous, included at base only. On dry slopes at about 4500 ft. elev. n.w. of Solitario Peak, Presidio Co.; endemic.

9. *Quercus Gambelii* Nutt. GAMBEL OAK. Shrubs or small trees, sometimes quite large; twigs to 2 mm. thick, glabrous or stellate-pubescent, brown or reddish-brown with few inconspicuous lenticels; buds about 3 mm. long, 2-2.5 mm. broad, ovoid, acute or obtuse, brown, sparsely pubescent; stipules caducous or persistent about the terminal bud, 4-6 mm. long, subulate, pubescent; leaves deciduous, membranous, to 16 cm. long and 8 cm. broad, usually much smaller, elliptic to obovate or oblong in outline, apices rounded, bases truncate to cuneate, blades deeply incised with 4 to 6 oblong, entire or coarsely toothed, rounded or subacute lobes, the sinuses acute, narrowed or narrowly rounded at the base, reaching more than halfway to the midrib, upper surfaces from minutely stellate-tomentose becoming apparently glabrate and dark-lustrous-green but persistently microscopically spreading-pubescent, lower surfaces from densely stellate-tomentose variously persistently villous or velvety, especially about the midrib, or becoming glabrate, dull-green, sometimes glaucous; veins 4 to 6 on each side, each passing into a lobe; petioles to 2 cm. long, pubescent or partially glabrate with the lower leaf surface; *staminate catkins* 2-3 cm. long, rather loosely flowered, sparsely tomentose, the anthers moderately exerted from the deeply incised perianth; *pistillate catkins* 3-7 mm. long, 1- to 3-flowered distally; fruit annual, small, solitary or paired, sessile or on a peduncle to 1 cm. long; cups 7-15 mm. broad, 5-8 mm. high, deeply cup-shaped, bases round, margins thin and smooth; cup scales ovate, markedly thickened, the short narrowly rounded apices closely appressed, the thin margins very narrow, basally gray-tomentulose, the apices sparsely so or glabrous; acorns 12-15 mm. long, 8-10 mm. broad, ovoid to ellipsoid, light-brown, nearly glabrous, about one half included. *Q. novomexicana* (A.DC.) Rydb. On slopes and valley floors at high elev. in the Trans-Pecos; from Tex. to Colo., Ut. and n. Mex.

10. *Quercus undulata* Torr. Shrubs or rarely small trees; twigs about 1.5 mm. thick, obscurely fluted, densely or moderately tomentose, more or less completely glabrate the second year and gray with few inconspicuous lenticels; buds 1-2 mm. long, round-ovoid, pubescent or glabrate, reddish-brown; stipules persistent or soon caducous, 3-5 mm. long, subulate, pubescent; leaves deciduous or subevergreen, rather thick and coriaceous, usually 4-6 cm. long and 2-3 cm. broad, elliptic or oblong in outline, apices obtuse or sometimes nearly acute, truncate to rounded or cuneate at bases; blade coarsely and irregularly toothed or shallowly lobed, the teeth or lobes mucronate-tipped, upper surfaces sparsely stellate-pubescent, often scabrous, dark-green, somewhat lustrous, lower surfaces either sparsely or densely soft-stellate-pubescent, light-green, dull; petioles to 7 mm. long, pubescent like the lower leaf surface; fruit annual, solitary or paired, sessile or on a pubescent or tomentose peduncle to 1 cm. long; cups 1-1.2 cm. broad, 5-8 mm. high, shallowly or deeply cup-shaped, bases rounded, margins thin; cup scales triangular-ovate, the upper ones much-narrowed apically, much-thickened and closely tomentose, the thin apices nearly glabrous and closely appressed; acorns about 1.5 cm. long and 1 cm. broad, cylindrical or narrowly ovate, light-brown, glabrous, about one third included. *Q. Fendleri* Liebm., *Q. obtusifolia* (A.DC.) Rydb., non D. Don. Rocky slopes at high elev. in w. Tex.; n. to Colo. and s. to Coah.

11. *Quercus stellata* Wang. POST OAK. Moderate-sized trees; twigs to 4 mm. thick, fluted, usually flavescent-tomentose or farinaceous at first or rarely sparsely spreading-stellate-pubescent, variously glabrate with age or the tomentum turning gray; buds to 4 mm. long and 3 mm. broad at maturity, ovoid, rounded or sometimes acute, reddish-brown, sparsely pubescent; stipules 3-5 mm. long, very promptly caducous; leaves deciduous, rather thick, hard and membranous, usually about 8 cm. long and 6 cm.

broad, xeric forms often 4 cm. long and 2 cm. broad, mesic forms about 15 cm. long and 10 cm. broad, obovate to elliptic or obtriangular in outline, apices rounded, bases cuneate to cordate; blades undulately or deeply 2- to 4-lobed on each side, the principal upper pair often oblong or even clavate and perpendicular to the midrib so that with the narrowed apical and basal portions the blade is strikingly cruciform, upper surfaces lustrous and glabrous except for a sprinkling of minute stellate hairs, lower surfaces dull, more densely stellate-pubescent or glabrate, often quite glaucous; petioles to 15 mm. long, stellate-pubescent or glabrate as the lower leaf surface; *staminate catkins* 5-8 cm. long, rather loosely flowered, rachis flavo-tomentulose (if the twigs are likewise) or loosely spreading-pubescent (if the twigs are spreading-pubescent or glabrate); anthers pubescent, moderately exerted from the shallowly lobed and sparsely hairy perianth; *pistillate catkins* 3-10 mm. long or sometimes longer, 1- to 3-flowered, the pubescence closely similar to that of the twig; fruit annual, solitary or paired, moderate-sized or rarely large, subsessile or short-peduncled or the peduncle as much as 4 cm. long; cups 12-25 mm. broad, to 18 mm. high, deeply cup-shaped or sometimes goblet-shaped, bases rounded or sometimes constricted, margins thin or very thick and almost inrolled; cup scales oblong to triangular-ovate or broader, moderately or markedly thickened basally, finely pubescent; acorns to 3 cm. long and 18 mm. broad, usually smaller, subglobose to ellipsoid or even subfusiform and very acute, glabrous or very finely pubescent, two thirds included or covered at the base only. Dry upland woods, frequently on sandy soil, in cen. Tex. (one of the dominant species of the Cross Timbers) and the timber region of e. Tex.; e. to the Atl. and n. to Mass. and Kan.

11a. *Quercus stellata* × *Q. sinuata* var. *breviloba*. Twigs densely fulvous-tomentulose; leaves small and irregularly round-lobed as in the xerophytic westernmost forms of *Q. stellata*, the upper surfaces glabrate and very glossy, lower surfaces glossy although moderately pubescent with minute tightly appressed stellate hairs or densely stellate-pubescent and dull-white or gray; fruit intermediate between the parental forms. Sparse with both parents on mixed gravel and limestone banks.

12. *Quercus similis* Ashe. **BOTTOMLAND POST OAK.** Moderate to large trees; twigs 2-3 mm. thick, only slightly fluted, persistently gray-puberulent to velvety-tomentulose; buds 2-3 mm. long, ovoid, pubescent basally, brown; stipules 3-5 mm. long, subulate, pubescent, caducous or only those of the terminal buds persistent; leaves deciduous, thin and membranous, about 12 cm. long and 8 cm. broad (as little as 5 cm. long or to 16 cm. long), obovate, usually 2 pairs of lateral lobes with the apical pair sometimes clavate but the blade scarcely cruciform, basally narrow, cuneate to rounded, margins minutely revolute, lower surface minutely and sparsely stellate-puberulent, somewhat gray, upper surface glabrous and glossy-green at maturity; petioles 3-10 mm. long, pubescent like the twigs; pistillate catkins 2-10 mm. long, 1- to 3-flowered; fruit annual, solitary or paired, moderate-sized, short-peduncled, very similar to *Q. stellata*. *Q. stellata* var. *paludosa* Sarg., *Q. Ashei* Sterrett. The common post oak of wet stream bottoms in e. Tex.; s. Ark. and La., e. to S.C.

The upper terraces of some streams, particularly in Louisiana, exhibit intermediates between *Q. similis* and *Q. stellata* to which *Q. mississippiensis* Ashe is applicable.

13. *Quercus Boyntonii* Beadle. Rhizomatous shrubs 2-30 (-50) dm. tall, trailing or sometimes semierect; twigs 1.5-3 mm. thick, densely fulvous-tomentulose with a mixture of simple appressed glandular hairs and moderately spreading stellate hairs, the pubescence darkening and persisting through the second season; buds 2-3 (-4) mm. long, ovoid, acute or sometimes rounded, russet, sparsely pubescent; stipules deciduous, 3-5 mm. long, subulate, sparsely hairy; leaves deciduous or subevergreen, thin and rather soft, 5-10 (-12) cm. long, 2-6 (-8) cm. broad, cuneate to oblanceolate or obovate to oblong, characteristically roundly 3-lobed at the broad apex or sometimes 5-lobed above the entire cuneate base, margins minutely cartilaginous-revolute, upper surface glossy, when young sparsely glandular-puberulent and with scattered stellate hairs, at length glabrate or the stellate pubescence persistent especially about the midrib, lower surface dull, persistently fulvous-glandular-puberulent and stellate-pubescent or the pubescence silvery; the veins about 6 to 8 on each side, very irregular and with some intermediates, those passing into the lateral lobes very prominent, slightly raised above and prominently so beneath, markedly and irregularly branching and anastomosing; petioles 5-10 mm.

long, moderately slender, persistently pubescent like the twigs; *staminate catkins* 3-6 cm. long, fulvous-glandular-puberulent and stellate-pubescent, the puberulent anthers well-exserted from the ciliate perianth; *pistillate catkins* about 5 mm. long, about 3-flowered, subsessile and densely fulvous-pubescent; fruit annual, solitary or paired on peduncles 2-10 (-35) mm. long; cups 10-13 mm. broad, 5-10 mm. high, deeply cup-shaped or more shallow, the scales densely fulvous- or silvery-tomentulose, the bases moderately or markedly thickened, the thin apices closely appressed; acorns 10-17 mm. long, 7-10 mm. thick, broadly or narrowly ovoid, the ends broadly rounded, brown and minutely puberulent especially about the apex, about one half or only one third included. *Q. stellata* var. *Boynntonii* (Beadle) Sarg. Locally abundant on deep sands in loblolly pine forests in e.-cen. Tex., sporadically to e. Ala.

14. *Quercus* *Margaretta* Ashe. SAND POST OAK, RUNNER OAK. Low or moderate-sized shrubs branched from the base; twigs 1.5-2.5 mm. thick, fluted, glabrous and dull-brown or at most very sparsely spreading-stellate, the lenticels very inconspicuous; buds 3-3.5 mm. long, about 2 mm. broad, reddish-brown, from sparingly pubescent becoming glabrate; stipules about 5 mm. long, subulate, pubescent, promptly caducous or sometimes persistent about the terminal bud; leaves deciduous, hard and membranous, 5-12 cm. long, 3.5-10 cm. broad, obovate to oblong or elliptic in outline, apices broadly rounded, bases cuneate to rounded, blade 2- or 3-lobed on each side, sinuses deep, either broad or narrowed but rounded at the bottom, lobes rounded or clavate, simple or obscurely toothed or undulate, margins revolute, upper surfaces very sparsely sprinkled with minute stellate hairs or entirely glabrate, glossy-green, lower surfaces from densely crisped-stellate-tomentose becoming glabrate or more or less persistently pubescent, the lamina dull and somewhat glaucous; petioles 3-15 mm. long, tomentose or glabrate; fruit annual, solitary or paired, subsessile or short-stalked; cups 13-18 mm. broad, 7-10 mm. deep, deeply cup-shaped, bases rounded; cup scales oblong to ovate, very slightly thickened, the narrowed apices loosely appressed, densely short-pubescent; acorns 1-1.5 cm. long, 9-13 mm. broad, ovoid, light-brown, glabrous, about one half included. *Q. stellata* var. *Margaretta* (Ashe) Sarg. Low woodlands in deep sandy soil in cen. and e. Tex.; e. to the Atl. and n. to Va. and Okla.

14a. *Quercus* *Margaretta* × *Q. stellata*. Small trees; twigs variously intermediate between the glabrous and velvety-tomentulose forms of the parents, frequently spreading-stellate-pubescent; buds dull-red as in *Q. Margaretta*; leaves small, more prominently clavate-lobed or cruciform than in *Q. Margaretta*, more persistently villous beneath than in *Q. stellata*; fruit similar to *Q. Margaretta*. Scattered in n.-cen. and e. Tex. on sand beds with *Q. Margaretta* adj. to gravel and clay soils bearing *Q. stellata*.

15. *Quercus* *Drummondii* Liebm. POST OAK. Small or moderate trees; twigs 2.5-4 mm. thick, glabrous and light-brown or sparingly villous with spreading stellate hairs, the light lenticels becoming quite prominent; buds 4-7 mm. long, broadly or narrowly ovoid, scarcely acute, glabrous and dull-red or brown or sparingly brown-puberulent about the apex; leaves deciduous, rather thick and coriaceous, to 12 cm. long and 9 cm. broad, obovate in outline, deeply incised (one half to two thirds the distance to the midrib) by narrow or even closed sinuses, rarely the sinuses rounded, lobes 2 or 3 on each side, oblong, rounded or truncate or clavate, upper surfaces from sparsely spreading-stellate-hairy soon glabrate and glossy, lower surfaces from loosely tomentose or villous with spreading stellate hairs at length glabrate or persistently pubescent, especially along the midrib and veins, dull and somewhat glaucous where denuded; veins very irregular, the primary ones passing into the lobes and of corresponding number; petioles to 12 mm. long, from stellately pubescent usually glabrate or sometimes persistently pubescent; *staminate catkins* 5-6 cm. long, sparsely villous, rather loosely flowered; *pistillate catkins* very short, the subsessile involucre borne singly or in pairs, rarely on obvious short peduncles; fruit annual, moderate, solitary or paired, subsessile or borne on glabrous peduncles to 8 mm. long; cups 15-18 mm. broad, deeply cup-shaped or hemispheric; cup scales moderately thickened basally, attenuately narrowed apically, closely appressed, minutely buff or gray-pubescent; acorns 1.5-2 cm. long, about 1.3 cm. broad, narrowly ovoid or elliptic, glabrous and light-brown, one third to one half included. In deep sand belts of cen. Tex., eastw.

16. *Quercus* *Havardii* Rydb. SHIN OAK, SHINNERY OAK. Very low shrubs spreading by rhizomes, or small trees; twigs to 3 mm. thick, subterete or fluted, brown when exposed,

glabrous or more or less densely short grayish- or yellowish-tomentose, the second season glabrate or nearly so and gray, lenticels inconspicuous; buds about 2 mm. long, subglobose, sparsely pubescent, dark-reddish-brown; stipules caducous or persistent for a time, about 5 mm. long, filiform to subulate, pubescent; leaves deciduous, rather thick and hard, very polymorphic, to 10 cm. long and 5 cm. broad, from lanceolate or oblanceolate to usually oblong or elliptic or ovate to obovate, apices broadly rounded or rarely acute, bases rounded to cuneate, subentire to undulate, toothed or deeply lobed, the margin flat to revolute, upper surfaces lustrous, very sparsely stellate-pubescent or glabrate, lower surfaces grayish- or yellowish-tomentulose or more sparsely pubescent; petioles to 7 mm. long, their state of pubescence closely paralleling that of the twigs; *staminate catkins* 2-3 cm. long, rather densely flowered, very sparsely pubescent, the usually pubescent anthers moderately exerted; *pistillate catkins* 3-7 mm. long, 1- to 5-flowered distally; fruit annual, solitary or paired, subsessile or short-stalked, very polymorphic and very variable in size; cups 15-25 mm. broad, 10-12 mm. high, from deeply cup-shaped to goblet-shaped, bases rounded or constricted, margins very thin and smooth or thickened, inrolled and contorted; cup scales triangular-ovate to oblong, the narrowed apices loosely appressed, bases moderately or markedly thickened, uniformly pubescent (often canescent) or the thin apices of the superior scales glabrous and reddish-brown; acorns 12-25 mm. long, 14-18 mm. broad, ovoid, glabrous and brown or glaucescent, one third to one half included. In deep sand across the s. Panhandle plains; from e. Okla., w. to s.e. N.M., n.e. Ariz. and s.e. Ut.

16a. *Quercus Havardii* × *Q. stellata*. Shrubs or small trees 1-3 m. tall, occurring in clumps; twigs densely fulvous-tomentose or glabrate; leaves to 11 cm. long and 5 cm. broad, oblong to obovate, irregularly or regularly lobed or nearly entire, sometimes distinctly square-lobed, green and sparsely stellate-puberulent above, gray and stellate-tomentulose beneath or sparingly stellate; petioles 3-8 mm. long, pubescent like the twigs; acorns and cups ranging from the small sizes of typical *Q. stellata* to the large flaring cups and the broadly ovoid acorns of *Q. Havardii*. In deep sand on hills and plains throughout the e. range of *Q. Havardii*, from the s.e. cos. of the Tex. Panhandle into Okla. and southwestw. onto the Tex. Lower Plains.

16b. *Quercus Havardii* × *Q. Mohriana*. Low shrubs; twigs white- or gray-tomentose; leaves to 11 cm. long and 9 cm. broad, oblong to ovate, entire or coarsely round-toothed, dark-green and nearly glabrous above, white-tomentose or glaucous and sparingly stellate-pubescent beneath, the veins glabrous or nearly so; cups intermediate between those of the parents. On rocky slopes at the "breaks" of the Tex. Plains with both parents.

17. *Quercus grisea* Liebm. GRAY OAK. Large shrubs to moderate-sized trees; twigs 1-2 mm. thick, obscurely fluted, sparsely or densely buff- or gray-stellate-tomentulose or tomentose, gray and partially glabrate the second and third seasons, lenticels inconspicuous; buds about 2 mm. long, round-ovoid, glabrous or sparsely pubescent, dark-reddish-brown; stipules persistent, about 3 mm. long, subulate to filiform, pubescent; leaves deciduous or at most subevergreen, thick and coriaceous, to 8 cm. long and 4 cm. broad, usually much smaller, oblong to elliptic or ovate, apices acute or sometimes obtuse, rarely rounded, bases cordate, or merely rounded, margins minutely revolute, entire or low-dentate with the teeth mucronate-tipped, upper surfaces rather dull-green, very sparsely and minutely stellate-pubescent or rarely tomentose, lower surfaces opaque, very sparsely and minutely stellate-pubescent or tomentulose, rarely tomentose; petioles to 1 cm. long, tomentose; *staminate catkins* to 7 cm. long, rather loosely flowered, villous or tomentose, the glabrous anthers well-exserted; *pistillate catkins* to 4 cm. long, 1- to 6-flowered, tomentulose; fruit annual, solitary or paired, subsessile or short- or long-stalked, peduncle to 3 cm. long; cups 8-15 mm. broad, 4-10 mm. high, from deeply goblet-shaped to deeply cup-shaped, base rounded, margins thin, simple, and smooth; cup scales broadly ovate to oblong, the lower ones slightly or markedly thickened at the canescently tomentose bases, the thin and closely appressed apices sparsely pubescent and reddish-brown, those of the upper scales narrowed and rather elongate; acorns 12-18 mm. long, 8-12 mm. broad, ovoid to narrowly ovoid or ellipsoid, light-brown, glabrous or finely pubescent, over one half included or enclosed at the base only. *Q. oblongifolia* Coult., non Torr. On rocky igneous or dolomitic slopes at moderate elev. in w. Tex.; also N.M., Ariz. and Chih.

18. *Quercus Mohriana* Buckl. SCRUB OAK, SHIN OAK. Shrubs or small trees; twigs 1-2 mm. thick, fluted, from glabrous to stellately canescent or commonly gray-tomentose; buds about 2 mm. long, round-ovoid, sparingly pubescent, dark-reddish-brown; stipules early-caducous, about 3 mm. long, subulate to filiform, pubescent; leaves evergreen or deciduous, thick and coriaceous, to 8 cm. long and 35 mm. broad, oblong or elliptic, apices rounded or rarely acute, bases rounded, rarely cuneate or cordulate, entire or undulately toothed or merely few-denticulate, margins minutely revolute, undulately crisped or flat, upper surfaces very sparsely and minutely stellate-pubescent, dark-green, lustrous, lower surfaces densely gray- or white-tomentose or in a few forms obscurely but densely tomentulose; petioles 2-5 mm. long, tomentose like the twigs; *staminate catkins* 2-3 cm. long, rather loosely flowered, sparsely pubescent, the glabrous or pubescent anthers little-exserted; *pistillate catkins* 2-8 mm. long, distally 1- to 3-flowered; fruit annual, solitary or paired, subsessile or short-stalked, the peduncle sometimes 1 cm. long, tomentose like the twigs; cups 8-18 mm. broad, 5-12 mm. high, from shallowly to very deeply cup-shaped, base rounded or flat, margin thin, simple, smooth; cup scales triangular-ovate to oblong, the lower ones coarsely thickened basally and canescent-tomentose, the upper ones usually with elongate narrowed thin reddish nearly glabrous appressed apices; acorns 8-15 mm. long, 5-12 mm. broad, ellipsoid to ovoid, sparsely pubescent, light-brown, about one half included. On limestone hills and mts. at low elev. in w. and w.-cen. Tex., n. into the Plains Country; also Coah.

18a. *Quercus Mohriana* × *Q. grisea*. A very polymorphic assemblage of plants in which perhaps one or perhaps another of the differences between the parents is eliminated. In some specimens the typical glossy-dark-green upper surfaces and canescent-tomentose lower surfaces of the leaves of *Q. Mohriana* are associated with the typically ovate leaf-shape of *Q. grisea*. In others the gray concoloration of leaf surfaces of *Q. grisea* is associated with the more prominently spreading pubescence of *Q. Mohriana*. In still others the glossy green upper surface of *Q. Mohriana* appears with the moderately pubescent gray lower surface of *Q. grisea*. Occasionally the coloration and low habit of *Q. Mohriana* are maintained although the pubescence is short and the leaf shape is that of *Q. grisea*.

19. *Quercus arizonica* Sarg. ARIZONA WHITE OAK. Small or moderate-sized trees; twigs 1.5-2.5 mm. thick, fluted, sparsely or densely stellate-tomentose, usually persistently pubescent the second season, finally gray with few inconspicuous lenticels; buds about 3 mm. long, ovoid, subacute or rounded, sparsely pubescent or glabrate, dull-russet-brown; stipules persistent or sometimes deciduous, 5-8 mm. long, filiform or filiform-subulate, pubescent; leaves evergreen or subevergreen, thick and coriaceous or at least hard, to 8 cm. long and 3 cm. broad, elliptic or oblong to usually very narrowly obovate or oblanceolate, apices acute to usually obtuse or broadly rounded, bases cordate or rounded, entire or coarsely few- or many-toothed especially about the apex, teeth mucronate-tipped, low and obscure or prominent, margins cartilaginously revolute, upper surfaces slightly lustrous, sparsely and minutely stellate-pubescent, lower surfaces dull, sparsely stellate-pubescent or subtomentose, often glaucous; petioles to 1 cm. long, sparsely stellate-pubescent or tomentose; *staminate catkins* to 3 cm. long, rachis tomentose, moderately densely flowered, the anthers not exserted from the perianth; *pistillate catkins* to 2 cm. long, short-tomentose, 2- to 6-flowered toward the distal end; fruit annual, solitary or paired, subsessile or short-stalked; cup 1-1.5 cm. broad, 5-7 mm. high, hemispheric or cup-shaped, base rounded, margin rather coarse but simple and smooth; cup scales broadly ovate, the bases coarsely thickened, tomentose, the thin rounded apices closely appressed, puberulent, brown; acorns 8-12 mm. long, ovoid, light-brown, nearly glabrous, about one half included. *Q. endemica* C. H. Mull. On rocky slopes at moderate elev. in w. Tex.; also w. to Ariz. and n. Mex.

20. *Quercus intricata* Trel. Gregarious, intricately branched low shrubs; twigs 1-1.5 mm. thick, gray- or yellow-tomentose, darkened but persistently pubescent for several seasons; buds 1-1.5 mm. long, round, from sparsely pubescent to glabrate and dark-reddish-brown; stipules persistent, about 2 mm. long, subulate or ligulate-filiform, pubescent; leaves evergreen, sometimes persisting several seasons, very thick and hard, 1-2.5 cm. long, 5-13 mm. broad, ovate to oblong, obtuse, cuneate to cordate, margins very coarsely revolute and often crisped in addition, entire or few-toothed, upper surfaces somewhat lustrous, sparsely or moderately stellate-pubescent, lower surfaces persistently

buff-tomentose or glabrate the second season; petioles 2-3 mm. long, tomentose like the twigs; *staminate catkins* 2-3 cm. long, the rachis tomentose, very sparsely flowered, the oval anthers scarcely exerted from the glabrous or sparsely pubescent perianth; *pistillate catkins* 3-10 mm. long, 1- to 5-flowered, the peduncle tomentose like the twigs; fruit annual, solitary or paired, subsessile or stalked, the peduncle to 15 mm. long, tomentose like the twigs; cups about 1 cm. broad, 7-8 mm. high, deeply cup-shaped, the bases round, margins thin and simple; cup scales ovate or narrower, the canescent-tomentose bases moderately or markedly thickened, the reddish apices thin, closely appressed, nearly glabrous; acorns 9-12 mm. long, 8-10 mm. broad, ovoid, light-brown, nearly glabrous, one third to one half included at maturity. On dry rocky slopes at moderate elev. in w. Tex.; s. through Coah. to Zac.

21. *Quercus turbinella* Greene. SCRUB OAK. Rigid shrubs or small trees to 4 m. tall; twigs 1-2.5 mm. thick, variously fluted or subterete, glabrous or usually tomentulose and becoming glabrate, from brown becoming gray with few small lenticels; buds 1-2 mm. long, round-ovoid, minutely pubescent, brown; stipules persistent or rarely caducous, 2-4 mm. long, subulate, sparsely villous; leaves evergreen or subevergreen, very thick and coriaceous, to 4 cm. long and 2 cm. broad, elliptic or ovate, apices obtuse, bases cordate or sometimes rounded, on each side coarsely 3- to 5-toothed or very shallowly lobed, each tooth or lobe (including the apical one) spinose-tipped, the spines 1-1.5 mm. long, margins cartilaginously thickened, not revolute, flat or slightly crisped-undulate, upper surfaces lustrous or rather dull, rather glaucous or bluish-green, glabrous or very sparsely and minutely stellate-pubescent, lower surfaces dull, usually glaucous, minutely simple- or stellate-puberulent, the puberulence often glandular and usually yellow or reddish thus coloring the whole under surface; petioles 1-4 mm. long, glabrous or yellow-stellate-tomentose; fruit annual, solitary or several, scattered or grouped on the distal end of a tomentulose peduncle (1-4 cm. long); cups hemispheric or shallowly cup-shaped, 8-12 mm. broad, 4-6 mm. high, bases rounded, margins simple; cup scales ovate, the moderately thickened bases canescent-tomentose, the thin closely appressed rounded apices nearly glabrous and reddish-brown; acorns to 15 mm. long and 1 cm. broad, ovoid, light-brown, minutely villous or glabrate, one half or only one fourth included. On dry slopes at low elev. in extreme w. Tex.; w. to Ut., s. Calif. and Baja Calif.

22. *Quercus rugosa* Née. NETLEAF OAK. Shrubs or usually moderate-sized trees; twigs 1-2 mm. thick, tomentose to tomentulose, variously glabrate and brown or persistently pubescent, finally gray with few inconspicuous lenticels; buds 2-4 mm. long, ovoid, obtuse, sparsely pubescent or finally glabrate, brown; stipules long-persistent, about 5 mm. long, subulate, strigose; leaves evergreen to subevergreen or appearing to be deciduous, very thick and hard, to 10 cm. long and 7 cm. broad, usually much smaller, from broadly obovate to elliptic or rarely narrowly obovate, apices broadly rounded or rarely subacute, bases deeply cordate or shallowly so, entire except for the remotely apiculate apical region or coarsely few-toothed about the apex, margins usually somewhat revolute, cartilaginously thickened, undulately crisped or flat, the whole blade characteristically concave beneath but often flat, upper surfaces lustrous, dark-green, sparsely stellate-pubescent especially about the base of the midrib, lower surfaces dull, usually glaucous, or this masked by a fulvous glandular-puberulence, from tomentulose becoming nearly glabrate or persistently pubescent especially about the midrib; petioles to 7 mm. long, from tomentose to tomentulose, either persistently pubescent or finally becoming glabrate; *staminate catkins* 3-5 cm. long, rather loosely flowered, tomentose, the anthers little-exserted; *pistillate catkins* to 7 cm. long, the peduncle tomentose or usually tomentulose, slender, 2- to 12-flowered usually distally; fruit annual, solitary or paired or in threes on the end of a slender peduncle scarcely 2 mm. thick and to 6 cm. long; cups to 15 mm. broad and 9 mm. high, from deeply cup-shaped to saucer-shaped, base rounded or somewhat conic or constricted; cup scales ovate, on very young cups the thin brown glabrous apices loosely appressed or characteristically somewhat spreading, at maturity the bases coarsely thickened or only slightly so, canescent-tomentose or obscurely tomentulose, the thin apices appressed or conspicuously spreading; acorns to 2 cm. long and 15 mm. broad, ovoid to elliptic, light-brown, glabrous or minutely villous, one half included or covered at the base only. *Q. reticulata* H. & B., *Q. diversicolor* Trel. On wooded slopes at high elev. in w. Tex.; w. to Ariz., Baja Calif. and s. to s. Mex.

23. *Quercus sinuata* Walt. BASTARD OAK. Large trees to 20 m. or more in height, with a trunk diameter of 7.5 dm., the soft gray bark in broad thin scales; twigs 2-4 mm. thick, from sparsely stellate-pubescent quickly glabrate and gray with inconspicuous lenticels; buds 2.5-3.5 mm. long, broadly ovoid to subrotund, obtuse, scales dark-reddish-brown, glabrous or minutely ciliate; stipules early-caducous, membranous, 5-7 mm. long, ligulate or spatulate, stellate-pubescent dorsally; leaves deciduous, somewhat thick and coriaceous or quite thin (especially in shade forms), to 13 cm. long and 6 cm. broad, obovate to oblanceolate, apically broadly rounded, basally cuneate or sometimes rounded, margins entire to regularly or irregularly sinuately toothed or lobed (especially above the middle), minutely revolute, upper surfaces from sparsely minute-stellate becoming glabrate and glossy dark-green, lower surfaces persistently pubescent with minute appressed dense stellate hairs, strikingly silver or appearing green if the pubescence is sparse, occasionally tardily glabrate; petioles to 1 cm. long, sparsely stellate or glabrous; pistillate catkins about 5 mm. long, usually 2-flowered on minutely stellate peduncles; fruit annual, solitary or paired on peduncles to 1 cm. long or sessile; cups to 2 cm. broad and 8 mm. high, saucer-shaped or shallowly cup-shaped, flat or rounded at base, margins not inrolled; cup scales narrowly ovate, only moderately thickened basally, apically loosely appressed, silvery-puberulent all over, the margins dark-red; acorns to 18 mm. long and 17 mm. broad, elliptic to subrotund, glabrous except immediately about the apex, tan-brown, one fourth or less included. *Q. Durandii* Buckl. In moist forests in the timber region of e. Tex. and w. along river courses to the escarpment of the Edwards Plateau; e. to S.C.

23a. *Quercus sinuata* var. *breviloba* (Torr.) C. H. Mull. Shrubs or rarely trees with flaking gray bark; twigs to 3 mm. thick, subterete or fluted, grayish-brown, glabrous or minutely stellate-tomentulose, the numerous minute lenticels not at all conspicuous; buds 2-3 mm. long, broadly ovoid, obtuse or acute, glabrous or sparsely pubescent, dark-reddish-brown or grayish-brown; stipules rather promptly caducous, 3-5 mm. long, filiform-ligulate, pubescent; leaves deciduous, membranous but rather thick and hard or shade forms quite thin, to 8 cm. long and 4 cm. broad, usually smaller, obovate to oblanceolate or oblong, usually broadest above the middle, apices broadly rounded, bases cuneate or obtuse, rarely attenuately narrowed, entire to irregularly toothed or moderately lobed, margin not revolute, upper surfaces glabrous, usually quite lustrous, lower surfaces opaque, apparently glabrous but actually minutely appressed-stellate-puberulent and thereby canescent or (especially in shade forms) green and only sparsely puberulent or quite glabrous; petioles 2-3 mm. long, glabrous or pubescent like the twigs; *staminate catkins* to 8 cm. long, finally rather loosely flowered, tomentulose, the anthers moderately or only slightly exerted; *pistillate catkins* 3-7 mm. long, 1- to 3-flowered, densely short-tomentose; fruit annual, solitary or paired, sessile or on a pubescent peduncle to 7 mm. long; cups to 12 mm. broad and 8 mm. high, goblet-shaped or shallowly cup-shaped, base rounded or constricted, margins thin, smooth, simple; cup scales ovate, obtuse, the tomentose bases slightly or sharply keeled and thickened, the puberulent apices thin, closely appressed, dark-reddish-brown; acorns to 1.5 cm. long and 1 cm. broad, ovoid to elliptic, glabrous, light-brown, one fourth included. *Q. obtusifolia* var. ? *breviloba* Torr., *Q. annulata* Buckl., *Q. San-Sabeana* Buckl., *Q. breviloba* (Torr.) Sarg., *Q. Durandii* var. *breviloba* (Torr.) E. J. Palm. On openly wooded limestone hills at low elev. in cen. Tex.; also n.e. Mex.

24. *Quercus pungens* Liebm. SCRUB OAK. Shrubs or moderate-sized trees; twigs 1-2 mm. thick, fluted, tomentulose to short-velvety-tomentose or farinaceous, tardily glabrate and gray with small inconspicuous lenticels; buds about 2 mm. long, round-ovoid, sparsely pubescent, dark-reddish-brown; stipules persistent or caducous, 3-4 mm. long, subulate, pubescent; leaves evergreen or subevergreen, rather thick, very hard and stiff, to 9 cm. long and 4 cm. broad, usually smaller, elliptic to oblong, apices acute or obtuse, mucronate-tipped, bases rounded or cordulate, very rarely cuneate, coarsely toothed or incised, the teeth or lobes acute, rarely rounded, always mucronate-tipped, margins undulately crisped, not or scarcely revolute, upper surfaces very lustrous, minutely and sparsely stiff-spreading-stellate (therefore harsh and sandpaperlike to the touch), lower surfaces canescent, densely pubescent with two types of hairs, sericeous, appressed simple or stellate hairs covering the whole surface and scattered stiff spreading stellate hairs (therefore

also harsh to the touch), rarely nearly glabrous on both surfaces, the glabrous veins obvious against the pubescent blade; petioles to about 1 cm. long, tomentose like the twigs; pistillate catkins 3-5 mm. long, 1- to 3-flowered; fruit annual, solitary or paired, subsessile or on a peduncle scarcely 3 mm. long; cups to 13 mm. broad and 8 mm. high, shallowly cup-shaped to deeply cup-shaped with the base broader than the margin, base rounded, margin thin and simple; cup scales broadly ovate or the apices often narrowed and oblong, basally thickened or keeled and densely gray-tomentose, apices thin and closely appressed, glabrate or merely puberulent and reddish-brown; acorns to 1 cm. long and broad, broadly ovoid to subcylindric, apex rounded to subacute, light-brown, glabrous, one fourth included. *Q. undulata* var. *pungens* (Liebm.) Engelm., *Q. undulata* var. *Vaseyana* (Buckl.) C. H. Mull., *Q. undulata* Sperry. On dry rocky slopes at moderate elev. in w. Tex.; n. into N.M. and Ariz., s. into n.e. Mex.

24a. *Quercus pungens* var. *Vaseyana* (Buckl.) C. H. Mull. Shrubs or small trees; twigs 1-1.5 mm. thick, fluted, reddish- or grayish-brown, rarely glabrous, short stellate-tomentose or tomentulose, at length glabrate or persistently pubescent, the second season gray with conspicuous or inconspicuous lenticels; buds 1-1.5 mm. long, round-ovoid, obtuse, sparsely pubescent or glabrate, dark-reddish-brown or gray; stipules caducous, about 3 mm. long, subulate, sparsely pubescent; leaves subevergreen to evergreen, membranous or usually rather thick and coriaceous, to 6 cm. long and 2 cm. broad, narrowly lanceolate to usually oblong, apices acute or rarely obtuse, bases cuneate to rounded, coarsely 3- to 5-toothed on each side or shallowly lobed or entire, the teeth or lobes acute or obtuse but mucronate-tipped, margins cartilaginous-thickened, not revolute, upper surfaces dark-green, lustrous, glabrous or very sparsely stellate-puberulent, lower surfaces densely sericeous with minute appressed stellate hairs or these very sparse or wanting and the surface rather lustrous green, the principal veins glabrous and conspicuous against the usually pubescent lower surface; petioles to 5 mm. long, pubescent like the twigs; *staminate catkins* 2.5-3 cm. long, short-tomentulose, rather loosely flowered; *pistillate catkins* 3-5 mm. long, 1- to 2-flowered; fruit annual, solitary or paired, subsessile or on a peduncle 2-3 mm. long; cups to 1 cm. broad, 3-4 mm. high, saucer-shaped to cup-shaped, bases rounded, margin simple and thin; cup scales very broadly ovate, basally much-thickened and short-velvety-tomentose, apex thin, closely appressed, dark-red, glabrous; acorns to about 12 mm. long and broad, ovoid to oblong or subcylindric, light-brown, glabrous, one fifth to one third included. *Q. Vaseyana* Buckl., *Q. undulata Vaseyana* (Buckl.) Rydb., *Q. sillae* Trel. On dry limestone hills at low elev. in s.w. Tex.; also n.e. Mex.

25. *Quercus virginiana* Mill. LIVE OAK, ENCINO. Small or very large spreading trees; bark dark-brown or black and very deeply furrowed; twigs 1.5-3 mm. thick, round or fluted, white-gray or buff with a dense waxy appressed-stellate tomentum, appearing farinaceous to the naked eye, gray the second year and nearly glabrate with numerous inconspicuous lenticels; buds 2-2.5 mm. long, rounded, puberulent, red-brown; stipules immediately caducous, 2-4 mm. long, ligulate, brown, villous; leaves evergreen to subevergreen, thick and chartaceous, 3 or usually 5 to 9 or sometimes 12 cm. long, 1 or usually 2 to 4 or sometimes 6 cm. broad, from usually oblong or elliptic to obovate or oblanceolate, apices from broadly rounded and mucronate to acute, bases from cuneate to rounded or rarely cordate, margins entire to toothed or even lobed, strongly revolute, upper surfaces glossy and glabrous, lower surfaces dully canescent with a thick coating of minute appressed stellate hairs, the pubescence very waxy; veins 6 to 10 on each side with evanescent intermediates, branching and obviously anastomosing well within the margin, strongly raised on both surfaces (including even the ultimate reticulum) or slightly raised on the upper surface within impressions, the tomentum masking the veinlets on the lower surface but the midrib and usually the veins nearly glabrous and prominent; petioles 2 to 7 or rarely 10 mm. long, dorsally flattened and distally slightly winged, stellate-pubescent like the twigs or nearly glabrous like the midrib beneath; *staminate catkins* 2-4 cm. long, sparsely and minutely stellate-tomentose, moderately densely flowered, the perianth ciliate, the pubescent anthers scarcely exerted; *pistillate catkins* to about 2 cm. long, 1- or several-flowered, peduncles canescent like the twigs; fruit annual, solitary, paired or several on a peduncle to 5 cm. long and nearly glabrate; cups to 18 mm. broad and 12 mm. high, deeply goblet-shaped, the bases usually much-narrowed

or rarely nearly rounded, margins flat and smooth; cup scales triangular, moderately thickened basally, the short apices flat, gray-pubescent throughout; acorns ovoid or broadly fusiform, 15-30 mm. long, 12-18 mm. broad, glabrous and shiny-brown except for a ring of stellate hairs around the apex of the persistent style, one fourth or one third included. In timber region of e. and s. Tex., strictly near the coast; from Tex. e. to the Atl. and n. to Va.

25a. *Quercus virginiana* × *Q. stellata*. Several natural hybrids of *Q. virginiana* and *Q. stellata* occur sporadically in Texas. Because of their unusual nature they have been collected in numbers out of all proportion to their importance, some herbaria containing dozens of duplicates of single collections. Such entities occur usually as one or a few trees, and where several are present, they vary greatly.

These hybrids usually appear more like *Q. virginiana* than like *Q. stellata*. They differ from *Q. virginiana* in bearing leaves with the margins coarsely round-toothed or shallowly lobed and the lower surfaces bearing not only the persistent dense waxy pubescence of *Q. virginiana* but spreading stellate hairs typical of some forms of *Q. stellata*. The cups are somewhat peduncled and constricted basally as in *Q. virginiana*, but the acorns are more broadly ovoid as in *Q. stellata*.

This series of plants does not comprise an entity distinct from *Q. virginiana* nor even a unified entity of any sort and it is obviously not worthy of taxonomic distinction.

26. *Quercus fusiformis* Small. Large rhizomatous shrub or a large tree with rough black bark and spreading crown; twigs 1.5-2.5 mm. thick, densely fulvous-tomentulose, glabrescent the second year or persistently pubescent; buds about 1.5 mm. long, subglobose, glossy-dark-red, puberulent; stipules about 2.5 mm. long, subulate, pubescent, usually quickly caducous; leaves evergreen, hard and coriaceous, 2-7 cm. long, 5-20 mm. broad, oblong to elliptic or obovate, very polymorphic (one form elongate and acute, another broad and rounded, with all intermediates), apices very acute or rarely broadly rounded, bases cuneate or rounded, entire or irregularly 1- or several-toothed, margins somewhat revolute or nearly flat, upper surface glossy and glabrous or sparsely stellate-puberulent especially near the base of the midrib, lower surface uniformly dense stellate-tomentulose, the hairs appressed upon a variable layer of waxy puberulence; veins 8 to 10 on each side with occasional intermediates, irregularly branched and anastomosing, very inconspicuous above or slightly raised, scarcely prominent beneath; petioles 2-8 mm. long, densely tomentulose; *staminate catkins* 35-45 mm. long, rather loosely flowered on a sparsely tomentose and glandular peduncle, the hairy anthers somewhat exerted from the moderately pubescent calyx; *pistillate catkins* 15-55 mm. long, 2- or 3-flowered distally or many-flowered along their lengths; fruit solitary, paired or in threes on a coarse peduncle 1.5-8 cm. long; cups 7-12 mm. broad, 7-10 mm. high, goblet-shaped, somewhat constricted basally, the scales moderately thickened basally, densely white-tomentose, the apices dark-red and puberulent; acorns 1.5-2 cm. long, 1-1.3 cm. thick, narrowly ovoid to subfusiform, glabrous and dull-brown, one third or one half included. *Q. virginiana* var. *fusiformis* (Small) Sarg. and var. *macrophylla* Sarg., *Q. oleoides* var. *quaterna* C. H. Mull. (type only), *Q. virginiana* (juvenile) C. H. Mull. The s. Gulf Coast population of this species on deep sand (Aransas Co. southw.) is clearly introgressed by *Q. oleoides* Cham. & Schlecht. which occurs from Tam. southw. in Mex.

27. *Quercus minima* (Sarg.) Small. Shrub 2-10 dm. tall, spreading by rhizomes; twigs 1.5-2 mm. thick, from densely silvery or fulvous-stellate-tomentulose at length glabrate and dark-red; buds about 1.5 mm. long, subglobose, glossy-red, sparingly pubescent; stipules about 3 mm. long, subulate, sparingly pubescent, quickly caducous; leaves evergreen, hard and coriaceous, highly (constantly) polymorphic, the individual plants rarely uniform for one leaf-type, the lower leaves characteristically large and toothed or lobed, the upper usually narrowly oblong and entire, the narrow upper leaves tending to hold their pubescence more persistently than the broad lower ones, the narrow form 2-5.5 cm. long and 5-16 mm. broad, oblanceolate, entire or few-toothed near the acute or rounded apex, the base narrowly cuneate, the broad form 4.5-11.5 cm. long and 2-5 cm. broad, broadly oblanceolate to narrowly obovate, coarsely and irregularly toothed in the upper half or full length, obtuse or acute, broadly cuneate, margins slightly revolute, upper surface glabrous and glossy or sparingly stellate about the base of the midrib, lower surface densely or sparsely silvery appressed-stellate-puberulent, this

persistent or on some of the broad lower leaves variously deciduous, the midrib and principal veins glabrous; veins 4 to 12 on each side, very irregular, the higher numbers in the narrow leaves, much-branched and obviously anastomosing, slightly raised above, rather prominent beneath, the reticulum obscure; petioles 1-5 mm. long, stellate-pubescent; *staminate catkins* 4-5 cm. long, rather loosely flowered, the peduncle fulvous-stellate-tomentulose, the pubescent anthers finally well-exserted from the pubescent calyx; *pistillate catkins* 3-10 cm. long, 2- to several-flowered, the peduncle fulvous-pubescent but glabrate with the twigs; fruit solitary or paired on peduncles 5-30 mm. long; cup 10-15 mm. broad, 8-16 mm. high (in one form only 7 mm. broad and 5 mm. high), deeply goblet-shaped, usually markedly constricted basally, the scales silvery tomentose with puberulent or glabrous red apices protruding, the bases sometimes strongly thickened; acorns 15-20 mm. long, 8-12 mm. thick (in one form smaller), glabrous and rather glossy-brown, one fourth to one third included or more. *Q. virens* var. *dentata* Chapm., *Q. virginiana* var. *minima* Sarg., *Q. oleoides* var. *quaterna* C. H. Mull. (excl. type). Deep sands behind the beach areas of the e. and cen. Tex. Gulf Coast; e. to Fla. and N.C.

Failure to recognize this eastern species resulted in the description of *Q. oleoides* var. *quaterna*, the type of which, however, is *Q. fusiformis*.

27a. *Quercus minima* × *Q. stellata*. This cross occurs quite commonly where sand areas bearing *Q. stellata* invade the Coastal Plain and thus bring the two parents in contact. As in the hybrid between *Q. virginiana* and *Q. stellata*, the progeny more closely resemble the live oak in being evergreen, having fruit like the live oak, and in the foliage turning markedly yellow upon drying. However, the lobing of the leaves and the spreading pubescence of the lower leaf surface indicate in varying degrees parentage by *Q. stellata*. Common with both parents near the coast.

27b. *Quercus minima* × *Q. virginiana*. Where *Q. virginiana* reaches the Coastal Plain (usually on sandy or gravelly soil) it may come in contact with the shrubby plant, *Q. minima*. The resulting hybridization is manifested usually by intermediates in stature as well as leaf form and color. They are usually quite prominent as clones towering several feet above the surrounding shrubby parent. They do not extend far beyond the influence of the lighter soil type. Locally common with both parents near the coast.

28. *Quercus Emoryi* Torr. EMORY OAK. Small or large trees reaching 20 m. in height, with very roughly furrowed black bark; twigs 1-2.5 mm. thick, fluted, dark reddish-brown, from densely gray- or buff-stellate rather tardily glabrate and glossy or persistently pubescent, becoming gray the second season; buds 1.5-2.5 mm. long, ovoid, subacute or rounded, glossy-brown, glabrate; stipules caducous, 5-8 mm. long, ligulate, tan, densely pilose or merely ciliate and apically pilose; leaves subevergreen, thick and coriaceous, usually 3-6 cm. long and 1-2.5 cm. broad, sometimes smaller or larger, from narrowly lanceolate, hastate or oblong to ovate or elliptic, narrowly acute and spine-tipped to obtuse or even rounded, truncate to strongly cordate, entire or sparsely low-toothed to strongly toothed or shallow-lobed, the teeth and lobes aristate-tipped, margins flat or minutely revolute, both surfaces from stellate-pubescent soon glabrate and glossy or persistently stellate-pubescent basally about the midrib, the lower surfaces often bearing a prominent tuft of stellate hairs on either side of the base of the midrib, the basal margin sometimes ciliate; veins rather prominently raised on both surfaces; petioles to 12 mm. long, much-flattened dorsally, tan, from stellate-tomentose tardily glabrate or persistently pubescent dorsally; *staminate catkins* 2.5-5 cm. long, loosely white-villous, rather loosely flowered, the glabrous anthers moderately exerted from the villous perianth; *pistillate catkins* subsessile or short-peduncled, 1- or 2-flowered, stellate-tomentose like the twigs; fruit annual, solitary or paired on peduncles 1-2 mm. long and stellate-tomentose or glabrate; cups to 1 cm. broad and high, hemispheric to cup-shaped or goblet-shaped, the bases rounded or somewhat constricted, margins not inrolled; cup scales broadly ovate, thin, the usually broad apices closely appressed, characteristically glabrous except the ciliate margins or canescent-puberulent, chestnut-brown and glossy where glabrate; acorns 1-1.5 cm. long, 5-9 mm. broad, oblong or broadly ovoid, acute or rounded at apex, reddish-brown, minutely puberulent or glabrate, half included or enclosed at the bases only. Igneous mts. usually above 5,000 ft. elev. in the Trans-Pecos; w. into Ariz. and Chih.

28a. *Quercus Emoryi* × *Q. graciliformis*. Small trees, much-branched, with roughly furrowed black bark; twigs about 2 mm. thick, scarcely fluted, from dull reddish-brown

becoming gray with inconspicuous lenticels, from sparsely stellate-glabrescent; buds about 2 mm. long, ovoid, acute, glabrous; leaves persistent, coriaceous, 5-9 cm. long, 15-25 mm. broad, oblanceolate, the short apices acute, bases cuneate or somewhat rounded, coarsely 4- or 5-aristate-dentate on each side or entire below the middle, from sparsely stellate-puberulent on both sides becoming glossy and glabrous; veins about 5 on each side, passing into the teeth, somewhat prominent on both surfaces; petioles 5-7 mm. long, flattened dorsally, glabrate like the blades and reddish. *Q. Tharpii* C. H. Mull. Igneous slopes at about 4,000 to 6,000 ft. elev. in the Chisos Mts. of Trans-Pecos Tex.

28b. *Quercus Emoryi* × *Q. Gravesii*. Large spreading trees with roughly furrowed brown or black bark; twigs to 3 mm. thick, from densely stellate-hairy tardily glabrate and dark-red-brown, gray the second year; buds 3-4 mm. long, oblong to acutely ovoid, glossy brown, the scales ciliate; leaves deciduous, coriaceous, 6-11 cm. long, 2.5-5 cm. broad, broadly lanceolate to acutely ovate, sometimes attenuate by elongation of the terminal lobe, bases rounded to cuneate or cordate, setaceously 6- or 8-toothed or -lobed with rounded sinuses, rather persistently stellate-pubescent on both surfaces, frequently with a few prominent axillary tufts beneath, dull green on both surfaces, not turning crimson in the fall; petioles to 2 cm. long, stiff, stellate-pubescent or glabrate, red at base, straw-colored above, dorsally flattened; fruit biennial, solitary or paired and one aborted, on a peduncle 5-6 mm. long or subsessile; cups about 12 mm. broad and 8 mm. high; cup scales thin, appressed, the elongate apices narrowly rounded, light-brown, ciliate and densely pubescent dorsally with detachable canescent hairs; acorns to 22 mm. long and 1 cm. broad, oblong or cylindrical, finely pubescent, about one third included. *Q. robusta*. C. H. Mull. Moist wooded canyons in the Chisos Mts. with both parents.

29. *Quercus hypoleucoides* A. Camus. WHITE-LEAF OAK. Small or moderate trees with coarsely furrowed hard black bark; twigs 2-3 mm. in diameter, little-fluted, rather persistently gray-tomentulose, red with scarcely evident lenticels or somewhat pruinose in age; buds about 3 mm. long and 2 mm. broad, ovoid, reddish-brown, glabrescent with ciliate scales; leaves more or less persistent, very thick and leathery, to 10 cm. long or rarely longer, 1.5-3 cm. broad, lanceolate, aristately very acute, rounded or cuneate at base, typically entire or with a few small setiferous teeth or deeply and coarsely serrate, strongly revolute, glabrous or minutely puberulent and glaucous- or bluish-green above, densely canescent-tomentulose beneath; petioles to 15 mm. long, tomentulose or glabrate; *staminate catkins* 3-6 cm. long, white-pilose, rather loosely flowered, the glabrous ellipsoid anthers exerted; *pistillate catkins* 5-10 mm. long, 1- or 2-flowered at the end, the peduncle stellate-tomentulose; fruit annual or sometimes apparently biennial, solitary or unequally paired on more or less hoary peduncles to 15 mm. long; cups turbinate hemispheric, about 1 cm. in diameter, with thin appressed blunt scales markedly tomentulose but readily abraded and then pale-brown; acorns to 14 mm. long and 9 mm. broad, oblong to ovoid, minutely puberulent or glabrescent, about one third included. *Q. confertifolia* Torr., non H. & B., *Q. hypoleuca* Engelm., non Gand. Abundant in moist canyons at elev. of 7,000 to 9,000 ft. in Trans-Pecos Tex.; endemic.

29a. *Quercus hypoleucoides* × *Q. Gravesii*. Small trees to 10 m. tall, with roughly furrowed black bark; twigs 2-2.5 mm. thick, very inconspicuously fluted, reddish-brown, rather persistently tomentulose the second year with inconspicuous lenticels; buds 3-4 mm. long, acute, pubescent; stipules caducous; leaves evergreen or nearly so, 5-10 cm. long, 1.5-4 cm. broad, oblanceolate or oblong to narrowly elliptic, acute, basally cuneate or somewhat rounded, coarsely and aristately 3- or 4-toothed except about the base, margins minutely revolute, from sparsely stellate-puberulent glabrate and shiny above and more or less persistently floccose beneath, petioles 1.5-2 cm. long, from stellate-puberulent glabrate; *staminate catkins* about 25 mm. long, the peduncle hairy, loosely flowered, anthers exerted; *pistillate catkins* 1- to 3-flowered on very short tomentulose peduncles; fruit biennial, solitary or paired, short-pedunculata. *Q. livermorensis* C. H. Mull. Moist canyons at about 8,000 ft. elev. in the Davis Mts., associated with both suspected parents.

30. *Quercus incana* Bartr. SAND JACK, BLUE JACK. Low trees or shrubs to 8 m. tall; twigs 1-2 mm. thick, moderately or markedly fluted, yellowish- becoming gray-puberulent or tomentulose, the pubescence persistent for several years, lenticels scarcely visible; buds 3-7 mm. long, narrowly lanceolate or conic, appressed-pubescent or glabrate and reddish-brown; stipules caducous, about 7 mm. long, ligulate, tan, villous; leaves deciduous,

moderately thin but coriaceous, usually 6-8 cm. long and 2-3 cm. broad, sometimes smaller or larger, lanceolate to oblanceolate or elliptic to oblong, acute or sometimes rounded but always aristate-tipped, basally very acute to sometimes broadly rounded, entire or sometimes aristately few-toothed about the apices or rarely coarsely several-toothed, moderately revolute, rather persistently stellate-puberulent but glossy above, dull beneath with a feltlike gray stellate tomentum or rarely sparsely stellate; petioles to 7 mm. long, somewhat winged by the usually decurrent blade, dorsally and ventrally nearly glabrous, laterally gray-pubescent like the twigs; *staminate catkins* 4-5 cm. long, moderately densely flowered, the peduncle stellate-tomentose, the glabrous elliptic apiculate anthers well-exserted from the ciliate red perianth; *pistillate catkins* subsessile, 1- or 2-flowered; fruit biennial, solitary or rarely paired, subsessile; cups to 18 mm. broad and 7 mm. high, saucer-shaped to goblet-shaped, basally rounded, margins not inrolled; cup scales ovate, the narrow apices rounded, closely appressed, dorsally gray-tomentose, the margins and apices glabrate and glossy brown; acorns 12-15 mm. in diameter, subrotund, gray-puberulent, readily abraded and dull-brown, about one fourth included. *Q. cinerea* Michx., *Q. cinerea* β *dentato-lobata* A. DC. Sandy uplands in the timber belt of e. and cen. Tex.; on Coastal Plain from Va. s. to Fla., w. to Tex.

30a. *Quercus incana* \times *Q. marilandica*. Small trees to 10 m. tall; twigs about 3 mm. thick, stiff, persistently gray-tomentulose or puberulent; buds 6-8 mm. long, narrowly lanceolate, very acute, fulvous-tomentose; leaves to 16 cm. long, 3-7 cm. broad, oblong to narrowly obovate, apically broadly rounded or divergently 3-lobed, basally cuneate to broadly rounded, glabrate and shiny above, persistently floccose beneath especially along the midrib; petioles 6-10 mm. long; pubescent like the twigs; cups about 15 mm. broad, 6 mm. high, shallowly cup-shaped; cup scales fulvous-tomentulose, rather loosely appressed; acorns about 15 mm. long, subrotund, about one third included. Sandy uplands in the timber region of e. Tex. with the two parents and with intermediates.

31. *Quercus laurifolia* Michx. LAUREL OAK, SWAMP LAUREL OAK. Large trees to 18 m. tall, with hard gray or black bark; twigs 1-2.5 mm. thick, pliable, fluted or round, dark-reddish-brown, gray the second season, from densely fulvous-stellate promptly glabrate or remaining sparsely pubescent; buds about 4 mm. long and 2 mm. broad, very acute, slightly quadrangular, nearly glabrous, dark-reddish-brown; stipules quickly caducous, about 4 mm. long, ligulate or spatulate, tan, villous especially about the apex; leaves evergreen, thick and coriaceous or deciduous, 5-10 or sometimes 12-15 cm. long, to 8 cm. broad, characteristically oblanceolate or narrowly ovate, acute to broadly rounded at apex but aristate-tipped, cuneate to cordate at base, entire to variously undulate, margins moderately revolute, from sparsely stellate-puberulent glabrate and glossy above or persistently somewhat pubescent about the base of the midrib, similarly glabrate beneath but dull; petioles to 4 mm. long, rose-color or dark-red, glabrate or sparsely stellate; *staminate catkins* 2-2.5 cm. long, densely villous, moderately densely flowered, the small ellipsoid anthers moderately exerted from the villous perianth; *pistillate catkins* on peduncles 1-3 mm. long, 1- to 3-flowered; fruit biennial, solitary or paired on a short peduncle or subsessile; cups 14-18 mm. broad, 5-7 mm. high, shallowly bowl-shaped, flat basally or turbinate; cup scales tightly appressed, ovate, minutely dense-puberulent, tan and glossy where abraded, margins not inrolled; acorns about 15 mm. long, subglobose to broadly ovoid, apically broadly rounded, basally flattened, tan or brown, minutely and sparsely puberulent, included at base only. *Q. obtusa* (Willd.) Pursh, *Q. rhombica* Sarg. Wet forests, particularly along streams, in s.e. Tex.; e. to the Atl.

32. *Quercus hemisphaerica* Bartr. LAUREL OAK. Shrubs to small trees to 10 m. tall, with smooth gray or furrowed black bark; twigs 1-2.5 mm. thick, very stiff, round or only slightly fluted, dark-reddish-brown, gray the second season, densely fulvous-stellate the first season; buds 3-4 mm. long, 2.5-3 mm. broad, very acute, nearly glabrous, dark-reddish-brown; stipules tardily deciduous, 4-5 mm. long, ligulate, villous; leaves evergreen, highly variable, 3.5-8 cm. long, 1-4 cm. broad, from narrowly oblong to obovate, usually acute and aristate-tipped, basally rounded to cordate or sometimes cuneate, entire or variously apically toothed or basally lobed, the teeth and lobes aristate, margins markedly revolute, upper surface minutely and sparsely puberulent, glossy-green, lower surface similar to upper but dull, more densely and persistently puberulent near the base; petioles 2-3 mm. long, rose-color becoming red with maturity, pubescent as the twigs; catkins and fruit similar to *Q. laurifolia* but smaller; cups 1-1.3 mm. broad, 3-4

mm. high; acorns 1-1.2 mm. long. *Q. myrtifolia* Cory & Parks, non Willd., *Q. laurifolia* C. H. Mull. (p.p.), non Michx. Sandy woodlands, sometimes forming mottes on sandy prairies, often dominating stream terraces, along the Gulf Coast in Tex.; e. to the Atl.

32a. *Quercus hemisphaerica* × *Q. falcata*. Differing from *Q. hemisphaerica* in having large variable leaves 5-17 cm. long and 1.5-12 cm. broad, entire to undulate or deeply and irregularly lobed, persistently pubescent on the lower surface or merely with axillary tufts; cups deeply bowl-shaped, the scales densely tomentose; acorns densely puberulent. Differing from *Q. falcata* in the less lobed thick leaves with sparse pubescence beneath; acorns subglobose. In various sites with *Q. hemisphaerica* e. of the San Antonio River near the Gulf Coast in Tex.

33. *Quercus Phellos* L. WILLOW OAK. Moderate or large trees to 20 m. tall, with a trunk diameter of 7.5 dm. and hard rather smooth bark; twigs 1-2 mm. thick, fluted, glabrous or from stellate-tomentose quickly glabrate or rather persistently floccose, dull-reddish-brown with inconspicuous lenticels; buds 2-4 mm. long, 1.5-2 mm. broad, narrowly ovoid to usually lanceolate, very acute, the scales dark-russet and glabrous except the ciliate edges; stipules caducous, 6-8 mm. long, filiform-ligulate to spatulate, dorsally villous, apically tomentose; leaves deciduous, moderately thin but coriaceous, usually 6-12 (or rarely 16) cm. long and 1-2.5 (or even 4) cm. broad, linear-lanceolate to sometimes oblanceolate or even narrowly ovate or obovate, setaceous acute at apex or sometimes obtuse but aristate-tipped, cuneate or narrowly rounded basally, entire, strongly revolute in the bud and lengthening before unfolding (thus filiform for a time), margins eventually flat or undulate or minutely revolute, upper surfaces dark, dull- or glossy-green, glabrous to tomentose along the midrib toward the base, lower surfaces lighter dull-green, from villous-tomentose to glabrate or with conspicuous axillary tufts or densely tomentose along the midrib; petioles 1-4 mm. long, from densely stellate-tomentose promptly or tardily glabrate; *staminate catkins* 25-35 mm. long, moderately closely flowered, villous, the oval anthers well-exserted from the villous-tomentose perianth; *pistillate catkins* 1-3 mm. long, 1- to 3-flowered; fruit biennial, solitary or paired on peduncles to 5 mm. long or sessile; cups 1-1.5 cm. broad, 4-8 mm. high, saucer-shaped to goblet-shaped, the base flat or markedly constricted, the margin not inrolled; cup scales narrowly ovate, the attenuately rounded apices closely appressed, minutely dense-tomentose except the glabrous brown margin; acorns 1-1.5 cm. long, nearly as broad, subrotund, broadly rounded, densely puberulent or glabrate and dull-brown, one fourth included or enclosed at base only. In moist forests in the timber region of e. Tex.; e. to the Atl. and n. to Ill. and N.Y.

33a. *Quercus Phellos* × *Q. falcata*. Twigs 2-4 mm. thick, glabrate or persistently tomentulose; buds 4-6 mm. long, narrowly lance-ovoid, acute, sparsely fulvous-tomentose about the apex; leaves thin, 8-20 cm. long, 2-10 cm. broad, lanceolate, attenuately acute, cuneate to rounded, very polymorphic, entire or few-toothed to falcately lobed, glabrous and glossy above, persistently somewhat pubescent or even tomentose beneath; petioles to 2 cm. long, glabrate or tomentulose like the twigs; cups 12-15 mm. broad, 6-8 mm. high, deeply or shallowly cup-shaped, the scales buff-tomentulose and somewhat loosely appressed; acorns 1 cm. long or more, subglobose, one half included or less. In moist forests in the coastwise timber region of e. Tex., with both suspected parents.

33b. *Quercus Phellos* × *Q. nigra*. Twigs 1-2 mm. thick, glabrate; buds 2-3 mm. long, ovoid, acute, fulvous-pubescent; leaves very polymorphic, 6-15 cm. long, 1.5-6 cm. broad, linear to clavate or cruciform, cuneate, acute or rounded, aristate-tipped or not, entire to undulate or even coarsely trilobate above the middle, glabrate or with fulvous tufts in the axils of the principal veins beneath. Sparse with both parents in wet lowland forests.

34. *Quercus nigra* L. WATER OAK. Moderate or large trees to 15 m. tall, with boles to 5 dm. in diameter and hard smooth or shallowly furrowed black bark; twigs 1-2 mm. in diameter, fluted, glabrous or from scantily stellate quickly glabrate and glossy dark-reddish-brown with conspicuous pale lenticels or not, gray the second season; buds 3-5 mm. long, 2-3 mm. broad, ovoid, subacute, dark-reddish-brown, densely fulvous-strigose above the middle; stipules caducous, 6-10 mm. long, ligulate to spatulate, tufted at apex; leaves subevergreen, rather thick and leathery, to 14 cm. long and 5 cm. broad, oblong to usually cuneiform or clavate, sometimes oblanceolate, entire or 3-lobed apically or variously toothed or lobed and distorted in cases of heterophylly, broadly rounded or rarely

acute at the apices, attenuately cuneate or rarely narrowly rounded at the bases, margins flat or minutely revolute, from minutely puberulent glabrate and glossy above, dull green or coppery and glabrate beneath or usually with prominent axillary tufts; petioles 3-7 mm. long, prominently winged by decurrence of the blade, from sparingly stellate-tomentose glabrate or persistently pubescent; *staminate catkins* 4-7 cm. long, densely or sparsely arachnoid-tomentose, rather loosely flowered, the anthers well-exserted from the villous perianth; *pistillate catkins* 3-5 mm. long, 1- to 3-flowered; fruit biennial, solitary or paired on a peduncle to 5 mm. long or subsessile; cups 9-15 mm. broad, 2.5-5 mm. high, at most deeply saucer-shaped, basally very flat or somewhat rounded, margins not inrolled; cup scales narrowly ovate, closely appressed, densely fulvous-sericeous-tomentose; acorns 8-10 mm. long, 9-15 mm. broad, hemispheric to subglobose, very flat at base, broadly rounded apically, densely minute-pubescent, dull-brown where abraded, included at base only. *Q. aquatica* Walt., *Q. nigra* var. *tridentifera* Sarg. In wet forests in the timber region of e. Tex.; e. to the Atl. States and n. to Mo. and Del.

34a. *Quercus nigra* × *Q. marilandica*. Twigs 3 mm. thick, stellate-tomentose or tardily glabrate; buds coarser and more densely fulvous-tomentose than in *Q. nigra*; leaves intermediate between the parents or polymorphic; cups similar to *Q. nigra* in form but larger and with the scales loosely appressed. Uncommon with both parents at the edges of wet forests in e. Tex.

34b. *Quercus nigra* × *Q. incana*. Twigs densely short-stellate-tomentose; leaves oblong to narrowly obovate, rounded at apex, acute or rounded at base, stellate-pubescent beneath or tardily glabrate. Sparse with both parents in moist woodlands in e. Tex.

35. *Quercus graciliformis* C. H. Mull. Small trees to 8 m. tall, with slender gracefully arching branches and pendent leaves, the furrowed bark hard and gray; twigs to 1.5 mm. in diameter, markedly fluted, quickly glabrate or persistently stellate toward the terminus, deep-glossy-red to brown, gray the second year with few scarcely evident small buff lenticels; buds 1.5-2 mm. long, 1-1.5 mm. broad, ovoid, acute or rounded, glossy-brown, the scales ciliate; stipules caducous, 3-6 mm. long, setaceous to spatulate, sparsely villous; leaves subevergreen, thin but coriaceous, 8-10 cm. long, 2-3 cm. broad, narrowly lanceolate, long-attenuate and aristate apically, cuneate at the bases, aristately and often unequally 8- to 10-toothed or -lobed with somewhat deep rounded sinuses or these very shallow, soon glabrate and entirely smooth or rarely an axillary tuft beneath, glossy-green above, more dull and slightly coppery beneath; petioles 1.5-2 cm. long, dorsally flattened, glabrate, deep-red at base and shading into straw-color, very flexible; pistillate catkins about 4 mm. long, usually 2-flowered, deep-reddish-brown, usually glabrous; fruit biennial, solitary or sometimes paired, subsessile; cups scarcely 1 cm. in diameter, 3 mm. deep or rarely more, deep-saucer-shaped, the margins not inrolled; cup scales ovate, thin and closely appressed, the rounded apices brown, dorsally canescent, glabrous near the margins, ultimately ciliate; acorns acutely narrow-ovoid, about 15 mm. long and 1 cm. broad, densely fine-pubescent, with longitudinal dark striae, enclosed only at the base. *Q. graciliformis* var. *parvilobata* C. H. Mull., *Q. graciliformis* f. *parvilobata* C. H. Mull., *Q. Canbyi* Cory & Parks, non Trel. In dry rocky canyons in the igneous Chisos Mts. of Trans-Pecos at about 5,500 ft. elev., usually associated with a high water table; endemic.

36. *Quercus shumardii* Buckl. SHUMARD RED OAK, SOUTHERN RED OAK. Large trees to 18 m. tall, with straight boles to 1 m. in diameter and hard furrowed black or plated gray bark; twigs 1.5-3 mm. thick, fluted, from sparsely and irregularly stellate-pubescent promptly glabrate, tan to brown, dull; buds 4-7 mm. long, 2-3 mm. broad, approximately spindle-shaped, very acute or exceptionally broadly rounded, completely glabrous or the apex slightly pubescent, dull straw-color or light-brown, the erose scales becoming quite ragged in time; stipules caducous, 6-10 mm. long, filiform-ligulate, sparingly villous; leaves deciduous, scarlet in autumn, thin but hard and parchmentlike, 8-17 cm. long, 6-15 cm. broad, narrowly ovate to usually ovate or obovate or subrotund in outline, deeply 2- to 4-lobed on each side with narrow rounded open to closed sinuses reaching one half or three fourths the distance to the midrib, each lobe (including the terminal one) bearing few or many irregular long-aristate teeth toward its apex, each tooth or lobe ultimately very acute, bases truncate or subequilaterally rounded or minutely decurrent on the petiole, margins flat or obscurely undulate, minutely cartilaginous-revolute, upper surface from sparsely stellate quickly glabrous and becoming dark-shiny-green, lower surface similarly glabrate but with prominent axillary stellate tufts, duller and lighter green,

somewhat coppery; petioles 3-5 cm. long, straw-colored, basally tinged with rose, glabrate with the blades; *staminate catkins* 8-10 cm. long, sparsely stellate, rather sparsely flowered, the glabrous anthers exerted from the glabrous perianth; *pistillate catkins* 4-8 mm. long, usually 2-flowered, quickly glabrate; fruit biennial, solitary or paired on a peduncle 1-5 mm. long, 2-3 mm. thick; cups 2-2.5 cm. broad, 7-10 mm. high, from shallowly goblet-shaped to usually flat with abruptly raised sides only 5 mm. high, bases flat or somewhat constricted, margins not inrolled; cup scales narrow and elongate, the tips rounded and closely appressed, bases sometimes suberous, minutely tomentose except the extreme apex, shiny brown where abraded; acorns 20-25 mm. long, 18-22 mm. broad, ovoid, obtuse at apex, flat at base, from minutely fulvous-sericeous-tomentose tardily glabrate and brown, included at base only. *Q. coccinea* Coult., non Muenchh., *Q. rubra* Coult., non L., *Q. palustris* Coult., non Muenchh., *Q. texana* Sarg., non Buckl., *Q. Schneckii* Britt., *Q. Shumardii* var. *Schneckii* (Britt.) Sarg. In moist forests in the timber region of e. Tex., w. along waterways to the escarpment of the Edwards Plateau; e. to the Atl. and n. to Mo. and O.

37. *Quercus texana* Buckl. TEXAS RED OAK, SPANISH OAK. Moderate or small trees to 10 m. tall, with hard rough furrowed black or smooth gray bark; twigs 1-2 mm. in diameter, fluted, from sparingly stellate quickly glabrate and shiny dark-reddish-brown with inconspicuous lenticels, dull-gray the second season; buds 3-5 mm. long, 1.5-2.5 mm. broad, lanceolate to narrowly ovoid, acute, dark-reddish-brown, tomentose above the middle or merely at the apex, scales sometimes erose; stipules caducous, 5-10 mm. long, filiform to ligulate, villous; leaves deciduous, scarlet in autumn, thin but hard, 6-14 cm. long, to 12 cm. broad, ovate to obovate or subrotund in outline, deeply 2- or 3- or 4-lobed on each side with narrow rounded sinuses reaching one half to nine tenths the distance to the midrib, the lobes cuneate or usually oblong, each (including the terminal one) several-toothed with long aristae distally, basally cuneate to usually truncate, margins flat or minutely revolute, upper surfaces from moderately stellate-tomentose promptly glabrate and dark-shiny-green, lower surfaces similarly glabrate but with inconspicuous axillary tufts sometimes persistent, lighter green or sometimes coppery; petioles to 5 cm. long, very slender, reddish basally or straw-colored throughout, glabrate with the leaves; *staminate catkins* to 8 cm. long, rather openly flowered, the peduncle sparingly villous, the glabrous anthers exerted from the sericeous-fimbriate perianth; *pistillate catkins* 4-8 mm. long, 1- to 3-flowered, glabrate; fruit biennial, solitary or paired on a peduncle 2-8 mm. long; cups 12-18 mm. broad, 5-11 mm. high, cup-shaped or deeply goblet-shaped, markedly constricted basally, the margins not inrolled; cup scales densely minute-tomentose except the shiny brown apices or the upper margins, closely or rather loosely appressed; acorns 1.4-2 cm. long, 1-1.7 cm. broad, narrowly or broadly ovoid, rounded apically and basally, detachably dense-puberulent, brown and dull when abraded, one fourth or one half included. *Q. rubra* var. *texana* Buckl. On rocky limestone slopes of the cen. Tex. uplands; endemic.

38. *Quercus Gravesii* Sudw. CHISOS RED OAK, GRAVE'S OAK. Small or large trees reaching 13 m. in height and 7.5 dm. in trunk diameter with very roughly furrowed hard black bark, that of the branches smooth and gray; twigs 1-2 mm. thick, fluted, glabrous or from fulvous-stellate glabrate and reddish-brown with few rather inconspicuous lenticels; buds 3-6 mm. long, 1.5-2.5 mm. broad, acute, the ciliate scales dark-red-brown and canescent-tomentose about the apex; stipules early-caducous, 5-10 mm. long, ligulate to broadly spatulate, ciliate and apically tomentose; leaves deciduous, scarlet in autumn, thin but coriaceous, to 14 cm. long and 12 cm. broad, ovate to broadly lanceolate or obovate in outline, attenuately acute to obtuse at apex, basally rounded to occasionally cuneate, typically 2- or 3-lobed on each side with deep rounded sinuses broadly open and reaching only one half or rarely three fourths the distance to the midrib, the lobes typically cuneate and entire or oblong and setaceous few-toothed distally, the terminal lobes much-elongated, entire, toothed or slightly lobed, atypical leaves sometimes merely low-toothed or the lobes occasionally clavately divided, in any event all teeth or lobes aristate-tipped, upper surfaces dark-green, somewhat glossy, from stellate-pubescent early glabrate, lower surfaces light-green or coppery, dull, glabrous or rather persistently but sparsely minute-stellate, with or without dense axillary tufts; petioles to 25 mm. long and 1 mm. thick, glabrous or glabrate; *staminate catkins* 6-7 cm. long, rather loosely flowered, sparsely stellate-villous, the anthers well-exserted from the ciliate-villous red

perianth; *pistillate catkins* to 15 mm. long, 1- to 3-flowered on a glabrate red-brown peduncle; fruit biennial, solitary or paired on a peduncle to 12 mm. long; cups 1-1.5 cm. broad, 5-8 mm. high, deeply turbinate or hemispheric, the base constricted or rounded; cup scales narrowly rounded, closely appressed, light brown, densely minute-tomentose, with glabrous sometimes dark-brown margins; acorns ovoid, 12-15 mm. long and 8-10 mm. broad, apically sericeous-puberulent or glabrate and dull-light-brown, one third to one half included. *Q. texana* Sarg., non Buckl., *Q. stellipila* (Sarg.) Parks, *Q. chesosensis* (Sarg.) C. H. Mull. In igneous mts. of the Trans-Pecos or rarely along arroyos in limestone, above 4,000 or usually 5,000 ft. elev., common in the Davis, Glass and Chisos mts.; s. through the mts. of Coah.

39. *Quercus tardifolia* C. H. Mull. Small erect trees with short stiff branches and hard furrowed bark; twigs about 2 mm. thick, somewhat fluted, densely fulvous-stellate-tomentose the first season, glabrate or nearly so the second season and red-brown with minute inconspicuous lenticels, finally becoming gray; buds 3.5-4 mm. long, 2 mm. thick, acutely fusiform, hairy at the apices, the broadly truncate scales usually split at the end, slightly pubescent and often ciliate; stipules at length deciduous, 5-6 mm. long, setiform to broad-ligulate, pubescent at apex; leaves evergreen, the new ones appearing in dense tomentum about the first of July, rather thick and chartaceous, 5-9 cm. long, 25-55 mm. broad, oblong-ovate to subobovate, 3- or 4-lobed on each side with shallow or moderate sinuses, the lobes aristate-tipped and entire or rarely 2-toothed, short and rather broadly acute like the apices, basally subequilateral and slightly cordate, the upper surfaces dull-blue-green, at length glabrate, lower surfaces detachably stellate-tomentose; petioles 1.5-2 cm. long, 1-1.5 mm. thick, red at base, glabrate with the leaves; fruit biennial, solitary or paired, sessile; scales of young cups thin and closely appressed, short apices truncate, glabrous and brown, tomentose basally. In woodlands at about 7,000 ft. elev. along arroyos in the igneous Chisos Mts. of w. Tex.; endemic.

40. *Quercus falcata* Michx. SOUTHERN RED OAK, SPANISH OAK. Large trees to 20 m. tall, with a trunk diameter of 5 dm. and roughly furrowed hard black bark; twigs 1-3 mm. thick, fluted, from sparsely or densely fulvous-stellate-tomentose tardily glabrate or persistently pubescent, brown, becoming gray the second season with conspicuous or inconspicuous lenticels; buds 4-8 mm. long, narrowly ovoid, acute, somewhat quadrangular or round, deep-red-brown, puberulent, tomentose about the apex or all over; stipules caducous, about 1 cm. long, ligulate, dorsally densely tomentose; leaves deciduous, rather thin and papery, to 23 cm. long and usually smaller, 15 cm. broad, very polymorphic, typically ovate or lanceolate in outline, frequently obovate to cuneiform, apically long-attenuate or obtusely clavate, basally cuneate to round or truncate, typically deeply falcate-lobed with broadly rounded sinuses reaching within 1 or 2 cm. of the midrib or with few broad lobes or entire with 3 lobes at the apex, apical lobes typically elongate, toothed at the ends, all lobes and teeth tipped with aristae, margins finely or coarsely revolute, upper surfaces from densely fulvous-stellate-tomentose glabrate and dark-glossy-green or more or less persistently pubescent especially toward the bases, lower surfaces persistently fulvous-tomentose, some forms very sparingly stellate-villous, especially shade leaves; petioles 1-3.5 cm. long, shorter in some shade forms, dorsally glabrate and ventrally pubescent like the blade; *staminate catkins* 6-8 cm. long, densely fulvous-tomentose, rather loosely or closely flowered, the anthers well-exserted from the ciliate perianth; *pistillate catkins* 5-10 mm. long, 1- to 3-flowered, from fulvous-pubescent tardily glabrate like the twigs; fruit biennial, solitary or paired on peduncles to 1 cm. long and 3 mm. thick; cups 1-2 cm. broad, 6-8 mm. high, goblet-shaped to turbinate, basally rounded or markedly constricted, margins not inrolled; cup scales ovate, somewhat thickened basally, the apices rather loosely appressed, dorsally densely short-fulvous-tomentose except the glossy brown margins; acorns 12-15 mm. long, 8-15 mm. broad, ovoid or flattened basally, rounded apically, sparingly puberulent, dull-brown, about one third included. *Q. digitata* (Marsh.) Sudw., *Q. rubra* var. *leucophylla* Ashe, *Q. rubra* Sarg., non L., *Q. rubra* var. *triloba* (Michx.) Sarg., *Q. rubra* var. *pogodaefolia* (Ell.) Sarg., *Q. rubra* var. *digitata* (Marsh.) Cory & Parks. In moist or wet forests in the timber region of e. Tex., in river bottoms or uplands; ranging e. to the Atl. and n. to N.J. and Mo.

41. *Quercus marilandica* Muenchh. BLACKJACK. Small trees to 10 m. tall, with short trunks to 4 dm. in diameter and very roughly furrowed hard black bark that is reddish or ivory-colored within; twigs to 4 mm. thick, fluted or round, very stiff, from dingy

stellate-tomentulose glabrate and brown or persistently pubescent, gray the second season; buds 4-8 mm. long, ovoid to lanceolate, very acute, reddish-brown and sparsely villous to densely fulvous-tomentulose or strigose; stipules caducous, 6-8 mm. long, narrowly spatulate, membranous, densely villous; leaves deciduous, thick and hard, to 18 cm. long and broad, usually smaller, cuneate to broadly clavate in outline, subtire to distinctly 3-lobed at the broad apices, rarely with a pair of basal lobes, the lobes acute to broadly rounded, aristate-tipped from the veins, apices acute to usually rounded, bases cordate to cuneate, margins cartilaginous-revolute, upper surfaces from densely tomentulose glabrate and glossy-dark-green or persistently pubescent especially about the bases of the midribs, lower surfaces similarly glabrate and dull-light-green or persistently fulvous-glandular puberulent, in either event with prominent stellate axillary tufts, pubescence of both surfaces characteristically a mixture of glandular-puberulence with simple strigose and stellate-villous-pubescence of which the latter is first shed; veins about 6 or 7 on each side, those passing into the lobes prominent; petioles to 15 mm. long, from densely stellate-tomentulose promptly or tardily glabrate with the twigs or persistently pubescent; *staminate catkins* 5-7 cm. long, stellate-tomentulose or villous, rather loosely flowered, the anthers exerted from the perianth pubescent within and dorsally at the apices of the lobes; *pistillate catkins* 3-5 mm. long, 1- or 2-flowered, glabrate with the twigs; fruit biennial, solitary or paired, subsessile or on a peduncle to 1 cm. long; cups to 2 cm. broad and 12 mm. high (or much more by the constriction of the bases), hemispheric to shallowly or deeply goblet-shaped, bases round or much-constricted, margins not inrolled; cup scales narrowly ovate to oblong, thin and closely or loosely appressed or sometimes basally thickened, buff-tomentulose except the narrow glossy brown margins; acorns to 2 cm. long and 15 mm. broad, elliptic, broadly rounded at both ends, from minutely villous glabrate and light-brown, about one third included. *Q. nigra* Coult., non L., *Q. marylandica* var. *Ashei* (Sudw.) Cory & Parks. In upland forests in the timber belt of e. Tex. and w. to cen. Tex., abundant on sand or on clay and gravel hills; e. to the Atl. and n. to N.Y. and Kan.

41a. *Quercus marilandica* × *Q. texana*. Similar to *Q. texana* in the reddish-brown twigs and the deeply lobed and aristately toothed leaves, the terminal lobes sometimes clavate, the blade intermediate in texture between the parents, lacking pubescence beneath or this reduced to axillary tufts, not puberulent; resembling *Q. marilandica* in the buff pubescence of the buds and of the constricted acorn cups. Sparse on wooded banks with both parents.

42. *Quercus velutina* Lam. BLACK OAK. Moderate or large trees to 15 m. tall, with trunk diameter of 5 dm. and coarsely furrowed hard black bark, orange-yellow within; twigs 2-4 mm. thick, coarsely fluted, from fulvous-stellate-tomentulose tardily glabrate and reddish-brown with inconspicuous raised lenticels, gray the second season; buds 6-10 mm. long, ovoid, sometimes quadrangular, acute or rounded, densely fulvous- or gray-tomentulose or strigose; stipules caducous; leaves deciduous, thin and chartaceous or rather thick, to 25 cm. long and 20 cm. broad, ovate or obovate in outline, 2- or 3- or 4-lobed on each side with usually broad open rounded sinuses reaching one half to three fourths the distance to the midribs, apices and lobes acute or truncate, irregularly several-toothed and long-aristate, obtuse to rounded or even cordate at bases, margins minutely cartilaginous-revolute, upper surfaces from minutely sparse-stellate-puberulent glabrate and rather glossy-dark-green or persistently puberulent especially about the bases of the midribs, lower surfaces from rather densely stellate-puberulent and glandular becoming glabrate and dull-light-green except for stellate tomentum along the midribs and conspicuous fulvous tufts in the axils of the veins; petioles 5-7 cm. long, from stellate-tomentulose glabrate with the leaves, straw-colored or basally reddish; *staminate catkins* 10-15 cm. long, tomentulose or pubescent; *pistillate catkins* 8-16 mm. long, 1- or 2-flowered, the peduncle glabrate and reddish-brown with the twigs; fruit biennial, solitary or paired on a peduncle 2-8 mm. long; cups 2-2.5 cm. broad, 1-1.5 cm. high, hemispheric or deeper, usually goblet-shaped by the marked constriction of the base, the margin not inrolled; cup scales narrowly ovate, thin but loosely appressed or the apices spreading, densely tan-tomentulose except for the glossy brown glabrous apices and margins; acorns about 2 cm. long, 16-18 mm. broad, ovoid to elliptic or subglobose, detachably tomentulose or glabrate and dull-light-brown, one third to one half included. In upland forests in the timber region of e. Tex.; e. to Ga. and n. to Ia. and Vt.

42a. *Quercus velutina* × *Q. marilandica*. Small trees intermediate between the parents in leaf size and shape, the basal lobes much shorter than the apical ones; petioles 3-4 cm. long; cups like those of *Q. marilandica*. In upland forests with the parents in n.e. Tex. and Ark.

FAM. 53. ULMACEAE MIRB. ELM FAMILY

Trees or rarely shrubs with watery sap; buds with imbricate scales; leaves simple, 2-ranked, alternate, usually oblique at base, pinnately veined, serrate or rarely entire; stipules deciduous; flowers perfect or unisexual with both sexes on the same plant; perianth 4- or 5-merous, rarely more or less, usually somewhat connate; stamens (in bud) with curved or somewhat sigmoid filaments, as many as or twice as many as the perianth lobes; filaments straight; ovary superior, 1-celled, with 1 suspended anatropous ovule; style 2-parted; fruit a samara, nut or drupe.

About 15 genera with more than 200 species in both hemispheres.

- 1. Leaves 3-veined at base; pairs of veins usually less than 6; winter-buds appressed; parts of perianth free; fruit a globose drupe 1. *Celtis*, p. 492.
- 1. Leaves with 7 or more pairs of parallel veins, the lowest pair not prominent; winter-buds somewhat spreading; perianth more or less connate (2)
- 2(1). Flowers perfect, produced before the leaves or in autumn; fruit flat, winged; leaves usually doubly serrate 2. *Ulmus*, p. 494.
- 2. Flowers at least partly unisexual, appearing with the leaves, the pistillate ones axillary on the young branchlets; fruit an ellipsoid wingless nut; leaves simply serrate
..... 3. *Planera*, p. 496.

1. CELTIS L. HACKBERRY. SUGARBERRY

Trees or rarely shrubs, polygamo-monoecious, deciduous (in our region); bark usually gray, smooth, sometimes with corky warty excrescences; winter-buds small; leaves with fairly long petioles, 3-nerved at base, entire or serrate; flowers appearing with the leaves on the young branchlets; staminate flowers in fascicles towards the base; perfect flowers above, solitary in the axils of the leaves; calyx 5-lobed, persistent; stamens 5 or 6; fruit a subglobose or ovoid drupe with a firm outer coat, usually with scanty sweet pulp and a bony stone with smooth or sculptured surface, ripening in autumn but persisting long after leaf-fall.

About 80 species in the temperate regions of the Northern Hemisphere and in the tropics. Commonly planted as shade trees or for ornament.

- 1. Plants armed with spines; leaves usually less than 2 cm. wide
..... 1. *C. pallida*.
- 1. Plants unarmed; leaves usually much more than 2 cm. wide (2)
- 2(1). Leaves typically elliptic-lanceolate to ovate-lanceolate and mostly sharply acute to long-acuminate; distribution mainly in east and south Texas (3)
- 2. Leaves typically broadly to narrowly ovate and obtuse to acute or abruptly long-acuminate (then coarsely serrate); distribution mainly in central, west and north-west Texas, rarely in east Texas (4)
- 3(2). Lower leaf surface softly pubescent; fruits usually light-brown; endemic to the country south of San Antonio 2. *C. Lindheimeri*.
- 3. Lower leaf surface essentially glabrous or with coarse pubescence mainly on the veins; fruits mostly reddish or orange; widespread in east and south Texas
..... 3. *C. laevigata*.
- 4(2). Leaves typically 45 mm. long or less, the margins mostly entire
..... 4. *C. reticulata* (typical phase).
- 4. Leaves mostly 50 mm. long or more, the margins commonly more or less coarsely serrate (5)

- 5(4). Distribution in Panhandle; leaves typically abruptly acuminate-attenuate
5. *C. occidentalis*.
5. Distribution in east Texas; leaves obtuse to subacute (6)
- 6(5). Leaves typically ovate-elliptic, thinnish or rarely subcoriaceous; in southeast Texas
6. *C. tenuifolia*.
6. Leaves typically broadly ovate, thickish; in northeast Texas
4. *C. reticulata* (large-leaved phase).

1. *Celtis pallida* Torr. GRANJENO, DESERT HACKBERRY. Shrub rarely to 3 m. high, with numerous spiny flexuous spreading white-puberulent branches; spines in pairs, to 25 mm. long; leaves ovate to ovate-oblong or elliptic, to 3 cm. long and 2 cm. wide, usually smaller, rounded to acutish at the apex, entire or sparingly crenate-dentate, thickish, somewhat scabrous; flowers small, white, in polygamous cymes of 3 to 5 flowers that exceed the petiole, the lower flower mostly staminate with rudimentary pistils, the terminal flower perfect; styles thick, cleft nearly half their length; fruit ovoid, glabrous, about 6 mm. long, orange, yellow and red, with an acid juicy pulp. *C. spinosa* Spreng. var. *pallida* (Torr.) M. C. Johnst. On mesas, foothills, thickets and brushlands of w. and s. Tex.; from Tex. to Ariz. and n. Mex.

A close relative of this species, *C. iguanaea* (Jacq.) Sarg., a shrub with serrulate leaves 3-5.5 cm. wide and short-pilose fruits, has been attributed to coastal Texas but we have seen no material of this species from the state. It occurs from Mexico southward.

2. *Celtis Lindheimeri* Engelm. A much-branched wide-spreading tree, occasionally to 10 m. high with a trunk diameter to 15 dm.; bark of the trunk and main branches with numerous corky warts; twigs and branchlets villous-pubescent; leaves rather firm, ovate to ovate-lanceolate or oblong-lanceolate, 4-7 cm. long, 2-3.5 cm. wide, obtuse to acute or shortly acuminate at apex, rounded to subcordate at the oblique base, entire or sometimes with a few serrations on the margins, deep-green and somewhat scabrous-pubescent above, pale and tomentose beneath; petioles stout, 3-4 mm. long, tomentose; pedicels sparingly pubescent, curved, 1-1.5 cm. long; drupe subglobose, 7-9 mm. in diameter, light-brown, translucent, smooth and shining; seeds globose, strongly 4-ribbed, prominently reticulate. *C. Helleri* Small. In arroyos and brushlands, apparently endemic in the country s. of San Antonio (Bexar Co.).

3. *Celtis laevigata* Willd. TEXAS SUGARBERRY, PALO BLANCO. Tree to 30 m. high, with spreading often pendulous branches to form a broad crown; bark light-gray, smooth or covered with corky warts; branchlets pubescent at first, eventually glabrous; leaves with petioles 6-10 mm. long, thin and membranaceous to coriaceous, uniformly pale-green on both surfaces, with conspicuous veins, lanceolate to oblong-lanceolate or sometimes ovate-lanceolate, entire to somewhat serrate, the typically long-acuminate apex commonly prolonged and often curving at the tip, leaves of the fruiting branchlets less than one half as broad as long, 4-10 cm. long, 15-45 mm. wide; drupes subspherical, 5-8 mm. in diameter, beakless, orange to brown or red, on pedicels 6-15 mm. long; stone 4.5-7 mm. long, 5-6 mm. broad. *C. mississippiensis* Bosc., *C. Berlandieri* Kl. In sandy loam, rocky soil or alluvial soil along streams in woodlands, palm groves and thickets in the e. two thirds of Texas, w. to Hardeman, King and Val Verde cos., s. to Cameron Co.; from Fla. to Okla. and Tex., n. to Va., Ill., Mo. and Kan.; also n.e. Mex.

Several variants of this species are attributed to Texas. The var. *laevigata* has essentially entire membranous lanceolate to oblong-lanceolate leaves that are smooth or only sparingly hirtellous above, while var. *texana* Sarg. has more ovate-lanceolate leaves that are essentially entire, coriaceous, pubescent on the veins beneath, and often scabrous above. The var. *Smallii* (Beadle) Sarg. has rather thin usually copiously serrate leaves.

4. *Celtis reticulata* Torr. NETLEAF HACKBERRY, PALO BLANCO. Small trees or tall shrubs rarely to about 16 m. high, the trunk rarely to 6 dm. in diameter; bark gray, with corky ridges; branches somewhat compressed, the younger ones villous; leaves with petioles about 6 mm. long, ovate, obtuse to acute or sometimes subacuminate, rounded to somewhat cordate at base, 3-7 cm. long, 1.5-4 cm. wide, entire or occasionally somewhat serrate above the middle, rather thick, the upper surface shining and scabrous, strongly reticulate-veined and usually pale or somewhat yellowish beneath; flowering branches elongating rapidly; fruit spherical, reddish or reddish-black, often beaked, the flesh

sweet, 8-9 mm. in diameter, the pedicel exceeding the petiole. *C. laevigata* var. *reticulata* (Torr.) Benson. On limestone hills, shinnery oak dunes, breaks and rocky canyon slopes, and in arroyos, mesquite groves and about tanks, ponds, and along watercourses from Tex., Okla. and Colo., w. to Wash., Ida., Calif. and n. Mex.

This species is represented by two phases in Texas. Typical material with leaves mostly less than 45 mm. long is frequent in the Texas Panhandle, south to the Trans-Pecos and on the Edwards Plateau to Tom Green, Brown and Sutton counties, with apparently disjunct stations in Newton County in southeast Texas and Denton County in the West Cross Timbers. A phase with larger leaves occurs in east Texas, south to Henderson County. It is quite possible that this larger-leaved form should be separated varietally from typical *C. reticulata*, but for the time being it seems best to combine the two phases.

5. *Celtis occidentalis* L. HACKBERRY, BEAVER-WOOD. Large or small tree or low shrub greatly varying in response to habitat; old bark deeply furrowed and checkered or warty; branchlets mostly pubescent; leaves of fruiting branchlets (those subtending flowers and fruits) broadly to narrowly and obliquely ovate, coriaceous, scabrous, definitely with 10 to 40 serrate teeth on at least the broader (often on both) margin, mostly two fifths to four fifths as broad as long, abruptly long-acuminate, mostly 3-12 (averaging 8) cm. long and 1.2-9 (averaging 4.5) cm. wide; blades of leading shoots longer; drupe orange-red to fuscous, on pedicels to 15 mm. long, spherical or nearly so, 8-11 mm. long, commonly with a thick beak; stone 7-9 mm. long, 5-8 mm. thick. Incl. var. *crassifolia* (Lam.) Gray, *C. crassifolia* Lam. On sandy or rocky banks of rivers, in alluvial soils in open woodlands along streams and in dry rocky soils in canyons in the Panhandle; from Mass. to Ida., s. to n. Fla., Tenn., Ark., Okla. and n. w. Tex.

Typically broadly ovate and abruptly acuminate scabrous leaves with conspicuously serrate margins are a combination of characters that distinguish this species from *C. reticulata*, the only other species of *Celtis* found in the Texas Panhandle.

6. *Celtis tenuifolia* Nutt. DWARF HACKBERRY. Shrub or small tree to about 8 m. high, glabrous to somewhat pubescent; leaves of fertile branchlets entire or very sparingly toothed (on sprouts mostly toothed), ovate to occasionally ovate-elliptic, thin and smooth to coriaceous and scabrous above, one half to three fourths as broad as long, 2-8 cm. long, 1-4 cm. broad, blunt, acute or merely short-acuminate at apex, gray-green on both surfaces or darker green above; drupes spherical, beakless, 5-8 mm. in diameter, glaucous, orange to brown or cherry-red, not much puckered in drying, on pedicels 3-13 mm. long; stone 5-7 mm. long and 5-6 mm. broad. On hardwood slopes and along streams in open woodlands in s.e. Tex.; from Fla. w. to e. Tex. and Okla., n. to Pa., Ind., Mo. and Kan.

This large shrub or small tree with ovate to ovate-elliptic bluntish leaves is found in east Texas from San Augustine southward. The var. *georgiana* (Small) Fern. & Schub. differs from the smooth thin-leaved var. *tenuifolia* in having larger coriaceous leaves that are more or less scabrous on their upper surface and pubescent beneath.

2. ULMUS L. ELM

Deciduous or rarely semievergreen trees; buds conspicuous; leaves short-petioled, commonly in 2 rows, usually oblique at base, strongly straight-veined, mostly doubly serrate; flowers perfect, appearing in spring before the leaves or in autumn in the axils of the leaves, in fascicles or racemes; calyx campanulate, 4- to 9-lobed with an equal number of stamens; filaments long and slender; fruit a 1-celled and 1-seeded compressed nutlet surrounded by a broad or rarely narrow membranous wing, ripening a few weeks after flowering.

About 45 species in the temperate regions of the Northern Hemisphere. Ornamental trees much planted as street or shade trees.

1. Flowers appearing in autumn in the axils of the leaves; calyx divided beyond the middle; leaves typically oblong-elliptic and obtuse-rounded at apex, mostly less than 5 cm. long 1. *U. crassifolia*.
1. Flowers appearing in spring before the leaves; calyx lobes short; leaves acute or acuminate, mostly more than 5 cm. long (2)

- 2(1). Flowers with slender pedicels, drooping; fruits ciliate; leaves smooth above and doubly serrate; leaf buds glabrous or only slightly whitish pubescent (3)
- 2. Flowers with short pedicels, not pendulous, in dense clusters; leaves scabrous above or simply serrate; leaf buds with long rusty hairs to essentially glabrous (4)
- 3(2). Fruit glabrous except the ciliate margin; leaves obovate-oblong to elliptic; branches not corky; flowers fascicled2. *U. americana*.
- 3. Fruits pubescent; leaves ovate-oblong to oblong-lanceolate; branches usually more or less corky; flowers racemose3. *U. alata*.
- 4(2). Leaf buds covered with long rusty hairs, obtuse; leaves usually 100 mm. or more long, scabrous on upper surface, doubly serrate; fruit noticeably pubescent in the middle4. *U. rubra*.
- 4. Leaf buds pale-pubescent or glabrous; branchlets smooth, glabrous or pubescent; leaves 75 mm. or less long, smooth on upper surface, usually simply serrate; fruit glabrous5. *U. pumila*.

1. *Ulmus crassifolia* Nutt. CEDAR ELM, OLMO. Tree to 25 m. high, with flat scaly-ridged light-brown bark; branches often with 2 opposite corky wings; buds essentially glabrous; leaves ovate to ovate-oblong or elliptic, 2.5-6 cm. long, to 3 cm. wide, obtuse to acute, often nearly simply serrate, subcoriaceous, subpersistent or tardily deciduous, shiny-green and rough above, soft-hairy beneath; flowers in short-stalked 3- to 5-flowered fascicles; calyx deeply divided beyond the middle into 4 to 8 equal lobes; samara oblong, flat, about 1 cm. long. In woodlands, ravines and open slopes in cen. and s. Tex., July-Oct.; from Miss. to Ark. and Tex.

This species flowers in autumn while all our other native species of elm flowers in early spring.

2. *Ulmus americana* L. AMERICAN ELM, WHITE ELM. Tall tree with the limbs usually gradually spreading outward to form a wide-spreading crown with pendulous branches, to 30 m. high; bark light-gray, scaly and deeply fissured with broad forking scaly ridges; branchlets pubescent when young or sometimes nearly glabrous; buds ovoid, obtuse to acute, glabrous or only slightly whitish short-pubescent; leaves with petioles 5-8 mm. long, in 2 rows, ovate-oblong, 7-15 cm. long, 5-7.5 cm. wide, unequal at base, acuminate at apex, doubly serrate, glabrous and more or less scabrous above, pubescent or nearly glabrous beneath; flowers with elongated unequal pedicels 1-2 cm. long; calyx with 5 to 8 unequal short lobes; stamens 7 or 8, exerted; stigmas white; samaras elliptic, flat, about 1 cm. long, deeply notched at apex, the incision reaching the nutlet, ciliate. Along streams and rivers in lowland areas with rich soil in e. third of Tex., Feb.-Apr.; from Fla. n. to Nfld., w. to foot of Rocky Mts.

Extensively planted as a shade tree in the United States, but threatened by Dutch elm disease.

3. *Ulmus alata* Michx. WINGED-ELM, WAHOO, CORK-ELM. Small tree with spreading branches to form a round-topped oblong crown, to 15 m. high; bark thin, light-brown, irregularly fissured; branchlets nearly glabrous, usually developing 2 broad opposite corky wings; buds acute, essentially glabrous; leaves with petioles 1-3 mm. long, ovate-oblong to oblong-lanceolate or elliptic, 3-10 cm. long, to 4 cm. wide, acute to acuminate at apex, rounded to subcordate at the oblique base, doubly serrate, mostly shiny-dark-green and glabrous above, soft-pubescent beneath, with axillary tufts, subcoriaceous, turning dull yellow before falling; racemes short, few-flowered; stamens usually 5; samaras ovate-elliptic to oblong, flat, about 8 mm. long, narrow-winged, with slender incurved beaks at the apex, villous. Along streams, woodlands and thickets in e. Tex., Feb.-Mar.; from Fla. to Tex., n. to Va. and w. to Ill. and Mo.

Sometimes planted as a street tree in the southern states.

4. *Ulmus rubra* Muhl. SLIPPERY ELM, RED ELM. Tree with spreading branches to form usually a broad open crown, to 20 m. high; bark dark-brown, deeply furrowed, the inner bark mucilaginous; branchlets stiffish, pubescent and scabrous, red-brown or orange; buds large, fulvous-pubescent with long hairs; leaves with petioles 4-8 mm. long, obovate to ovate or elliptic, 1-2 dm. long, 5-7.5 cm. wide, long-acuminate at apex, very asymmetric at base, doubly serrate, dark-green and very rough above, densely soft-pubescent beneath,

turning dull-yellow in fall; flowers short-stalked, in dense clusters; stamens 5 to 9; stigmas pinkish; samaras suborbicular to obovate or broadly elliptic, flat, 1-2 cm. long, slightly notched, rufous-pubescent in the center. *U. fulva* Michx. Mostly in woodlands and thickets along rivers and streams in the e. third of Tex.; from Fla. to Tex., n. to Que. and w. to the Dakotas.

The mucilaginous inner bark was formerly used in medicine.

5. *Ulmus pumila* L. ASIATIC ELM, CHINESE ELM, SIBERIAN ELM. A usually small tree with rounded crown and rough bark; branches slender, glabrous or glabrate; twigs hairy when young; buds essentially glabrous; leaves in 2 rows, narrowly elliptic to lanceolate, 25-75 mm. long, short-pointed, essentially symmetrical, simply serrate, thick, smooth and dark-green above, becoming smooth beneath; flowers small, greenish, in clusters in early spring; stamens 8; fruits flattened, round-obovate, glabrous, about 13 mm. in diameter.

Widely cultivated in Texas as an ornamental, but it is highly susceptible to cotton root-rot and canker-disease. A native of Asia but occasionally escaping.

3. PLANERA J. F. GMEL.

A monotypic genus.

1. *Planera aquatica* (Walt.) J. F. Gmel. WATER-ELM, PLANER-TREE. Small deciduous polygamo-monoecious tree with spreading branches to form a low broad crown, to about 12 m. high, the short trunk with reddish-brown scaly and flaky bark; branchlets puberulous; winter-buds subglobose, minute; leaves with petioles 3-6 mm. long, rhombic-ovate to ovate-oblong, 3-8 cm. long, to 25 mm. wide, unequal at the rounded to cuneate base, acute at apex, unequally serrate, scabrate above, pinnately veined, at maturity glabrous; calyx deeply 4- or 5-lobed; staminate flowers in clusters at base of the young branchlets; stamens 4 or 5; perfect flowers 1 to 3 in the axils of the young leaves; fruit ellipsoid, about 8 mm. long, with irregularly crested fleshy ribs. In water of streams and lakes and in alluvial floodplains subject to periodic flooding, often forming large stands, in e. Tex.; from Fla. to Tex., n. to s. Ill. and Ky.

FAM. 54. MORACEAE LINK

MULBERRY FAMILY

Deciduous trees or shrubs, sometimes herbs, with milky sap; leaves alternate or rarely opposite, entire to serrate or lobed; stipule present, sometimes persistent; flowers unisexual, small, regular, usually in aments or heads or affixed to a variously shaped torus or on the inside of a hollow receptacle; corolla none; *staminate flowers* 2- to 6-merous, the parts free or more or less united; stamens as many as the sepals and opposite them, straight or inflexed and elastic; sepals of *pistillate flowers* 4, more or less united; stigmas 1 or 2; ovary superior or inferior, 1-celled, 1-ovuled; fruit a small achene or drupe usually enveloped by the fleshy perianth, sometimes on a fleshy gynophore, often assembled into an aggregate fruit (syncarp).

About 55 genera and 1,400 species, chiefly tropical. Most of the species in our region have distinctive leaves. The same plants may have entire leaves as well as variously lobed leaves, some of which are "mitten-shaped."

1. Flowers in a hollow receptacle; filaments straight; leaves entire or lobed, convolute in bud; stipules connate, enclosing the terminal bud, leaving a ringlike scar 4. *Ficus*, p. 498.
1. Flowers in aments or heads; leaves folded or involute in bud; stipules free, not leaving a ringlike scar (2)
- 2(1). Leaves with entire margins; branches spiny; flowers of both sexes in heads or clusters; syncarp globose, with a crustaceous rind . . . 2. *Maclura*, p. 498.
2. Leaves serrate or dentate, undivided or lobed; branches never spiny; staminate flowers in aments; stamens inflexed (3)

- 3(2). Syncarp ovoid to cylindric, fleshy, juicy; buds with 3 to 6 scales; leaves alternate1. *Morus*, p. 497.
 3. Syncarp globose, at maturity exerted on fleshy gynophores; buds with 2 or 3 scales; leaves sometimes opposite3. *Broussonetia*, p. 498.

1. MORUS L. MULBERRY. MORAL

Deciduous unarmed monoecious or dioecious trees or shrubs; bark usually scaly; buds with 3 to 6 imbricate scales; leaves undivided or lobed, serrate or dentate, with 3 to 5 nerves at base; stipules lanceolate, deciduous; flowers unisexual, both sexes in stalked axillary pendulous aments; calyx 4-parted; stamens 4; filaments inflexed in bud, later partly enclosed by the involute sepals; stigmas 2; fruit an ovoid compressed achene, covered by the succulent white to black calyx, aggregating into an ovoid to cylindric edible syncarp that resembles a blackberry.

About 12 species in temperate and subtropical regions of the Northern Hemisphere. Trees grown for their edible fruit, their ornamental nature or for their leaves which constitute the chief food of the silkworm.

1. Petioles usually less than 1 cm. long; mature leaf blades 7 cm. or less long, very scabrous on both surfaces1. *M. microphylla*.
 1. Petioles 1 cm. or more long; mature leaf blades usually more than 8 cm. long, slightly (if at all) scabrous on only one surface (2)
 2(1). Leaves glabrescent or only slightly pubescent in axils of largest veins on lower surface, often variously lobed2. *M. alba*.
 2. Leaves soft-pubescent on lower surface, usually unlobed3. *M. rubra*.

1. *Morus microphylla* Buckl. MOUNTAIN MULBERRY, TEXAS MULBERRY. Shrub or small scrubby tree to 7 m. high, with a trunk 15 cm. in diameter; bark light-gray, smooth, becoming fissured and scaly; leaves with a petiole to 15 mm. long, ovate, 3-7 cm. long, often 3- to 5-lobed, rounded to subcordate at base, abruptly pointed at apex, serrate or crenate-serrate, scarious above, pubescent or sometimes glabrous beneath; staminate catkins 1-2 cm. long; fruit ovoid, purple or blackish when ripe, 1-1.5 cm. long, juicy, edible. In canyons, limestone and igneous slopes in the w. two thirds of Tex., Mar.-Apr.; from Tex. to Ariz. and s. to Mex.

2. *Morus alba* L. WHITE MULBERRY, RUSSIAN MULBERRY, SILKWORM MULBERRY, MORAL BLANCO. Small tree to 15 m. high with spreading branches to form a round-topped crown; branchlets slightly pubescent at first or glabrous; leaves with petioles 1-2.5 cm. long, ovate to broadly oval, to 2 dm. long, rounded to cordate at the oblique base, subobtuse to short-acuminate at apex, coarsely toothed with obtusish teeth, often variously lobed, light-green and usually smooth above, hairy-tufted in axils beneath or nearly glabrous; pistillate spikes 5-15 mm. long, the staminate spike about twice as long; flowers small and greenish; syncarp ovoid to oblong-cylindric, 1-2.5 cm. long, white, pinkish to purplish-violet, or reddish, edible, sweet but insipid. *M. nigra* L. In woodlands and rocky areas mostly in cen. and s. Tex., Mar.-Apr.; a nat. of China but naturalized in much of N.A. and Eur.

The leaves of this species are the main food of silkworms.

3. *Morus rubra* L. RED MULBERRY, MORAL. Tree to 20 m. high, with a short trunk and stout spreading branches to form a broad round-topped crown, the bark smooth or scaly; branchlets pubescent at first; leaves with petioles 2-3 cm. long, broadly ovate to ovate-oblong, entire to variously lobed, dark-green, turning bright-yellow in autumn, to 2 dm. long, usually much smaller, truncate to subcordate at base, abruptly long-acuminate at apex, rather closely and sharply serrate, scabrous or sometimes nearly smooth above, soft-pubescent beneath; staminate catkins 2-5 cm. long; pistillate catkins 2-2.5 cm. long; syncarp 2-3 cm. long, juicy, finally dark-purple, edible. In upland woods and floodplains mostly in e. and cen. Tex., Mar.-May; from Mass. to Fla., w. to S.D., Neb., Kan. and Tex.

The Lampasas mulberry, var. *tomentosa* (Raf.) Bur., has exceptionally large fruits and leaves that are glossy above and whitish-tomentose beneath.

2. MACLURA Nutt.

A monotypic genus.

1. *Maclura pomifera* (Raf.) Schneid. BOIS D'ARC, OSAGE ORANGE, NARANJO CHINO, BOW-WOOD. Medium-sized spiny deciduous dioecious tree with an open irregular round-topped crown, to 20 m. high, sometimes forming thickets; bark deeply furrowed, dark yellowish-brown; sap milky; branchlets light-green, soon glabrous, with axillary thorns, becoming light-brown the first winter; spines to 25 mm. long, stout; leaves with petioles 3-5 cm. long, entire, ovate to elliptic-lanceolate, broadly cuneate to subcordate at base, acuminate at apex, bright-green and lustrous, turning clear-yellow in fall, to 12 cm. long; stipules minute; flowers unisexual, 4-merous; clusters of pedicelled staminate flowers 25-35 mm. long; heads of sessile pistillate flowers 2-2.5 cm. across; syncarp globose, to 15 cm. in diameter, the mammillate rind wrinkled; seed nearly 1 cm. long. *Toxylon pomiferum* Raf. In and on edge of fields, fence rows, ravines and waste places generally, most frequent in e. half of Tex., Apr.-May; also Ark. and Okla.; widely cult. as a hedge plant and escaping in various places through s. U.S.

3. BROUSSONETIA Vent.

About 8 species native to eastern Asia and Polynesia.

1. *Broussonetia papyrifera* (L.) Vent. PAPER MULBERRY. Small deciduous dioecious tree to 16 m. high, with widespreading branches to form a broad rounded crown; sap milky; bark smooth, tan-gray; branchlets stout, pubescent; leaves with petioles to 1 dm. long, alternate or occasionally opposite, ovate to oval, to 2 dm. long, broadly rounded to cordate at base, acuminate at apex, coarsely dentate, often deeply and irregularly lobed (especially on young plants), scabrous above, grayish and velvety-pubescent beneath; stipules ovate-lanceolate, distinct, deciduous; flowers greenish, 4-merous, unisexual; staminate cylindric catkins 6-8 cm. long, pendulous; syncarp a dense globose head about 2 cm. in diameter, orange-color, the protruding fruits red, showy. *Papyrius papyrifera* (L.) O. Ktze. Often planted for ornamental and sometimes as a street tree; nat. of China and Japan, occasionally naturalized from N.Y. to Fla., Tex. and Mo.

4. FICUS L.

About 800 species in the tropical and subtropical regions of both hemispheres.

1. *Ficus carica* L. COMMON FIG, FIGUERA. Usually a spreading deciduous shrub with long occasionally procumbent branches, rarely a small tree with short stem and wide-spreading branches to form a broad flattened crown, to 10 m. high, usually much smaller; branchlets stout, grayish, glabrous; leaves alternate, with petioles 2-5 cm. long, 3- to 5-lobed, rarely undivided, to 2 dm. long and about as wide, usually cordate at base, palmately nerved, the lobes usually obovate and obtuse at the apex and irregularly dentate, scabrous above and below with stout stiff hairs; stipules connate, enclosing the terminal bud, caducous to leave a ringlike scar; flowers unisexual, borne inside of a hollow receptacle with a narrow orifice; *staminate flowers* with 2- to 6-parted perianth and 1 or 2, rarely 3 to 6 stamens; *pistillate flowers* usually with more segments; style eccentric, short or filiform, with a peltate to filiform stigma; receptacle axillary and solitary pyriform, at maturity 5-8 cm. long, greenish or brownish-violet. A nat. of w. Asia; cult. since early times for its edible fruit which is of great commercial importance. Many pomological varieties are distinguished. Occasionally escaped and established.

FAM. 55. URTICACEAE Juss.

NETTLE FAMILY

Annual or perennial herbs, sometimes with stinging hairs, frequently succulent and with watery sap; leaves simple, alternate or opposite, mostly stipulate; flowers minute, greenish, unisexual or rarely perfect, in simple or branched spikes or clusters; calyx 2- to 5-cleft or of separate sepals; petals none; stamens as many as the calyx lobes or sepals

and opposite them, the filaments inflexed; ovary superior, 1-celled; style simple, with a capitate or filiform stigma; ovule solitary, erect or ascending, orthotropous; fruit an achene, often tipped with the persistent style or enclosed by the accrescent calyx.

About 45 genera and 600 species of wide geographic range, but mostly tropical and subtropical.

1. Leaves alternate (2)

1. Leaves opposite (3)

2(1). Margin of leaves essentially entire1. *Parietaria*, p. 499.

2. Margin of leaves dentate2. *Boehmeria*, p. 500.

3(1). Calyx of pistillate flowers tubular or cupuliform, enclosing the achene; plants without stinging hairs2. *Boehmeria*, p. 500.

3. Calyx of pistillate flowers of 2 to 5 separate or nearly separate sepals (4)

4(3). Plants more or less pubescent, beset with stinging bristles; achene enclosed by the calyx3. *Urtica*, p. 501.

4. Plants glabrous, smooth and shining, without stinging bristles; achene longer than the calyx4. *Pilea*, p. 502.

1. PARIETARIA L. PELLITORY

Annual or perennial herbs, often flimsy, with simple or diffusely branched and tufted stems devoid of stinging hairs; leaves alternate, more or less petiolate, exstipulate, usually opaquely punctate, entire, prominently 3-nerved; involucre of 2 to 6 free or somewhat united bracts; flowers polygamous, in clustered axillary cymes; *staminate flowers* with a perianth of 4 more or less united sepals and 4 stamens, the ovary rudimentary; *pistillate flowers* with a perianth similar to that of the staminate flowers, the included free ovary with a tufted stigma; achenes nearly ovoid, enclosed in the brownish 4-nerved calyx, with a shiny crustaceous pericarp.

About 30 species, widely distributed.

1. Mature calyx campanulate, subglobose to subcylindric, mostly 2 mm. or less long, mostly noticeably exceeded by the involucral bracts; stems simple or sparsely branched, finely pubescent1. *P. pensylvanica*.

1. Mature calyx cylindric, mostly 2-3 mm. long, about equaling or exceeding the involucral bracts; stems much-branched, more or less shaggy-pubescent (2)

2(1). Leaves elliptic to elliptic-lanceolate or linear-lanceolate, the larger blades 3 times or more as long as wide2. *P. obtusa*.

2. Leaves suborbicular-ovate to rhombic-ovate or sometimes ovate-lanceolate, the larger blades about twice as long as wide3. *P. floridana*.

1. *Parietaria pensylvanica* Muhl. HAMMERWORT. Slender annual, finely pubescent; stems weak, ascending or reclining, to 4 dm. long, simple or sparsely branched at base, sparsely to densely pubescent with mostly curled or hooked hairs; leaves with slender petioles, thin and flimsy, rhombic-lanceolate to elliptic-lanceolate or linear-lanceolate, to 7 cm. long, entire, obtuse at the narrowed apex, cuneate at base, minutely scabrous-pubescent; flower clusters sessile, in all but the lowermost leaf axils; bracts of the involucre linear, obtuse, 4-5 mm. long, much-exceeding the calyx; calyx lobes acute; achenes ovoid, shining, minutely apiculate, 1 mm. long. On shaded banks and about large boulders, uncommon in e. and cen. Tex., n. to the High Plains, Mar.-May; from Fla. to Tex. and Mex., n. to Ont. and B.C.

2. *Parietaria obtusa* Rydb. Slender annuals, more or less shaggy-pubescent; stems usually much-branched at the base, the branches spreading, to about 4 dm. long; leaves with slender petioles, elliptic to linear-lanceolate, obtuse at the often attenuated apex, minutely scabrous-pubescent, to about 6 cm. long; bracts of the involucre linear-elliptic to narrowly lanceolate, obtuse to acute, 3-4 mm. long, about equal to calyx; calyx lobes ovate, obtuse or rarely acutish. *P. pensylvanica* var. *obtusa* (Rydb.) Shinners. In rich moist soil, usually in shade of trees, shrubs or boulders, mainly in the Edwards Plateau and Trans-Pecos, Mar.-July; from n. Mex. and Tex., n. to Colo., Ut. and s. Mo.

3. *Parietaria floridana* Nutt. Slender annual, often densely shaggy-puberulent or pubescent; stems ascending or spreading, to about 3 dm. long, usually much-branched at base; leaves with slender filiform petioles, thin, numerous, usually ovate to subrhombic, rarely more than 3 cm. long, usually less than 2 cm. long, obtuse at the apex or sometimes short-acuminate but obtuse, entire, rounded to cuneate at base, palmately 3-veined; flower clusters in nearly all the axils; bracts of the involucre linear to linear-lanceolate, 2-3 mm. long, obtuse to acute; about equal to the calyx; achenes ovoid, shining, with a flanged stipe, symmetrically apiculate, usually less than 1 mm. long. *P. debilis* of Am. auth. In sandy-gravelly soil on brushy slopes, in cedar brakes and palm groves, rarely in salt marshes, mainly along the coast and w. to the Trans-Pecos, Feb.-June; from Fla. w. to Calif. and Mex., n. to N.H.

Typical *P. floridana* has small suborbicular-ovate to broadly ovate leaves with the three main nerves rising at its truncate to rounded base. Our small-leaved coastal specimens referred to this species do not conform entirely since the lateral veins arise somewhat above the base of the leaf blade.

2. BOEHMERIA JACQ. FALSE NETTLE

Herbs, shrubs or small trees, devoid of stinging hairs, monoecious or dioecious; leaves opposite or alternate, stipulate; flowers clustered, axillary; *staminate flowers* minute, with a 4-parted calyx and 4 stamens; *pistillate flowers* with a tubular or urceolate entire or 2- to 4-toothed calyx enclosing the ovary; style filiform-subulate, persistent, stigmatic and papillose down one side; fruit formed by the dry accrescent calyx that closely invests the elliptic achene.

About 100 species mostly in tropical regions of both hemispheres.

- 1. Plant dioecious; leaves alternate; flowers in axillary or lateral compound clusters 1. *B. nivea*.
- 1. Plants monoecious; leaves opposite; flowers in glomerules on branches (2)
- 2(1). Leaf blades thinnish, coarsely serrate; petioles usually about as long as the blades 2. *B. cylindrica* var. *cylindrica*.
- 2. Leaf blades leathery, finely serrate; petioles much shorter than the blades 2. *B. cylindrica* var. *Drummondiana*.

1. *Boehmeria nivea* (L.) Gaud. RAMIE. Perennial shrubby plant to 3 m. high; stem and branches more or less woody; leaf blades broadly ovate, to 3 dm. long, the margins dentate, the upper surface rough, the lower surface densely white-pubescent; achene about 1 mm. long. *Ramium niveum* (L.) Small. In waste places and cult. soils and along roadsides in s.e. Tex., summer-fall; from Fla. to Tex., n. to S.C.

This species that produces the important fiber, ramie, is a nat. of Asia that has become introd. and naturalized in s. U.S.

2. *Boehmeria cylindrica* (L.) Sw. BOG-HEMP, FALSE NETTLE, BUTTON-HEMP. Perennial, usually dioecious, glabrous to pubescent or even scabrous, erect, to about 12 dm. high, the stem simple or rarely branched; leaves mostly long-petioled, opposite or rarely alternate, ovate to ovate-lanceolate or oblong-lanceolate, the blade to about 15 cm. long and 8 cm. wide, rather thin to leathery, smooth to scabrous, acuminate at apex, rounded to somewhat cordate at base, serrate, 3-nerved; stipules distinct; flowers about 2 mm. broad, unisexual, the two kinds sometimes intermixed, the small clusters densely aggregated in simple and elongated axillary spikes, the staminate spikes interrupted, the pistillate spike often continuous and frequently leaf-bearing at apex; fruit ovate to suborbicular, compressed, minutely winged, apiculate, hairy, to 1.5 mm. wide. In bogs, marshes, swamps, seepage areas and in wet soil and water along rivers and streams in sun or shade, mostly in e. Tex. but extending w. to Val Verde Co. in w. Edwards Plateau and n. to Hemphill Co. in the High Plains, June-Oct.; from Fla. to Tex., n. to Ont. and Que., w. to Minn., Neb. and Ill.

Those plants that are usually in more exposed situations than var. *cylindrica* and have

narrower, oblong-lanceolate, thicker leaves with petioles mostly 2 cm. or less long and harshly scabrous above and pubescent beneath are segregated as var. *Drummondiana* Wedd. (*B. scabra* Small). The leaves also are commonly recurved to give the plant a drooping appearance, and the fruiting spikes are more dense and thicker and the fruits larger than in var. *cylindrica*.

3. URTICA L. NETTLE

Annual or perennial herbs with stinging hairs, dioecious or monoecious; stem simple or branched; leaves opposite, petioled, dentate or serrate, stipulate; flowers clustered in geminate racemes or heads; staminate calyx deeply 4-parted and with 4 stamens; pistillate calyx with unequal sepals, the longer inner ones enclosing the flattened achene; stigma essentially sessile, tufted.

About 50 species of wide distribution, mostly in the North Temperate Zone.

1. Inflorescences distinctly branched (2).

1. Inflorescences simple, unbranched (4)

2(1). Plants annual; petioles mostly more than half as long as the usually ovate-elliptic blades, usually exceeding the inflorescences; distribution Rio Grande Valley ...
.....5. *U. chamaedryoides* var.

Runyonii.

2. Plants perennial; petioles mostly less than half as long as the elliptic-lanceolate to narrowly lanceolate blades, mostly shorter than the inflorescences; distribution Plains Country and Trans-Pecos region (3)

3(2). Plant usually densely pubescent throughout, without or with few scattered bristles; leaves mostly elliptic-lanceolate1. *U. Serra.*

3. Plant very sparsely pubescent to essentially glabrous and more or less bristly throughout; leaves mostly linear-lanceolate2. *U. gracilis.*

4(1). Plants coarse; inflorescences densely cylindric, mostly 2 cm. or more long; distribution in mountains of the Trans-Pecos region3. *U. gracilentata.*

4. Plants delicate; inflorescences usually capitata or only slightly ellipsoid, usually about 1 cm. long; distribution east of the Trans-Pecos region (5)

5(4). Cystoliths on upper leaf surface dense and pimply, minute, round, darkish; uppermost leaves not greatly different in size and shape from lower ones, the marginal teeth typically triangular with straight margins4. *U. urens.*

5. Cystoliths on upper leaf surface irregular and scattered, mostly linear-cylindric, whitish; uppermost leaves rather abruptly much-reduced from lower ones and narrowly lanceolate, the marginal teeth usually ovate-elliptic and with convex margins
.....5. *U. chamaedryoides* var.

chamaedryoides.

1. *Urtica Serra* Bl. Perennial 1-2 m. high, the stem stout, throughout nearly glabrous or with short-strigose pubescence and with scattered or no bristles; leaves with petioles that are about one third the length of the blade, ovate-lanceolate to elliptic-lanceolate, rounded to subcordate or cuneate at base, acuminate at apex, coarsely toothed, to 1 dm. long, sparsely strigose above but becoming glabrate with age, velvety-pubescent beneath with short fine hairs; flower clusters dense, much shorter than the leaves; achenes usually much shorter than the inner sepals, dull-olive-brown, sparsely papillate-roughened. *U. Brewerii* Wats. Low ground and stream banks in mts. of the Trans-Pecos, July-Oct.; from w. Tex. to Ut., s. Calif. and adj. Mex.

2. *Urtica gracilis* Ait. TALL WILD NETTLE. Slender perennial, to 1 m. high, mostly monoecious or very rarely dioecious; stem glabrous or somewhat setulose and sparingly pilose; leaves slender-petioled, lanceolate to linear-lanceolate, rounded to cuneate at base, glabrous on both surfaces or sparingly pilose beneath; leaves with petioles about one third to one fourth as long as blades, those subtending the lowest inflorescences to 15 cm. long, very coarsely toothed; stipules thin, narrowly lanceolate to linear, acuminate, greenish or stramineous, glabrous to pilose, very much shorter than petioles; inflorescences

usually forking, slender, mostly moniliform or interrupted. In thickets, springy places and along streams, in rich soil in the Plains Country and Trans-Pecos, June-Aug.; almost throughout temp. N.A.

This plant is closely allied to, if not conspecific with, *U. dioica* L. of Eurasia.

3. *Urtica gracilentata* Greene. Coarse annual, to 15 dm. high; stem stout, simple or sparingly branched from base or on upper part of stem, nearly glabrous to downy and with stinging bristles; petioles of the lower leaves more than half as long as to longer than the blades; leaf blades thin, broadly ovate (at least the lower ones), to 1 dm. long, often nearly as wide, cordate to subcuneate at the base; marginal teeth of leaves triangular to broadly triangular-ovate, narrowly obtuse to acuminate, sometimes with minute marginal teeth, directed only slightly upward; stipules small, lanceolate; racemes slender, cylindrical, to 4 cm. long at maturity, unbranched. In moist shaded canyons and on high mt. slopes in the Trans-Pecos, July-Oct.; also N.M. and Ariz.

4. *Urtica urens* L. BURNING NETTLE, DOG NETTLE, ORTIGA. Erect or ascending annual, to 6 dm. high, with stinging bristles; stem branching from base or occasionally simple; leaves with slender petioles about as long as or shorter than the blade or sometimes longer than the blade, suborbicular-ovate to ovate-oblong or elliptic, subcordate to cuneate at base, rounded to acute at apex, thin, essentially glabrous, to 4 cm. long and 3 cm. wide, deeply and sometimes doubly incised-serrate; cystoliths small, round; stipules oblong, 1-4 mm. long; flower clusters rather dense, mostly much shorter than the petioles; flowers white or pale-yellow, androgynous, mainly pistillate, both kinds mixed in the same clusters; fruiting calyx with hispid-ciliate margins; achene 2 mm. long. In sandy or clayey soils in open woodlands and waste places in the s. third of Tex., Feb.-Aug.; a nat. of Eur. that is widely distributed over much of N.A.

5. *Urtica chamaedryoides* Pursh. ORTIGUILLA. Slender annual to 7 dm. high, with spreading stinging bristles; stems erect, branched from base and sometimes with axillary branches on mainstems; leaves with petioles slender, about as long as or shorter than the blade, broadly ovate to elliptic-lanceolate or (on upper part of stem) narrowly lanceolate, obtuse to acute at apex, cordate to truncate or cuneate at base, thin, sometimes purplish on lower surface, the margin coarsely serrate, the marginal teeth usually rounded and with convex sides, to 6 cm. long and 4 cm. wide, usually much smaller; cystoliths mostly linear-cylindrical; stipules linear-lanceolate, 1-4 mm. long; flowers in globular heads that are usually supported by short slender peduncles that are much shorter than the subtending petioles, 2 to several in each axil. Among boulders in humus of wooded slopes, in bottomlands and on shell mounds and rocky slopes mainly in cen. and s. Tex., Feb.-July; from Fla. to Tex. and Mex., n. to W.Va., Ky., Mo. and Okla.

Those plants found in extreme south Texas whose leaves have large, more triangular, teeth and whose inflorescences are typically cylindrical and often branched, are segregated as var. *Runyonii* Correll.

This species and the Old World *U. urens* are superficially very similar. However, besides the difference in the shape of the cystoliths noted in the key, the upper leaves of this species, that are greatly and usually abruptly reduced, are typically narrowly lanceolate while the gradually and less reduced upper leaves of *U. urens* are typically elliptic to rhombic-elliptic. The teeth of the leaves of this species also tend to be more rounded than the more triangular teeth of *U. urens*. Several collections, especially from north-central Texas, show evidence of possible introgression with *U. urens*.

4. PILEA LINDL.

RICHWEED. CLEARWEED

About 400 species, mainly in the tropics.

1. *Pilea pumila* (L.) Gray. Low annual to 7 dm. high, usually much smaller, simple to bushy-branched, the bases of large plants decumbent, essentially glabrous throughout; leaves opposite, with petioles about one third as long as to longer than the blade, to 15 cm. wide, lustrous, translucent, ovate, rounded to cuneate at base, with a conspicuous linear entire apex, with as many as 17 coarse rounded teeth on each margin, when dried the surface covered with small whitish lines (cystoliths), the primary nerves rising from base and narrowly winged; flowers unisexual, green or whitish, in axillary cymes to 3 cm. long; *staminate flowers* with 3 or 4 sepals and stamens, often mixed with the *pistillate*

flowers; calyx of *pistillate* flowers deeply 3-parted, each of the unequal segments subtending a concave scalelike staminodium; ovary free, with a sessile stigma; fruit a compressed thin-walled achene that is subtended by the persistent calyx, ovate, pale green, smooth and unspotted or with purple markings, 1.3-2 mm. long. *Adicea pumila* (L.) Raf. In moist or wet rich soils of woods, especially in seepage and along streams, in e. Tex., June-Nov.; from e. Can. and N.E., s. to Fla. and Tex., w. to S.D., Ia. and Kan.

Most of our material is referable to var. *Deamii* (Lunell) Fern. which is more southern in distribution than var. *pumila*, and has leaves more rounded at the base and with 11 to 17 teeth on each margin, whereas the largest leaves of var. *pumila* are mostly cuneate at the base and have only 3 to 11 teeth on each margin.

FAM. 56. VISCACEAE MIQ.⁴³

MISTLETOE FAMILY

Plants shrubby or herbaceous, aerial parasites on other seed plants, pubescent or glabrous, monoecious or dioecious; stems evergreen, usually forked, brittle and much-branched, with generally swollen and articulated nodes; leaves opposite, simple, entire, evergreen or sometimes reduced to scales; flowers minute (about 2 mm. or less long), monochlamydeous (corolla absent), unisexual, solitary or clustered at the nodes or in axillary spikes or cymes; perianth segments 2 to 4, valvate; *staminate* flowers with stamens opposite, adnate or free and equal in number to the tepals, sometimes with a vestigial style; pollen spherical; *pistillate* flower with a simple style and terminal stigma; ovary inferior, 1-celled and without ovules, the embryo sac originating from a short placental column; fruit baccate, with a viscous layer and persistent tepals.

A family of about 11 genera and 450 species, found on all continents but with the greatest development in tropical and subtropical regions. Two genera occur in the contiguous United States.

1. Plants yellow-green to orange, leafless parasites on pines, usually less than 2 dm. tall; stems generally angled; anthers 1-celled, with a flattened ringlike pollen chamber surrounding a central nonsporogenous connective; pistillate flowers usually with 2 perianth segments; fruit greenish or purplish with a distinct transverse median line, at maturity pedicellate, reflexed, compressed and explosive . . .
 1. *Arceuthobium*, p. 503.

1. Plants green, with or without foliaceous leaves, usually over 2 dm. tall; stems terete; anthers 2-celled, upright, without an obvious connective; pistillate flowers usually with 3 perianth segments; fruit white or pinkish, without a distinct transverse median line, at maturity sessile, erect, not compressed or explosive
 2. *Phoradendron*, p. 504.

1. ARCEUTHOBIUM BIEB.⁴⁴

DWARF MISTLETOE

Shrubs or herbs parasitic on coniferous trees, glabrous, angled (at least when young), dioecious; stems variously colored from greenish-yellow to orange, reddish and black, not deciduous, without central xylem cylinder; leaves reduced to minute opposed connate scales; flowers decussate on young shoots, 2-3 mm. across; *staminate* flowers with perianth segments 3- or 4-merous, bearing a sessile 1-celled circular anther at the base of each perianth segment; *pistillate* flower manifestly epigynous, with one style; perianth segments persistent, adate to ovary, 2-merous; ovary 1-chambered; fruit an ovoid berry, 1-seeded, mucilaginous and bicolored (distal and basal portions of different shades), explosive at maturity.

A group of approximately 28 species mostly in the western United States and Mexico; three species in the Old World.

⁴³ Heretofore the American mistletoes have been placed in the family Loranthaceae, which was subdivided into two subfamilies, the Loranthoideae and Viscoideae. These subfamilies have recently been formally raised to family status by Bryan Barlow. The family diagnosis and key to genera supplied by Delbert Wiens.

⁴⁴ Contributed by F. G. Hawksworth and Delbert Wiens.

- 1. Parasite on *Pinus ponderosa*; largest shoots over 3 mm. in diameter at base, orangish
1. *A. vaginatum* subsp. *cryptopodum*.
- 1. Parasite on pinyon pines; largest shoots less than 3 mm. in diameter at base, greenish-yellow to brownish2. *A. divaricatum*.

1. *Arceuthobium vaginatum* (Willd.) J. Presl subsp. *cryptopodum* (Engelm.) Hawksworth & Wiens. Bush to 3 dm. thick; stems nonglaucous, generally orange; basal internodes 10-15 mm. long, 3-5 mm. thick; staminate flowers 3- (sometimes 4-) merous, about 3 mm. across; mature fruits 4-5 mm. long. Incl. f. *cryptopodum* (Engelm.) Gill, *A. robustum* Engelm. Parasitic on *Pinus ponderosa* in the Davis and Guadalupe Mts. (not known for the Chisos Mts. although it is common in the nearby Sierra del Carmen in Coah.), May-June; Ut. and n. Colo., s. to Son., Chih. and Coah.; other subsp. occur in Mex.

2. *Arceuthobium divaricatum* Engelm. Bush to 2 dm. thick; younger shoots glaucous, older portions nonglaucous; shoots greenish to brown, older portions darker; basal internodes 7-10 mm. long, 2-3 mm. thick; staminate flowers 3- or 4-merous, 2-3 mm. across; mature fruits 3-4 mm. long. *A. campylopodum* f. *divaricatum* (Engelm.) Gill. Parasitic on *Pinus edulis* and *P. cembroides* in the Davis Mts., Aug.-Sept.; Calif., Ut. and Colo., s. to Baja Calif., s. Ariz. and s. N.M.

2. PHORADENDRON NUTT.⁴⁵ MISTLETOE

Shrubs parasitic on other woody plants, dioecious (in Texas species); leaves (and sometimes stems) chlorophyllous, opposite, evergreen, either well-developed or reduced to connate scales in some species; flowers unisexual, about 2 mm. across, borne in spike-like or thin-cylindrical axillary inflorescences from a few mm. to a few cm. long, with the flowers sunken in the rachis; perianth segments 3- (rarely 2- or 4-) merous, distinct, deltoid, scalelike, persistent, seldom erect and never spreading; *staminate flower* bearing a sessile 2-celled anther at base of each perianth segment; *pistillate flower* manifestly epigynous, with 1 style, the perianth segments persistent; ovary 1-chambered; fruit a small drupe (but without an obviously indurated endocarp), 1-seeded with a glutinous mucilaginous mesocarp, usually whitish.

A New World genus of wide distribution, but primarily tropical, with about 250 species.

- 1. Pistillate inflorescence usually with 1 segment and 2 flowers; internodes usually less than 2 cm. long; leaves either reduced to inconspicuous scales or well-developed, usually less than 25 mm. long or 5 mm. broad; parasitic on juniper and cypress (2)
- 1. Pistillate inflorescences with 2 or more segments and more than 2 flowers per segment; internodes generally over 2 cm. long; leaves well-developed and broad, usually more than 25 mm. long and 10 mm. broad; parasitic on dicotyledons (4)
- 2(1). Leaves reduced to connate scales about 1 mm. long1. *P. juniperinum*.
- 2. Leaves clearly developed and usually more than 5 mm. long (3)
- 3(2). Anthesis from December through February; plants stellate-pubescent2. *P. capitellatum*.
- 3. Anthesis from June through September; plants glabrous or young tissues only slightly puberulent3. *P. Bolleanum* subsp. *Hawksworthii*.
- 4(1). Anthesis from approximately July through September; fruit pubescent, at least with a ring of short hairs below the calyx; plants densely stellate-pubescent at apices (moderately so on older parts), often appearing frosty; parasitic almost exclusively on *Quercus*4. *P. villosum* subsp. *Coryae*.
- 4. Anthesis from November through March; fruit glabrous; plants glabrous or glabrate, sometimes parasitic on *Quercus* but common on *Celtis*, *Fraxinus*, *Platanus*, *Populus*, *Prosopis*, *Salix*, *Ulmus*, etc.5. *P. tomentosum*.

⁴⁵ Contributed by Delbert Wiens.

1. *Phoradendron juniperinum* Gray. Small bush to 4 dm. thick; stems at maturity woody at base, glabrous; internodes 5-12 mm. long; leaves reduced to scales about 1 mm. long, often finely ciliate; *staminate* inflorescence with 1 or 2 segments, the individual segments with 5 to 9 flowers; *pistillate* inflorescence with 1 segment and 2 flowers; fruit white to pinkish, 4 mm. thick. On *Juniperus* in the Chisos, Davis and Guadalupe Mts. (also on *Cupressus* in the Chisos Mts.) of the Trans-Pecos, July-Sept.; Ore., Ut. and Colo., s. to Mex.; another subsp. known from the Pac. Coast.

2. *Phoradendron capitellatum* Trel. Bush to 6 dm. thick; stems at maturity becoming woody at base; internodes 5-15 mm. long, glabrate; leaves oblanceolate-linear, 8-14 mm. long, 1-2 mm. broad, acute or obtuse at apex, attenuate or sessile at base, the venation inconspicuous; blades densely stellate-pubescent when young to lightly stellate-pubescent in age; inflorescence moderately stellate-pubescent; *staminate* inflorescences with 1 to 3 segments, individual segments with 6 to 15 flowers; *pistillate* inflorescences with 1 or 2 segments, individual segments with 2 or 3 flowers; fruit pinkish-white, about 3 mm. thick. *P. Bolleanum* var. *capitellatum* (Trel.) Kearn. & Peeb. On *Juniperus*, reported from "w. Texas," Dec.-Feb.; s. N.M., w. Tex., Chih. and Son.

3. *Phoradendron Bolleanum* (Seem.) Eichler subsp. *Hawksworthii* Wiens. Bush to about 25 cm. thick; stem bases becoming woody at maturity, glabrous or slightly puberulent on younger portions; internodes 6-12 mm. long; leaves oblanceolate-linear, subsessile, 6-25 mm. long, 1.5-3 mm. broad, obtuse to rounded at apex, often subterete, the venation inconspicuous; *staminate* inflorescence with 1 segment and 3 to 6 flowers; *pistillate* inflorescence with 1 segment and 2 flowers; fruit white to pinkish, 4 mm. thick, glabrous. In mts. of the Trans-Pecos, on *Juniperus*, July-Sept.; other subspecies occur in the mts. of w. U.S., and n. Mex.

Subsp. *densum* (Trel.) Wiens is not presently known from Texas, but it occurs in the adjoining Sierra del Carmen in Coahuila; it is distinguishable from subsp. *Hawksworthii* by its wider (usually over 2 mm.), more flattened leaves, and increased number of flowers (6 or more) per segment on the staminate inflorescence.

4. *Phoradendron villosum* (Nutt.) Nutt. subsp. *Coryae* (Trel.) Wiens. Bush to about 1 m. thick, most parts densely whitish-stellate-pubescent at apices, moderately so on older parts; stems at maturity becoming generally woody; internodes 15-38 mm. long; leaves obovate-elliptic to orbicular, 13-27 mm. long, 1-2 cm. broad, rounded to acute at apex, subtruncate to acute at base, the veins usually inconspicuous or occasionally evident on lower surface; inflorescences densely stellate; *staminate* inflorescences with 2 to 5 segments, individual segments with 14 to 45 flowers; *pistillate* inflorescences with 2 or 3 segments, individual segments with 6 to 12 flowers. *P. Coryae* Trel., *P. Harvardianum* Trel. On *Quercus* species in the Chisos, Davis and Guadalupe Mts. of the Trans-Pecos, July-Sept.; Ariz., Chih., Coah., N.M. and Tex.; other subsp. occur in w. U.S. and Mex.

5. *Phoradendron tomentosum* (DC.) Gray. INJERTO. Bush to 1 m. or more thick, most parts glabrate, the younger parts often densely short-stellate-pubescent; internodes 8-59 mm. long; leaves elliptical-obovate to orbicular, 16-48 mm. long, 9-29 mm. broad, obtuse-rounded at apex, rounded to attenuate at base, the veins evident to obscure; petioles 2-4 mm. long or obsolescent, often more densely pubescent than the blade; *staminate* inflorescence with 2 to 7 segments, individual segments with 15 to 60 flowers; *pistillate* inflorescence with 2 to 6 segments, individual segments with 6 to 20 flowers; fruit white, 4-6 mm. thick, essentially glabrous. Our most abundant mistletoe, found on a variety of woody plants but usually on *Celtis*, *Fraxinus*, *Platanus*, *Populus*, *Prosopis*, *Quercus* and *Salix*. Widely distributed in the state and represented with us by 2 subsp. as follows:

Subsp. *tommentosum*: Plant moderately to densely short-pubescent, especially on the younger parts, becoming moderately to lightly so on older parts; internodes 8-39 mm. long; leaves obovate-elliptic, 16-40 mm. long, 9-22 mm. broad; inflorescences moderately to densely pubescent; *staminate* inflorescences with 2 to 6 segments, individual segments with 15 to 42 flowers; *pistillate* inflorescence with 2 to 6 segments, individual segments with 6 to 11 flowers. *P. flavescens* of auth., *P. serotinum* var. *pubescens* (Engelm.) M. C. Johnst. Trans-Pecos, Edwards Plateau, Rio Grande Plains and Plains Country, late Nov.-Mar.; from Tex. n. to Okla., s.e. Kan., e. Ark. and La., s. to Coah., N.L., Dgo. and Tam.; plants becoming glabrate in e. Tex. and perhaps conspecific with *P. serotinum* (Raf.) M. C. Johnst. which occurs farther east.

Subsp. *macrophyllum* (Engelm.) Wiens. Plants glabrous (in Tex.) or glabrate; internodes 22-59 mm. long; leaves obovate, to elliptic-orbicular, 23-48 mm. long, 15-29 mm. broad; inflorescences subglabrous to moderately short-pubescent; *staminate* inflorescence with 2 to 7 segments, individual segments with 15 to 60 flowers; *pistillate* inflorescence with 2 to 5 segments, individual segments with 6 to 20 flowers. Primarily on *Populus*, along the Rio Grande from El Paso to vicinity of Presidio, Dec.-Mar.; Calif., Baja Calif., Ariz., N.M., Tex., Coah., Chih. and Son.

FAM. 57. SANTALACEAE R. BR. SANDALWOOD FAMILY

Trees, shrubs, herbs and subherbs (in ours) with simple exstipulate leaves and regular flowers commonly in racemes, panicles or corymbose clusters, sometimes parasitic; perianth 4- to 5-cleft, valvate in bud, its tube coherent with the 1-celled inferior ovary; stamens borne on a fleshy disk in the perianth tube; pistil one; ovules 2 to 4, suspended from the apex of a stalklike free central placenta that rises from the base of the cell; fruit an indehiscent 1-seeded nutlet that is crowned by the persistent perianth lobes.

Several hundred species in about 30 genera in Eurasia and North America.

I. COMANDRA NUTT. BASTARD TOAD-FLAX

Characters of the family. Plant a root-parasite; leaves alternate; flowers perfect. About 5 species in North America and Europe.

1. *Comandra pallida* A. DC. Plant herbaceous but perennial, to 3 dm. tall; stems arising at intervals from a slender underground stoloniferous rootstock, simple or frequently with widespreading branches, leafy throughout; leaves linear to linear-lanceolate, entire, acute, firm, usually glaucous, to about 2 cm. long and 3 mm. wide; flowers white and pink, in corymbose clusters; perianth segments petaloid, elliptic-lanceolate, marginally ciliolate, 3-4 mm. long, with a tuft of long erect hairs arising below the middle on the inner surface; fruit ovoid to subglobose, about 8 mm. long, green becoming yellowish. On dry breaks and hills, deep sandy soil, rocky grassy slopes and plains, frequent in the Plains Country, rare e. to Cooke Co. in n.-cen. Tex., Apr.-June; from Man. to B.C., s. to Minn., Tex., N.M. and Ariz.

This species is known to parasitize a number of species in many different plant families.

FAM. 58. ARISTOLOCHIACEAE JUSS.⁴⁰ BIRTHWORT FAMILY

Twining shrubby vines or low herbs; leaves essentially sessile to petioled, exstipulate, mostly cordate at base and entire; flowers perfect, 3-merous, regular or irregular (in ours); calyx conspicuous, usually bizarre in shape and lurid in color, valvate in bud and coherent (at least at base) to the 6-celled ovary; corolla absent or vestigial; stamens 6 in ours, more or less united with the style; anthers adnate, extrorse; fruit a capsule or berry, many-seeded; seeds anatropous.

About 400 species in 7 genera, mostly tropical.

I. ARISTOLOCHIA L. BIRTHWORT. TACOPATE

Perennial herbs or vines; leaves alternate, sessile or petiolate, palmately veined; flowers perfect, irregular, solitary or fascicled in the axils of the leaves, the perianth 3-merous; calyx tubular, corollalike, S-shaped or U-shaped, more or less 3-lobed at summit or straight and with a single unilateral terminal lobe, with or without a utriculus on the convex side of the unpaired limb segment; stamens 6; anthers sessile and adnate to the

⁴⁰ Adapted partly from Howard W. Pfeifer in Ann. Missouri Bot. Gard. 53: 115-196. 1966.

3- to 6-lobed style; ovary wholly adnate or partially inferior; style short and stout; fruit a septicidal 6-lobed or 6-angled capsule that opens from the base or from the apex; seeds numerous, horizontal, flat or concave-inflated.

About 350 species of wide distribution. Some species are highly ornamental. Some recent authors have, with apparent good reason, followed Rafinesque in segregating the species in our region into three genera. We have maintained the traditional treatment.

1. Erect herbs; flowers borne at the base of the stem in the lowermost leaf axils; capsule always open from the top with the valves spreading (2)
1. Twining vines or viney plants with weak spreading or trailing stems; flowers borne in the leaf axils on the upper part of the stem; capsule opening from the bottom or irregularly (4)
- 2(1). Leaves essentially sessile and clasping, firm and thickish, prominently reticulate-veined beneath; plant manifestly pubescent with stiff spreading hairs 1. *A. reticulata*.
2. Leaves petioled, thin and herbaceous, not prominently reticulate-veined; plant sparingly pubescent with soft hairs (3)
- 3(2). Leaves ovate to ovate-oblong, not conspicuously hastate, typically 30 mm. wide or more; capsule usually about 10 mm. long 2. *A. Serpentaria*.
3. Leaves narrowly triangular to lanceolate, conspicuously hastate, typically 25 mm. wide or less; capsule mostly 6 mm. long or less 2. *A. Serpentaria* var. *hastata*.
- 4(1). Coarse high-climbing twining vine; leaves broadly rounded, mostly more than 1 dm. wide; plants in eastern third of Texas 3. *A. tomentosa*.
4. Small spreading plants with slender nontwining stems; leaves not as above, less than 1 dm. wide; plants in western two thirds of Texas (5)
- 5(4). Leaves linear to narrowly lanceolate, tapering at base; plants of sandy soils in south Texas 4. *A. longiflora*.
5. Leaves typically triangular-ovate, with a broad sinus and somewhat auriculate at base (6)
- 6(5). Leaves thin, more than 4 cm. long, essentially glabrous; on alluvial soils of the Rio Grande Valley 5. *A. Marshii*.
6. Leaves thickish, rarely to 4 cm. long, mostly pubescent; in rocky areas in the Edwards Plateau and Trans-Pecos regions (7)
- 7(6). Limb of calyx broadly elliptic to suborbicular; plants villous to villous-hispidulous 6. *A. Coryi*.
7. Limb of calyx lanceolate to linear-lanceolate and attenuate; plants usually somewhat velvety and tawny (8)
- 8(7). Calyx 6-7 cm. long 7. *A. Wrightii*.
8. Calyx 3.5-4 cm. long 7. *A. Wrightii* var. *texana*.

1. *Aristolochia reticulata* Nutt. TEXAS DUTCHMAN'S-PIPE. Perennial from a slender fibrous-rooted rootstock, to 4 dm. high; stems usually several, erect or decumbent, angled, simple or branched below, zigzag, hirsute; leaves few, bright-green, nearly sessile and clasping, oblong to oval or broadly ovate, firm, obtuse to subacute at apex, to 12 cm. long and 65 mm. wide, often undulate, prominently reticulate-veined beneath, more or less pubescent along the veins on both sides; inflorescence a several-flowered bracted raceme that arises from the lowest nodes of the stem, often covered by fallen leaves; bracts ovate to suborbicular; perianth dark-brown, pubescent, 8-10 mm. long; anthers shorter than the broad trilobate style; capsule reddish-brown, prominently 6-angled, subglobose, to about 15 mm. in diameter; seeds deeply concave, adorned with minute grayish irregularly shaped tubercles on the rounded face, ovate-cordate in outline, about 5 mm. long. In humus of pine-hardwood forests, pine-savannahs and rocky woodlands in e. Tex., May-July; also w. La. and s.w. Ark.

This species would be placed in the segregate genus *Endodeca* along with *A. Serpentaria* if this genus were divided. The basal inflorescences, peculiar seeds and habit of the plant are the obvious common characteristics of these two species.

2. *Aristolochia Serpentaria* L. VIRGINIA DUTCHMAN'S PIPE, VIRGINIA SNAKE-ROOT. Plant a herbaceous perennial, to 6 dm. tall, thinly pubescent; stems erect, slender, from a knotty rhizome; leaves slender-petioled, thinnish, ovate to ovate-oblong or narrowly lanceolate, cordate to hastate or sagittate at the base, acuminate at apex, to 15 cm. long and 8 cm. wide, reduced to scales below; flowers solitary on short slender scaly peduncles that arise from the lowest nodes of the stem and are to 8 cm. long; perianth strongly curved, 1-2 cm. long, pubescent, deep-purple to brownish; limb broad, flaring, madder-purple, obtusely 3-lobed; capsule ellipsoid to subglobose, to 13 mm. in diameter; seeds obovoid, 4-5 mm. long, adorned with minute scattered papillae on the face. *Endodeca Serpentaria* (L.) Kl. In moist or dry upland woods, about ledges and on wooded rocky slopes on the Edwards Plateau and in e. Tex., Apr.-June; from Tex. to Fla., n. to Mo., Ill., s. N.Y. and Conn.

Plants with extremely narrow sagittate leaves, especially common in the south, are usually segregated as var. *hastata* (Nutt.) Duchartre (*A. hastata* Nutt.)

3. *Aristolochia tomentosa* Sims. WOOLLY DUTCHMAN'S PIPE, PIPE-VINE. A high-climbing woody twining vine, to 25 m. long or more, more or less densely white-pubescent throughout (especially when young); leaves petioled, ovate to broadly orbicular-reniform, cordate at base, broadly rounded at apex, densely tomentose beneath, to 2 dm. long and wide; peduncles axillary, solitary or paired, downy, bractless; perianth about 4 cm. long, densely tomentose, with an oblique dark-purple orifice and a rugose reflexed yellowish or greenish-yellow 3-lobed limb; capsules cylindrical, to about 8 cm. long and 3 cm. in diameter; seeds triangular, flat, grayish, about 1 cm. long. *Isotrema tomentosa* (Sims) H. Huber. In shaded areas along streams, in bottomland forests along rivers and in post oak woods in n.-cen. and e.-cen. Tex., Mar.-May; from Fla. to Tex., n. to Okla., Mo., Ill. and N.C.

4. *Aristolochia longiflora* Engelm. & Gray. SWAN-FLOWER. Plant a low perennial, ascending to spreading or often entirely prostrate, to about 25 cm. across, from a long aromatic rootstock; stems elongated, slender, with short internodes, somewhat pubescent; leaves short-petioled, mostly linear-elongated to setaceous, often with a few oblong-lanceolate, all with base and apex acute, to 13 cm. long and 15 mm. wide, scarcely pubescent above, glabrate below; perianth with a short tomentose peduncle, elongated, to about 1 dm. long and 1 cm. wide; tube more or less arcuate, mauve, to about 3 cm. long, the orifice grayish; limb linear to narrowly lanceolate, obtuse to acute at the narrow apex, to about 7 cm. long, purplish-brown; capsule obovoid-subquadrate, glabrous, about 2 cm. long; seeds dark brown, triangular, about 5 mm. long. In hard packed sandy silt and in sandy loam in open grassy areas or in shade in s. Tex., Mar.-Nov.; also in adj. Mex.

5. *Aristolochia Marshii* Standl. Herbaceous twining vine; stem slender, simple or branched, sparsely pilose with short lax hairs, the internodes elongated; leaves thin-herbaceous, with a slender petiole 1-3.5 cm. long, triangular-ovate and entire to deeply 3-lobed almost to the base, to 9 cm. long and 75 mm. wide, deeply cordate at the base, the sinus wide open, green above with sparse short hairs, somewhat paler beneath, slightly pilose on the nerves and between the nerves puberulent to glabrous, 5-nerved at the base, the terminal lobe narrowly oblong and gradually attenuated from the base to the apex, the much smaller semioval lateral lobes obtuse; flowers axillary, solitary, the hirsute peduncle 5-10 mm. long; bracts linear-lanceolate to lanceolate, acute, about 1 cm. long; perianth reddish-purple, about 35 mm. long, shortly hirsute; utricle obovoid, 6-8 mm. long; tube nearly upright, 5-10 mm. long; limb 2-3 cm. long, triangular-lanceolate, more or less auriculate at base, narrowly attenuated to the obtuse apex, to about 1 cm. wide at base, the margins incurved. In alluvial soil in the Rio Grande Valley, spring-summer; also Coah.

6. *Aristolochia Coryi* I. M. Johnst. Prostrate perennial herb that arises from a deep fusiform succulent root; stems many, slender, often with elongated branches towards the base, to 4 dm. long and 1.5 mm. thick, sparsely hispidulous-villous; leaves green, with petioles to 25 mm. long, triangular to triangular-ovate in outline, obtuse to acute at apex, conspicuously auriculate as to be 3-lobed, to 5 cm. long and 4 cm. wide, usually much smaller, with ciliolate margins, more or less sparsely and inconspicuously villous to villous-hispidulous, the large rounded divergent auricles separated by a broad sinus and to 15 mm. long and 1 cm. wide; flowers solitary in leaf axils, on peduncles to 8 cm. long, subtended by a foliaceous ovate bract; perianth 2-3.5 cm. long, brownish or

brownish-purple marked with yellow, more or less minutely villous; utricle to 7.5 mm. long and 6 mm. wide, somewhat asymmetrical, glabrous within; tube lightly falcate-arcuate, to 15 mm. long and 3 mm. wide, bearing hairs within above the middle; limb to 18 mm. long and 1 cm. wide, broadly and obliquely elliptic to suborbicular; capsule shortly stipitate, angular, elliptic to obovoid or depressed-globose, to 2 cm. long and 15 mm. wide; seeds blackish-brown, flat and triangular, about 6 mm. wide. *A. brevipes* and its var. *acuminata* of auth. In crevices of ledges and cliffs, on rim rock and rocky slopes in the Edwards Plateau and s. Trans-Pecos, Apr.-Sept.; also n. Mex.

The broadly elliptic to suborbicular limb of the tube readily distinguishes this species from the vegetatively similar *A. Wrightii*.

7. *Aristolochia Wrightii* Seem. Prostrate perennial herb that is very similar in appearance and habit to *A. Coryi*, the entire plant usually somewhat velvety and tawny; leaves broadly ovate-triangular to subreniform in outline, with broad rounded auricles and an obtuse to acute apex, to about 4 cm. long and wide; perianth 3.5-7 cm. long; utricle to about 6 mm. long and 3 mm. wide; tube almost straight to only slightly curved, to about 12 mm. long and 3 mm. wide; limb to 45 mm. long and 1 cm. wide across the auriculate base, lanceolate to linear-lanceolate and often attenuate to a pointed apex; capsule shortly stipitate, angular, subglobose-quadrant, 10-15 mm. long and wide; seeds blackish, triangular, lightly emarginate at apex, flat, about 5 mm. wide. *A. brevipes* var. *Wrightii* (Seem.) Duchartre. On walls of canyons, among boulders and on rocky hills in the mts. of the Trans-Pecos, Mar.-June; also n. Mex.

Those plants, more frequent with us, whose perianths are 3.5-4 (not 6-7) cm. long, are segregated as var. *texana* I. M. Johnst.

Aristolochia Watsonii Woot. & Standl., of New Mexico and Arizona, has been reported from west Texas but we have seen no material from the state. It is similar in habit to *A. Coryi* and *A. Wrightii* but its subtomentose leaves are much narrower and more elongated than in those species, being to 85 mm. long, and the basal lobes are very much narrower and more elongated.

FAM. 59. RAFFLESACEAE DUM.

RAFFLESIA FAMILY

Fleshy parasitic plants on the roots, stems or branches of various trees and shrubs; leaves scalelike, inconspicuous, only a few of them subtending the flower outside tissue of host plant; flowers minute (in ours) to very large, solitary or rarely spicate, rarely perfect, usually unisexual by abortion; calyx somewhat epigynous with 4 to 10 imbricate or less commonly valvate segments, similar to subtending scales (in ours); anthers sessile, arranged in 1 to 3 series around a fleshy central column, the latter expanded at apex into a fleshy disk; pistillate flowers with a ring-shaped stigma around the margin of a fleshy disk surmounting the column; ovary inferior, 1-celled, with several placentae extending inward almost to center; ovules numerous, with a single integument; seeds minute, numerous.

About 50 species in 8 genera, primarily in the tropics. It is of interest that the family to which our tiny plant belongs includes a plant that has the largest of all known flowers, *Rafflesia Arnoldii* R. Br., a native of Malaysia.

1. PILOSTYLES GULL.

Characters of the family. About 20 species, mostly in the American tropics, but also in Africa, Persia and Australia.

1. *Pilostyles Thurberi* Gray. Vegetative part of plant entirely imbedded in the stems and branches of host plant, only the small brownish flowers with their subtending scales exerted from the bark of the host plant; floral bracts 4 to 7, broadly ovate to suborbicular, 1-1.5 mm. long, fleshy at the broad base, gradually thinner toward apex, irregularly erosulate along the margins; flowers solitary on fleshy peduncles to 1.5 mm. long, unisexual, with 4 or 5 distinct obovate yellowish perianth segments about 1.5 mm. long that are similar to the subtending bracts, with a thick central column expanded at apex into a fleshy disk (about 1 mm. in diameter) that bear under its margin the anthers in

staminate flowers and the ring-shaped stigma in pistillate flowers; ovary inferior; capsule many-seeded. *P. Covillei* Rose. Parasitic on *Dalea formosa* and *D. frutescens* in our area, mostly in w.-cen. and n.w. Tex., May-July; from Tex. to Calif. and n. Mex.

FAM. 60. POLYGONACEAE JUSS. KNOTWEED FAMILY

Caulесcent or rarely аcaulescent herbs or herbaceous vines; leaves alternate or rarely opposite or whorled, the blades entire or rarely lobed or toothed; petioles usually present; stipules (ocreae) present, usually sheathing the nodes, variously long-sheathing or short-sheathing or sometimes deeply or shallowly lobed and sometimes fringed, rarely seemingly absent (*Eriogonum*; *Brunnichia*); flowers small, hypogynous, perfect or unisexual, usually in racemes or in involucrate clusters, sometimes solitary at the nodes; calyx of 2 to 6 usually nearly entirely separate sepals, sometimes developing keels or wings, often corolla and whitish or pinkish; corolla absent; stamens 2 to 9, the filaments often dilated basally; anthers 2-celled, each cell with a longitudinal slit; ovary 1-celled, usually trigonous (3-carpellate) or less commonly lenticular (when one of the carpels is suppressed); styles 3 or 2, usually not much united; ovule solitary, orthotropous; endosperm horny or mealy, usually copious; fruit a trigonous or lenticular achene, usually falling still covered by the remains of the calyx and androecium.

A widely distributed family of about 35 conservative genera or upwards of 45 narrowly drawn ones. Some of the species are good honey plants. The Buckwheat, *Fagopyrum sagittatum* Gilib., is a member of this family; it does not do well in cultivation so far south as Texas, but has been grown in experimental plots.

- 1. Vines with tendrils; endosperm ruminant (2)
- 1. Herbs or if vines then tendrils absent; endosperm not ruminant (3)
- 2(1). Flowers rose-color or white6. *Antigonon*, p. 526.
- 2. Flowers greenish or yellowish7. *Brunnichia*, p. 527.
- 3(1). Flower or flower clusters in involucre of whorled partially united bracts; stamens 9; ocreae absent1. *Eriogonum*, p. 510.
- 3. Flowers not so borne, the bracteal leaves when present always solitary; stamens 4 to 8; ocreae present though in some species reduced (4)
- 4(3). Sepals of widely disparate size, the outer ones not enlarged, the 3 inner ones erect and greatly enlarged in fruit; stigmas peltate, tufted2. *Rumex*, p. 516.
- 4. Sepals not greatly disparate in size at fruiting time; stigmas not tufted (5)
- 5(4). Branches appearing to emerge from internodes due to a brief coalescence of the lower parts of the branch and the stem internode; plants heathlike with very short internodes and minute leaves3. *Polygonella*, p. 519.
- 5. Branches emerging directly from nodes (6)
- 6(5). Flowers not in terminal spikelike or racemelike inflorescences or if so then a joint (zone of abscission) present between blade and petiole or else the plants vinelike4. *Polygonum*, p. 519.
- 6. Flowers in terminal spikelike or narrowly racemelike inflorescences; blades never jointed to petioles; styles never indurate and persistent or if so less than 0.5 mm. long; plants often aquatic or semiaquatic, never vinelike5. *Persicaria*, p. 523.

I. ERIOGONUM MICHX.⁴⁷ WILD BUCKWHEAT

Annual, biennial or perennial herbs, subshrubs or shrubs, with basal or cauline alternate exstipulate entire leaves; inflorescences simple to compound, umbellate, cymose or racemose, subtended by scalelike or foliaceous whorled bracts; perianth white, red, purple or yellow, glabrous to glandular or pubescent, 6-merous in two whorls of threes, stipitate or not stipitate on pedicels that exert the flowers from the sessile or peduncled

⁴⁷ Contributed by James L. Reveal.

turbinate to campanulate 4- to usually 5- or 10-lobed or -toothed involucre; stamens 9, the filaments usually pilose at the base; achenes glabrous or tomentose, winged in some, 3-angled; embryos straight or curved in mealy endosperm.

About 225 species, mainly in western North America.

1. Plants perennial (Doubtful cases should be keyed under both alternatives) (2)
1. Plants annual or biennial (16)
- 2(1). Perianth stipitate (3)
2. Perianth not stipitate (5)
- 3(2). Plants tall and erect, leafy; perianth and achenes densely white- to silvery-tomentose; throughout much of Texas 6. *E. longifolium*.
3. Plants low and spreading; bracts foliaceous; perianth sparsely pubescent; achenes glabrous or only sparsely pubescent (4)
- 4(3). Perianth cream-color to greenish-white, often becoming pinkish-orange in fruit; north and west Texas 7. *E. Jamesii*.
4. Perianth bright-yellow or greenish-yellow; Texas Panhandle 8. *E. Correllii*.
- 5(2). Perianth glabrous externally (6)
5. Perianth not glabrous externally (11)
- 6(5). Tall erect herbs; achenes not winged, 4-9 mm. long (7)
6. Low spreading subshrubs; achenes not winged, less than 4 mm. long (8)
- 7(6). Plants from deep taproots, the roots often chambered; leaves glabrous except for the midveins and margins; achenes winged the entire length, 5-9 mm. long; north and west Texas 1. *E. alatum*.
7. Plants from branching woody spreading caudices; leaves strigose on both surfaces; achenes winged at the apices, 4-6 mm. long; central Texas 2. *E. Nealleyi*.
- 8(6). Calyx segments similar (9)
8. Calyx segments dissimilar (10)
- 9(8). Leaves 5-20 mm. wide, subglabrous to glabrous above; inflorescences cymose; northwest Texas 11. *E. Fendlerianum*.
9. Leaves 1-3 mm. wide, densely tomentose above and below; inflorescences racemose; west Texas 12. *E. Wrightii*.
- 10(8). Leaves oblanceolate, finely silky-pubescent; involucre deeply 6-lobed; rare, west Texas 13. *E. suffruticosum*.
10. Leaves elliptic to deltoid or orbicular, densely tomentose; involucre shallowly 5-lobed; common, west and central Texas 17. *E. tenellum*.
- 11(5). Plants glandular with hirsute hairs; perianth strigose; rare, south Texas 5. *E. Greggii*.
11. Plants not glandular or with hirsute hairs (12)
- 12(11). Perianth sparsely white-pilose externally (13)
12. Perianth densely white- or silvery-pubescent externally (15)
- 13(12). Stems glabrous; perianth white, sparsely pubescent externally; central Texas .. 2. *E. Nealleyi*.
13. Stems strigose or woolly; perianth yellow or maroon, usually conspicuously pubescent (14)
- 14(13). Perianth yellow; west Texas 3. *E. hieracifolium*.
14. Perianth maroon to reddish-purple; Chisos Mts., west Texas 4. *E. hemipterum*.
- 15(12). Stems tomentose; involucre 3-4 mm. long; inflorescences sparsely branched; north Texas 9. *E. lachnogynum*.
15. Stems glabrous; involucre 1.5-2.5 mm. long; inflorescences of several branches; west Texas 10. *E. Havardii*.

- 16(1). Stems leafless, glabrous; outer calyx segments fan-shaped; mainly west Texas
 19. *E. rotundifolium*.
16. Stems leafy, tomentose or nearly so (17)
- 17(16). Perianth white-pubescent internally; plants to 10 dm. high or more (18)
17. Perianth glabrous internally; plants mostly less than 5 dm. high; west Texas (19)
- 18(17). Outer calyx segments obovate; involucre 2.5-4 mm. long, densely tomentose; throughout most Texas except for the coastal region
 14. *E. annuum*.
18. Outer calyx segments oblong-cordate; involucre 2-2.5 mm. long, glabrous to sparsely tomentose; mainly central and east Texas 15. *E. multiflorum*.
- 19(17). Involucres sessile and closely appressed to the stems, the lobes erect; outer calyx segments fan-shaped 16. *E. polycladon*.
19. Involucres often peduncled, the lobes long and reflexed at maturity; outer calyx segments orbicular-cordate 18. *E. Abertianum*.

1. *Eriogonum alatum* Torr. Short-lived monocarpic perennial herb from stout chambered taproots, strigose, sparsely so to glabrous above, 5-20 dm. high; leaves basal and cauline; basal leaves linear-lanceolate to lanceolate or oblanceolate, 5-15 cm. long, 3-15 mm. wide, glabrous except for the strigose margins and midveins, the petioles often winged or margined and 2-5 cm. long, the rosettes persistent for 2 to 5 years; cauline leaves 1-6 cm. long, becoming reduced above; stems erect, 3-10 dm. high; inflorescences paniculate cymes 2-10 dm. long; involucre campanulate, strigose, 2-4 mm. long and wide; perianth yellowish, 1.5-2.5 mm. long in anthesis; calyx segments lanceolate, becoming 3-6 mm. long in fruit and often reddish; achenes reddish-brown, 5-9 mm. long, 3-winged the entire length, exserted. *E. triste* Wats. On open grasslands in the low mts. of w. Tex., June-Sept.; n.e. Mex. to n.w. Neb., w. to Ariz. and Ut.

Var. *glabriusculum* Torr. Erect plants 1-2 m. high; inflorescences and involucre glabrous or nearly so, 2-6.5 dm. long. On open grasslands in the Panhandle of n. Tex., May-Nov.; n. Tex. and cen. Okla.

2. *Eriogonum Nealleyi* Coult. Erect perennial herb, 5-12 dm. high, from branched woody spreading caudices, glabrous nearly throughout; leaves basal and cauline; basal leaves oblanceolate to spatulate, strigose on both surfaces, to 8 cm. long, 5-15 mm. wide, the petioles slightly winged and 1-2.5 cm. long; cauline leaves few or absent and highly reduced, oblanceolate, to 4 cm. long, 3-8 mm. wide; inflorescences open paniculated cymes; peduncles 1-8 cm. long, erect or ascending; involucre broadly turbinate to campanulate, 2-3 mm. long, 2-4 mm. wide; perianth white, 1.5-2 mm. long in anthesis, glabrous or sparsely strigose externally; calyx segments elliptic to oblong, becoming 2.5-3 mm. long in fruit and pink or reddish; achenes reddish-brown, 4-6 mm. long, winged at the apices, exserted. Infrequent and locally common on rocky or gravelly soils in open grasslands of cen. Tex., Aug.-Sept.; endemic.

3. *Eriogonum hieracifolium* Benth. Tall erect perennial herb to 7 dm. high, from branched woody caudices, strigose or woolly nearly throughout; leaves basal and cauline; basal leaves oblanceolate to spatulate, 3-15 cm. long, 5-20 mm. wide, sparsely to densely strigose, the petioles 5-50 mm. long; cauline leaves few, 1-7 cm. long, 3-10 mm. wide; inflorescences open paniculated cymes; peduncles 5-30 mm. long, slender, erect; involucre campanulate, 2.5-4 mm. long, 2.5-5 mm. wide; perianth yellow, 1.5-2.5 mm. long in anthesis, white-pilose externally; calyx segments narrowly ovate, becoming 3-5 mm. long in fruit and often reddish; achenes brownish- or yellowish-green, 4-6 mm. long, the upper half winged, exserted. *E. pannosum* Woot. & Standl. Open areas in grasslands and pinyon woodlands in the low mts. of w. Tex., June-Oct.; w. Tex. across N.M. to e. Ariz.

4. *Eriogonum hemipterum* (T. & G.) S. Stokes. Erect perennial herb, 2-6 dm. high, with branched woody caudices, strigose nearly throughout; leaves basal and cauline; basal leaves oblanceolate to elliptic or spatulate, strigose, 2-7 cm. long, 5-15 mm. wide, the petioles winged and 5-30 mm. long; cauline leaves few, 1.5-5 cm. long, 2-9 mm. wide, reduced above; inflorescences open paniculate cymes; peduncles 5-30 mm. long, slender and erect; involucre broadly turbinate to campanulate, 2-4 mm. long, 1.5-4 mm. wide; perianth red to reddish-purple or maroon, 1.5-2.5 mm. long in anthesis, be-

coming 2.5-3.5 mm. long in fruit, strigose externally, the calyx segments spatulate to obovate; achenes reddish-brown, 3.5-5 mm. long, upper third winged, exserted. *E. hieracifolium* f. *atropurpureum* Standl. Locally common on loamy soils in heavy shrub growth in the canyons of the Chisos Mts., Brewster Co., June-Nov.; w. Tex. and adj. Coah. in the n. Sierra del Carmen.

5. *Eriogonum Greggii* T. & G. Erect perennial herb. 1-4 dm. high, from branched caudices, glandular-pubescent with tack-shaped glands scattered among hirsute hairs nearly throughout; leaves basal and at the nodes; basal leaves broadly spatulate, glabrous except for the ciliate margins and midribs or uniformly stipitate-glandular, to 1 dm. long, 5-20 mm. wide, gradually tapering to broad petioles; cauline leaves oblanceolate to obovate or spatulate, 3 to 10 per node, 5-40 mm. long, 2-15 mm. wide; inflorescences cymose and often with one side suppressed, branching 3 to 15 times; peduncles 1-7 cm. long, slender, erect or ascending; involucre broadly campanulate, 1.5-3 mm. long, 3-5 mm. wide, strigose and glandular; perianth reddish to reddish-brown, 1.5-2 mm. long in anthesis, becoming 2.5-3.5 mm. long in fruit, strigose externally, the calyx segments oblong to lanceolate; achenes reddish-brown, 3-4 mm. long, the beaks slightly winged, exserted. Locally common on plains and grasslands, known in Tex. only from Hidalgo Co.; extreme s. Tex. to N.L. and Coah.

6. *Eriogonum longifolium* Nutt. Tall erect leafy perennial herbs 1-2 m. high, the stems sparsely pubescent or more commonly glabrous; basal leaves oblong to lanceolate or oblanceolate, 1-2 dm. long, 1-3 cm. wide, thinly pubescent below, nearly or quite glabrous above, the petioles 4-10 cm. long and winged at the base; cauline leaves similar to the basal ones only more reduced and sessile; inflorescences paniculate cymes, about one half the length of the plants with numerous branches, glabrous or nearly so; peduncles (when present) to 3 cm. long, erect; involucre turbinate to turbinate-campanulate, 4-6 mm. long, 2.5-4 mm. wide; pedicels 5-10 mm. long; perianth stipitate, densely white- to silvery-pubescent externally, yellow and glabrous internally, 4-5 mm. long in anthesis; calyx segments lanceolate to oblong-lanceolate, the segments becoming narrower and the perianth (including the stipe) 5-8 mm. long in fruit; achenes 4-4.5 mm. long, densely white-tomentose. Incl. var. *plantagineum* Engelm. & Gray, *E. vespinum* Shinn. On sandy soil mainly on the edges of pine and oak woodlands throughout much of e. Tex., June-Aug.; s. Mo. and n. Ark., e. Okla. and e. Tex. to w. La.; morphologically grading into var. *Harperi* (Goodm.) Reveal in n.w. Ala., var. *gnaphalifolium* Gand in cen. Fla., and the following variety.

Var. *Lindheimeri* Gand. Plants 3-20 dm. tall, the stems pubescent nearly throughout; leaves shorter, the basal leaf blades 0.5-1.8 cm. long, 3-25 mm. wide, densely tomentose below, subglabrous to tomentose above, with petioles to 7 cm. long; inflorescences of few to several branches, about one third the length of the plant; peduncles (when present) to 6 mm. long; involucre mostly campanulate, 4-6 mm. long, 3-6 mm. wide, with pedicels 4-8 mm. long; achenes 4-6 mm. long. Incl. subsp. *diffusum* S. Stokes, *E. texanum* Scheele, *E. texanum* Coult. & Fish., *E. cortaceum* Coult. & Fish. On calcareous clay or sandy soils throughout much of the n.e. part of the Panhandle and w. Tex., e. to cen. Tex., June-Oct.; cen. Kan. and w. Okla. to Tex.

7. *Eriogonum Jamesii* Benth. Erect perennial herb from freely branching woody spreading caudices; leaves mainly basal, 1.5-5 cm. long, 1-2.5 cm. wide, oblong or elliptic to oval or suborbicular, densely whitish- or greenish-tomentose below, finely tomentose to glabrate and green above, the petioles about as long as or longer than the leaf blades; flowering stems 1-3 dm. high, tomentose; inflorescences cymose, with foliaceous bracts similar to the basal leaves only highly reduced; involucre turbinate, 3-7 mm. long, 3-5 mm. wide, with 5 to 8 shallow lobes, tomentose; perianth greenish-white to cream, often becoming pinkish-orange in fruit, 3-6 mm. long, the stipe 1-2 mm. long, the calyx segments broadly oblong to obovate and pubescent externally; achenes brown, 2-3 mm. long, sparsely pubescent at the apices. On dry plains and hillsides in the w. part of the Panhandle, becoming more frequent in the low mts. of w. Tex., July-Oct.; s. Colo. and Kan. to n. Mex., w. to Ariz.

Var. *undulatum* (Benth.) S. Stokes. Plants spreading and forming large mats, 1-2.5 dm. high and to 1 m. across; leaves 1-2.5 cm. long, the margins crispate. *E. undulatum* Benth. On dry talus slopes in the Chisos Mts. of w. Tex., July-Oct.; w. Tex. and n.e. Mex.

8. *Eriogonum Correllii* Reveal. Robust erect perennial herb from large woody caudices; leaves basal, lanceolate to oblong, 4-15 cm. long, 1-3.5 cm. wide, densely white-tomentose below, sparsely tomentose to glabrous and green above, the pubescent petioles 4-10 cm. long; flowering stems tomentose, 2-4 dm. high; inflorescences cymose, with large foliaceous bracts that become reduced above; involucre turbinate to campanulate, 3-5 mm. long, 2-4 mm. wide, with 5 to 7 shallow lobes, tomentose; perianth yellow or greenish-yellow, 3-7 mm. long, the stipe 1-2 mm. long, pubescent externally; calyx segments dissimilar, the outer whorl of segments 3-5 mm. long and to 2 mm. wide, the inner segments 4-7 mm. long and to 3 mm. wide in fruit; achenes brown, 3.5-6 mm. long, sparsely pubescent at the apices. *E. Jamesii* var. *flavescens* of Tex. ref. On clay mounds, caprock and in protected areas on rocky ledges, locally common in the Panhandle of n. Tex., July-Oct.; endemic.

9. *Eriogonum lachnogynum* Torr. Erect perennial herb, 1-3.5 dm. high, with branching woody matted caudices; stems grayish-tomentose, 1-2 dm. long; leaves basal, lanceolate to oblanceolate or narrowly elliptic, 1-3 cm. long, 3-5 mm. wide, densely white- or silvery-tomentose, the petioles 5-25 mm. long; inflorescences short, subcapitate to cymose or somewhat umbellate, to 6 cm. long; peduncles 2-15 mm. long, tomentose; involucre campanulate, 3-4 mm. long, sessile or peduncled; perianth yellow internally, densely pubescent with abundant short white hairs externally, 2.5-4 mm. long in anthesis, becoming 3.5-4.5 mm. long in fruit, the calyx segments lanceolate; achenes brown under the dense white tomentose hairs, 3-4 mm. long. *E. tetraeuris* Small. On sandy to gravelly or clay soils in the n. Panhandle of Tex., June-Sept.; e. Colo. and Kan., s. to n. Tex. and N.M., w. to extreme e. Ariz.

10. *Eriogonum Havardii* Wats. Erect perennial herb 3-6 dm. high, with branched woody caudices; stems glabrous except among the leaves, 5-25 cm. long; leaves basal, narrowly elliptic to oblanceolate, 1-5 cm. long, 2-10 mm. wide, densely white- or silvery-tomentose, the petioles 5-20 mm. long; inflorescences cymose, glabrous, 1-4 dm. long; peduncles 5-60 mm. long, slender, erect; involucre campanulate, 1.5-2.5 mm. long, 2-3 mm. wide; perianth yellow internally, densely pubescent with abundant short white hairs externally, becoming 2.5-3 mm. long in fruit; achenes brown, glabrous, 2-2.5 mm. long. *E. leucophyllum* Woot. & Standl. On gravelly, rocky or slate soils derived from limestone in the low mts. of w. Tex., June-Sept.; also s.e. N.M.

11. *Eriogonum Fendlerianum* (Benth.) Small. Subshrubby perennial, 1.5-4 dm. high; leaves on the lower two thirds of the plants, lanceolate to elliptic, 2-4 cm. long, 5-20 mm. wide, densely white-tomentose below, subglabrous to glabrous and green above, the petioles 5-20 mm. long; lower stems tomentose among the leaves, subglabrous to glabrous above; inflorescences cymose, open; involucre sessile along the branches, peduncled for 1-5 mm. in the forks of the branches, turbinate, 2.5-4 mm. long, 1.5-3.5 mm. wide; perianth white, 2.5-4 mm. long, the calyx segments elliptic to oblong; achenes brown, 2-2.5 mm. long. *E. Ainsliei* Woot. & Standl. On sandy to gravelly or clay soils in n.w. Tex., July-Sept.; s.w. Colo. and adj. n. N.M. to Tex.

12. *Eriogonum Wrightii* Torr. Low highly branched and spreading perennial subshrub from branched woody caudices, 1.5-4 dm. high; leaves on the lower half of the plants, crowded, oblanceolate to elliptic, 5-15 mm. long, 2-5 mm. wide, entire or crenulate, densely white-tomentose above and below or subglabrous and green above, the petioles 2-5 mm. long; flowering stems several, tomentose or rarely glabrous, to 3 dm. long; inflorescences racemose, 5-30 cm. long; involucre turbinate, 2-2.5 mm. long, tomentose, solitary; perianth white, 2.5-3.5 mm. long, the calyx segments obovate; achenes brown, 2.5-3 mm. long. On rocky slopes in the low mts. of w. Tex., July-Sept.; w. Tex. and adj. n. Mex. to Ariz. with several vars. along the Pac. Coast.

13. *Eriogonum suffruticosum* Wats. Low spreading highly branched perennial subshrub from branching woody caudices, 1-2 dm. high; leaves tufted at the ends of the branches, elliptic, revolute, 5-8 mm. long, 1-2.5 mm. wide, silky-tomentose, the petioles 1-2 mm. long; flowering stems 1-3 cm. long; inflorescences cymose, to 1 cm. long; involucre campanulate, 2-3 mm. long, tomentose, the deeply divided 6 lobes 1-1.5 mm. long and spreading outwardly to become reflexed; perianth white to yellowish-white with large reddish to maroon midribs; calyx segments dissimilar, the outer whorl of segments

fan-shaped and 2-4 mm. long and wide, the inner segments oblanceolate and 3.5-6 mm. long, becoming erect in fruit; achenes light-brown, 3-3.5 mm. long. On rocky slopes in the low mts. of w. Tex., rare, Apr.-May; endemic.

14. *Eriogonum annuum* Nutt. Tall leafy biennial or late-flowering annual herb, 5-20 dm. high, floccose to densely white-tomentose nearly throughout; leaves mostly on the lower three fourths of the plant, alternate, oblong to oblanceolate, to 7 cm. long, 3-15 mm. wide, rarely revolute in some, densely tomentose below, less so above, the petioles mostly less than 5 mm. long; inflorescences open cymes or umbels, rarely compacted cymes; involucre turbinate to campanulate, 2.5-4 mm. long, 2-3 mm. wide, on short stout peduncles less than 5 mm. long or sessile, densely tomentose; perianth white to rose, maturing to dark-red-brown, 1-2 mm. long, glabrous externally, densely long-white-pubescent externally; calyx segments dissimilar, the outer whorl of segments obovate, the inner segments narrowly ovate to oblong; achenes brown, 1.5-2 mm. long, glabrous or sometimes tangled in the pubescence of the perianth so as to appear to be pubescent. *E. Lindheimerianum* Scheele, *E. cymosum* Benth. On sandy to gravelly soils in open grasslands or more commonly in disturbed places in fields and along highways throughout most of Tex. except for the immediate Gulf Coastal Plains, Apr.-Nov.; s. Mont. and N.D. to n.e. Mex.

15. *Eriogonum multiflorum* Benth. Tall leafy annual (probably biennial) herb, 5-20 dm. high, floccose to whitish- or brownish-tomentose nearly throughout; leaves mostly on the lower three fourths of the plant, lanceolate or oblanceolate to elliptic or ovate, to 4 cm. long, 4-15 mm. wide, entire or some undulate or even revolute, densely tomentose below, floccose above, sessile or short-petioled; inflorescences short, rather compact, cymose; involucre turbinate, 2-2.5 mm. long and wide, on short stoutish peduncles less than 4 mm. long or sessile, glabrous to sparsely tomentose; perianth white, maturing tan with large red-brown to brown midribs, 1.5-2 mm. long, glabrous externally, sparsely white-tomentose internally; calyx segments dissimilar, the outer whorl of segments oblong-cordate and 1.5-2 mm. long and wide, the inner segments oblong to lanceolate; achenes brown, 1.5-2 mm. long, glabrous. On sandy to gravelly soils in oak or pine forests and woodlands, or occasionally in open places throughout most of cen. and e. Tex., (Apr.) Sept.-Nov.; s.e. Okla. and Tex. to La. and n.e. Mex.

16. *Eriogonum polycladon* Benth. Erect annual herb, 1-6 dm. high, densely white-tomentose nearly throughout; leaves cauline, narrowly oblanceolate to broadly elliptic, 1-3 cm. long, 5-15 mm. wide, the petioles 3-10 mm. long; inflorescences narrow, strict, cymose, more than half the length of the plant; involucre sessile, appressed to the stems, prismatic, 1.5-2.5 mm. long, tomentose to glabrous; perianth white to pink, 1.5-2 mm. long; calyx segments dissimilar, the outer segments broadly fan-shaped and 1-1.5 mm. wide, the inner segments narrowly lanceolate to narrowly oblong and 0.4-0.6 mm. wide; achenes dark-brown, 1-1.3 mm. long. On sandy to gravelly soil in w. Tex., July-Oct.; Tex. and n. Mex. to Ariz. and s. Ut.

17. *Eriogonum tenellum* Torr. Erect perennial herb from branched woody caudexes, the stems to 5 dm. high, glabrous and glaucous; leaves strictly basal, matted, elliptic to ovate or orbicular, 3-15 mm. long, 3-10 mm. wide, densely grayish- or whitish-tomentose, the petioles 4-20 mm. long; inflorescences of erect dichotomous branches, spreading in the crown; peduncles 5-60 mm. long, slender, erect; involucre turbinate, 2-4 mm. long, 1.5-3 mm. wide; perianth white or pink, 1.5-2.5 mm. long in anthesis, becoming 3-3.5 mm. long in fruit; calyx segments dissimilar, the outer whorl of segments ovate to obovate or suborbicular and 2 mm. wide, the inner segments narrowly oblong and 0.5-1 mm. wide, shorter than the outer segments; achenes brown, 2-3 mm. long. Incl. var. *leptocladon* Benth. On rocky slopes, ledges or crevices, or on open rock outcrops in grasslands in w. Tex., June-Oct.; e. Colo. to n.e. Mex.

Var. *ramosissimum* Benth. Leaves elliptic to deltoid, densely sheathing up the stems to 15 cm.; leaf blades 3-12 mm. long, 2-7 mm. wide; inflorescences open, usually with several slender branches; plants subcespitose. *E. tenellum* var. *caulescens* T. & G. On granite ledges and crevices in flat outcrops in cen. Tex., June-Sept.; endemic.

Var. *platyphyllum* (Torr.) Torr. Leaves ovate to suborbicular or orbicular, sheathing up the stems to 2 dm. and often at the lower nodes; leaf blades to 3 cm. long and wide;

inflorescences open, with few branches; plants often subshrubby, 2-6 dm. high. *E. platyphyllum* Torr. On gravelly to rocky soils or on rocky ledges in w. Tex., July-Oct.; w. Tex. and n.e. Mex.

18. *Eriogonum Abertianum* Torr. Profusely branched spreading or erect annual herb with few to several appressed-hirsute stems to 5 dm. long; leaves basal and cauline, all loosely villous to hoary pubescent; basal leaves ovate to oblong, 1-4 cm. long, 1-3 cm. wide, the petioles to 6 cm. long; cauline leaves obovate-lanceolate to linear, sessile or nearly so; peduncles (when present) to 6 cm. long, hirsute; involucre broadly campanulate, the tubes 2-3 mm. long, with 5 oblong lobes 4-6 mm. long and 1-2 mm. wide, reflexed at maturity, villous-canescens; perianth white to pale-yellow, often becoming tinged with rose or reddish, 3-4.5 mm. long; calyx segments dissimilar, the outer whorl of segments orbicular-cordate and 3-4 mm. long and wide, the inner segments spatulate to lanceolate and 0.7-1.2 mm. wide and 3-4.5 mm. long; achenes dark-brown, 0.6-1 mm. long. Incl. var. *neomexicanum* Gand., *E. cyclosepalum* Greene, *E. lappulaceum* Greene, *E. pinetorum* Greene. On sandy to gravelly flats or slopes in open grasslands and occasionally along the highways in w. Tex., flowering the year around but mainly from Mar.-Nov.; w. Tex. to s. Ariz., s. to cen. Mex.

Exceedingly variable in size and dimensions of all parts and in the amount of pubescence; the kind of plant depending upon the local environment and the time of the year the collection is made.

19. *Eriogonum rotundifolium* Benth. Spreading annual herb to 4 dm. high and to 1 m. across, glabrous and glaucous nearly throughout; leaves basal, orbicular or cordate, 1-2 cm. long, 15-25 mm. wide, densely white-tomentose below, subglabrous and green above, the petioles 1.5-4 cm. long; inflorescences open to densely branched cymes, with the several branches arising from near the base of the plant and spreading outwards to form low flat-topped crowns; peduncles stoutish, 3-15 mm. long, erect; involucre turbinate to campanulate, 1-2 mm. long, 1.5-2.5 mm. wide; perianth white, maturing brownish-white or rose to red, 1-2 mm. long; calyx segments dissimilar, the outer whorl of segments flabellate, the inner segments lanceolate, the perianth tube often dark brown; achenes dark-brown, 1.5-2 mm. long. Incl. var. *angustum* Goodm. On sandy to gravelly soils in grasslands or occasionally along the highways in w. Tex., with an outlying population in Knox Co., Mar.-Oct.; w. Tex. and n. Mex. to e. Ariz.

In Gould's *Texas Plants* (1962), the following species of *Eriogonum* were attributed to the state: *E. arcuatum* Greene, a synonym of *E. Jamesii* var. *flavescens* Wats. of New Mexico and Arizona north into Utah and Colorado; *E. atrorubens* Engelm., a species restricted to northern Mexico; *E. cernuum* Nutt., a widespread species but as yet apparently not actually represented from Texas; *E. racemosum* Nutt., a species that occurs from New Mexico and Colorado westward to California, but not expected to be in Texas.

2. RUMEX L.⁴⁸ DOCK

Annual or perennial herbs; leaves alternate, flat, undulate or crisped, narrowed to cordate or auricled at base; ocreae thin, brittle, often brownish; flowers greenish, on pedicels that are jointed to and terminate short peduncles, in distant or approximate whorls disposed usually in elongate panicles; sepals 6, the inner 3 usually developing entire, toothed or spiny wings one or each of which usually bears a grainlike tubercle, in fruit greatly increasing in size compared to their size at anthesis and erect and usually loosely coherent to the achene (called *valves* in fruit); the 3 outer sepals much smaller than the inner ones, usually lanceolate or subulate and slightly spreading or arcuate; stamens 6; ovary sessile; styles 3, the stigmas peltate and tufted; achene trigonous.

About 200 species widespread in the world. The sap usually is quite acid and in some species has been used in tanning leather, especially the "canaigre," *R. hymenosepalus*.

1. Flowers unisexual or polygamous; leaves usually hastately lobed (2)

1. Flowers usually bisexual; leaves never hastately lobed (3)

⁴⁸ Adapted partly from K. H. Rechinger, Jr. in *Field Mus. Nat. Hist., Bot. Ser.* 17(1): 1-151. 1937.

- 2(1). Valves (inner sepals) not larger than the achenes . . . 1. *R. Acetosella*.
- 2. Valves distinctly overtopping the achene 2. *R. hastatulus*.
- 3(1). Stems erect, ascending or procumbent; axillary shoots present (4)
- 3. Stems usually erect; axillary shoots absent (8)
- 4(3). Pedicels (2) 2.5 to 5 times as long as the valves . . . 3. *R. verticillatus*.
- 4. Pedicels at most twice as long as the valves (5)
- 5(4). Valves 7-8 mm. long, 8-12 mm. broad 4. *R. spiralis*.
- 5. Valves much smaller (6)
- 6(5). Leaves ovate-lanceolate, broadest below the middle; valves more than 4.5 mm. long 5. *R. altissimus*.
- 6. Leaves usually narrower, lanceolate or linear-lanceolate, if exceptionally broad then the fruits much smaller (7)
- 7(6). Leaves small and thickish, in the dry state olive-green, often undulate, somewhat obtuse, with strongly prominent nerves beneath; panicles interrupted, most whorls remote 6. *R. chrysocarpus*.
- 7. Leaves larger, rather thin, in the dry state pale-green, acute; nerves scarcely prominent; fruiting panicle not interrupted or only in the lower part 7. *R. mexicanus*.
- 8(3). Valves not tuberculate and as measured (including the basal lobes) altogether about 14 mm. long, 11 mm. broad or more 8. *R. hymenosepalus*.
- 8. At least one of the valves bearing a tubercle dorsally (9)
- 9(8). Valves entire-margined (10)
- 9. Valves denticulate (11)
- 10(9). Leaves small, flat and truncate; valves very small, scarcely broader than the thick grains; whorls remote and nearly all with bracteal leaves 10. *R. conglomeratus*.
- 10. Leaves large, somewhat crisped or undulate, often narrowed at base, seldom truncate; valves (3.5-) 5-6 mm. long; only the lower whorls with bracteal leaves and occasionally remote 9. *R. crispus*.
- 11(9). Perennial; basal leaves at most 2.5 times as long as broad, cordate at base 11. *R. pulcher*.
- 11. Plant annual or biennial; basal leaves 3 times as long as broad 12. *R. violascens*.

1. *Rumex Acetosella* L. SHEEP SORREL. Perennial herb, low and slender; leaves linear to lanceolate, hastate; flowers usually unisexual, occasionally polygamous; valves entire, not enlarged after anthesis, not longer than the achene and without tubercles dorsally. *Acetosella Acetosella* (L.) Small. Rare in waste places, near railroads, cen. Tex. and perhaps elsewhere, probably not a persistent member of our flora, spring; Euras. weed, now widely adv.

2. *Rumex hastatulus* Ell. HEART SORREL. Perennial herb, 15-80 cm. tall, slender, erect; leaves pale-green, often crowded near the base, the basal ones 2-10 cm. long and 3-18 mm. broad, lanceolate to oblong-linear or usually with a hastate bladelike portion and a long narrow basal portion; inflorescence leafless, narrow; flowers unisexual; valves 2.5-3 mm. long, 2.7-3.2 mm. broad, longer than the achene, not tuberculate; achene 0.9-1 mm. long, 0.6-0.7 mm. thick. *R. Engelmannii* Meisn. Very abundant in open sandy ground in e., s.e. and n.-cen. Tex., spring; Gulf States, n. to N.C., Ill., Mo. and Okla., a waif even farther n. The name, through error, has sometimes been spelled "*hastulatus*."

3. *Rumex verticillatus* L. SWAMP DOCK. Perennial herb; stems erect, 4-10 dm. tall, slender, commonly purplish; basal leaves linear-lanceolate, 5 to 7 times as long as broad; cauline leaves narrowly linear-lanceolate, 6 to 9 times as long as broad; fruiting pedicels (2) 2.5 to 5 times as long as the valves; valves at maturity 4-5 mm. long, 2.5-4 mm. broad, each dorsomedially with a pronounced tubercle. Infrequent in low ground, often wet meadows, s.e. Tex., spring; s.e. Can. and e. U.S., w. to Mo., Ark. and Tex.

4. *Rumex spiralis* Small. Perennial herb from creeping rootstocks; stems erect, usually purplish, to 1 m. tall; leaves of lower part of stem ovate to oblong-lanceolate, 10-15 cm. long, 35-55 mm. broad, 2.5 to 5 times as long as broad; pedicels (2-) 3-5 mm. long, even in fruit shorter than the valves; valves 7-8 mm. long, 8-12 mm. broad, somewhat cordate, each dorsomedially with a pronounced tubercle. Local in poorly drained or seasonally moist calcareous clay soil, Rio Grande Plains, spring; endemic.

5. *Rumex altissimus* Wood. PALE DOCK. Perennial herb; stems erect or basally procumbent, to 8 dm. tall; leaves of lower part of stem broadly ovate-lanceolate to oblong-lanceolate, 12-18 cm. long, 40-55 mm. broad, 2.5 to 4 times as long as broad; leaves of upper part of stem smaller; inflorescences rather crowded; valves 4.5-6 mm. long, 3-4 (-5) mm. broad, each with or without a dorsomedial tubercle or 1 with and 2 without; achene about 3 mm. long and 2 mm. broad. *R. ellipticus* Greene. Frequent in wet places, e. and n.-cen. Tex., Plains Country and parts of Edwards Plateau, spring; most of U.S. except Pac. States.

6. *Rumex chrysocarpus* Moris. AMAMASTLA. Perennial herb from creeping rootstocks; stems erect or basally procumbent, usually only 4-6 dm. tall, often reddish; leaves linear-lanceolate to oblong-linear, 5-12 cm. long, 3.5 to 5 times as long as broad, drying a rather dark olive-green; inflorescence usually interrupted, never leafy; valves dark-reddish-brown, tough, 3.5-4.5 mm. long, 3-4 mm. broad, triangular to rotund-triangular, each one dorsomedially with a pronounced tubercle; infructescence often crowded; achene 2.5-3 mm. long, 1.5-2 mm. broad. *R. Berlandieri* Meisn., *R. Langloisii* Small. Abundant in low seasonally wet places, s.e. Tex. and Rio Grande Plains, less frequent n. to n.-cen. Tex., Edwards Plateau and the Trans-Pecos, spring-summer; La., Tex., Tam., Ver. and Michoac.

7. *Rumex mexicanus* Meisn. Very similar to *R. chrysocarpus* but the inflorescences and infructescences more crowded; leaves larger, thinner and much paler green and more acute; valve 1.8-2.5 mm. long; achene only about 2 mm. long. *R. triangulivalvis* (Danser) Rech. f. Infrequent in the El Paso region in the Trans-Pecos, spring; Que. to B.C. and s. to Mo., Tex. and cen. Mex.

8. *Rumex hymenosepalus* Torr. CANAIGRE. Perennial herb with clusters of tuberous roots; stems erect, stout and coarse, 3-10 dm. tall; basal leaves oblong- to narrowly obovate-lanceolate, the stem leaves narrowly lanceolate; valves 14-15 mm. long (including the lateral lobes at base), 11-12 mm. broad, or even larger, never having dorsal tubercles, their texture thin-membranous; achene 4-5 mm. long. Locally abundant in the Trans-Pecos and sparingly e. on the Edwards Plateau and in the Plains Country, usually in deep sand, spring; Baja Calif., Calif., Nev., Wyo., Ariz., Colo., N.M., Chih. and Tex.

9. *Rumex crispus* L. YELLOW DOCK, CURLY DOCK. Perennial herb; stems straight, erect; leaves cuneate at base, wavy-margined; petiolar bases of leaves canaliculate on upper side; panicle elongate, the whorls usually dense and approximate, only the lower whorls (if any) with bracteal leaves; pedicels about 1.5 times as long as the valves; valves rotundly ovate, subcordate, marginally entire, each with a dorsomedial tubercle or occasionally only one of the valves tuberculate. Local in seasonally moist usually disturbed ground; n.-cen., e. and s.e. Tex., Edwards Plateau and Trans-Pecos, spring; a Euras. weed, now widely adv. in temp. areas.

10. *Rumex conglomeratus* Murr. Rather similar to *R. crispus*; lower leaves cordate at base, flat; branches of the panicle divergent, whorls of inflorescence each with a bracteal leaf, remote; pedicels usually not longer than the fruit; valves entire-margined, 2.5-3 mm. long, each with a large tubercle dorsally. Rare in wet sandy spots in e. Tex and perhaps elsewhere, probably not a persistent member of our flora, spring; nat. of Eur., now widely adv.

11. *Rumex pulcher* L. FIDDLE DOCK. Perennial herb; stems erect; lower leaves small, cordate at base, somewhat crisp marginally, often pubescent beneath; branches of the panicle very divergent, often intricately enmeshed at fruiting time; some of the whorls with bracteal leaves, all remote; pedicels thick, not longer than the fruit, jointed in the middle; valves denticulate-margined, 4.5-6 mm. long, 2.5-4.5 mm. broad, usually all dorsomedially tuberculate but the tubercles of disparate size even in the same flower; achenes 3-4 mm. long. Frequent and widespread in seasonally moist usually disturbed ground in e. half of Tex., spring; Medit. region, now widely adv. in warm-temp. regions.

Reports of *R. obtusifolius* L. in Texas are apparently based on misdetermined specimens

of *R. pulcher*. It differs from *R. pulcher* primarily in having its whorls of flowers mostly contiguous, its pedicels longer than the calyx in fruit, and its lower stem and lower petioles only slightly, not densely, pubescent.

12. *Rumex violascens* Rech. f. Annual or biennial or perhaps perennial at times; stems stoutish, to 8 dm. tall, often in the upper part more or less zigzag; basal leaves 3 times as long as broad, oblanceolate to elongate-obovate, the stem leaves smaller and proportionately narrower and longer; valves 2.5-3 mm. long, 2-3 mm. broad, marginally denticulate and each dorsomedially tuberculate but the tubercles often disparate in size in the same flower; achenes 1.7 mm. long. Locally frequent near El Paso in the Trans-Pecos, spring; Tex., N.M., Ariz., Calif., Son. and Coah.

3. POLYGONELLA MICHX.⁴⁹ JOINTWEEDS

Plants subherbaceous annuals or (suffrutescent) perennials from woody taproots; stems erect or prostrate; branches usually profuse, appearing internodal in origin because of a brief coalescence of the stem and branch internodes; leaves alternate; inflorescences racemelike; flowers small, usually bisexual; calyx petaloid, with 2 outer and 3 inner sepals; outer sepals enclosing the others in bud and often slightly accrescent, the inner ones distinctly accrescent; stamens 8 in 2 series, 3 inner and 5 outer, the inner ones opposite the 3 inner sepals and with filaments dilated abruptly above the base; achene trigonous. *Gonopyrum* Fisch. & Mey.; *Thysanella* Gray.

A genus of 8 species restricted to eastern and southern North America.

1. Subherbaceous annual; ocreae ciliate 3. *P. Parksii*.
1. Suffrutescent perennials; ocreae not ciliate (2)
- 2(1). Styles and stigmas 0.5-1 mm. long at anthesis; leaves about as thick as wide ...
..... 2. *P. americana*.
2. Styles and stigmas altogether only 0.1-0.13 mm. long at anthesis; leaves narrowly clavate to widely spatulate 1. *P. polygama*.

1. *Polygonella polygama* (Vent.) Engelm. & Gray. OCTOBER-FLOWER. Suffrutescent perennial from long woody taproots; leaves narrowly clavate to widely spatulate, (2.5-) 4-16.2 (-36) mm. long, (0.3-) 0.6-3.6 (-5) mm. broad, the margins hyaline at least along the apical half, obtuse at apex, cuneate at base; ocreae not ciliate; styles and stigmas altogether only 0.1-0.13 mm. long; achene and the calyx at maturity (1.3-) 1.4-1.8 (-2.1) mm. long. *P. brachystachya* Meisn. var. *lamtnigera* Fern., *P. Croomii* Chapm. Infrequent in loose sands, e. and s.e. Tex., June-Oct.; Coastal States, Va. to Tex.

2. *Polygonella americana* (Fisch. & Mey.) Small. Suffrutescent perennial from long woody taproots; leaves about as thick as wide, (4-) 5.2-12 (-19) mm. long 0.5-0.9 (-1.2) mm. broad, the margins not hyaline, frequently scarious and erose at apex; ocreae not ciliate; styles and stigmas together 0.5-1 mm. long; achene and calyx at maturity (2.5-) 3-3.6 (-4) mm. long. *P. ericoides* Engelm. & Gray, *Gonopyrum americanum* Fisch. & Mey. Local in loose sands of e., s.e. and n.-cen. Tex. and the Plains Country, summer; S.C., Ga., Ala., Mo., Ark., La., Tex., Okla. and N.M.

3. *Polygonella Parksii* Cory. Subherbaceous annual from woody taproots; young stems erect, 5-15 dm. tall; leaves linear, 1-15 mm. long, 0.3-0.8 mm. broad, obtuse at apex; ocreae with several awnlike bristles; achenes about 2 mm. long. Very rare and local in deep loose sands of Atascosa, Leon and Wilson cos., spring-summer; endemic.

4. POLYGONUM L.⁵⁰ KNOTWEED. SMARTWEED

Herbs or herbaceous-textured vines without tendrils; leaves alternate; petioles present but sometimes obscure and seeming to be incorporated into the sheathing stipules (ocreae); flowers on short pedicels, solitary or in small groups at the upper nodes, (the upper nodes in some species so crowded that a spikelike inflorescence results); calyx

⁴⁹ Adapted partly from James H. Horton in *Brittonia* 15: 177-203, 1963.

⁵⁰ Treatment of the first two species by Thomas R. Mertens.

5- or 6-parted, 3 of the sepals (only slightly if at all larger than the rest) exterior and usually covering the angles of the achene, usually white or pink; achene lenticular or trigonous.

A cosmopolitan genus of about 200 species.

1. Leaf blade and short petiole (to which the ocrea is united) separated by a joint or zone of abscission (2)
1. Leaf blade not jointed to petiole (7)
- 2(1). Strong perennials, often rhizomatous (3)
2. Taprooted annual or rarely weak perennials (4)
- 3(2). Leaves prominently striate-nerved and rigid 3. *P. striatulum*.
3. Leaves not prominently striate-nerved and not rigid . . . 4. *P. texense*.
- 4(2). Achenes dull to mildly shiny, mildly to coarsely striated, inequilaterally trigonous 1. *P. aviculare*.
4. Achenes generally smooth and shiny (5)
- 5(4). Achene in calyx about 3 mm. long, equilaterally trigonous, each face of achene being smooth, black and shiny but having striated margins; stems more or less 4-angled or very narrowly 4-winged below the ocreae . 6. *P. tenue*.
5. Achene entirely smooth, not black; angling of stem less pronounced (6)
- 6(5). Achene very shiny, reddish-brown at maturity, about 2 mm. long, trigonous with one face slightly broader than the other two; upper leaves reduced to minute bracts and upper internodes very short so that flowers are crowded in terminal spikelike clusters 5. *P. argyrocoleon*.
6. Achene mahogany-colored, equilaterally trigonous, sharp-angled, very mildly striate to smooth, shiny, 2-3 mm. long; closely appressed calyx characteristically yellowish-green, consisting of 6 sepals 2. *P. ramosissimum*.
- 7(1). Plants with erect or ascending stems, not at all vinelike; styles persistent, deflexed, hook- or hornlike, rigid, about 4 mm. long . . . 10. *P. virginianum*.
7. Plants vinelike or with long weak reclining stems; styles not rigid, persistent and elongate (8)
- 8(7). Stems 4-angled, weak and reclining, not twining (Sect. *Tracaulon*) 7. *P. sagittatum*.
8. Stems twining (9)
- 9(8). Calyx after anthesis becoming about 3.5 mm. long, closely investing the achene, the 3 outer sepals minutely keeled but never winged 9. *P. Convolvulus*.
9. Calyx after anthesis eventually about 6 mm. long, the 3 outer sepals with dorsomedial wings 0.25-1 mm. broad 8. *P. cristatum*.

1. *Polygonum aviculare* L., *sens. lat.* KNOTWEED. Taprooted annual or very weak perennial, very diverse in habit, either with an upright mainstem and ascending branches (when growing among dense herbaceous vegetation) or usually prostrate and rooting at the very numerous nodes (when on flat bare ground); leaves few to numerous, sparse to crowded; blades caducous or long-persistent, linear to usually narrowly oblong or narrowly elliptic, (2-) 3-15 (-25) mm. long, green, flat, without conspicuous nervation; flowers solitary or in 2's or 3's at some of the nodes, crowded or not; pedicels filiform, much shorter than the ocreae so that the flower and fruit are always erect; sepals 5 (calyx never opening, perhaps indicating cleistogamy), 3 of them exterior over the angles of the achene and 2 inner ones over 2 of the achene faces. Widespread but local nearly throughout Tex. (except extreme s.), May-Nov.; very widespread in temp. regions, perhaps originally nat. to Eur.

On the basis of achene and calyx characters 3 species in the *P. aviculare* aggregate may be differentiated as follows: (1) plants having achenes with 2 convex and 1 narrowly concave side are referred to *P. arenastrum* Bor.; achenes mildly striated, reddish-brown, about 2 mm. long; the persistent calyx covering the achene is divided for about half its

length; (2) plants designated as *P. buxiforme* Small have reddish-brown striated achenes 2-2.5 mm. long, cordate in shape, with 1 broad flat face and 2 more or less equal concave sides; the persistent perianth is divided for about two thirds its length and is characterized by having lateral papery margins or wings; (3) achenes of *P. aviculare* (*sens. str.*) are typically coarsely striated, dull, 2.5-3 mm. long and narrower, and less heart-shaped than those of *P. buxiforme*; the persistent perianth completely covers the achene, is divided almost to the base and lacks the lateral papery margins characteristic of *P. buxiforme*.

2. *Polygonum ramosissimum* Michx. Taprooted annual (in some situations the taproot becoming ligneous and as much as 1 cm. thick late in the season), rather variable in habit but (except in injured specimens) having only one ascending or usually erect mainstem near ground level, the whole plant (2-) 3-12 dm. tall and usually with numerous ascending or erect branches; leaf blades of midstem lanceolate or linear, (4-) 7-22 mm. long, green, flat, without conspicuous nervation, either persistent or falling, uppermost (bracteal) leaves with smaller blades, persistent or falling; flowers solitary or in 2's or 3's at the nodes of the upper 1-2 cm. of the stem and branches, not crowded; pedicels filiform, at least some of them on the plant at fruiting time long enough to bend over (i.e., exerted from ocreae) so that the yellowish-green fruiting calyx (which completely covers the achene) is drooping; sepals nearly always 6 (very rarely 5); achenes mahogany-colored, equilaterally trigonous, sharp-angled, mildly striate to smooth, usually shiny and 2-3 mm. long. Widespread though local over the state in seasonally wet low areas, absent only from the Rio Grande Plains, summer-fall; most of e. U.S. s. to Del., Pa., O., Ind., Ill., Mo., Tex. and N.M.

3. *Polygonum striatulum* Robins. Strongly perennial herb with woody crowns to 2 cm. thick and short; rhizomes 2-3 mm. thick; stems 2-4 (-5) dm. tall, numerous from the base, arcuate-ascending; lower blades nearly linear, 1-3 cm. long, acute at both ends, rather rigid, markedly longitudinally striate as viewed under a lens, many of them persistent even until fruiting time; upper leaves striate but mostly reduced to mere bracts, the blades 1-2 (-5) mm. long and linear, persistent; flowers erect, the pedicels included in the ocreae; calyx and achene much as in *P. texense*. Rare and local in Brooks and Kleberg cos. in coastal s. Tex., (Apr.-) May-July; endemic.

The name *P. camporum* Meisn. (or *P. brasiliense* Koch) has been applied to this species, apparently erroneously.

4. *Polygonum texense* M. C. Johnst. Perennial herb to 6 dm. tall, each shoot from a short reddish-brown fibrous (from ocreae remnants) caudex 2-3 (-10) mm. thick, usually (perhaps always) with brown rhizomes 2-3 mm. thick and with internodes to 4 cm. long; aerial shoots with solitary ascending stems 1-2 mm. thick from each crown, with some ascending branches at irregular intervals but usually unbranched in their distal halves or thirds; leaf blades of the innovations (emerging in April) lanceolate, 15-24 mm. long, 4-7 mm. broad, green, flat, without conspicuous nervation, blunt at apex, narrowed and with an abscission joint at base, falling by May; petiole about 2 mm. long, inconspicuous and appearing as part of the ocrea; ocreae 6-11 mm. long; lower part of ocrea strongly nerved and clasping the petiole, the upper part hyaline (except for the nerves) and with 3 acute lobes, eventually becoming shredded into fibers and lost; uppermost leaves reduced to bracts with subsistent blades 2-10 mm. long, those of the upper 2 to 10 cm. of stem usually less than 4 mm. long and quite inconspicuous; flowers solitary or in 2's or 3's at the upper nodes, erect or somewhat nodding; pedicels filiform, about 2 mm. long, almost all included in the lower part of the ocreolae; calyx about 2 mm. long, 5-parted to below the middle with the lobes broadly oblong, rounded at apex, white with some medial reddish or greenish markings and at anthesis spreading; achene 2-2.5 mm. long, ovoid in over all outline, in transection almost equilaterally triangular (one side, the one not furnished with an inner sepal, usually slightly smaller and more concave than the others), dark brown at maturity, rather lustrous. Infrequent in seasonally moist places on Edwards Plateau and s. part of Plains Country (Andrews, Crockett, Howard, Sutton and Val Verde cos.), summer-fall; endemic.

5. *Polygonum argyrocoleon* Kunze. Taprooted annual, the roots becoming ligneous toward fall and simulating the perennial habit; stems striate, erect with several ascending branches, the whole plant 2-5 dm. tall; upper parts of ocreae hyaline and long-lacerate;

petioles adnate to and as long as ocreae; blades jointed to petioles, green, membranous, at midstem lance-linear, 1-3 cm. long, narrowed to both ends; upper leaves reduced to minute bracts and the upper internodes shortened so that the flowers are crowded in terminal spikelike clusters 2-5 cm. long or more; calyx about 1.5 mm. long at anthesis, about 2 mm. long in fruit, divided nearly to base; achenes trigonous, reddish-brown, with one face broader than the others, about 2 mm. long, very lustrous. Infrequent or rare in seasonally moist places in w. Tex. (Brewster, Hudspeth, Pecos and Upton cos.), May-Oct.; nat. of Near and Middle East, now adv. in Calif. and Tex.

6. *Polygonum tenue* Michx. Slenderly taprooted annual, the roots and mainstems about 1-2 mm. thick; stems erect, somewhat branched, 2-3 (-4) dm. tall, stems (and branches) more or less 4-angled or very narrowly 4-winged below the ocreae which have 2 long subulate lobes; petiole as long as and adnate to ocrea; blade jointed to petiole, linear, 5-30 mm. long, 1 (-3) mm. broad; flowers solitary or in 2's (or 3's) at the upper nodes, nearly sessile, always erect; calyx about 3 mm. long; sepals 5; style 0.3-0.4 mm. long, 3-parted to near the base; achene triquetrous, about 3 mm. long, black, smooth and shiny at maturity, margin of face of achene characteristically dull and striate. Pollen of *P. tenue* is of the *Duravia*-type thus indicating that this species should be assigned to *Polygonum* Sect. *Duravia*. Rare in e. half (Denton and Gonzales cos.) of Tex., in sterile oak woods, Sept.-Nov.; e. half of U.S.

7. *Polygonum sagittatum* L. TEARTHUMB, ARROW-VINE. Basally stoloniferous or sub-rhizomatous, probably perennial; stems ascending, thin, weak and reclining or scandent, to 2 m. long, 4-angled and finely channeled, armed on the angles with minute recurved prickles; leaf blades lanceolate or broadly so, 1-12 cm. long, sagittate-cordate basally, apically acute; petioles long in lower leaves, short in upper ones; inflorescences terminal and axillary (a very small tight head of white or pale-pink flowers on a very long peduncle longer than leaves); calyx 5-parted; stamens 8; achene triquetrous, 3-3.5 mm. long, black or brownish, smooth. *Tracaulon sagittatum* (L.) Small. Infrequent at margins of lakes, swamps, marshes and bogs in e. Tex., June-Oct.; Nfld. to Sask., s. to Fla. and Tex.

The related species *P. Meisnerianum* Cham. & Schlecht. has repeatedly dichotomously branched peduncles and the bases of the blades are nearly sessile and only very shallowly (if at all) cordate; it has been reported to occur in Texas, but we have seen no specimens.

8. *Polygonum cristatum* Engelm. & Gray. Short-lived perennial vine (flowering first year); stems annual, twining; leaf blades deltoid to shallowly sagittate-deltoid, 2-9 cm. long, only very slightly (if at all) acuminate; flowers reflexed (pendulous) on very slender pedicels several mm. long, at the middle nodes borne in twos or threes but on some of the distal parts of the stems borne in racemelike masses; calyx after anthesis eventually about 6 mm. long, 3 of the sepals with flat, toothed or crimped wings 0.25-1 mm. broad; achenes lustrous, trigonous, 3-3.5 mm. long. *Tiniaria cristata* (Engelm. & Gray) Small, *Bilderdykia cristata* (Engelm. & Gray) Greene, *P. scandens* L. var. *cristatum* (Engelm. & Gray) Gl., *Reynoutria scandens* (L.) Shinnars var. *cristatum* (Engelm. & Gray) Shinnars. Edges of woods in e. and n.-cen. Tex. (possibly also canyons in Plains Country), Aug.-Oct.; Tex., Ark., Okla. and La.; sparingly elsewhere where probably adv.

Polygonum scandens L. has been reported to occur in Texas (Wheeler Co.) but we have seen no specimens; it has more deeply sagittate leaves and denser inflorescences and infructescences, the mature calyxes about 1 cm. long and with wings 1.5-3 mm. broad at summit.

9. *Polygonum Convolvulus* L. BLACK BINDWEED. Annual vine, glabrous but minutely scurfy; stems twining, 1-12 dm. long; leaf blades ovate-deltoid or usually ovate-sagittate, 15-60 mm. long, acuminate; flowers borne usually in pairs or threes at the same nodes or toward the ends of the branches flowers in racemelike inflorescences; pedicels very slender, 2-3 mm. long, reflexed; calyx after anthesis becoming about 3.5 mm. long, closely investing the achene, the 3 outer sepals minutely keeled; achene 3.5-4 mm. long, triquetrous, black. *Bilderdykia Convolvulus* (L.) Dum., *Tiniaria Convolvulus* (L.) Webb & Moq., *Reynoutria Convolvulus* (L.) Shinnars. Infrequent or rare, usually in disturbed soil and often in gardens and flowerbeds, nearly throughout Tex., except extreme Trans-Pecos, Apr.-Sept.; a Eur. weed now widely adv.

10. *Polygonum virginianum* L. JUMP SEED. Annual herb; stems erect or reclining, 3-15 dm. tall; ocreae marginally truncate and ciliate; leaf blades ovate to elliptic-ovate or

ovate-lanceolate, 3-16 cm. long, acute; flowers in long terminal very loose and interrupted wandlike or spikelike aggregations; pedicels about 3 mm. long; calyx greenish-white, about 4 mm. long, 4-parted to near the middle; achene lenticular, strongly biconvex, 3.5-4 mm. long, ovoid-oblong, topped by the 2 persistent deflexed and hooked (hornlike) rather rigid styles about 4 mm. long. *Antenorion virginianum* (L.) Roberty & Vautier, *Tovara virginiana* (L.) Raf. Local in rich woodlands, e., s.e. and n.-cen. Tex., June-Oct.; Que., Ont. and most of e. U.S.; also Pue. and Hgo.

5. PERSICARIA MILL.⁵¹

Herbaceous glabrous or appressed-pubescent annuals or perennials with alternate stipulate (sheathlike ocreae) leaves; flowers small, mostly in spikelike racemes, 4- to 6-merous; sepals distinct, petaloid; stamens 6 to 8; anthers small, linear, occasionally highly colored; styles 2 or 3, joined at or near base; fruit a lenticular or trigonous 1-celled dark-brown or black achene.

About 120 species, world-wide.

1. Ocrea (stipular sheath) with marginal cilia less than 1 mm. long (2)
1. Ocrea with marginal cilia 1.5 mm. long or more (8)
- 2(1). Peduncles with numerous stalked glands (3)
2. Peduncles without stalked glands (sessile ones may occur) (5)
- 3(2). Styles and stamens of the same length (or nearly so), not exerted from calyx; achene lenticular, flat or nearly so on both surfaces; flowers white to pink; annual 3. *P. pensylvanica*.
3. Styles or stamens exerted; achene lenticular and with at least one side convex or ridged (4)
- 4(3). Racemes 1 or 2, terminal; achene plump, strongly biconvex; leaves and ocreae obviously pubescent (at least when young); sepals in fruit more than 4 mm. long, strongly veined; flowers pinkish-red; stems green; perennial 1. *P. coccinea*.
4. Racemes numerous, lateral and terminal; achene ridged or with only one strongly convex face; leaves and ocreae glabrous or nearly so; sepals in fruit usually less than 4 mm. long; flowers white or pink; stems usually cherry-red (at least at nodes); annual 2. *P. bicornis*.
- 5(2). Racemes usually nodding; sepals with prominent anchor-shaped veins near apex; achene lenticular, flat, about 2 mm. long; annual ... 4. *P. lapathifolia*.
5. Racemes erect; sepals without anchor-shaped veins; achene biconvex, oval in cross section; annual or perennial (6)
- 6(5). Leaf blades less than 2 times as long as wide, long-petioled (usually 25 mm. long or more); mature ocrea short, about as wide as high; petioles, stems and peduncles copiously pubescent with strigose hairs; calyx 3.3 mm. long or more, pink to pinkish-red; annual 5. *P. orientalis*.
6. Leaf blades more than 2.5 times as long as wide, short-petioled (less than 20 mm. long); mature ocrea at least 1.5 times longer than broad; petioles, stems and peduncles glabrous or pubescent; calyx 2-4.5 mm. long, white or pinkish-red (7)
- 7(6). Peduncles and ocreolae strigose or stipitate-glandular; stamens or styles strongly exerted from the flowers; calyx in fruit 4 mm. long or more, pinkish-red; racemes 1 or 2, terminal 1. *P. coccinea*.
7. Peduncles and ocreolae not strigose or stipitate-glandular (glands, if present, sessile); stamens and styles mostly included; calyx in fruit less than 3.5 mm. long, white or pinkish-white; racemes numerous, terminal and lateral 6. *P. densiflora*.

⁵¹ Contributed by James S. Wilson.

- 8(1). Leaf blades less than twice as long as wide; petioles usually 25 mm. or more long; mature ocrea short, about as wide as high; petioles, stems and peduncles copiously pubescent with strigose hairs; flowers pinkish-red; robust annual 5. *P. orientalis*.
8. Leaf blades at least 2.5 times as long as wide; petioles usually less than 20 mm. long; mature ocrea at least 1.5 times as long as broad (9)
- 9(8). Calyx glandular (10)
9. Calyx without glands (12)
- 10(9). Achenes biconvex, oval in cross section; styles 2; stems stout, usually over 7 mm. in diameter at base; perennial 6. *P. densiflora*.
10. Achene mostly trigonous, triangular in cross section; styles 3; stems less than 6 mm. in diameter at base (11)
- 11(10). Achenes black, lustrous, smooth; young flower buds white or green-tipped; inflorescence erect 7. *P. punctata*.
11. Achenes black, dull, minutely pitted; young buds pinkish; inflorescence usually nodding 8. *P. Hydropiper*.
- 12(9). Achenes trigonous; styles 3 (13)
12. Achenes lenticular; styles 2 (15)
- 13(12). Racemes usually less than 4 cm. long, mostly rounded at the apex; marginal cilia of ocrea usually less than 3 mm. long; achene ovoid, longer than wide, lenticular or trigonous (if trigonous, the faces slightly concave) 9. *P. vulgaris*.
13. Racemes usually more than 4 cm. long, tapering to the apex; marginal cilia of ocrea usually 3 mm. long or more; achenes trigonous, about as wide as long, the sides or faces flat (14)
- 14(13). Ocrea with marginal cilia usually 6 mm. or more long; leaves usually 15 mm. or more wide; stems usually 7 mm. or more in diameter at base 10. *P. setacea*.
14. Ocrea with marginal cilia usually less than 6 mm. long; leaves usually less than 15 mm. wide, if wider then the ocrea usually less than 5 mm. long; stems less than 7 mm. in diameter at base 11. *P. hydropiperoides*.
- 15(12). Racemes usually less than 4 cm. long, mostly rounded at the apex; marginal cilia of ocrea usually less than 3 mm. long; achene lenticular or trigonous (if trigonous, the faces slightly concave); annual 9. *P. vulgaris*.
15. Racemes usually more than 4 cm. long, tapering to the apex; marginal cilia of ocrea usually 3 mm. or more long; perennial (16)
- 16(15). Peduncles and ocreolae strigose or stipitate-glandular; stamens or styles strongly exerted from the flowers; calyx in fruit 4 mm. long or more, pinkish-red; racemes 1 or 2, terminal 1. *P. coccinea*.
16. Peduncles and ocreolae not strigose or stipitate-glandular (glands, if present sessile); stamens and styles mostly included; calyx in fruit less than 3.5 mm. long, white or pinkish-white; racemes numerous, terminal and lateral 6. *P. densiflora*.

1. *Persicaria coccinea* (Muhl.) Greene. Perennial from subterranean rhizomes; stems mostly erect, greenish, to 15 dm. high; leaf blades lanceolate, usually pubescent (particularly beneath), acute to truncate at base, 5-25 cm. long, 1-6 cm. wide; ocrea usually ciliate, pubescent, much longer than wide; peduncles stipitate-glandular or strigose-pubescent; racemes terminal, 1 or 2; calyx pink to reddish-pink, 4 mm. long or more in fruit; stamens included or exerted (always of different length than the styles); styles 2, included or exerted; achenes infrequent, biconvex, turgid, 2.8-4 mm. long, black, lustrous. *Polygonum coccineum* Muhl. Ponds, rivers, streams, lakes and ditches in e. Tex., June-Oct.; throughout N.A.

2. *Persicaria bicornis* (Raf.) Nieuw. PINK SMARTWEED. Annual from taproot; stems erect, much-branched, cherry-red (at least at the nodes), 1-20 dm. high; leaf blades lanceolate, punctate, glabrous except for a few appressed hairs, 5-18 cm. long, 1-4 cm.

wide; ocrea eciliate or occasionally with cilia less than 1 mm. long, higher than wide; peduncles stipitate-glandular; racemes erect, numerous, terminal and lateral; calyx pinkish, 5-parted, 2.7-4.6 mm. long; stamens 6 to 8, included or exerted (always of different length than the styles); styles 2, included or exerted; achene lenticular, ridged or humped on at least one face, dark-brown or black, lustrous, 2.5-3.5 mm. long and nearly as wide. *Polygonum bicorne* Raf., *Polygonum longistylum* Small. Wet areas, ditches and disturbed habitats (often a first year invader) throughout Tex., May-Jan.; Neb. to Colo. and s. to Tex., Calif. and Mex.

The plants in southern Texas often have slightly fringed ocreolae (fringe absent in north) and more pronounced ridges on the achene than their northern counterparts.

3. *Persicaria pensylvanica* (L.) Small. SMARTWEED. Annual from taproot; stems erect, much-branched, usually greenish, mostly glabrous, 1-20 dm. high; leaf blades lanceolate, punctate, glabrous or with some scattered appressed hairs, 5-22 cm. long, 1-5 cm. wide; ocrea eciliate, longer than wide, thin and brittle; peduncles stipitate-glandular or stipitate-glandular and pubescent; racemes numerous, erect, terminal and lateral; calyx white to pinkish, 5-parted, 3.1-4.2 mm. long; stamens of nearly the same length as the styles and not exerted from the calyx; styles 2; achene lenticular, flat or concave on both faces, dark-brown or black, lustrous, 2.5-3.4 mm. long and nearly as wide. *Polygonum pensylvanicum* L. Wet or disturbed areas in (mostly) e. Tex., May-Nov.; throughout N.A.

4. *Persicaria lapathifolia* (L.) Small. Annual from taproot; stems erect, much-branched, greenish, 1-25 dm. high; leaf blades lanceolate, punctate, glabrous (occasionally densely white-tomentose beneath in aquatic forms), 5-30 cm. long, 1-5 cm. wide; ocrea eciliate, glabrous, strongly ribbed, higher than wide, brittle; peduncles glabrous or somewhat appressed-pubescent, occasionally glandular; racemes mostly nodding but on small specimens usually erect, numerous; calyx white to pinkish-white, 4- or 5-parted, 2-2.9 mm. long, 1.1-1.9 mm. wide, bearing anchor-shaped veins near the apex of each sepal; stamens included; styles 2; achenes lenticular, dark-brown or black, 2-2.5 mm. long, 1.8-2.4 mm. wide, usually concave on one side. *Polygonum lapathifolium* L. Wet areas, disturbed habitats, throughout Tex., Apr.-Dec.; introd. from Eur. and now throughout N.A.

5. *Persicaria orientalis* (L.) Spach. PRINCESS-FEATHER. Annual from taproot; stems erect, branched, usually green, strigose, 4-30 dm. high; leaf blades obovate, commonly truncate at base, strigose beneath, 6-22 cm. long, 4-12 cm. wide; ocrea usually ciliate, about as wide as high; peduncles tomentose; racemes numerous, erect; calyx 5-parted, pink to reddish-pink, epunctate, 4-4.5 mm. long in fruit; stamens included; styles 2; achenes lenticular, turgid, oval in cross section, black, lustrous, 3-3.5 mm. long, 1.8-2.6 mm. wide. *Polygonum orientale* L. E. Tex., June-Nov.; a garden escape in e. U.S.; nat. of Eur.

6. *Persicaria densiflora* (Meisn.) Moldenke. Perennial; stems erect, branched, usually 7 mm. or more wide at base, usually glabrous, 6-20 dm. high; leaf blades lanceolate, mostly glabrous, 5-25 cm. long, 2-5 cm. wide; ocrea ciliate or eciliate, brittle, longer than wide; peduncles occasionally glandular or slightly pubescent; racemes numerous, long, often appearing compound, mostly erect; calyx whitish to whitish-pink, 5-parted, 2.3-3.2 mm. long; styles 2; achene lenticular, turgid, oval in cross section; lustrous, dark-brown to black, 1.9-2.5 mm. long. *Polygonum densiflorum* Meisn. Wet areas (often in water) along the Coastal Plain, June-Nov.; infrequent but throughout e. U.S. and southw.

7. *Persicaria punctata* (Ell.) Small. WATER SMARTWEED. Annual or perennial; stems ascending, green, glabrous or nearly so, 1-10 dm. high; leaf blades lanceolate, punctate, 3-15 cm. long, 5-20 mm. wide; ocrea 2 to 4 times as long as wide, ciliate, the bristles usually less than 6 mm. long; peduncles usually glabrous, glandular; racemes numerous, usually erect, mostly moniliform; calyx dotted with yellowish glands, mostly green or greenish-white, excluding the stipe less than 3 mm. long (in ours); stamens included; styles 3; achenes dark-brown or black, lustrous, trigonous (occasionally lenticular-turgid), 1.8-3 mm. long and about three fourths as wide. *Polygonum punctatum* Ell. Wet areas throughout but more common in e. Tex., Feb.-Dec.; throughout N.A. and S.A.

Often confused with *P. Hydropiper* which has dull achenes and nodding racemes.

8. *Persicaria Hydropiper* (L.) Opiz. WATER SMARTWEED. Annual or perennial; stems ascending, glabrous or nearly so, green, 1-10 dm. high; leaf blades lanceolate, punctate, 3-16 cm. long, 5-20 mm. wide; ocrea 2 to 4 times as long as wide, ciliate, the bristles usually less than 6 mm. long; peduncles usually glabrous, glandular; racemes numerous,

moniliform, commonly nodding or drooping; calyx yellow-glandular, green or greenish-white (pink at tip on young buds), 2.5-4.1 mm. long in fruit; stamens included; styles usually 3; achenes dark-brown or black, dull, minutely pitted, mostly trigonous, 2-3.3 mm. long. *Polygonum Hydropiper* L. Rare, mostly e. Tex., June-Dec.; throughout N.A. and also parts of Euras.

Similar to and often confused with *P. punctata*.

9. *Persicaria vulgaris* Webb & Moq. LADY'S-THUMB, MOCO DE GUAJOLOTE. Annual; stems much-branched, ascending, glabrous or nearly so, green or occasionally marked with red, 1-10 dm. high; leaf blades lanceolate, nearly glabrous, 3-15 cm. long, 5-18 mm. wide; ocrea brittle, 2 to 4 times as high as wide, ciliate, the bristles usually less than 3 mm. long; peduncles usually glabrous; racemes numerous, usually less than 3 cm. long (rarely to 5 cm.), dense; calyx without glands, white, pink or purple, 2.2-3.2 mm. long; stamens included; styles 2 or 3; achenes dark-brown or black, lustrous, lenticular or trigonous (if trigonous, the faces slightly concave), 2-2.7 mm. long. *Polygonum Persicaria* L. Common in disturbed areas or wet ground throughout Tex., June-Dec.; introd. from Eur. and now throughout N.A.

Similar to and often confused with *P. hydropiperoides*.

10. *Persicaria setacea* (Baldw.) Small. Perennial; stems large, the base (usually 7 mm. or more in diameter) often decumbent and rooting at the nodes, greenish above, to 2 m. high; leaf blades lanceolate, scabrous to strigose, 7-24 cm. long, 1-6 cm. wide; ocrea 6-18 mm. long, pubescent, ciliate, the bristles 6-22 mm. long; peduncles strigose to glabrous; racemes numerous, erect, tapering to the apex, usually over 4 cm. long; calyx without glands, white to pinkish-white, 2-2.9 mm. long; stamens included; styles 3; achenes dark-brown to black, lustrous, trigonous (the faces flat), 1.5-2.5 mm. long and about three fourths as wide. *Polygonum hydropiperoides* var. *setaceum* (Baldw.) Gl. Wet areas in e. Tex. and Gulf Coast, June-Oct.; s.e. U.S. and southw.

Overlapping with *P. hydropiperoides* var. *opelousana* in many characteristics.

11. *Persicaria hydropiperoides* (Michx.) Small. Annual or perennial; stems erect, often rooting at nodes, glabrous or nearly so, to 1 m. high; leaf blades lanceolate, minutely scabrous to strigose, 3-17 cm. long, 8-15 mm. wide; ocrea ciliate, the bristles usually less than 5 mm. long, scabrous to strigose, at least twice as long as wide; racemes mostly 4-8 cm. long, numerous, usually tapering to the apex; calyx white to pink, without glands, 2-3.2 mm. long; stamens included; styles 3; achenes dark-brown or black, lustrous, trigonous (the faces flat), 1.6-2.3 mm. long (usually about 1.9 mm. long). *Polygonum hydropiperoides* Michx. Wet areas throughout Tex., June-Nov.; throughout N.A.

Many intergrades occur between the two varieties of this taxon and between them and *P. setacea*.

Var. *opelousana* (Ridd.) J. S. Wils. Differing from var. *hydropiperoides* in narrower leaves (rarely over 1 cm. wide), longer cilia on the ocrea (usually over 5 mm. long) and shorter achenes (usually about 1.7 mm. long). *Polygonum opelousanum* Ridd., *P. hydropiperoides* var. *opelusanum* (Ridd.) Stone. Wet areas in e. Tex., Apr.-Nov.; throughout s.e. U.S. and n. Mex.

The most common variety in Texas, being particularly abundant in wet ditches, swales, etc. In many areas, this taxon is hardly, if at all, separable from var. *hydropiperoides*.

6. ANTIGONON ENDL.

PRIVY-VINE

A tropical American genus of about 8 species.

1. *Antigonon leptopus* H. & A. QUEEN'S WREATH, COAMECATL, CORONA DE LA REINA. Perennial vine from enlarged somewhat tuberlike roots; stems annual (at our latitude), tendril-bearing; leaves alternate, thin, reticulate-veined, ovate, 2-13 cm. long, entire, usually deeply cordate at base and acuminate at apex; flowers pendulous in branched inflorescences, pink or less often white; fruiting calyx commonly 5-10 mm. long; endosperm ruminant. Commonly planted in s. and e. halves of Tex., in the s. part occasionally volunteering (especially about old homesteads), summer-fall; nat. of Mex., widely introd. in warm temp. regions.

One of our most desirable ornamentals; eagerly sought by bees and hummingbirds.

7. BRUNNICHIA GAERTN. EARDROP VINE

A monotypic North American genus.

1. *Brunnichia ovata* (Walt.) Shinn. Perennial vine; stems perennial at least in part, climbing by means of tendrils; leaves alternate, entire, ovate or ovate-lanceolate, truncate or subcordate at base, acute to acuminate at apex, 3-15 cm. long; flowers in terminal paniced spikelike racemes, with calyx greenish or yellow-green; achene trigonous, about 6 mm. long, closely invested by the accrescent and leathery somewhat winged hypanthium that becomes nearly 3 cm. long. *B. cirrhosa* Gaertn. Infrequent on edge of and in woods near streams, lakes and ponds in e. Tex., spring-summer; Gulf States, n. to Mo., Tenn. and S.C.

There is some question regarding the name of this plant since the names "ovata" and "cirrhosa" were published within a few months of each other, and it is not certain which has priority.

FAM. 61. CHENOPODIACEAE VENT.⁵²
GOOSEFOOT FAMILY

Herbaceous weedy plants, glabrous or pubescent, with inconspicuous flowers; stems more or less succulent, often articulate; leaves opposite or alternate, with no stipules nor scarious bracts, sessile or petiolate; blades flat, broad or often succulent and cylindrical or subterete, sometimes reduced to scales, entire, dentate or lobed; flowers perfect, unisexual or polygamous, usually regular, minute, usually green, with the free calyx imbricated in the bud, usually solitary in small cymose glomerules that are spicate, axillary, paniculate or cymose, or flowers axillary and solitary, sometimes arranged in terminal strobiles or sunken in depressions in the stem; stamens as many as lobes of the flower or occasionally fewer and inserted opposite them or on their bases; ovary 1-locular, becoming a 1-seeded thin utricle or rarely an achene; styles or stigmas 2, rarely 3 to 5; perianth simple, persistent, mostly enclosing the fruit; embryo coiled into a ring around the mealy endosperm (if any is present) or conduplicate or spiraled.

About 100 genera and 1,400 species, world-wide, many weeds. Represented in Texas by 16 genera and about 48 species.

1. Embryo annular, hippocrepiform, conduplicate or semiannular, partly or wholly surrounding the endosperm; perianth segments slightly if at all imbricate (2)
1. Embryo spirally coiled; endosperm lacking or divided by the embryo into two parts (14)
- 2(1). Fruit opening after ripening or at termination of a lid; flowers perfect 1. *Beta*, p. 528.
2. Fruit indehiscent (3)
- 3(2). Leaves well-developed; stems not jointed; flowers usually glomerate or solitary in the axils (4)
3. Leaves reduced, scalelike; stems jointed; flowers in fleshy spikes or sunken in joints of the stems, perfect, ebracteolate (13)
- 4(3). Fruit naked when ripe; flowers perfect, spicate, ebracteolate 11. *Corispermum*, p. 546.
4. Fruits when ripe enclosed by the perianth or by bracts (5)
- 5(4). Pubescence of inflated stellate or glandular hairs, or these sometimes lacking (6)
5. Pubescence sericeous; flowers usually perfect, mostly ebracteolate (12)
- 6(5). Flowers mostly perfect, ebracteolate (7)
6. Flowers usually unisexual, the pistillate ones bracteate (9)

⁵² Contributed by Clyde F. Reed; cf. his treatment in C. L. Lundell, *Flora of Texas* II: 21-88. 1969 for complete synonymy.

- 7(6). Stamen 1; perianth segment 1 2. *Monolepis*, p. 528.
 7. Stamens usually 3 to 5; perianth segments 3 to 5 (-8)
 8(7). Perianth horizontally winged in fruit 3. *Cycloloma*, p. 529.
 8. Perianth not winged 4. *Chenopodium*, p. 529.
 9(6). Pubescence of branched hairs; seed vertical; perianth none in the pistillate flowers 8. *Eurotia*, p. 545.
 9. Pubescence of inflated hairs or lacking; seed vertical or horizontal (10)
 10(9). Bracts of pistillate flowers strongly obcompressed, carinate dorsally; pistillate flowers bibracteate 7. *Suckleya*, p. 545.
 10. Bracts of pistillate flowers usually compressed, never strongly obcompressed; pistillate flowers without a perianth (11)
 11(10). Stigmas 4 or 5; leaves and stems glabrous; bracts united to near the apex 5. *Spinacia*, p. 538.
 11. Stigmas 2 or 3; leaves and stems with inflated hairs, at least when young 6. *Atriplex*, p. 538.
 12(5). Perianth segments horizontally winged in fruit 9. *Kochia*, p. 545.
 12. Perianth segments all or some of them produced into an elongate spine in fruit 10. *Bassia*, p. 546.
 13(3). Bracts subtending the flowers alternate, fleshy, peltate, persistent or tardily deciduous; flowers forming dense cylindric sessile spikes; seed smooth; endosperm copious 12. *Allenrolfea*, p. 547.
 13. Bracts subtending the flowers opposite, united, persistent; flowers sunken in depressions of the branches; seed pubescent; endosperm none 13. *Salicornia*, p. 547.
 14(1). Flowers ebracteolate, the staminate ones consisting of stamens arranged beneath a peltate scale in an amentlike spike 14. *Sarcobatus*, p. 548.
 14. Flowers bracteolate, mostly perfect, never in amentlike spikes (15)
 15(14). Bractlets small, scalelike, shorter than the perianth; embryo plano-spiral 15. *Suaeda*, p. 549.
 15. Bractlets equaling or longer than the perianth; embryo usually conic-spiral 16. *Salsola*, p. 551.

1. BETA L.

About 6 species native to Europe and the Mediterranean region.

1. *Beta vulgaris* L. BEET. Annual or biennial herb, usually glabrous throughout, the roots (hypocotyl) much-thickened, often grown as a vegetable; stems 6-12 dm. tall, one of several from each root, paniculately branched above, green or often red; leaves alternate, the petioles of lower rosulate ones often equaling the blades; blades oval or ovate-oblong, often undulate, fleshy; flowers perfect, in glomerules, sessile in the axils of leaves or terminal in simple spikes that become elongated and interrupted with age; perianth urceolate, 5-lobed, adherent to the base of the ovary, in fruit closed and indurate; calyx tubes oblong, becoming linear, obtuse and strongly carinate; stamens 5, perigynous; stigmas 2 to 5, connate at the base; pericarp attached to the perianth below and free from the seed; seed horizontal, orbicular or reniform, 1.5-2 mm. broad, smooth; embryo annular, surrounding the copious endosperm.

Cultivated for its beet-root and leaves as vegetables and its root for sugar; occasionally escaped from cultivated areas.

2. MONOLEPIS SCHRAD.

About 6 species in both the New World and Old World.

1. *Monolepis Nuttalliana* (Schult.) Greene. POVERTY WEED. Annual herb, low and branched at the base, with pale-green foliage; stems stout, decumbent or ascending,

much-branched, 1-3 dm. tall, succulent, rather mealy when young, becoming glabrate in age; leaves alternate, fleshy, short-petioled or subsessile, the upper leaves sessile, the leaf blades triangular to lanceolate, 1-6.5 cm. long, with a pair of divergent lobes toward the base, sometimes a few teeth above, otherwise entire; flower clusters sessile, densely many-flowered with bracts, often reddish in age; sepals single, entire, persistent, bractlike, fleshy or coriaceous, oblanceolate or spatulate, acute or acutish; stamen 1 or lacking in pistillate flowers; styles 2, filiform; stigmas 2, subulate, connate at the base; pericarp or utricle ovoid, compressed, evenly pitted at maturity, adherent to the seed; seed 1 mm. in diameter, vertical, flattened, dark-brown or black, the margin entire; embryo annular, surrounding the mealy endosperm; radicle inferior. In alkaline and dry soils, Man. to Alta., s. to Calif., Tex., Mo. and Son.; on ballast in Me.; Sib.; Patagonia.

3. CYCLOLOMA Moq.

A monotypic genus.

1. *Cycloloma atriplicifolium* (Spreng.) Coult. **TUMBLE RINGWING, WINGED PIGWEED.** Annual herb 1.5-8 dm. tall and of equal diameter; stems erect or spreading, divaricately branched, striate, the branches slender, obtusely angled, loosely and thinly woolly, more or less glabrate in age except around the flowers; leaves alternate, sessile or short-petioled (2-15 mm. long); blades lanceolate to ovate 2-8 cm. long, 6-15 mm. broad, coarsely sinuately dentate, thin, acute at the apex, cuneate at the base; flowers polygamous (perfect and pistillate), in paniculate spikes, without bracts; sepals 5, keeled, the perianth developing at maturity into a horizontal wing; calyx wings white-hyaline, irregularly lobed and toothed, 4-5 mm. in diameter, covering the utricle, becoming red or purple in age; stamens 5; ovary densely tomentulose; styles 2 or 3, partially united; utricle depressed-globose, enclosed in the calyx; seed flat, about 1.5 mm. wide, horizontal, black, smooth; pericarp membranaceous, free from the seed; embryo annular, enclosing the mealy endosperm; radicle centrifugal. Weedy, often found in sandy fields, Man. to Ind., s. to Ariz. and Tex.; adv. in e. U.S. and Eur.

4. CHENOPODIUM L. GOOSEFOOT. PIGWEED

Annual or perennial weedy herbs, rarely suffrutescent, often strongly scented, usually with mealy-coated or glandular foliage but sometimes glabrate; stems sometimes quite rough and nearly woody; leaves alternate, usually petiolate, flat, varying from linear to ovate or hastate to lanceolate, the blade entire, toothed or lobed, quite variable; flowers perfect or rarely unisexual, in axillary or terminal spikes or glomerules; perianth usually 5-parted, calyxlike; sepals persistent, flat or keeled; stamens 1 to 5; ovary superior, usually depressed, 1-celled; styles 2 to 5; utricle containing one horizontal or vertical seed; pericarp usually adherent to the seed, sometimes fleshy; embryo curved or annular, surrounding the mealy endosperm; radicle inferior or centrifugal.

A large genus of weedy plants, represented in Texas by 26 species. Some species are used as potherbs while *C. quinoa* Willd. is a valuable cereal plant in South America.

- 1. Plants variously both pubescent and glandular; perianth parts separate or fused only at the base (2)
- 1. Plants glabrous or farinose but not glandular or pubescent (5)
- 2(1). Seeds vertical, 0.5-0.7 mm. broad; flowers in small glomerules in the axils of the lobed leaves 1. *C. pumilio*.
- 2. Seeds chiefly horizontal, 0.6-1 mm. broad (3)
- 3(2). Flowers in small glomerules or short spikes, these chiefly bracteate in an extensive paniculate inflorescence; well-developed leaves usually more than 6 cm. long; lower leaf surfaces glandular; perianth parts inconspicuously glandular, usually glabrous 4. *C. ambrostoides*.
- 3. Flowers in dichotomous cymes; leaves chiefly less than 3 cm. long; perianth and lower surface of leaves glandular or else these glabrous and young branches inconspicuously whitish vesiculous-pubescent; leaves sinuate-pinnatifid (4)

- 4(3). Glands on perianth parts chiefly stalked; stems densely glandular; perianth parts acute to attenuate, not keeled or tuberculate; cymes contracted in usually dense racemes 2. *C. Botrys*.
4. Glands on perianth parts chiefly sessile or lacking; stems moderately to sparingly pubescent or glandular; perianth parts acute or obtuse, keeled or tuberculate, glandular; cymes diffuse, in racemes or panicles 3. *C. incisum*.
- 5(1). Seeds vertical or both vertical and horizontal in the same inflorescence; plants glabrous or farinose but if conspicuously farinose on lower leaf surfaces then farinules inconspicuous or lacking on the perianth parts; perianth parts chiefly 3-parted (4- or 5-parted in horizontal flowers which are terminal in the glomerules), the divisions entire or apiculate; stigmas not over 0.5 mm. in length; annuals (6)
5. Seeds horizontal, rarely and exceptionally a few vertical; plants variously farinose, usually prominently so and at least as much so on the perianth parts as on the leaves; perianth 5-parted (7)
- 6(5). Perianth parts 3 or 4 (of flowers with vertical seeds), united nearly to the tip; stigmas 0.2-0.3 mm. long, usually ascending in a V; leaves glabrous, deltoid to rhombic or spatulate, shallowly denticulate to entire; free tips of sepals minutely but definitely apiculate 5. *C. chenopodioides*.
6. Perianth parts usually 5 (of flowers with vertical seeds), free nearly to the base or some but not all in each flower united above the middle; stigmas scarcely exceeding 0.1 mm., horizontally spreading; leaves densely white-farinose below, ovate or narrowly ovate, undulate or serrate, not hastate, the teeth and tips obtuse; perianth parts glabrous; horizontal seeds largely exposed by the sepals, numerous in the glomerules; glomerules chiefly ebracteate in small axillary or terminal spikes 6. *C. glaucum*.
- 7(5). Principal leaves linear to narrowly ovate or oblong, usually less than 15 mm. broad and occasionally to 20 mm. across the basal lobes, 3 times as long as broad, entire or with basal lobes and sometimes with low teeth in thin-leaved forms, 1- to 3-nerved or occasionally pinnately veined; petioles shorter than the blades; pericarp separable and smooth or attached and glandular-roughened, never reticulate or alveolate; sepals without definite apiculate tips, exposing the mature fruit laterally and dorsally; seeds maturing nearly uniformly in the cymes (8)
7. Principal leaves deltoid to deltoid-rhombic or ovate, 1 to 3 times as long as broad, pinnately veined, entire; sepals with definite apiculate tips (12)
- 8(7). Principal leaves oblong to lanceolate or ovate-lanceolate, moderately thin to almost fleshy, entire or if with prominent basal lobes then the terminal lobe lanceolate and less than 8 mm. broad; plant upright to low and spreading; pericarp separable 7. *C. desiccatum*.
8. Principal leaves linear or nearly so, chiefly fleshy, one-nerved, the margins entire; pericarp attached to the seed (9)
- 9(8). Sepals united to or above the widest part of the seed, appendaged by an undulate collar from the sinuses, not carinate; seeds 1.5 mm. broad, rugose, strongly flattened, umbonate 8. *C. cycloides*.
9. Sepals without an undulate collar from the sinuses, carinate; pericarp green or greenish (10)
- 10(9). Seeds 1.2-1.5 mm. wide; pericarp tuberculate-roughened; sepals sparingly farinose and appearing "water-soaked"; calyx closed in fruit; plants to 6 dm. tall, nearly glabrous 9. *C. pallelescens*.
10. Seeds 0.8-1 mm. wide; sepals densely farinose; calyx open in fruit; plants densely farinose (11)
- 11(10). Plants usually less than 4 dm. tall, not ill-scented; calyx scarcely covering the fruit 10. *C. leptophyllum*.
11. Plants 4-8 dm. tall, ill-scented; calyx cleft nearly to the base, yellowish tinged with green, erect at maturity to expose the fruit ... 11. *C. hians*.

- 12(7). Leaf blades deltoid to rhombic-deltoid or variously ovate but otherwise nearly entire (13)
12. Leaf blades ovate or rhombic-ovate to deltoid, 2-10 (-20) cm. long, longer than broad, at least the lower ones conspicuously deeply or shallowly toothed above the basal lobes (18)
- 13(12). Branches weak, often prostrate; leaves broadened above the base but not hastate; sepals variously united, at least some for three fourths their length 12. *C. Vulvaria*.
13. Branches erect or if spreading not weak or prostrate; leaves with or without basal lobes; sepals united less than half their length (14)
- 14(13). Pericarp separable (15)
14. Pericarp adherent to the seed (17)
- 15(14). Leaves membranaceous to coriaceous, less than 3 cm. broad, the blades with a basal lobe; seeds 0.9-1.1 mm. broad, maturing relatively uniformly and covered by the sepals; plants profusely branched, low and bushy 15. *C. incanum*.
15. Leaves thin, the blades deltoid or ovate; seeds averaging more than 1 mm. broad, maturing mixed in the glomerules and exposed at maturity; plants upright, strict or variously branched (16)
- 16(15). Leaf blades deltoid, 1-4 (rarely 5) cm. broad, scarcely longer than broad, the base with prominent hastate lobes; seeds mostly 1.1-1.5 mm. broad 13. *C. Fremontii*.
16. Leaf blades ovate, 1.5 cm. broad or less, only occasionally with a basal lobe; seeds mostly 1-1.3 mm. broad 14. *C. atrovirens*.
- 17(14). Seed 1 mm. broad; flowers in small axillary glomerules shorter than the leaves 16. *C. carnosulum*.
17. Seed 1.3-1.5 mm. broad; flowers in rather large glomerules, these in dense stout narrowly paniculate spikes 17. *C. neomexicanum*.
- 18(12). Leaves thin; fruit maturing very prominently mixed so that mature fruit and young perfect flowers are present in the glomerules at the same time; sepals weakly or not at all keeled, largely exposing mature fruit; pericarp usually separable; seeds more than 1 mm. broad (19)
18. Leaves thin to membranaceous or coriaceous; flowers in glomerules in nearly the same stage of development (20)
- 19(18). Leaves rounded or tapering at the base, the teeth short and ascending, gradually reduced to entire bracts subtending most of the inflorescence branches; pericarp smooth, strongly separable; seeds 1.1-1.5 mm. broad 18. *C. Standleyanum*.
19. Leaves rounded to truncate or cordate at the base, the teeth usually long-tapering and spreading; inflorescence ebracteate or the main branches subtended by rather well-developed leaves; seeds 1.5-2.5 mm. broad, umbonate-lenticular, their margins obtuse to moderately acute; pericarp thin and delicate, cellular-reticulate, readily separable or attached 19. *C. gigantospermum*.
- 20(18). Leaves all strongly deltoid and prominently sinuate-dentate or only the few uppermost reduced to entire lanceolate bracts; stigmas short (0.1 mm. or less) and stout; seeds 1.2-1.5 mm. broad, the margins acute, the surface irregularly roughened; pericarp strongly adherent; sepals keeled, farinose, obtuse, largely exposing the fruit; plants rarely exceeding 4 dm. in height; inflorescence somewhat cymose, shorter than the leaves 20. *C. murale*.
20. Leaves rhombic-ovate, variously toothed, gradually reduced upward to entire lanceolate bracts; stigmas long or short but not stout (21)
- 21(20). Seeds and pericarp foveolate-reticulate, 1-1.5 mm. broad; style base often prominent (though less than 1 mm. long); leaves thin to coriaceous; sepals with a prominent winged keel often equaling half the width of the sepal 26. *C. Berlandieri*.

21. Seeds essentially smooth; pericarp smooth or inconspicuously irregularly roughened; leaves mainly membranaceous in texture; sepals usually not strongly keeled, the keel rarely as much as one fourth the width of the sepal; style divided essentially to the base (22)
- 22(21). Pericarp thin and strongly separable; leaves moderately thin; sepals strongly farinose to the tip21. *C. albescens*.
22. Pericarp usually attached but varying to separable; sepals with a hyaline or yellowish less farinose border (23)
- 23(22). Leaves large, the blades 6-14 cm. long, the lower ones doubly sinuate-dentate with sharp teeth, the upper ones reduced to sharply serrate or occasionally entire bracts, strongly farinose, the farinules often tinged red on young leaves; plants robust, 1-3 m. tall25. *C. giganteum*.
23. Leaf blades rarely exceeding 6 cm. long, variously toothed but scarcely sharply doubly sinuate-dentate, the upper ones reduced to entire lanceolate bracts; sepals largely covering the fruits; inflorescences densely flowered (24)
- 24(23). Seeds 0.9-1.2 mm. broad; plants flowering in second week of September; lower and median leaves not more than 1.5 times as long as wide, coarsely toothed (the lower ones more or less doubly so at the base)24. *C. missouriense*.
24. Seeds mostly 1.1-1.5 mm. broad; plants not restricted in flowering time; sepals largely covering the fruit (25)
- 25(24). Leaf blades scarcely longer than broad, the basal lobes often bipartite; sepals united to or above the broadest part of the fruit, usually strongly keeled
.....22. *C. opulifolium*.
25. Leaf blades 1.5 or more times as long as broad; sepals not united to broadest part of fruit, variously keeled23. *C. album*.

1. *Chenopodium pumilio* R. Br. RIDGED GOOSEFOOT. Annual herb, pubescent and glandular throughout; stems several from the base, ascending, spreading or prostrate, 2-4 dm. long; leaves ovate or oblong to lanceolate, 1-3 cm. long, with 2 to 4 coarse teeth on each side, lobed, densely beset with large yellow glands beneath, the petioles half as long as the blades; flowers small, in glomerules forming spikes 2-5 mm. long in all axils, occasionally in short terminal spikes; calyx beset with large yellow glands; stamen usually 1; fruiting calyx dry; seed small, vertical. *C. carinatum* of recent auth., not R. Br., 1810. Nat. of Austral.; naturalized in waste places in Calif. and Tex.; also in Mass., N.Y., Mo., N.J. and D.C.

2. *Chenopodium Botrys* L. JERUSALEM OAK. Annual herb, with a strong but not unpleasant aromatic scent; stems erect, 2-6 dm. tall, densely glandular-viscid throughout, much-branched, the branches ascending; leaves oblong or oval, 1-5 cm. long, sinuate-pinnatifid, entire or sinuately lobed, the lobes obtuse or rounded, truncate to cuneate at the base, petioles half as long as or shorter than the blades, the blades of leaves in the inflorescence reduced and often entire; inflorescence of numerous densely many-flowered cymes, the whole finally forming a narrow elongate nearly naked panicle; flowers subsessile, 1 mm. long; calyx cleft nearly to the base, the lobes oval or oblong and acute or acuminate, densely glandular-pubescent, imperfectly enclosing the fruit at maturity; pericarp thin, whitish, firmly attached to the seed; seed subglobose, 0.6 mm. in diameter, dark-brown, dull, vertical or horizontal. Nat. of Eur., Asia and Afr.; adv. and naturalized as a weed throughout U.S. and Can. in waste places, ditches, cinder dumps and railroad beds; also S.A.

3. *Chenopodium incisum* Poir. Annual herb, strong-scented; stems erect, 2-6 dm. tall, simple or branched at the base, the branches ascending, paniculately branched, sparsely puberulent or glabrate, often tinged with red; leaves deltoid-ovate or oblong to narrowly oblong, 2-6.5 cm. long, 1.5-3 cm. wide, obtuse or acuminate at the apex, truncate or narrowed and cuneate at the base, sinuate- or laciniate-pinnatifid, the lobes oblong or deltoid, bright-green, glabrous or minutely viscid-villous on the upper surface, covered beneath with yellow glands; inflorescence of numerous loosely few-flowered axillary cymes, these finally forming narrow elongate naked panicles; flowers sessile in the forks

of the branches and solitary at the ends of the slender lateral branches, the pedicellate flowers usually abortive with their pedicels spinose; calyx deeply cleft, the lobes oval or oblong and acute or obtuse, corniculate-appendaged, covered with yellow or orange-yellow sessile glands, incompletely enclosing the fruit; seed horizontal, 0.5-0.8 mm. broad, depressed-globose, dark-brown, the pericarp adherent. Dry places, s. Colo. and w. Tex. to Ariz., s. to C.R.; adv. in Mass. and Me.; also in Afr. and S.A.; June-Sept.

A medicinal plant in Mexico.

4. *Chenopodium ambrosioides* L. MEXICAN TEA, WORMSEED, EPAZOTE. Annual or perennial herb, glabrous or glandular, ill-scented; stems erect or ascending, 3-10 dm. tall; branches stout, simple or paniculately branched, glabrous or puberulent below, usually glandular-villous or tomentulose about the inflorescence but occasionally glabrous; leaves oblong to ovate or lanceolate, 2-12 cm. long, 15-55 mm. broad, sinuate-dentate or sinuate-pinnatifid, the lobes acute or obtuse, copiously gland-dotted or the glands absent, puberulent to short-villous or glabrous; flowers solitary or usually glomerate in dense or interrupted slender or stout elongate spikes, these naked or leafy (the blades much smaller than the lower ones, lanceolate to oblanceolate or spatulate to linear, obtuse to acute or attenuate); calyx about 1 mm. high, glabrous or short-villous, usually gland-dotted, the lobes rounded-ovate and obtuse, completely enclosing the fruit; stamens exerted; pericarp very thin and deciduous; seed horizontal or vertical, 0.6-0.8 mm. broad, nearly black, the margin obtuse. Incl. var. *anthelminticum* (L.) Gray. Waste places, cult. grounds and shores, salt marshes, a weedy and medicinal herb, Ont. and Me., s. to Fla., Tex. and Calif.; summer-fall; Berm.; naturalized in Eur., Asia and Afr.; nat. of trop. Am., W.I. and Mex. and C.A. to S.A.

5. *Chenopodium chenopodioides* (L.) Aellen. Annual herb; stems prostrate and low-branching or upright; leaves glabrous or promptly glabrate beneath, rhombic or spatulate, shallowly sinuate or entire; flowers terminal and lateral in glomerules, these either separate or forming contracted spikes in the axils of leaves or bracts, or in small or large panicles, the terminal flowers with horizontal seeds, the lateral flowers with vertical seeds; perianth parts (with vertical seed) 3 or 4, united nearly to the tips, the free tips minutely but definitely apiculate; stigmas chiefly 0.2-0.3 mm. long, usually ascending as in a *V. C. rubrum sensu* N. A. auth., *C. humile sensu* N. A. auth. Saline habitats, Wash. to Calif., Nev., Wyo., Col. and Tex.; also N.Y.

6. *Chenopodium glaucum* L. Annual herb; stems erect or prostrate, branched throughout, the branches stout and 1-4.5 cm. long, glabrous, often reddish; leaves with petioles equaling or shorter than the blades, oblong to ovate-oblong, 1-5 cm. long, 5-15 mm. broad, obtuse, narrowly or broadly cuneate at the base, the margins sinuate-angled or sinuate-dentate, the teeth obtuse or acute, pale-green and glabrous on the upper surface, densely farinose beneath; flowers sessile in dense glomerules, these arranged in slender interrupted axillary and terminal simple or paniculate naked spikes 1.5-4 cm. long, the inflorescence glabrous; calyx herbaceous, deeply cleft, the lobes 5 (rarely 3 or 4), obovate-oblong, obtuse, imperfectly enclosing the fruit; stamens 5 or 1 to 3 in the lateral flowers; pericarp green, free; seed vertical or horizontal, 0.6 mm. broad, dark-reddish-brown, nearly smooth, the margin acutish. Nat. of Eur., Asia, Afr., Austral. and Greenl.; adv. from N.B. to Va., Neb. and Tex.

7. *Chenopodium desiccatum* A. Nels. THICKLEAF GOOSEFOOT. Annual herb; stems erect, 1-5 dm. tall, usually much-branched throughout, the stout branches ascending or spreading, copiously farinose or finally glabrate, often tinged with red; leaves with short petioles about half as long as the blades, oblong to ovate-oblong, 8-20 (-40) mm. long, 4-10 mm. broad, obtuse or acutish at the apex, cuneate and 3-nerved at the base, entire, densely and coarsely farinose on both sides or becoming glabrate on the upper surface, the upper blades little-reduced; flowers in rather dense glomerules crowded to form short stout paniculate spikes; calyx densely and coarsely farinose, the obovate lobes obtuse and carinate, completely enclosing the fruit; pericarp free; seed horizontal, 1-1.5 mm. broad, turgid, nearly smooth, shining, dark-reddish-brown to black, the margin obtuse. In arid regions and dry soils, S.D. to Ida. and Wash., s. to Kan., Mo., Tex., N.M. and Calif., July-Sept.

Var. *leptophylloides* (Murr.) H. A. Wahl. Annual herb; stems erect, 2-8 dm. tall, much-branched throughout or simple below, the branches ascending or suberect, glabrate

or farinose; leaves lanceolate to oblong-elliptic, obtuse or acute at the apex, cuneate at the base, 2-6 cm. long, 4-18 mm. wide, the petioles about half as long as the blades, 3-nerved, entire or the larger ones commonly with a short rounded tooth on each side near the base, thick, densely farinose beneath, usually glabrous and bright-green on the upper surface, the upper blades reduced; flowers in dense glomerules; calyx lobes obtuse, rough and white-margined, green on the back, slightly to strongly carinate, completely enclosing the fruit; pericarp free; seed horizontal, 1-1.5 mm. broad, smooth, shining, black, the margin obtuse. *C. pratericola* Rydb. In arid soils and in waste grounds, Sask. to Wash., s. to Mo., Tex., N.M., Calif. and n. Mex., occasionally adv. in e. U.S., July-Sept.

8. *Chenopodium cycloides* A. Nels. Annual herb; stems erect, 3-4 (often to 12.5) dm. tall, much-branched, the slender branches ascending, usually from a spreading base, mostly simple, glabrous or very sparsely and finely farinose, usually reddish; leaves narrowly linear, 1-1.5 cm. long, 1-1.5 mm. broad, 1-nerved, obtuse or acutish, thick, bright-green, glabrous on the upper surface, minutely and sparsely farinose beneath; flowers in rather large glomerules, these in slender or stout short dense or interrupted narrowly paniculate spikes, the inflorescence nearly naked; calyx sparsely farinose, shallowly lobed, the lobes broadly rounded at the apex and rounded on the back, the margins scarious, the whole calyx broadly spreading and slightly accrescent in fruit; pericarp adherent, bright-red, minutely tuberculate; seed horizontal, strongly compressed, 1.5 mm. broad, very smooth, black, shining, the margins acutish. On sand hills, s.w. Kan. to Tex. and s. N.M.

9. *Chenopodium pallescens* Standl. Annual herb; stems erect, 3-6 dm. tall, much-branched throughout, the branches subdichotomous, stout, erect, spreading or ascending, obtusely angled, striate, pale-green, glabrate or sparsely and finely farinose; leaves linear, 15-35 mm. long, 1.5-3 mm. broad, 1-nerved, obtuse or acutish, attenuate at the base, entire and thick, pale-green, glabrous or very sparsely and closely farinose, the petioles 2-5 mm. long, the upper blades shorter and narrower; flowers in large glomerules, these in short interrupted broadly paniculate or cymose-paniculate spikes, the inflorescences sparsely leafy; calyx slightly farinose, deeply cleft, the lobes rounded-ovate, fleshy, green, carinate, completely enclosing the fruit; pericarp thickish, firmly adherent to the seed, finely tuberculate; seed horizontal, 1.2-1.5 mm. broad, nearly smooth, black, shining, the margins rounded. Barrens and sand dunes, Ind., Mo. to Okla. and cen. Tex., s.e. Colo. and s.e. N.M.

10. *Chenopodium leptophyllum* Wats. Annual herb; stems erect, simple or branched below, green or reddish, 2-8 dm. tall, much-branched above, striately angled, branches densely farinose or becoming glabrate; leaves 1-6 cm. long, 2-3 (rarely 6) mm. broad, densely white-farinose, becoming glabrate above, obtuse, thick, 1-nerved, the petioles very short; flowers in large glomerules, these in dense erect paniculate spikes; calyx densely farinose, slightly to strongly carinate, scarcely covering the seed; seed 0.8-1 mm. broad, black, shining, with the pericarp firmly attached, horizontal. Dry places, canyons, slopes, Man. and Alta., southw. to Tex., N.M., Ariz., Calif. and Mex.; adv. eastw.; on sandy beaches from Me. to N.J.; adv. in Eur.; June-Sept.

11. *Chenopodium hians* Standl. Annual herb, ill-scented; stems 4-8 dm. tall, usually simple at the base or with a few short slender weak branches, sparsely branched above, the branches stout, erect or nearly so, copiously and coarsely farinose, obscurely and obtusely angled; leaves alternate; petioles stout, half as long as the blades or shorter; blades elliptic-oblong to oblong or narrowly lance-oblong, 1.2-3 cm. long, 3-8 mm. wide, rounded or obtuse at the apex, very shortly apiculate, cuneate at the base, green and glabrate on the upper surface, densely and rather coarsely white-farinose beneath, thick, the upper blades sometimes linear; flowers in large glomerules, these in very stout dense erect axillary or narrowly paniculate spikes; calyx densely farinose, cleft nearly to the base, the lobes rounded-oblong or ovate, obtusely carinate, yellowish tinged with green, erect at maturity and exposing the fruit; pericarp closely adherent; seed horizontal, 0.8-1 mm. broad, black, shining, nearly smooth, the margin obtuse. Dry hillsides, waste places, rangelands and roadsides, Wyo., Nev., Ut., N.M. and w. Tex.

12. *Chenopodium Vulvaria* L. Annual herb, with fetid odor, strongly white-mealy throughout; stems erect or ascending, widely branched from the base, the branches 1-5 dm. tall, slender or stout; leaves broadly ovate, 1-3.5 cm. long and as wide, obtuse or

acute, entire, rounded or broadly cuneate to the petiole, glabrescent above, copiously farinose beneath; inflorescences few, of small glomerules in compact leafy spikes, chiefly from the axils of the upper leaves; calyx segments densely farinose, obtuse, rounded on the back, completely enclosing the fruit; pericarp adherent to the seed; seed dull, black, about 1 mm. wide, slightly punctulate, horizontal, depressed-globose, the margins rounded. Nat. of Eur.; sparsely adv. from Fla. to Tex. and Calif.; also Wisc., Md., Ont. and Que.

13. *Chenopodium Fremontii* Wats. Annual herb; stems erect, 2-10 dm. tall, the branches slender, ascending, often flexuous, sparingly white-mealy to light-green, glabrous; leaves broadly triangular to rhombic, sinuate-dentate, 15-65 mm. long and nearly as broad, rounded and mucronate at the apex, the base with a prominent hastate lobe, the lobes oval to rounded-obovate, the slender petiole about half as long as the blade; flowers in clusters, these forming slender spikes or an open panicle; calyx usually sparsely farinose, deeply cleft, strongly carinate, nearly covering the fruit; stigmas short; pericarp free; seed horizontal, smooth or slightly rugulose, black, shining, fully 1 mm. broad, the margin obtuse. Canyons and bushy areas, moist places, Sask. and B.C. to N.D., s. to w. Tex., N.M., Nev., Ariz. and n. Mex.; May-Sept.

Forma *farinosum* Aellen. Plants more bushy in form and smaller; leaves smaller, thicker, more grayish-farinose, resembling those of *C. incanum* but with the habit and seed characteristics of typical *C. Fremontii*. Mainly in mt. areas, Ida. to Tex.

Var. *Pringlei* (Standl.) Aellen. Very similar to typical *C. Fremontii* except the leaves are serrate. N.D. to Tex. and Mex.

14. *Chenopodium atrovirens* Rydb. Annual herb; stems erect, 1-5 dm. tall, usually much-branched, the branches slender or stout, ascending, green, striate, glabrate; leaves broadly oblong to triangular-oblong or ovate, 1.5-3 cm. long, 5-15 mm. broad, obtuse or rounded at the apex, rounded to cuneate at the base, entire or rarely with 2 small rounded lobes at the base, usually thick, thinly farinose beneath when young but soon glabrate, the petioles slender and about two thirds as long as the blades; inflorescence sparsely farinose, the large glomerules dense and arranged in interrupted paniculate spikes or the spikes often simple, naked or nearly so; calyx deeply cleft, the obovate lobes rounded or emarginate, white-margined, sharply carinate, completely enclosing the fruit; pericarp free; seed horizontal, 1-1.3 mm. broad, dark-reddish-brown, shining, faintly rugulose, the margins obtuse. Mont. to e. Ore., s. to Colo., Tex. and Calif.

15. *Chenopodium incanum* (Wats.) Heller. Annual herb; stems erect, 1-5 dm. tall, much-branched throughout, the branches very stout, spreading or ascending, angled and striate, densely farinose; leaves triangular-rhombic to rhombic-orbicular, 1-3 cm. long and often as wide, obtuse or rounded and apiculate at the apex, rounded to broadly cuneate at the base, hastately lobed with rounded or obtuse lobes, very thick, densely white-farinose or often glabrate on the upper surface; flowers in large dense glomerules arranged in dense stout crowded paniculate spikes, the inflorescence leafy or naked, the leaves often oblong and entire; calyx densely farinose, the lobes carinate; stamens often exerted; pericarp free; seed horizontal, 0.9-1.1 mm. broad, smooth, black, shining, the margin obtuse. Dry plains and hillsides, sandy wastes, especially in "prairie-dog towns," Sask. and Alta. to S.D., s. to Neb., Ut., Nev., s. Calif., Tex. and Mex.; adv. in Mo. and Me.; May-Aug.

16. *Chenopodium carnosulum* Moq. Annual herb; stems erect or ascending, much-branched, the slender branches spreading, striate, 1-3 dm. tall, sparsely farinose when young, glabrate in age; leaves rhombic-deltoid to ovate-oblong or elliptic, 4-8 mm. long, 2-4 mm. wide, obtuse or acute, cuneate to rounded at the base, thick and succulent, sparsely farinose when young but soon glabrate, entire or shallowly lobed near the base, the lobes broadly rounded, the lateral veins vague, the petioles 1-2 mm. long; inflorescence densely leafy; flowers in small axillary glomerules shorter than the leaves; perianth 5-lobed, the lobes rounded, farinose, succulent, subcarinate, imperfectly enclosing the fruit; pericarp adherent to the seed, thin, green; seed horizontal, 1 mm. broad, nearly black, the margin obtuse. Tex. and Mex. s. to Ecu., Bol., Chile and Arg.

17. *Chenopodium neomexicanum* Standl. Annual herb, ill-scented; stems erect, 6-7 dm. tall, simple below, sparsely branched above, the branches slender, strongly ascending, sparsely and very finely farinose, nearly terete, often tinged red; leaves deltoid to

orbicular-ovate or rhombic-ovate, 15-28 mm. long, rounded at the apex and scarcely apiculate, truncate or rounded at the base, subhastate with low rounded or acutish lobes, very thin, green and very finely farinose beneath, the upper smaller blades often ovate to oblong, entire, acute; flowers in rather large glomerules, these in dense stout narrowly paniculate spikes, the inflorescence nearly naked; calyx rather sparsely farinose, cleft to the middle or lower, the lobes rounded-obovate, green, slightly carinate, completely enclosing the fruit; pericarp adherent to the seed; seed horizontal, 1.3-1.5 mm. broad, nearly black, shining, punctulate, the margin obtuse. Mts. of Trans-Pecos Tex. to s.w. N.M. and s.e. Ariz.

18. *Chenopodium Standleyanum* Aellen. Annual herb; stems erect or arched, slender, to 1 m. tall or to 2.5 m. long in woodland situations; leaves thin, green or sparsely white-mealy, those of primary axis larger than those of the branches, long-lanceolate to ovate-lanceolate or rarely ovate, to 8 cm. long and 1 cm. wide, acute, entire or the primary ones with a few low teeth (serrate-margined), acute or cuneate at the base, the upper leaves entire; flowers single or few in small glomerules, these forming short interrupted spikes, the latter grouped into a loose open slender often nodding terminal panicle; calyx more or less white-mealy, rounded, scarcely more than curling over the margins of the mature fruit; pericarp smooth, papery, fragile, easily separable from the seed; seed black, lustrous, 1-1.5 mm. in diameter, smooth to faintly striolate, longitudinally striolate over the radicle. Dry open woods, stream banks, waste areas and open grounds, also on cliffs, s. Que., Conn., N.Y. and Ind. to S.D., s. to Va., Fla., Ark., e. Tex. and N.M.

19. *Chenopodium gigantospermum* Aellen. Annual herb; stems erect, 6-13 dm. tall, green, glabrous, angled, the branches spreading; leaves rhombic-ovate or triangular-ovate, 4-17 cm. long, long-acuminate, rounded or subcordate at the base, sharply sinuate-dentate, with 1 to 4 large teeth on each side or the uppermost entire; flowers in large open leafless panicles; calyx with the sepals oblong, slightly keeled, partly covering the fruit; pericarp moderately thin, greenish-hyaline, less reticulate, separable or attached to the seed; seed umbonate-lenticular, tapering from the raised center to the sharply defined margin, punctate, about 2 mm. thick, black. *C. hybridum* of Am. auth., non L. A nat. plant of weedy habit, widely distributed in waste places in N.A., except in the s.e. states, Que. to B.C., s. to Va., Wash., Calif., Tex. and N.M.; June-Aug.

20. *Chenopodium murale* L. Annual herb, deep-green, somewhat mealy, stout and succulent; stems loose, erect or decumbent, 1-6 dm. long, simple or commonly branching from the base, glabrous or sparingly farinose; leaves thin, ovate to rhombic-ovate, 2-8 cm. long, 2.5-5 cm. wide, acute or obtuse, subtruncate to cuneate at the base, coarsely sinuate-dentate, glabrate or often copiously farinose (at least beneath), lustrous on the upper surface, the petioles equaling or shorter than the blades; flowers sessile, more or less farinose, in naked clusters or glomerules, arranged in lax or dense axillary and terminal cymes or panicles; calyx deeply cleft, the oblong lobes obtuse, herbaceous, green, obscurely carinate, partially enclosing the fruit; stamens exerted; styles short; pericarp green, adherent to the seeds; seed horizontal, sharp-angled, 1.2-1.5 mm. broad, blackish, dull, pitted or finely punctulate, the margin acute. Sandy wastes, draws, cult. soils, a common weed in yards and waste places, nat. of Eur., Asia and Afr.; widely adv. and established nearly throughout N.A. from s. Can. to Guat. and the W.I.; Mar.-Oct.

21. *Chenopodium albescens* Small. Annual herb; stems erect, 4-10 dm. tall, much-branched, the branches stout, obtusely angled, strongly ascending, pale-green, striate, copiously and finely farinose; leaves broadly rhombic-ovate to oval, 2-4.5 cm. long, 13-25 mm. wide, mostly obtuse or rounded at the apex, usually short-cuspidate or apiculate, obtuse to cuneate at the base, shallowly sinuate-dentate, often with only 2 shallow rounded lobes at the base, thick, pale-green and glabrate on the upper surface, densely and finely farinose beneath; inflorescence usually copiously leafy, with smaller ovate-oblong to lanceolate or elliptic and acute or acuminate leaves, the petioles half as long as the blades; flowers in small glomerules, these in short stout dense paniculate spikes; calyx densely farinose to the very tips, deeply cleft, the lobes rounded-ovate and slightly carinate, completely enclosing the fruit; pericarp thin, free; seed horizontal, 1 mm. long, very smooth, black, shining, the margin obtuse. In dry soils, w. Kan. and Ia. to Colo., w. Tex., Nev. and N.M.; June-Aug.

22. *Chenopodium opulifolium* Schrad. Annual herb; stems erect or ascending, 3-10 dm. tall, much-branched, the branches slender or stout, ascending from a widely spreading base, the lower branches usually elongate, obtusely angled, dark-green, sparsely farinose or glabrate; leaves very broadly ovate-rhombic, 2-4 cm. long and usually as broad, rounded at the apex or obtuse, broadly cuneate to subtruncate at the base, often shallowly 3-lobed, sinuate-dentate with obtuse or acutish teeth, thin, bluish-green, glabrate on the upper surface, sparsely and very finely farinose beneath, the upper blades smaller, rhombic-ovate and often entire; flowers in rather small glomerules, these in stout dense paniculate spikes, the inflorescence commonly narrow and copiously leafy; calyx densely farinose, the lobes rounded-ovate and carinate, completely enclosing the fruit; pericarp adherent to the seed; seed horizontal, 1.1-1.5 mm. broad, nearly smooth, black and shining, the margin rounded. *C. viride sensu* Standl., non L. Nat. of Eur., Asia and N. Afr.; adv. at e. coast seaports from N.Y., N.J., Pa., Del. and Md.; also in Ill., Mo. and Tex.

23. *Chenopodium album* L. PIGWEED, LAMB'S-QUARTERS. Annual herb, pale-green, sometimes turning reddish; stems erect, stout, 6-30 dm. tall, usually simple below the inflorescence, paniculately branched above, usually white-mealy throughout to glabrous, obtusely angled, striate; leaves oval-rhombic, rarely ovate or lanceolate, 2.5-8 cm. long, usually conspicuously longer than broad, obtuse or rounded and apiculate at the apex, often shallowly 3-lobed, irregularly sinuate-dentate, rarely subentire, mostly thick, pale-green and glabrate above, very finely and commonly densely farinose beneath, the reduced upper blades ovate to lanceolate, usually entire, acute and mucronate, not hastate; flowers in large glomerules, these in dense axillary or terminal stout erect or ascending paniculate spikes to 3 dm. long, the inflorescence usually narrow and compact, rarely lax, grayish-green, sparsely leafy; calyx copiously and finely farinose, deeply lobed, the lobes green, white-margined, acutely keeled, completely enclosing the fruit; pericarp adherent to the seed; seed horizontal, black, shining, 1.1-1.5 mm. broad, nearly smooth to minutely pitted, the margin obtuse. *C. viride* L. A Euras. weed., Nfld. to Fla., w. to Yuk. and B.C., s. to Mex. and S.A.; N. Afr.; Apr.-Sept.

24. *Chenopodium missouriense* Aellen. Annual herb; stems to 15 dm. tall, glabrescent or farinose; leaves thin, rhombic-ovate, rarely exceeding 6 cm. long, variously toothed, the lower and median ones not more than 1.5 times as long as wide, coarsely toothed, the lower leaves more or less doubly toothed at the base, the upper leaves reduced to entire lanceolate bracts; inflorescence relatively flexuous and arching, densely flowered; flowers in glomerules in nearly the same stage of development, flowering about the second week of Sept.; calyx slightly farinose, the lobes sharply keeled, largely covering the fruit; pericarp closely adherent; seed 0.9-1.2 mm. broad, often punctulate. Roadsides, streets and alleys, in vacant lots, waste places and in cult. fields, widely distributed s. of N.E. and the Great Lakes Region in e. N.A., s. and w. to Mo., Tex. and Mex.

25. *Chenopodium giganteum* D. Don. Annual herb; stems erect, 1-3 m. tall, much-branched, the branches stout, ascending or erect from a spreading base, sharply angled, bright-green, striped with red, sparsely and finely farinose; leaves broadly rhombic, 6-14 cm. long and the lower ones fully as broad, obtuse or rounded at the apex, not apiculate, broadly cuneate to subtruncate at the base, usually shallowly 3-lobed, rather finely and irregularly sinuate-dentate, often doubly dentate with obtuse or acutish teeth, rather thick, bright deep-green on the upper surface, finely farinose beneath when young but soon glabrate, the smaller upper blades rhombic-ovate to oblong or elliptic, usually dentate, rarely entire, bright-red (at least when young); flowers in small glomerules, these in dense stout broadly paniculate spikes; calyx copiously farinose, usually reddish, the lobes slightly carinate. A cult. Eur. plant, sometimes escaping; adv. in s. Ga. and n. Fla., Tex. and Cuba; Arg.

26. *Chenopodium Berlandieri* Moq. PITSEED GOOSEFOOT. Annual herb, usually ill-scented but not always; stems erect, 4-15 dm. tall, much-branched, often simple at the base, the branches ascending, often from a spreading base, slender or stout, obtusely angled, striate, pale- to deep-green, glabrate; leaves rhombic-ovate or oval to oblong, 1.2-3 (rarely 4) cm. long, 6-13 mm. wide, acute or obtuse and mucronulate, irregularly sinuate-dentate, the teeth obtuse or acute, the blades usually not at all 3-lobed, broadly cuneate or rounded at the base, thick or rarely thin, often densely farinose when young,

becoming glabrate in age; leaf blades of the inflorescence reduced, ovate to linear-lanceolate, acuminate, often entire; flowers in small glomerules, these in slender or stout dense or interrupted paniculate spikes, the branches of the inflorescence usually slender, sometimes spreading, sparsely leafy; calyx densely farinose, deeply cleft, the broadly ovate lobes obtuse or acute and sharply keeled, completely enclosing the fruit; pericarp adherent to the seed; seed horizontal, 1-1.5 mm. broad, punctulate or smooth, black, shining, the margin obtuse or rounded. *C. texanum* Murr., *C. Palmeri* Standl. Dry soils, mainly on the Coastal Plain from Tex. and Mex. to Fla. and N.C.; adv. in N.E.; also Eur.; July-Sept.

Var. *Zschackei* (Murr.) Murr. Annual herb; stems 2-10 dm. tall; leaves thin to coriaceous, variable in size and shape but larger than in the other varieties; sepals usually strongly keeled; inflorescence leafy; seed 1.2-1.5 mm. thick. Cen. and w. U.S. and Can., e. to Ont., Ill., Ark. and Tex.; also in s.e. Pa. and s.w. Va.

Var. *Boscianum* (Moq.) H. A. Wahl. Annual herb; stems erect, 3-10 dm. tall, simple below; leaves very thin and membranaceous, 2-6 cm. long, the lower leaves broadly triangular-oblong to lanceolate, not prominently 3-lobed; calyx very slightly keeled, very sparsely farinose, the lobes obovate-orbicular, bright-green, white-margined; pericarp free from the seed; seed horizontal, 1.3 mm. broad, black, shining, the margin obtuse. In open woods, thickets, waste grounds and roadsides, s.w. Que. and s. Ont. to Minn., N.D. and Neb., s. to N.E., Ga. and Tex., most common from e. Tex. to Fla.; July-Oct.

Var. *sinuatum* (Murr.) H. A. Wahl. Annual herb; stems sparsely branched; leaves 25 mm. long, yellow-green, dusty, long-petioled, the lower and middle leaves definitely 3-lobed, the lateral lobes barely divaricate and 2-parted, the terminal lobe elongate, toothed (1 to 4 teeth) with the margins parallel nearly to the tip, the upper leaves narrow, simply hastate; inflorescence leafy, sparsely spicate-glomerulate, the glomerules yellow-dusty; keel of the perianth segments small; seed 1-1.3 mm. thick. Kan. to Tex., w. to Calif. and Mex.

5. SPINACIA L.

Three species that are native to the Mediterranean region and central Asia.

1. *Spinacia oleracea* L. SPINACH. Annual glabrous herb; stems stout, erect, 30-45 cm. tall, simple or branched; leaves alternate, numerous, the petioles 1-4 cm. long; blades triangular-ovate or oval, hastate or subhastate, 4-10 cm. long, acutish, entire or sinuate-dentate, the upper blades narrower than the lower ones, cuneate at the base; flowers unisexual or rarely perfect with both sexes on same plant; staminate glomerules arranged in interrupted terminal spikes; *staminate flowers* with a 4- or 5-parted perianth, the oblong segments obtuse, with 4 or 5 stamens inserted at the base of the perianth, the anthers exserted; *pistillate flowers* usually axillary, without a perianth, subtended by 2 bracts; fruiting bracts 2-4 mm. long, sessile, green, united except at apex and enclosing the utricle, usually with 2 stout divaricate spines; ovary subglobose; stigmas 4 or 5, capillary, connate at the base, long-exserted; ovule subsessile; utricle included in the cartilaginous or indurate bract tube; pericarp membranaceous, adherent to the seed; seed fuscous, dull, erect, rounded, slightly compressed, acute at base; embryo annular, surrounding the farinaceous endosperm; radicle inferior. Eur. garden plant, widely cult. over the World and occasionally escaped; spring-summer.

6. ATRIPLEX L. SALTBUSSH

Annual or perennial herbs or shrubs; stems usually furfuraceous; leaves alternate or opposite, sessile or petioled, entire, dentate to serrate or irregularly lobed or cleft; flowers solitary or clustered, axillary or in terminal spikes or panicles; staminate and pistillate flowers on the same or separate plants, either mixed in the inflorescence or the staminate flowers in axillary glomerules superior to or terminal to the pistillate axillary glomerules; *staminate flowers* ebracteate, with a 3- to 5-parted perianth, the obtuse segments oblong or obovate; stamens 3 to 5, inserted on the perianth base, the filaments united at the base or distinct, the anthers 2-celled; rudimentary ovary conical or lacking; *pistillate flowers*

each subtended by 2 bracts which enclose the fruit, distinct or united, fleshy, spongy or ligneous, the margins entire or variously indented, the backs smooth or variously appendaged, the perianth none or rarely of 1 to 5 squamellae or a 3- to 5-lobed membranaceous calyx, the stamens absent; ovary ovoid or depressed-globose; stigmas 2, subfiliform but thickened or compressed near the connate base; ovule either oblique or erect and with a short funiculus, or inverted and suspended from the end of an elongated funiculus; utricle with a membranaceous pericarp, this usually free from the seed; seed erect or inverted, rarely horizontal, the coats membranaceous to coriaceous or subcrustaceous; embryo annular around the farinaceous endosperm; radicle inferior, lateral or superior.

About 200 species, mostly in temperate and subtropical regions; ours mostly in saline or alkaline soils in desertic regions.

1. Radicle inferior; pistillate flowers all alike, without a perianth; bracts not inflated or spongiöse; annuals (2)
1. Radicle superior; plants never bright-green, with entire unappendaged bracts; annuals or perennials (3)
 - 2(1). Staminate perianth 4-cleft; plants decumbent, bright-green, glabrate; leaves mostly opposite (at least below); leaf blades usually hastate; fruiting bracts rounded-deltoid or ovate-deltoid 1. *A. patula* var. *hastata*.
 2. Staminate perianth 5-cleft; plants erect, densely furfuraceous; leaves all alternate; leaf blades all or most of them dentate, never linear; fruiting bracts rhombic to cuneate-orbicular 2. *A. rosea*.
- 3(1). Male and female flowers on the same plant; plants never fruticose, rarely suffruticose at the base; bracts united at least at the base (4)
3. Male and female flowers on separate plants, or polygamous (15)
 - 4(3). Fruiting bracts orbicular, pedicellate, 3 mm. long, finely and regularly radiate-dentate to the base, strongly compressed, the sides of the bracts smooth; terminal tooth of bract similar to the lateral ones 3. *A. elegans*.
 4. Fruiting bracts not orbicular or if so not radiate-dentate to the base nor strongly compressed (5)
 - 5(4). Fruiting bracts obovoid-globular, scarcely compressed, not flattened at the top, of loose fibrous and spongy consistency, the faces not appendaged, the margins entire 4. *A. holocarpa*.
 5. Fruiting bracts subtriangular, cuneate-orbicular to rhomboidal, the faces smooth or appendaged, the margins variously dentate (6)
 - 6(5). Leaf blades mostly deltoid to deltoid-ovate or broadly ovate, broadest at or near the base, usually entire; annuals (7)
 6. Leaf blades never deltoid nor ovate, usually broadest at or above the middle, the lower surface paler than the upper; bracts not truncate (10)
 - 7(6). Leaf blades truncate to cordate or clasping-cordate at the base (8)
 7. Leaf blades subhastate or angled at the base; fruiting bracts all alike on the same plant; bracts dentate well below the apex, compressed, the sides smooth or with a few short obtuse tubercles, the margins usually shallowly dentate (9)
 - 8(7). Fruiting bracts of 2 kinds on each plant; leaf blades petiolate, 1-3 cm. long, white, gray or scurfy 5. *A. saccaria*.
 8. Fruiting bracts all alike; leaf blades sessile, less than 1 cm. long, densely canescent-farinose, greenish-yellow 6. *A. Klebergorum*.
 - 9(7). Upper leaves short-petiolate, the lowest opposite, the margins smooth or sparsely tuberculate or cristate 7. *A. argentea*.
 9. Upper leaves sessile, the lowest alternate, the margins irregularly dentate or entire 7. *A. argentea* subsp. *expansa*.
- 10(6). Bracts red and succulent at maturity; perennial 8. *A. semibaccata*.
10. Bracts never succulent at maturity, usually herbaceous; annuals (11)

- 11(10). Leaf blades dentate (12)
 11. Leaf blades entire (13)
- 12(11). Staminate glomerules in elongate usually paniculate spikes; bracts 2-2.5 mm. long, their sides usually unappendaged; leaves white beneath, green above 9. *A. Wrightii*.
12. Staminate glomerules axillary or in very short simple spikes; bracts 3 mm. long, their sides tuberculate; leaves densely white-furfuraceous beneath, grayish-green and glabrate on the upper surface 10. *A. pentandra*.
- 13(11). Sides of bracts smooth, reticulate-veined; bracts compressed, 2-2.5 mm. long, longer than broad; staminate glomerules chiefly in terminal spikes 13. *A. Wardii*.
13. Sides of some of the bracts conspicuously tuberculate or cristate; leaf blades concolorous (14)
- 14(13). Staminate glomerules terminal or in terminal and axillary spikes; seeds about 2 mm. long; leaf blades 4-15 mm. wide 11. *A. arenaria*.
14. Staminate glomerules axillary; seed 1.5 mm. long; leaf blades 3 mm. wide or less 12. *A. texana*.
- 15(3). Bracts 4-winged longitudinally 14. *A. canescens*.
15. Bracts never longitudinally 4-winged, the sides smooth or variously appendaged (16)
- 16(15). Leaves opposite or nearly all opposite, the blades 1-1.5 mm. wide; bracts 2-3 mm. long, rounded at the apex 15. *A. matamorensis*.
16. Leaves alternate or only the lowest opposite (17)
- 17(16). Leaf blades dentate; perennial; fruiting bracts 8-15 mm. long, usually long-pedicellate, the sides with numerous long flattened appendages 16. *A. acanthocarpa*.
17. Leaf blades entire (18)
- 18(17). Perennial, usually less than 6 dm. tall; bracts 4-13 mm. long, sessile, the sides sparsely tuberculate or crested near the base, rarely smooth 17. *A. obovata*.
18. Perennial; tall shrubs with spinose branches, fruticose nearly throughout, to 6 dm. tall; bracts much longer than broad, 5-13 mm. long, entire or sparsely dentate, nearly sessile, the sides smooth, densely furfuraceous . 18. *A. confertifolia*.

1. *Atriplex patula* L. var. *hastata* (L.) Gray. Annual herb; stems erect to decumbent or procumbent, 3-9 dm. long, usually much-branched, the branches slender or stout, ascending or spreading, obtusely angled, sparsely or densely furfuraceous when young, often glabrate, green or stramineous; leaves usually opposite below, the others alternate, the petioles of the lower leaves up to half as long as the blades, the upper leaves very short-petioled; blades of the lower leaves broadly triangular to hastate or oval-hastate, 2.5-7 cm. long and nearly as broad, acute or obtuse at the apex, truncate at the base or with a rounded sinus, the margins entire or more usually sinuate-dentate or shallowly repand-dentate, the basal lobes acute, spreading or reflexed; blades of the upper leaves hastate-oblong to lanceolate and smaller, all the blades thin or succulent, bright-green or densely furfuraceous; flowers of both sexes usually on same plant, in slender or stout dense or interrupted naked simple or broadly paniculate spikes and usually also in axillary fascicles; staminate perianth usually 4-cleft; fruiting bracts sessile, rounded-deltoid or ovate-deltoid, 3-7 mm. long, herbaceous, united only at the truncate or rounded base, often reddish in age, acute, the margins denticulate or rarely entire, the sides usually short-tuberculate, densely furfuraceous or glabrate; seed 1.5-2.5 mm. long, nearly black; radicle inferior. Saline soils and salt marshes in rich soils, both coastal and inland, Nfld. to S.C., O., Ind., Ill., Mo., w. to B.C., Ore. and Calif., s. to Tex.; Eur., Asia and N. Afr.; June-Nov.

2. *Atriplex rosea* L. Annual herb; stems erect, 2-10 dm. tall, much-branched or simple at the base, the branches slender or stout, arched-ascending or rarely spreading, terete, stramineous or whitish, coarsely furfuraceous or glabrate; leaves alternate, the petioles

one third as long as the blades; blades ovate to rhombic-ovate or oval, 2-8 cm. long, 1-5 cm. wide, obtuse or acute, mucronulate, broadly cuneate or rounded at the base, sinuate-dentate above the base, with acute or obtuse teeth, thin, sparsely or densely furfuraceous, green or grayish, the uppermost leaves reduced, often entire or subhastate; flowers of both sexes on same plant, in many- or few-flowered axillary glomerules, usually also in interrupted naked terminal spikes; staminate perianth deeply 5-cleft; fruiting bracts sessile, rhombic to cuneate-orbicular, 4-5 mm. long, united at the base, acute, the margins dentate, the sides usually short-tuberculate; seed dark-brown, dull, orbicular, 1.5-2 mm. in diameter; radicle inferior. Roadsides, waste places, cult. areas, in alkaline soils, Wyo. to s. Wash., s. to s. Calif. and Mex.; adv. from N.Y. to Fla.; Eur., w. Asia, N. Afr. and Austral.; Aug.-Oct.

3. *Atriplex elegans* (Moq.) D. Dietr. WHITE-SCALE SALTBUSH. Annual or sometimes perennial herb; stems much-branched, the branches slender or stout, obtusely angled, 1.5-5 dm. long, ascending or procumbent, furfuraceous when young, usually glabrate in age; leaves alternate, numerous, sessile or short-petioled; blades oblong to oblanceolate or linear, 7-22 mm. long, 2-6 mm. wide, obtuse or acute at the apex, mucronulate, cuneate to attenuate at the base, remotely and irregularly repand-dentate or the upper ones entire, thin, closely white-furfuraceous beneath, usually green and glabrate on the upper surface; flowers of both sexes on same plant, in few-flowered axillary glomerules; calyx 5-parted; fruiting bracts short-pedicellate, 3 mm. long, orbicular, strongly compressed, coherent, the margins rather broad, green, deeply laciniate-dentate at the base, the sides carinate, furfuraceous, not appendaged; seed 1 mm. long; radicle superior. In alkaline soils, w. Tex. to s. Ariz., Baja Calif. and s. into Mex.

4. *Atriplex holocarpa* F.v.Muell. POP SALTBUSH. Perennial herb with a hard almost woody base; stems branching, diffuse or procumbent, 15-30 cm. tall, softly mealy-tomentose; leaves alternate, the petioles rather long; blades obovate or rhombic, irregularly toothed, 1-3 cm. long; flowers of both sexes on same plant, all axillary, the male flowers in the upper axils surrounded by female flowers, the female flowers only and usually few together in most axils, very small and globular at time of flowering; fruiting perianth obovoid-globular, scarcely compressed, not flattened at the top, about 1 cm. thick, of a loosely fibrous and spongy consistency, with a thin membranaceous epidermis and a thin inner membrane scarcely distinguishable from the pericarp and sometimes hardening over the seed as it ripens; summit of the perianth with a small orifice closed by 2 erect appressed entire or 3-toothed valves, rarely over 1 mm. long; seed with a superior radicle. Nat. of Austral.; a good forage plant, cult. in Wyo.; also known from Taylor Co., Tex.

5. *Atriplex saccaria* Wats. Annual herb; stems erect, terete, 1-5 dm. tall, much-branched to form a globose plant, stout, angled, roughly furfuraceous throughout; leaves alternate, numerous, 1-3 cm. long, all petiolate or the upper ones sessile, the petioles 2-5 mm. long; blades broadly cordate-ovate or subreniform, cordate or some broadly truncate at the base, acute at the apex, entire, thick, gray or whitish-scurfy; flowers of both sexes on same plant; *staminate glomerules* in the upper axils or in short naked terminal spikes; *pistillate flowers* usually in fascicles of 1 to 3 in the lower axils; calyx 5-cleft; fruiting bracts of 2 kinds; larger fruiting bracts on pedicels 4-6 mm. long, united at the base, round-triangular or suborbicular, 4-6 mm. long, irregularly and coarsely dentate; smaller fruiting bracts in the same axils, oblong to cuneate, 3 mm. long, truncate at the apex, dentate only at the summit, the faces smooth; seed brown, 1.5-2.2 mm. long; radicle superior. Dry alkaline ground, dry plains and hillsides, s.w. Wyo. to e. Ut. and Nev., s. to Tex., n.w. N.M., Colo. and Ariz.

6. *Atriplex Klebergorum* M. C. Johnst. Annual herb with a ligneous vertical taproot 5-9 mm. thick, pale-barked; stems erect, diffuse, the branches alternate, numerous, 15-40 cm. long, horizontal or distally ascending, terete, densely white-farinose when young, glabrate in age, acquiring thin flaky pale-brownish-white bark, the internodes mostly shorter than 1 mm.; leaves alternate, the lowermost subopposite, sessile, the larger ones 1 cm. long, ovate-deltoid, acute at the apex, truncate or slightly clasping at the wide base, the margins entire or toothed, rather firm and flat, very densely canescent-farinose with a greenish-yellow tinge; flowers unisexual with both sexes on same plant, sessile, axillary, inconspicuous, mostly in leafy lateral branches with extremely short internodes,

arising toward the tips of the secondary branches; *staminate flowers* solitary in the most distal axils, about 2 mm. wide, of 5 curved elliptic mucronulate mostly hyaline tepals, farinose dorsally and about 1.5 mm. long, the 5 large anthers opposite the tepals and nearly filling the perianth, the white filaments filiform and 1-1.3 mm. long; *pistillate flowers* densely farinose on the outside, the bracts inseparable from the ovary; styles 2, brown, filiform, about 3 mm. long, diverging from the apical depression between the teeth; fruit indehiscent, nutlike; fruiting bracts densely and coarsely furfuraceous, ovate-orbicular, 4-6 mm. in diameter, variably and irregularly 3- to 7-cleft around the margins, the divisions truncate and irregularly and indistinctly doubly cristate laterally; seed round-lenticular, about 1.5 mm. in diameter, dark-reddish-brown, shining; embryo peripheral, almost encircling the copious white endosperm; radicle superior. In silty or clayey soils, s. coastal Tex.; endemic.

7. *Atriplex argentea* Nutt. Annual herb; stems 15-60 cm. tall, erect, branched from the base, the plants globoid in outline, the branches rather stout, angled, furfuraceous when young; leaves opposite below, subsessile or petioled above, 2-5 cm. long; blades triangular-ovate to rounded-ovate, the margins smooth or sparsely tuberculate or cristate, gray-furfuraceous but sometimes glabrate, the upper surface greener; flowers of both sexes on same plant, the staminate ones in the upper axils or in short dense spikes or the staminate and pistillate flowers mixed in axillary clusters at least at the middle of the plant; fruiting bracts 4-8 mm. long and as wide, united to the middle or above, obovate to cuneate-orbicular, the margins green, subentire to laciniate, the faces smooth or appendaged; seed brown, 1.5 mm. long; radicle superior. Alkaline grounds, plains and valleys, Sask. to Ore., s. to N.M., Tex. and Calif.; introd. in e. U.S.; also in w. Minn. and w. Mo.

Subsp. *expansa* (Wats.) Hall & Clem. Annual herb or perennial; stems erect, 3-12 dm. tall, much-branched, forming clumps 3-10 dm. broad, finely mealy-scurfy; leaves alternate, with petioles 2-21 mm. long on the lower leaves; blades 3-nerved at the base, ovate to lanceolate-ovate or deltoid-ovate, irregularly dentate or entire, 25-75 mm. long and often as broad, the upper leaves reduced to sessile and more or less cordate floral bracts as broad as long or broader than long; spikes elongated, slender; flowers in small axillary glomerules or the glomerules in short naked terminal spikes; perianth 5-cleft; fruiting bracts sessile to subsessile, roundish, mostly 3-nerved, 5-7 mm. long, 2-4 mm. broad, the margins sharply dentate, the sides smooth or with a few irregular green projections or crests, or unappendaged; seed brown, 2 mm. long; radicle superior. Low alkaline valleys and bottomlands, Colo., Ut. and Nev., s. to w. Tex., Calif. and Mex. The more common form in the west.

8. *Atriplex semibaccata* R. Br. AUSTRALIAN SALTBUSH. Perennial herb from a woody elongated taproot; stems prostrate, diffusely spreading from the base, 6-12 dm. long, woody below, much-branched, the slender branches terete and 3-10 dm. long, whitish, sparsely furfuraceous or glabrate; leaves numerous, alternate, short-petioled; blades oblong or obovate-oblong, 1-3.5 cm. long, 2-9 mm. wide, obtuse or acute, cuneate to attenuate at the base, remotely repand-dentate or the upper ones entire, thin, densely and finely white-furfuraceous beneath, usually glabrate and green on the upper surface; flowers of both sexes on same plant, solitary or in small clusters in the axils, the staminate and pistillate flowers usually mixed in the same cluster or the staminate clusters in terminal glomerules; fruiting bracts sessile, red, slightly succulent, rhomboidal, acute, stipelike at the base, united for about one half, toothed at the lateral angles, 3-5 mm. long, smooth on the 3-nerved sides; seed 2 mm. long, dark-brown; radicle lateral. Nat. of Austral.; cult. as a forage plant and becoming spontaneous in Calif. and Ariz. to s. N.M. and Tex.

9. *Atriplex Wrightii* Wats. Annual herb; stems erect and ascending, 1.5-10 dm. tall, sparsely branched or simple at the base, the branches stout, obtusely angled, furfuraceous when young, usually glabrate in age; leaves numerous, alternate, sessile or short-petioled; blades linear to oblong, 15-75 mm. long, 3-25 mm. broad, rounded to acute at the apex, mucronate, cuneate to long-attenuate at the base, coarsely sinuate-dentate or entire, thin, densely and closely white-farinose beneath, usually green and glabrous on the upper surface; flowers of both sexes on the same plant; *staminate flowers* in glomerules, small, forming slender usually dense naked terminal narrowly paniculate spikes, the panicles 6-30 cm. long; *pistillate flowers* in few-flowered axillary clusters; calyx 5-cleft; fruiting

bracts short-pedicellate, cuneate-orbicular or broadly cuneate, 2-2.5 mm. long, united below, compressed, the apex rounded, acutely 5-dentate, the sides 3-nerved, usually not appendaged, rarely obscurely tuberculate; seed 1 mm. long, pale-brown; radicle superior. In alkaline soils, s. Calif. and Nev. to N.M. and Tex., s. to Mex.

10. *Atriplex pentandra* (Jacq.) Standl. Annual or perennial herb, often suffrutescent at the base; stems much-branched, the branches stout or slender, obtusely angled, ascending or procumbent, 3-8 dm. long, finely furfuraceous when young, glabrate in age; leaves alternate, sessile or short-petioled; blades oblong or rhombic-ovate to broadly obovate or narrowly oblong, 1-3 cm. long, 3-15 mm. broad, rounded to acute at the apex, mucronate, cuneate at the base, repand-dentate or sinuate-dentate to undulate or the upper ones entire, thin, densely white-furfuraceous beneath, grayish-green and usually glabrate on the upper surface; male and female flowers on the same plant; *staminate flowers* in short dense naked terminal spikes; *pistillate flowers* fascicled in the axils; calyx 5-cleft, the lobes with green keels; fruiting bracts sessile, broadly cuneate-orbicular, 3 mm. long and usually broader, united only at the truncate or broadly cuneate base, compressed, much-thickened at maturity, the margins deeply and acutely dentate, the sides with 2 dentate crests or covered with irregular conic-acute corky tubercles; seed brown, 1.5 mm. long; radicle superior. Sandy seashores, s. Fla. to Tex.; W.I.; Venez. and Col. to Peru.

11. *Atriplex arenaria* Nutt. QUELITE. Annual herb; stems erect, ascending or procumbent, much-branched, 1-5 dm. long, stout, obtusely angled, furfuraceous when young, glabrate in age; leaves alternate, short-petioled or sessile; blades oblong or oval to broadly obovate or narrowly oblong, 1.2-4 cm. long, 4-15 mm. broad, rounded to acute at the apex, mucronate, rounded to cuneate at the base, entire or undulate, rarely with 1 or 2 teeth, thin, densely whitish-furfuraceous beneath, grayish-green and glabrate on the upper surface; male and female flowers on same plant; *staminate* glomerules terminal or in dense or interrupted terminal or axillary naked spikes; *pistillate* flowers fascicled in the axils; fruiting bracts subsessile, cuneate-orbicular, 3-5 mm. long, usually broader, compressed, united to the middle, the apex rounded, 3- to 5-dentate with the teeth subequal, the sides irregularly tuberculate or with 2 lateral dentate crests, rarely not appendaged; seed reddish-brown, 2 mm. long; radicle superior. Sandy seashores, N.S. to Tex.; Berm. and Cuba.

12. *Atriplex texana* Wats. Annual herb from a long slender taproot, scurfy-pubescent; stems erect or ascending, rarely decumbent, sparsely and finely furfuraceous, terete, 1-5 dm. long, much-branched; leaves alternate, numerous, short-petioled or sessile; blades oblong-spatulate to oblong-oblongate, 6-25 mm. long, acute or obtuse at the apex, entire or unevenly repand-dentate, narrowed into short petioles, very closely furfuraceous; flowers of both sexes on same plant, in few-flowered axillary clusters, the *staminate* glomerules sessile in the uppermost axils; calyx 5-cleft; styles exserted; fruiting bracts sessile or subsessile, broadly cuneate to suborbicular, 2.5-4 mm. long, united at the base, with coarse equal triangular teeth, the faces reticulated and crested with 2 rows of acute tubercles, the margins green, deeply or shallowly dentate; seed 1.5 mm. long, reddish-brown; radicle lateral. *A. tuberculata* Coult. On hillsides, s. and w. Tex. to Mex.; spring-summer.

13. *Atriplex Wardii* Standl. Annual herb, rather rigid in appearance; stems erect, 1.5-2 dm. tall, much-branched, the branches stout, obtusely angled, ascending, furfuraceous; leaves alternate, sessile or nearly so; blades oblong, 1-2 cm. long, 2-5 mm. wide, obtuse or acutish at the apex, mucronate, cuneate at the base, entire, thin, densely white-furfuraceous beneath, glabrate on the upper surface; male and female flowers on the same plant; *staminate* glomerules in short dense naked terminal spikes; *pistillate* flowers densely fascicled in the axils; calyx 5-cleft; fruiting bracts sessile, broadly cuneate-obovate, 2-2.5 mm. long, 1.5-2 mm. broad, compressed, united to above the middle, thin even in age, the apex acutish, the free margin obscurely denticulate, the sides reticulate-veined, not appendaged; seed brown, 1 mm. long; radicle superior. In the Rio Grande Plains and Valley; endemic.

14. *Atriplex canescens* (Pursh) Nutt. FOUR-WING SALTBUSSH. Perennial herb, usually over 4 dm. (to 25 dm.) tall, woody throughout, loosely to densely branched; stems erect, rather stout, gray-scurfy; leaves 1-5 cm. long, sessile or nearly so, linear-spatulate to

narrowly oblong, cuneate at the base, usually obtuse at the apex, entire, rather thick, with a gray scurf, becoming glabrous; male and female flowers on separate plants, rarely on same plant, the staminate flower in glomerules in dense spikes of long terminal panicles that are leafy below; body of fruiting bracts little-compressed, united to the summit, conspicuously 4-winged from the sides and back of the bracts, faces smooth or with small appendages, the whole bract 4-15 mm. long, rarely longer; seed brown, 1.5-2.5 mm. broad; radicle superior. Dry mesas and alkaline valleys, prairies and hillsides, the most widely distributed species in Tex., Apr.-Oct.; Alta. and S.D. to Wash., s. to Ariz., Tex., Mex. and Calif.

15. *Atriplex matamorenensis* A. Nels. **QUELITE CENIZO**. Perennial herb from a woody taproot, somewhat scurfy; stems erect or ascending, 1-4 dm. tall, woody below, branched at the base, sparsely branched above or simple, the slender branches densely leafy and rather sparsely and closely furfuraceous, terete; leaves mostly opposite, sessile; blades thick, oblong or oblong-lanceolate, 2-5 mm. long, about equaling the nodes or surpassing them, acute, broadest at the base, densely grayish-furfuraceous; male and female flowers on separate plants, the pistillate ones solitary or in small axillary glomerules in stout leafy spikes; fruiting bracts sessile, suborbicular, 2-3 mm. long and broad, strongly compressed, united to above the middle, dentate nearly to the base, the triangular teeth acute, the faces 3-nerved, the sides not appendaged, furfuraceous; seed yellowish, 1 mm. broad; radicle superior. *A. oppositifolia* Wats., non Vill. In alkaline soils, s.w. Tex. and adj. Mex.; summer-fall.

16. *Atriplex acanthocarpa* (Torr.) Wats. Perennial evergreen shrub from a woody root, appressed-scurfy; stems erect, 3-10 dm. tall, branched, woody especially below; leaves alternate or the lowest opposite, silver-gray, short-petioled or subsessile; blades oblong to oblong-lanceolate, commonly subhastate, 1.5-5 cm. long, 5-25 mm. broad, acute, entire or sinuate, cuneately narrowed; male and female flowers on separate plants, the *staminate* ones in large glomerules in dense interrupted sparsely leafy paniculate spikes, the *pistillate* flowers fewer to solitary in axillary clusters; calyx 5-cleft, densely furfuraceous; mature bracts 8-15 mm. long, on slender or stout pedicels 4-20 mm. long, united to the linear apex, spongy, the edges deeply lacinate, the faces appendaged with flattened tubercles (to 8 mm. long); pedicel of fruit to 12 mm. long; seed 1.5-2 mm. long, broad; radicle superior. In alkaline soils, used for windbreaks, roadside cover and as ornamentals, w. Tex. to adj. Mex. and s. N.M.; summer-fall.

17. *Atriplex obovata* Moq. Perennial herb forming roundish bushes 2-5 dm. tall (rarely to a meter); stems erect, woody and fruticose at the base or sometimes nearly throughout, much-branched below, the branches slender or stout, terete, furfuraceous; leaves alternate or the lowest opposite, numerous, short-petioled or sessile; blades oblong to broadly oval or rounded-ovate, 1-2 cm. or rarely 3 cm. long, 6-13 mm. wide, round at the apex, obtuse to cuneate at the base, entire, usually thick, densely furfuraceous; male and female flowers on separate plants; *staminate* glomerules in slender or stout axillary or simple (or terminal and paniculate) naked spikes; *pistillate* clusters few-flowered, axillary, forming mostly naked simple or paniculate spikes; calyx 5-cleft; fruiting bracts cuneate-orbicular, usually sessile, 4-8 mm. long and somewhat broader (5-7 mm.), united only at the base, the margins herbaceous, denticulate, the sides sparsely tuberculate or crested near the base or rarely smooth; seed 1-1.5 mm. broad, reddish-brown; radicle superior. *A. Greggii* Wats. In alkaline soils and dry ground, w. and s.-cen. Colo., s. to w. Tex. and s. N.M. to Mex.

18. *Atriplex confertifolia* (Torr. & Frém.) Wats. Perennial shrub, compact and round, to 6 dm. tall, rigidly branched; stems, branches and twigs becoming spiny; leaves alternate, ovate to obovate or rarely elliptic, commonly caducous, 12-41 mm. long, 8-21 mm. wide, entire, the apex obtuse or rounded, abruptly cuneate at the base, the petioles 1-7 mm. long; axillary bud leaves ovate or obovate to elliptic, 1-12 mm. long, 1-7 mm. wide, persistent; male and female flowers on separate plants, in subpaniculate spikes, in fruit very dense; fruiting bracts sessile, ovate or elliptic, 5-13 mm. long, 5-10 mm. wide, convexly united and ligenous around the fruit, free, herbaceous and divergent above, not constricted basally, the margin entire or rarely undulate to denticulate or serrulate; seed oval, 1-2 mm. long, reddish-brown. Widely spread over alkaline desert valleys and hills, or bluffs, in Trans-Pecos Tex. and the Panhandle; e. Ore. to w. N.D., s. to Ariz., N.M., Tex. and Mex.

7. SUCKLEYA GRAY

A monotypic genus of southwestern United States.

1. *Suckleya suckleyana* (Torr.) Rydb. POISON SUCKLEYA. Annual succulent herb; stems stout, terete, diffusely branched, 2-4 dm. long, prostrate or ascending, sparingly scurfy-mealy or glabrate; leaves alternate, with petioles equaling or exceeding the blades; blades orbicular to rhombic-ovate, 1-3 cm. long, rounded at the apex, abruptly short-cuneate at the base, repand-dentate with short triangular acute or obtuse teeth, sparsely furfuraceous when young, soon glabrate; male and female flowers on same plant, in dense clusters in the axils of nearly all the leaves; *staminate flowers* in upper axils, without bracts or bractlets; calyx subglobose, membranaceous, 3- or 4-parted, 2 of the segments larger than the others, spatulate, not appendaged; stamens 3 or 4, their short filaments broad and flattened; *pistillate flowers* bibracteate; bracts conduplicate, ovate-rhombic and subhastate, obcompressed, carinate, connate below the middle, in fruit narrowly winged dorsally, the wings crenulate, glabrous or nearly so; with 2 short filiform stigmas; utricles enclosed by the bracts, compressed, the pericarp thinly membranaceous, free; seed ovate, compressed, orbicular, filling the cavity, 3 mm. long, reddish-brown; embryo hippo-crepiform or subannular, surrounding the copious endosperm; radicle superior. Valleys, along streams, Mont. and Colo. to Tex.; July-Aug.

Known to cause cyanide poisoning in livestock.

8. EUROTIA ADANS.

About 8 species in the Old World and New World.

1. *Eurotia lanata* (Pursh) Moq. COMMON WINTER-FAT. Perennial shrub, woody only at the base; stems 2-8 dm. tall, the branches stout, erect, densely white or brownish stellate-pubescent, mixed with slender long hairs; leaves alternate, sessile or short-petioled; blades 1.5-5 cm. long, linear to lanceolate, pubescent, entire, the margins strongly revolute; inflorescence in panicles, conspicuously pilose, appearing cottony, the indurate apices of the bracts noticeable in the hair; flowers usually imperfect, the plants usually either staminate or pistillate and only a few flowers of the other sex present, in axillary glomerules or in terminal spikelike clusters; *staminate flowers* with 4-parted villous perianth and 4 stamens; *pistillate flowers* without perianth, enclosed by a pair of long villous bracts which are united into a villous 2-beaked tube, connate below, accrescent and enclosing the utricles in fruit, finally dehiscent; styles 2; pericarp free from the seed, membranaceous; seed erect, compressed, vertical; embryo nearly annular; radicle inferior. Dry plains and slopes in w. and n.w. Tex., Apr.-Sept.; Sask. to Wash., s. to w. Kan., Tex., N.M. and Calif.; a valuable browse, being succulent throughout the winter.

Var. *subspinosa* (Rydb.) Kearn. & Peeb. BUSH WINTER-FAT. Perennial shrub; stems 4-10 dm. tall, the branches slender, ascending or spreading, becoming more or less spinescent in age, densely and finely stellate-pubescent with whitish hairs; leaves alternate or fasciculate; blades linear to linear-oblong, 5-30 mm. long, 1-4 mm. wide, obtuse, finely stellate-pubescent, the margins revolute; fruiting bracts 6 mm. long, the horns about 2 mm. long. Stony hillsides, Ut. and Nev. to s. Calif., n. Mex. and w. Tex.

9. KOCHIA ROTH SUMMER-CYPRESS

Annual or perennial herbs or low shrubs, woody at the base; stems erect, much-branched often to form pyramidal or rounded bushes, pubescent or rarely glabrous; leaves alternate or opposite, linear, often terete, entire, fascicled; flowers mostly perfect or some pistillate only, axillary, sessile, solitary or in small glomerules, without bracts; calyx herbaceous, 5-cleft, persistent over the fruit and finally developing horizontal scarious or membranaceous wings; stamens 3 to 5, usually exerted, the filaments compressed; ovary subsessile, depressed, the stigmas 2 or rarely 3, the styles filiform; utricles depressed-globose, with membranaceous persistent pericarp which is free from the seed; seed horizontal; embryo nearly annular, green; endosperm none.

Nearly 100 species, all but one in the Old World.

1. Annual herb; leaves petiolate, the thin blades lance-linear; calyx wings minute
 1. *K. scoparia*.
 1. Perennial herb; leaves sessile, the succulent blades terete or nearly so; calyx wings
 large and conspicuous 2. *K. americana*.

1. *Kochia scoparia* (L.) Roth. BELVEDERE. Annual herb; stems erect, much-branched, the branches erect or ascending, 3-15 dm. tall, very leafy, glabrous or short-pilose, becoming bright-red with age; leaves alternate, linear to linear-acute, 2-7 cm. long, 3-8 mm. broad, usually prominently 3- to 5-veined, tapering at the base to a slender petiole, those of the inflorescence smaller and without evident petioles, much-exceeding the small flower clusters, sometimes pilose-sericeous; flowers sessile, clustered in the axils of the leaflike but reduced bracts, forming short dense leafy spikes, pilose or glabrate in age; calyx 1.5-2 mm. broad, strongly winged horizontally, the triangular wings obtuse and 0.6 mm. long or less, not nerved; seed 1.5 mm. in diameter. *K. alata* Bates. A wasteland weed, nat. of Eur.; escaped from cult. in many parts of the U.S.; June-Aug.

Var. *culta* Farw. MEXICAN FIRE-BUSH. This is the most common form in cultivation; grown primarily for its globular dense habit and the foliage which turns purplish-red in autumn. Escaped from cult. in many areas of the U.S.

2. *Kochia americana* Wats. PERENNIAL SUMMER-CYPRESS. Perennial herb from a woody base; stems numerous, erect, 1.5-5 dm. (to 13 dm.) tall, loosely branched at or just above the base, simple above or occasionally with few erect branches, usually more or less villous-tomentose when young but soon glabrate; leaves numerous, sessile, often fascicled; blades 6-25 mm. long, terete but flattish when dry, fleshy, acutish, erect or spreading, sparsely sericeous or glabrous; flowers solitary or in 2's or 3's, white-tomentose; perianth in fruit 2 mm. broad, the flabellate wings 2 mm. long, distinct, membranaceous, crenulate, finely nerved; utricle glabrate; seed 2 mm. in diameter. Roadside alkaline plains and marshes, Wyo. and Colo. to w. Tex., n.w. N.M. and Calif.; summer.

10. BASSIA ALL. SMOTHER-WEED

About 10 species that are native to the Old World.

1. *Bassia hyssopifolia* (Pall.) O. Ktze. Annual herb; stems erect, 2-5 dm. tall, much-branched from the base, tomentose and villous, the branches terete or angulate; leaves alternate, numerous, sessile, linear to oblanceolate or narrowly oblong, obtuse to acute, 1-4 cm. long, often succulent, entire, reduced above, green or grayish-green, silky villous to appressed pilose; spikes numerous, about 4 mm. in diameter; flowers perfect, about 1 mm. broad; perianth 5-lobed, densely woolly, the teeth becoming prolonged into red hooked spines in the fruit; stamens 5, exerted, hypogynous; ovary ovoid, attenuate to a short or elongate style, with 2 or 3 capillary stigmas, the ovule subsessile; utricle with a transverse wing, enclosed in the perianth, membranaceous or indurate at the apex, indehiscent, the pericarp free from the seed; seed grayish-brown, dull, horizontal or nearly vertical; embryo annular, enclosing the scanty endosperm; radicle centrifugal. Waste places, especially in alkaline soils, nat. of Euras., introd. from w. Asia; Mass. to N.Y., w. to Pac. States; Trans-Pecos Tex., s. N.M. to n. Mex.; June-Sept.

11. CORISPERMUM L. TICKSEED

Annual caulescent herbaceous plants; stems much-branching, glabrous or pubescent, the pubescence of stellate hairs; leaves alternate, sessile, entire, 1-nerved, those of the inflorescence reduced to shorter but broader scarious-margined bracts; flowers perfect, solitary or in glomerules in the axils of the bracts, arranged in dense or lax spikes, green and small; perianth segments 1 to 3, minute, unequal, the posterior one largest, erect, 1-nerved, scarious, unchanged in the fruit; stamens 1 to 3, rarely 5, hypogynous, exerted, one of them longer; ovary exerted, with 2 stigmas, recurved and connate at the base; utricle ellipsoid to orbicular, plano-convex, indurate, the margins winged or merely acute; pericarp membranaceous and adherent to the seed; seed erect; embryo annular, surrounding the copious endosperm; radicle inferior.

About 60 species in the North Temperate Zone.

1. Fruit 3.5-4.5 mm. long; lower bracts as broad as or broader than the fruit
1. *C. hyssopifolium*.
1. Fruit 2-3.5 mm. long; lower bracts narrower than the fruit
2. *C. nitidum*.

1. *Corispermum hyssopifolium* L. Annual herb; stems slender, 1-6 dm. tall, spreading, much-branched, glabrous or finely stellate-villous, striate, often tinged with red, sparsely leafy; leaves often deciduous early, sessile; blades linear or linear-lanceolate, 1-7 cm. long, 1-3 mm. broad, cuspidate, glabrous or stellate-pubescent; spikes loosely or densely flowered, 2-8 cm. long, 4-8 mm. thick; bracts often overlapping, 4-10 mm. long, ovate or lanceolate, long-acuminate, scarious-margined, stellate-pubescent or glabrous, concealing the fruits; fruit (achenes) blackish, 3.5-4.5 mm. long, broadly ovate to elliptic or obovate to orbicular, to 0.5 mm. wide, short-mucronate, with a narrow firm wing; seed vertical; radicle inferior. Introd. from Euras., sandy or gravelly banks, shores of Great Lakes, Ont. and N.D., Alta. and Wash., s. to N.Y., Kan., Mo., Tex., Colo., Ariz. and Mex.; adv. along railroads and waste places elsewhere.

2. *Corispermum nitidum* Schult. Annual caulescent herb with villous foliage or glabrous at maturity; stems much-branched, 2-5 dm. tall, striate, tinged with red, glabrous or sparsely stellate-villous; leaves alternate, 1-5.6 cm. long, 1-2 mm. wide, narrowly linear, cuspidate, finely stellate-pubescent to glabrate, ascending or spreading; spikes slender, usually laxly flowered, 3-4 mm. in diameter; bracts scarcely imbricate; upper bracts 2-8 mm. long, ovate-lanceolate, scarious-margined, as broad as the fruit, stellate-pubescent; lower bracts linear or linear-lanceolate, 8-20 mm. long, narrower than the fruit; fruit greenish-black, 2-3.5 mm. long, narrow but conspicuously winged, pale. Introd. from Euras., in sandy fields and dry soils, Arctic Am. to Wash., Tex. and Ariz.; shores of Lake Mich., in Ind. and Ill.; adv. in waste places in Mo., N.D. to Ida., southw.; summer-fall.

12. ALLENROLFEA O. KTZE.

Four species that are native to America.

1. *Allenrolfea occidentalis* (Wats.) O. Ktze. PICKLE-WEED. Perennial suffrutescent succulent glabrous shrub 3-15 dm. tall; stems alternate, green or more or less glaucous, much-branched, the articulate branches ascending or spreading, the younger ones 1-3 mm. in diameter, the joints 2-10 mm. long; leaves alternate, very short, reduced to scales, triangular, clasping, acute or acutish, soon deciduous or often nearly obsolete; spikes very numerous, 6-25 mm. long, 2.5-4 mm. thick, obtuse; flowers perfect, sessile, with fleshy peltate bracts in dense cylindrical spikes; perianth much-reduced, obpyramidal, fleshy, angled, usually 4- or 5-lobed, unchanged in the fruit which it encloses; stamens 1 or 2, the filaments exerted, the anthers broadly oblong or orbicular; stigmas 2 or 3, short, usually distinct; utricles ovoid, compressed, enclosed in the spongy fruiting calyx; pericarp membranaceous and free; seed erect, oblong, smooth, brown or reddish-brown, about 0.6 long; embryo partly enclosing the copious endosperm; radicle inferior. In strongly alkaline places, Ore. to w. Tex., Baja Calif. and Son.; Apr.-Sept.

13. SALICORNIA L. GLASSWORT. SALADILLA

Annual or perennial herbs or subshrubs, often suffrutescent and succulent; stems much-branched, glabrous, fleshy, with opposite articulate branches, the joints dilated at the apex into a short sheath; leaves scalelike, opposite; flowers perfect or polygamous, sunk in the cavities of the internodes, 3 to 7 together on opposite sides of the joints, partly crowded by the sheathing fleshy bracts, the flowering joints forming cylindric terminal spikes, the flowers usually connate and adnate to the joints; perianth obpyramidal, fleshy, with a 3- or 4-toothed or truncate border, spongiose in fruit; stamens 1 or 2, the anthers exerted and didymous, the filaments filiform or subulate; style lacerate above or ending in 2 subulate stigmas; ovule subsessile; utricle included in the perianth, ovoid or oblong, the pericarp membranaceous; seed erect, oblong or ellipsoid, compressed, covered with short or long straight or curved hairs; endosperm none; embryo conduplicate; radicle inferior.

About 35 species in temperate and tropical regions of both hemispheres.

1. Stems annual; middle flowers higher than the lateral ones; seed 1.5-2 mm. long 1. *S. Bigelovii*.
1. Stems perennial with prolonged subligneous depressed stems and rhizomes; flowers nearly equal in height (2)
- 2(1). Primary branches of stems prostrate, rooting freely, the erect or ascending flowering branches usually simple and slender; spikes 2.5-3 mm. thick 2. *S. virginica*.
2. Primary branches erect or decumbent, not rooting, usually much-branched, the branches stout; spikes 4-5 mm. thick 3. *S. utahensis*.

1. *Salicornia Bigelovii* Torr. Annual herb, stout and succulent; stems erect, 1-6 dm. tall, green, with few to many stout spreading or ascending branches, the joints 7-25 mm. long and 2-3 mm. thick; sheaths 2-lobed, the lobes acutely mucronate, 2-4 mm. long, ovate to triangular-ovate, acuminate, at length spreading; spikes obtuse, 2-12 cm. long, 4-6 mm. thick, the joints 2-3.5 mm. long and 4.5-6 mm. thick; flowers 3 in each group; lateral flowers contiguous below the acute lower angle of the central one; middle flower slightly higher than the lateral ones, reaching very nearly to the edge of the joint; seed nearly black, 1.5-2 mm. long, covered with short curved hairs. Salt marshes and flats along the Atl. and Gulf coasts of N.A. from N.S. to Fla. and Tex., s. to Yuc., W.I. and Bah. I.; also Calif.; Aug.-Nov.

2. *Salicornia virginica* L. Perennial succulent herb, forming extensive mats, from subligneous rhizomes freely forking in sand; stems decumbent or trailing, rooting freely at the nodes, the branches 1-7 dm. long, greenish, turning lead-colored or pale-brown; spikes 1-6 cm. long, 2.5-3 mm. thick, mostly solitary at the tips of the ascending branches or peduncled along some axes, loosening in age, the sheaths rounded or the lobes acutish; joints 2.5-3 mm. long, 3-4 mm. thick; flowers in groups of 3; central flower cuneate-obovate, truncate across the top, scarcely surpassing the obliquely ovate lateral ones; mature scales broader than high, broadly ovate, with prominent horizontally divergent firm margins; seed 0.7-1 mm. long, a little longer than broad, densely covered with slender curved hairs. *S. perennis sensu* Standl., non Mill. Coastal salt marshes and flats, sea coasts, s. N.H. to Fla and Tex.; Alas. to Calif.; widely distributed in the W.I., w. Eur. and N. Afr.; Aug.-Oct., year round southw.

3. *Salicornia utahensis* Tidestr. UTAH SAMPHIRE. Perennial herb, suffrutescent at the base; stems 1.5-3 dm. tall, solitary or clustered, erect or decumbent, not rooting, sparsely- or much-branched, the branches erect or decumbent; joints 7-18 mm. long and 2-5 mm. thick; scalelike leaves connate, broadly triangular, about 3 mm. long, scarious-margined; spikes few, 1-2 cm. long, 4-5 mm. thick, on short lateral branches; flowers 3 in each cluster, subequal, of about the same height, extending nearly to the top of the joint, the bracts broader than long. Edge of saline lakes and along shores and on islands, Ut., N.M. and Tex.

14. SARCOBATUS NEES

A North American genus of 1 or 2 species. Known to be toxic to sheep.

1. *Sarcobatus vermiculatus* (Hook.) Torr. GREASEWOOD. Perennial shrub; stems 3-30 dm. tall, erect, much-branched; branches rigidly stout, becoming grayish, the younger ones yellow-white, glabrous or pubescent with short white branched hairs, the ultimate branchlets stout and spinose; leaves linear to linear-filiform, 1-4 cm. long, entire, fleshy, glabrous or sparsely stellate-pubescent, obtuse or acute at the apex, narrowed at the base, the lower leaves of the branchlets opposite and often shorter than the others; staminate flowers in terminal catkinlike spikes 7-30 mm. long; perianth lacking but each flower subtended by a peltate stipitate bract, with 3 or less stamens per flower; scales rhombic-orbicular, sometimes abruptly acuminate, sometimes tinged with red, glabrous or pubescent; pistillate flowers sessile, solitary or 2 together in the axils of the leaves, with a perianth, this margined by narrow borders which (in fruit) develop into broad membranaceous horizontal wings 6-12 mm. wide, sometimes tinged with red, the axis of the fertile inflorescence often prolonged and bearing 1 to 8 staminate flowers; perianth

of the fertile flowers compressed, turbinate, confluent with the ovary; stigmas 2, subulate, recurved; fruit coriaceous, winged at the middle, the broad wing scarious, veined and crenulate, the lower part of the fruit turbinate, the upper part conical, minutely stellate-pubescent (at least when young), the body 4-5 mm. long and 2.5-3.5 mm. broad; seed erect, orbicular; embryo spirally coiled; endosperm none. Flat ground, barren or alkaline soils, w. N.D. to Alta. and Sask., s. to Tex., Colo., N.M. and Calif.

15. SUAEDA SCOP. SEA BLITE. SEEPWEED

Annual or perennial herbs, sometimes shrubby plants, more or less fleshy; leaves alternate, narrow, usually linear or terete and relatively small; flowers perfect or polygamous, solitary or clustered in the upper axils, bracteate; sepals 5, keeled or narrowly winged at maturity; stamens 5, with short filaments; ovary 1-celled, rounded or flat on the top; styles often 2; utricle compressed, surrounded by the calyx; seed horizontal or vertical; embryo coiled in a flat spiral; endosperm absent or scant.

More than 100 species of cosmopolitan distribution; mostly along sea coasts and in saline soils.

1. Calyx lobes (at least some of them) corniculate-appendaged or winged; leaves broadest at the base, ascending or spreading, those of the inflorescence ovate or ovate-lanceolate; flowers and leaves crowded 1. *S. depressa*.
1. Calyx lobes not appendaged nor winged, often cucullate or carinate (2)
- 2(1). Annuals or perhaps sometimes perennial but not suffrutescent at the base; all the calyx lobes equally carinate (3)
2. Perennials, suffrutescent at the base (4)
- 3(2). Seed 1-1.5 mm. broad 2. *S. linearis*.
3. Seed 0.8 mm. broad or less 3. *S. mexicana*.
- 4(2). Stems and leaves glabrous or nearly so; leaves subterete to distinctly flattened (5)
4. Stems and leaves densely tomentulose or villous when young, sometimes glabrate in age; leaves terete and green (8)
- 5(4). Leaves green (6)
5. Leaves glaucous, mostly less than 1 cm. long (7)
- 6(5). Leaves 3-7 mm. long, 1-3 mm. broad, compressed . 4. *S. duripes*.
6. Leaves 10-30 (-40) mm. long, 1-1.5 mm. broad, subterete 5. *S. Torreyana*.
- 7(5). Calyx segments deltoid; plants blackish (when dry) or purplish (when alive) ..
..... 6. *S. nigrescens* var. *glabra*.
7. Calyx segments obtuse; plants blue-gray 7. *S. conferta*.
- 8(4). Calyx glabrous or nearly so; flowers 1.5-2 mm. broad, globose-obovoid, 1 to 5 per axil; seed horizontal, 1 mm. in diameter 8. *S. tampicensis*.
8. Calyx densely pubescent; flowers 1-1.5 mm. broad, globose, 3 to 9 per axil; seed vertical, 0.7 mm. in diameter 9. *S. suffrutescens*.

1. *Suaeda depressa* (Pursh) Wats. Annual or perennial herb; stems erect to decumbent, low, simple or freely branching from the base, glabrous and glaucous, 2-10 dm. tall or long; leaves green or glaucous, linear, semiterete, 7-40 mm. long, often crowded, acute, usually broadest at the base, subulate; bracts 2-3 mm. long, ovate-lanceolate, rather crowded on the branchlets; flowers crowded, 3 to 7 in each axil; spikes slender, short or elongate; calyx cleft to the middle, the lobes distinctly unequal, 1.5-2 mm. wide at maturity, the upper 1 or 3 sepals prominently cucullate; stamens 5; stigmas 2 to 5; seed about 1 mm. broad, slightly reticulate, black, horizontal. In saline or alkaline soils, w. Minn. and Sask., w. to Mont. and Wash., s. to Kan., Neb., Mo., Tex., Nev. and Calif.; July-Oct.

Var. *erecta* Wats. Stems simple or branched at the base, strictly erect, 15-45 cm. tall, glabrous, often glaucous; leaves 2-3 cm. long, acute; flowering branchlets dense, their

short leaves ovate-acuminate; calyx lobes somewhat unequal, with a conspicuous horizontal wing on the back. Alkaline soils, coastal Calif. e. to the Rocky Mts. and Tex.

2. *Suaeda linearis* (Ell.) Moq. Annual herb; stems glabrous, erect or ascending, 2-9 dm. tall, profusely branched; leaves deep-green, not glaucous, narrowly linear, plano-convex, nearly terete, the primary ones to 5 cm. long, those of the branches progressively shorter; spikes often elongate, usually dense; bracts 4-7 mm. long; calyx at maturity about 2 mm. wide, deeply cleft, the lower 4 or 2 sepals round on the back, the upper 1 or 3 distinctly cucullate; seed horizontal, 1-1.5 mm. wide, smooth, shining and black. Salt marshes, sandy coasts, Coastal Plain from Me. to Fla., w. to Tex.; W.I. and Bah. I.; Aug.-Oct.

3. *Suaeda mexicana* (Standl.) Standl. Annual herb; stems glabrous, pale-green, 3-12 dm. tall, mostly branched at the base, the numerous branches ascending or nearly erect and elongate; leaves numerous but not crowded, linear, the lower ones 12-25 mm. long and 1.2 mm. broad, acuminate or attenuate, those of the inflorescence shorter; inflorescence paniculately branched, the branches erect; flowers crowded in the axils and forming spikes 4-5 mm. thick; calyx deeply cleft, the lobes rounded, becoming enlarged, strongly cucullate in age, the fruiting calyx 3 mm. broad; stamens exserted; seed 0.8 mm. in diameter, horizontal, shining, dark-brownish-red. A halophytic gypsophile, w. Tex. to S.L.P.

4. *Suaeda duripes* I. M. Johnst. Plants succulent, herbaceous or fruticose; stems slender, 5-30 cm. tall, ascending or decumbent, smooth or obscurely vesiculate-tuberculate, glabrous or very sparsely and minutely pilose; leaves succulent, linear or oblong-ovate, 3-7 mm. long, 1-3 mm. broad, compressed, gradually contracted to the base, very short-petioled, broadly affixed from the base to about 1.5 mm. above, indurate and persistent on the stem, obtuse or round at the apex; glomerules many-flowered, borne at the base of leaves, indurate; bracteoles inconspicuous, soon deciduous, membranaceous, triangular or lanceolate-triangular, usually entire; perianth lobed below the middle, succulent before anthesis, at maturity vesiculate and suberose, incrassate, depressed, about 2-2.5 mm. in diameter, the lobes prominently convex; seed erect, black, shining and smooth. Trans-Pecos Tex.; endemic.

5. *Suaeda Torreyana* Wats. QUELITE SALADO. Perennial shrub; stems erect, mostly glabrous, green, woody at the base, the herbaceous branches usually slender, ascending, sparsely leafy, 6-10 dm. tall; leaves green, subterete or distinctly flattened, linear to linear-spatulate, 1-3 (rarely to 4) cm. long, 1-1.5 mm. wide, acute or slightly acuminate, those of the inflorescence much-reduced to 2-5 mm. long and abruptly mucronate or obtuse; flowers globose, 1 to 5 in each axil, about 1 mm. broad at anthesis, the branches of the inflorescence slender but not flexuous; calyx deeply cleft, the lobes green, obtuse, closely incurved, rounded on the back and obtuse; utricle obovoid-lenticular, enclosed by the calyx lobes; seed vertical or horizontal, 1-1.5 mm. broad, dark-brown to black, shining, minutely tuberculate. Salt marshes and alkaline soils, e. Ore. and Wyo. to Calif., s. through Nev. to Tex. and w. N.M.; Apr.-Oct.

6. *Suaeda nigrescens* I. M. Johnst. var. *glabra* I. M. Johnst. Perennial shrub; stems 3-6 dm. tall, ascending, erect or decumbent, the branches all glabrous and often glaucous, the young branches rarely very sparsely pilose and pale; leaves succulent, more or less glaucous, glabrous, 3-4 mm. long and roundish; flowers in glomerules at the base of the upper leaves, barely conspicuous, subspicate; fruiting calyx glabrous, turbinate, 1.5-2 mm. in diameter; seed black, shining, obliquely ovoid, erect or horizontal, about 1 mm. long. Irrigation ditches, saline plains and salt flats, N.M., Tex. and Mex.

7. *Suaeda conferta* (Small) I. M. Johnst. Perennial shrub; stems erect or ascending, 4-10 dm. long, the branches prostrate or spreading, forming dense tufts, very brittle, glabrous; leaves numerous, glabrous, the blades fleshy and blue-gray, mostly less than 1 cm. long and 1-2 mm. broad, oblong; flowers solitary or clustered in the axils of the rather approximate leaves, especially numerous on the branchlets; calyx segments obtuse; seed about 1 mm. broad. Along the sea coast, Tex. and e. Mex.; W.I.

8. *Suaeda tampicensis* (Standl.) Standl. Perennial herb, green; stems much-branched, the branches stout, ascending or decumbent, copiously short-villous, paniculately branched; leaves terete, 7-15 mm. long, acute or acuminate, spreading, those of the inflorescence little-reduced; flowers 1.5-2 mm. broad, globose-obovoid, 1 to 5 in each

axil; bractlets acuminate; calyx glabrous or nearly so, cleft to below the middle, the lobes rounded at the apex, fleshy, rounded on the back; seed usually horizontal, 1 mm. broad, black and shining. Coastal sandy areas, s. Tex. and Mex.

9. *Suaeda suffrutescens* Wats. **DESERT SEEPWEED.** Perennial shrub, often making mounds 12-15 dm. across; stems woody, erect, green, much-branched, 5-9 dm. tall, the branches diffuse or spreading, paniculately branched, leafy, the herbage tomentose; leaves numerous, pubescent, terete, mostly 5-13 mm. long, acute, not crowded, those of the inflorescence much-reduced, ascending or spreading; flowers small, 1-1.5 mm. broad, globose, clustered in the axils, mostly 3- to 9-flowered, crowded in dense spikes; calyx cleft to below the middle, the obtuse lobes thin and rounded on the back, densely pubescent; bractlets acuminate or attenuate; stamens exserted; seed mostly vertical, 0.7 mm. broad, obscurely tuberculate, black. On saline and alkaline plains and valleys, w. and n.w. Tex. to Ariz. and s. Calif., s. to Mex.; spring-fall.

16. SALSOLA L.

About 150 species cosmopolitan in distribution; mostly maritime or in saline soils.

1. *Salsola Kali* L. **RUSSIAN THISTLE, TUMBLEWEED.** Annual herb, much-branched from the base, becoming hemispherical; stems 3-8 dm. tall, glabrous to pubescent or short-villous, conspicuously green and purple-striped, often tinged with red, the very stout branches ascending or spreading and glabrous to scabrous or short-villous; leaves usually alternate, linear to filiform, almost terete, sessile or clasping, pungent-tipped, usually 1.2-3 cm. long and thick but occasionally to 7 cm. long and more fleshy or succulent, often bluish-green, scabrous or glabrous, 1.5-2 mm. wide, the upper leaves often shorter and broader, their bases much-thickened and indurate in age and closely enclosing the fruit; bracteal leaves usually 5-8 mm. long; flowers perfect, sessile, small, subtended by two bractlets in addition to the leaf, solitary in the axils or sometimes several together; perianth 5-parted, the segments oblong or lanceolate, concave, becoming strongly transversely carinate and horizontally winged in the fruit, the basal portions free or connate, the apices free and usually inflexed; fruiting calyx 3-10 mm. wide when well-developed, those of the lowest flowers often merely carinate across the back, the segments sharp-pointed; wings of the calyx persistent, membranaceous, whitish or pinkish, making the fruit 3-8 mm. in diameter; stamens 5 or fewer, hypogynous or rarely inserted in a small disk, the filaments subulate or linear, the anthers short or elongate; stigmas 2 or rarely 3, subulate; ovule subsessile or suspended from a long funicle; utricle flattened, broadly ovoid, or orbicular, the apex concave or convex, included in the perianth; pericarp fleshy or membranaceous, free from the seed; seed horizontal, rarely inverted, erect or oblique, orbicular, 1.5-3 mm. broad, black, shining; endosperm none; embryo spiral or cochleate-spiral, usually green. Incl. var. *tenuifolia* Mey., *S. pestifer* A. Nels. Dry plains and valleys, common along roadsides and in cult. fields, Euras.; perhaps nat. along the e. seacoast and rarely adv. inland; thoroughly naturalized in w. N.A. from Minn. and Sask. to Wash., Calif. and Tex.; July-Oct.

FAM. 62. AMARANTHACEAE JUSS.⁵³

AMARANTH FAMILY

Weedy herbs and subshrubs, annuals or perennials, with erect to prostrate or scandent stems; leaves alternate or opposite, petioled or sessile, without stipules; flowers perfect to imperfect or polygamous, solitary or glomerulate, racemose, spicate or capitate, each flower or flower cluster subtended by imbricate bracts; perianth of 2 to 5 distinct scarious or chartaceous tepals, rarely 1 or entirely absent in some species of *Acnida*; corolla absent; stamens 2 to 5, opposite the tepals; ovary superior, 1-celled; styles 1 or 2 and terminal or absent; fruit a membranous utricle, circumscissile, irregularly dehiscent or indehiscent; seeds erect or inverted, lenticular, oblong or reniform-orbicular, smooth or nearly so, lustrous; embryo annular, the cotyledons incumbent, the radicle inferior or superior.

⁵³ Contributed by Clyde F. Reed; cf. his treatment in C. L. Lundell, *Flora of Texas II*: 89-150. 1969 for complete synonymy.

About 850 species in 65 genera, cosmopolitan but mostly tropical; represented in Texas by 62 species and 6 varieties in 13 genera.

1. Ovules 2 or more; stamens 5 and hypogynous; filaments subulate or filiform, connate at the base into a short cup; anthers 4-celled; leaves alternate; erect or scandent herbs 1. *Celosia*, p. 552.
1. Ovules solitary; stamens hypogynous, rarely perigynous (2)
- 2(1). Anthers 4-celled; filaments distinct or united at the base (3)
2. Anthers 2-celled; stamens 2 to 5; flowers 5-merous (6)
- 3(2). Seed inverted; radicle ascending or superior; stamens 5, rarely 2 or 4; utricle indehiscent; stigma capitate 5. *Achyranthes*, p. 563.
3. Seed erect; radicle inferior (4)
- 4(3). Perianth present in all flowers; stamens 5, rarely 1 to 3; bracts not much-enlarged and not cordate in fruit 2. *Amaranthus*, p. 553.
4. Perianth lacking or only occasionally present in pistillate flowers; stamens 5 (5)
- 5(4). Floral bracts not enlarged 3. *Acnida*, p. 561.
5. Floral bracts much enlarged and broadly cordate in fruit 4. *Acanthochiton*, p. 562.
- 6(2). Most of the flowers unisexual; inflorescence paniculate (7)
6. Few (if any) flowers unisexual; leaves opposite (8)
- 7(6). Leaves opposite; ours erect or scandent herbs 6. *Iresine*, p. 563.
7. Leaves alternate; erect pubescent branched shrubs 7. *Dicraurus*, p. 565.
- 8(6). Style 1 or none; stigma 1 and capitate or bilobed (9)
8. Styles 1 or 2; stigmas typically 2 (11)
- 9(8). Inflorescences mostly terminal; filaments united into a tube; erect or ascending herbs 10. *Froelichia*, p. 568.
9. Inflorescences mostly axillary; prostrate herbs (10)
- 10(9). Filament tube a short cup or adnate to the fused perianth; staminodia absent ... 8. *Guilleminea*, p. 565.
10. Filament tube longer than the ovary and free from the perianth and/or staminodia present 9. *Alternanthera*, p. 567.
- 11(8). Filament tube long; flowers in terminal heads 13. *Gomphrena*, p. 572.
11. Filaments united into a short cup (12)
- 12(11). Perianth stipitate; inflorescence spicate 11. *Philoxerus*, p. 570.
12. Perianth sessile; inflorescence a single flower or the flowers in glomerules 12. *Tidestromia*, p. 571.

1. CELOSIA L.

Annual or perennial herbs and shrubs; stems erect or scrambling; leaves alternate, petiolate, entire or lobed; flowers perfect, in terminal or axillary spikes or axillary glomerules, commonly white, silvery or colored, each flower subtended by a bract and two bractlets; perianth of 5 distinct tepals, in fruit erect and concealing the fruit, scarious, striate; stamens 5, connate at the base; ovary subglabrous, the ovules 2 to several, the style none to short or elongate, the stigmas capitate or subulate; utricle ovoid or subglobose, thin, membranaceous, usually circumscissile at the middle or dehiscing irregularly; seeds 2 to several, lenticular, often erect, lustrous; embryo annular; endosperm starchy.

About 60 species in tropical and temperate regions.

1. Inflorescences usually of simple terminal spikes 15-20 mm. in diameter (larger and cristate in cult. forms); tepals bright-white, pink or red (other colors in cult. forms), 6-9 mm. long 1. *C. argentea*.
1. Inflorescences of terminal or axillary panicles composed of few to numerous spikes 3-10 mm. in diameter; tepals stramineous to dark-brown, 3-6 mm. long, prominently veined (2)

- 2(1). Leaf blades deep-green, deltoid to triangular-lanceolate, not lobed; stigmas 3; stems erect or clambering2. *C. nitida*.
 2. Leaf blades green, hastately lobed, lanceolate to lance-triangular; stigmas 2; stems much-branched, low, shrubby3. *C. Palmeri*.

1. *Celosia argentea* L. COCKSCOMB, CRESTA DE GALLO. Annual herb; stems erect, glabrous, leafy, to 1 m. tall; leaves lanceolate to nearly linear, 8-15 cm. long, usually long-tapering to both ends; spikes terminating the stem and also in the upper axils, sessile or peduncled, 2-15 cm. long, in a variety of colors; tepals lance-oblong, 6-9 mm. long, in wild plants silvery, in cultivated forms also pink, yellow and red; style indurate and exerted at maturity; utricle circumscissile at the middle; seeds 2 to several, lenticular, lustrous. Nat. of trop. Am., where it is widely distributed; occasionally escaped from cult., summer and early fall.

Forma cristata (L.) O. Ktze. COCKSCOMB. Cult. as an annual; leaves ovate with cristate inflorescences, variously crested and branched; flowers red, crimson, yellow, purple or white. Rarely escaped from cult.

2. *Celosia nitida* Vahl. ALBAHACA. Perennial herb from a long woody taproot, with glabrous slender erect or vinelike stems 3-15 dm. long; young stems tinted red, widely branching; leaves alternate, with petioles 5-20 mm. long, drying blackish, lighter beneath, ovate to deltoid-ovate or ovate-lanceolate, 2-7 cm. long, acute to acuminate at both ends; bracts half as long as the tepals, ovate to lanceolate, keeled, acuminate; spikes solitary or paniced, 1-5 cm. long; tepals oblong to elliptic-lanceolate, firm, 3-5 mm. long, acuminate, dark-brown, strongly parallel-veined; style short; utricle included, globose-ovoid, shorter than the perianth; seed lenticular, about 1 mm. long, black, smooth. *C. paniculata* of auth., not L. In sandy soils in thickets and brush, gravelly hills and woods, especially along coasts, extending through the Rio Grande Plains into the Edwards Plateau, Mar.-Nov.; from Fla. Keys to Tex. and n.e. Mex.; W.I., coast of n. S.A.

3. *Celosia Palmeri* Wats. Low perennial shrub; stems much-branched, the branches glabrous and slender; leaves alternate, with slender petioles 3-12 mm. long, lanceolate to lance-triangular, 1.5-5 cm. long, 4-25 mm. wide, more or less asymmetric, hastately lobed, the lobes shallow and rounded, shortly decurrent, green, glabrous or sparsely puberulent beneath; flowers few, sessile in short spikes 1-2 cm. long and 8 mm. in diameter, with 2 to 5 spikes clustered at the end of each branch; rachises of the inflorescence sparsely tomentulose; bracts ovate to ovate-oblong, half as long as the tepals or shorter, acute to acuminate, often with a pungent tip, sparsely villous; tepals 5 mm. long, oblong, acute, pale to dark-brown, thin, many-veined; stamens 5, the filaments equaling or exceeding the ovary and dilated at the base; style longer than the ovary; stigmas 2, shorter than the style; utricle elongate-ovoid, shorter than the tepals; seeds 3 or 4, rounded, 1 mm. in diameter, smooth, black, lustrous. In open woodlands and about boulders in mts. of the Trans-Pecos; also n.e. Mex.

2. AMARANTHUS L.

PIGWEEED. AMARANTH

Annual weedy herbs, especially near irrigated or cultivated places, monoecious; stems erect or prostrate, branching at the base or above; leaves alternate, petiolate, flat, pinnately veined, entire or undulate; flowers unisexual or a few appearing perfect, with staminate and pistillate flowers on the same or separate plants, in dense terminal or axillary spikes or clusters, each subtended by 3 conspicuous red, green or purple bracts; perianth segments (tepals) 2 to 5 (only 1 evident in *A. californicus*), distinct, glabrous; stamens 5, sometimes 1 to 3, separate; anthers 4-celled (appearing 2-celled after dehiscence), opening lengthwise, the filaments distinct; ovary 1-celled, with 2 or 3 stigmas; ovule 1; utricle one-seeded, 2- or 3-beaked at the apex, circumscissile, irregularly splitting or indehiscent; seeds lenticular, erect, compressed, lustrous, smooth; embryo coiled into a ring around the albumen; radicle inferior.

About 60 species, cosmopolitan.

1. Staminate and pistillate flowers borne on separate plants (2)
1. Staminate and pistillate flowers on the same plant with occasional perfect ones (7)

- 2(1). Plants pistillate; tepals 5, at least the inner ones spatulate (3)
2. Plants staminate; outer tepals with heavy midvein, often definitely longer than the inner (5)
- 3(2). Utricle indehiscent, about 3 mm. long; leaf blades coriaceous; plants erect but usually sprawling 3. *A. Greggii*.
3. Utricle circumscissile, about 1.5-2 mm. long; leaf blades membranaceous; plants erect (4)
- 4(3). Longest outer tepal acute or acuminate with midvein excurrent into a rigid point; bract and outer tepals conspicuously longer than the inner tepals; bract with very heavy midrib, excurrent; style branches usually 2, sometimes 3 1. *A. Palmeri*.
4. Tepals all obtuse or retuse, the midveins excurrent slightly or not at all; bract and outer tepals scarcely exceeding inner tepals; bract with extremely heavy midrib, not excurrent far beyond the lamina; style branches usually 2 2. *A. arenicola*.
- 5(2). Outer tepals acuminate, the midveins excurrent as rigid spines; bracts about 4-6 mm. long, about twice as long as perianth 1. *A. Palmeri*.
5. Outer tepals acute or obtuse, apiculate but the dark midvein not excurrent; bracts shorter than the tepals, glabrous; leaf margin smooth (6)
- 6(5). Leaf blades membranous; plants erect 2. *A. arenicola*.
6. Leaf blades coriaceous; plants erect or sprawling 3. *A. Greggii*.
- 7(1). Tepals of pistillate flowers spatulate, usually contracted into a narrow claw at the base, more or less urceolate (at least in age) (8)
7. Tepals of pistillate flowers oblong to obovate, not contracted into a claw (16)
- 8(7). Inflorescence of axillary few- to many-flowered clusters; stems weak, ascending or prostrate (9)
8. Inflorescence of terminal spikes, with clusters of axillary flowers also present; stems stout, usually erect (12)
- 9(8). Pedicels and bracts usually but not always (cf. *A. scleropoides*) much-thickened and indurate (10)
9. Pedicels and bracts neither thickened nor indurate (11)
- 10(9). Utricle indehiscent, the sides wearing thin; style branches usually 2, rarely 3 ... 4. *A. crassipes*.
10. Utricle circumscissile at the middle; style branches usually 3, rarely 2 5. *A. scleropoides*.
- 11(9). Utricle indehiscent; leaf blades oblong-lanceolate; leaves crowded at the ends of the branches 6. *A. Berlandieri*.
11. Utricle circumscissile; leaf blades suborbicular to obovate or oval; leaves not crowded; tepals very faintly nerved 7. *A. polygonoides*.
- 12(8). Utricle indehiscent; leaf blades lanceolate to linear-oblong, 1-3 cm. long 8. *A. obcordatus*.
12. Utricle dehiscent (13)
- 13(12). Stamens 5; inflorescence leafy throughout (14)
13. Stamens 2 or 3 (15)
- 14(13). Bracts shorter than the pistillate perianth; leaf blades obtuse 9. *A. chihuahuensis*.
14. Bracts longer than the pistillate perianth; leaf blades acute 10. *A. Torreyi*.
- 15(13). Tepals of pistillate flowers with fimbriate margins; bracts one half or less as long as the tepals 11. *A. fimbriatus*.
15. Tepals of pistillate flowers with entire or crenulate margins; bracts equaling or exceeding the flowers; axillary glomerules mostly equaling or exceeding the petioles 10. *A. Torreyi*.

- 16(7). Utricle indehiscent; inflorescence usually in short terminal spikes; bracts not pungent, not exceeding the tepals; leaf blades retuse, longer than broad, usually more than 1 cm. long; stems prostrate or ascending, green23. *A. viridis*.
16. Utricle dehiscent (17)
- 17(16). Inflorescence of terminal and axillary simple or paniculate spikes, with glomerules of flowers often present also in the axils of the leaves (18)
17. Inflorescence wholly of axillary glomerules (24)
- 18(17). Spines present in the axils of the leaves; utricle irregularly or imperfectly dehiscent12. *A. spinosus*.
18. Spines lacking; utricle regularly circumscissile (19)
- 19(18). Pistillate tepals rhombic-ovate to broadly spatulate, the edges overlapping; terminal spikes usually recurved from the base13. *A. hypochondriacus*.
19. Pistillate tepals lanceolate to elliptic or oblong to narrowly spatulate, distinct or at most the edges barely touching; spikes erect or the uppermost recurved from the middle (20)
- 20(19). Pistillate tepals usually shorter than the utricle or (if longer) acuminate or acute (21)
20. Pistillate tepals obtuse or truncate, equaling or usually conspicuously longer than the fruit (23)
- 21(20). Bracts obtuse or acutish, equaling or up to 1.5 times as long as the tepals, usually red or purple14. *A. cruentus*.
21. Bracts acute or acuminate, usually twice as long as the tepals, commonly green or pale-reddish (22)
- 22(21). Spikes slender; bracts 3-5 mm. long, thin15. *A. hybridus*.
22. Spikes stout; bracts usually more than 5 mm. long, thick16. *A. Powellii*.
- 23(20). Inflorescence usually tipped with red; pistillate tepals 1.5-2 mm. long; plants nearly glabrous17. *A. Wrightii*.
23. Inflorescence pale-green; pistillate tepals 3 mm. long; plants copiously villous18. *A. retroflexus*.
- 24(17). Tepals in both staminate and pistillate flowers 4 or 5; seed 1.5 mm. in diameter; stems prostrate19. *A. blitoides*.
24. Tepals 1 to 3; seed 0.6-0.8 mm. in diameter; stems erect or prostrate (25)
- 25(24). Tepals of pistillate flowers 2 or 3, all except one reduced to minute scales; stems slender, prostrate20. *A. californicus*.
25. Tepals of pistillate flowers 3, equal or nearly so; stems stout, erect or ascending (26)
- 26(25). Plants densely viscid-pubescent; leaf blades crispate21. *A. pubescens*.
26. Plants not viscid-pubescent; leaf blades not crispate ...22. *A. albus*.

1. *Amaranthus Palmeri* Wats. Plant very weedy, with an elongated taproot to 15 mm. in diameter; stems 6-10 dm. tall, branched at the base and much-branched above, glabrous to villous-pubescent; leaves alternate, with long slender petioles, rhombic-ovate to rhombic-lanceolate, 1-6 cm. long, acute to abruptly acuminate at the apex, cuneate or rounded at the base; staminate and pistillate flowers on separate plants, in slender erect or drooping dense spikes or thyrses 15-30 cm. long, either all terminal on leafy branches or (if leafless) branch thyrses present, these loosely arranged and each subtended by a leaf; bracts 4-6 mm. long, twice as long as the perianth, the midrib moderately heavy in the male, very heavy in the female, excurrent into a spine; *male flowers* with 5 stamens and 5 tepals; inner tepals 2.5-3 mm. long, obtuse or emarginate; outer tepals 3.5-4 mm. long, acuminate, with conspicuous long-excurrent midvein; *female flowers* with 5 recurved tepals, each with conspicuous branched midvein; inner tepals usually 2-2.5 mm. long, spatulate, emarginate, slightly denticulate; outer tepals 3-4 mm. long, acute, with a midvein excurrent as a rigid point; style branches usually 2, rarely 3; utricle 1.5-2 mm.

long, thin, subglobose, circumscissile, somewhat rugose; seed obovate, lenticular, 1-1.3 mm. in diameter, dark-reddish-brown. In silt, sandy and gravelly soils, river banks, valleys, arroyos, drainage basins, irrigation ditches, dumps and gardens, throughout most of Tex., summer-fall; w. Kan. to Calif., s. to Tex. and Mex.; introd. in Mo.; rarely adv. in e. U.S.

2. *Amaranthus arenicola* I. M. Johnst. SANDHILLS AMARANTH. Plant with erect stems to 2 m. tall, whitish, glabrous, striate, simple or branched at the base, branched above; leaves alternate, with slender petioles 5-7 mm. long, oval-oblong to oblong-linear, 1.5-8 cm. long, rounded to acutish at the apex, obtuse to attenuate at the base, yellowish-green, glabrous, the veins conspicuous beneath; male and female flowers on separate plants, in slender dense or interrupted spikes or thyrses to 4 dm. long, either all terminal on leafy branches or (if a few leafless) branch thyrses present, these loosely arranged and each subtended by a leaf; bracts usually 1.5-2.5 mm. long, lanceolate, acuminate, the midrib barely excurrent; *male flowers* with 5 stamens and 5 nearly equal tepals about 5 mm. long, the inner tepals emarginate or obtuse, the outer ones obtuse or acute, all apiculate with dark midveins not excurrent; *female flowers* with 5 recurved spatulate tepals, each with conspicuous usually branched midvein, the inner tepals 1.5-2 mm. long and emarginate or obtuse, the outer tepals 2-2.5 mm. long and obtuse-apiculate; style branches 2; utricle 1.5 mm. long, thin, subglobose, circumscissile, rather smooth; seed round, lenticular, 1-1.3 mm. in diameter, dark-reddish-brown. Sandhills, swales, dried ponds, lakeshores, river sandbars, marshes, fields, roadsides and along railroads, throughout most of Tex., July-Nov.; Kan., Okla. and Ia. to Tex., w. to Colo., Nev. and N.M.

3. *Amaranthus Greggii* Wats. Plant from a taproot, with glabrous or sparsely villous herbage; stems stout, erect or much-branched at the base, the branches ascending or sprawling, 2-9 dm. long, striate, green; leaves few, rhombic-ovate to oblong, 1-3.5 cm. long, thick and fleshy, slightly scabrous, narrowed into slender short petioles to 18 mm. long, rounded at apex, acute to rounded at base, deep-green, sparingly viscid-puberulent or glabrate, prominently veined beneath; male and female flowers on separate plants, in stout elongated spikes or thyrses 5-15 cm. long and 7-10 mm. thick, leafy-bracted, somewhat interrupted below; bracts 1.5-2.5 mm. long, lanceolate to ovate, acuminate, scarious, the midrib barely excurrent; *male flowers* with 5 stamens and 5 nearly equal tepals; tepals usually 2.5-3 mm. long, the inner ones emarginate or obtuse, the outer ones obtuse or acute, all apiculate but the dark midribs not excurrent; *female flower* with 5 recurved nearly equal tepals 2.5-3 mm. long, the inner tepals spatulate and emarginate, the outer ones obovate-oblong and obtuse, all with heavy conspicuously branched barely excurrent midveins; style branches 3; utricle 3 mm. long, oblong, acutish, slightly excurrent or shorter than the tepals, nearly smooth, somewhat fleshy, indehiscent; seed 1.3-1.8 mm. in diameter, obovoid, lenticular, blackish to dark-brown, lustrous. *A. myrianthus* Standl., *A. annectans* Blake. Coastal dunes and beaches along the seacoast from Jefferson Co., Tex. to Tam. and Yuc.; summer-fall.

4. *Amaranthus crassipes* Schlecht. Plant from an elongate taproot; stems prostrate or decumbent, 2-6 dm. long, often sparingly branched, rather fleshy, glabrous; leaves alternate, with petioles 4-40 mm. long, obovate to elliptic, 1-4 cm. long, round or notched at the apex, cuneate at the base, deep-green, glabrate; inflorescences axillary, the short axes much-thickened (to 1 mm.) and indurate; male and female flowers on same plant or occasional flowers appearing perfect; bracts minute, keeled; tepals of the pistillate flowers 4 or 5, spatulate, scarious, 0.2-2.5 mm. long; style bifid or trifid to base; utricle compressed-obovoid, 1.4-1.8 mm. long, obtuse or emarginate, papillate above the middle, coriaceous, indehiscent; seed broadly obovate, 1-1.4 mm. long, dark-brown or black, lustrous. *A. Warnockii* I. M. Johnst. From the coast through the Rio Grande Plains and Edwards Plateau to the Trans-Pecos, June-Oct.; nat. of trop. Am.; naturalized in waste places along the Gulf Coast and rarely adv. at e. seaports, Fla. and the Keys to Tex.; W.I., Bah. I. and n. S.A.

5. *Amaranthus scleroides* Uline & Bray. BONEBRACKT AMARANTH. Stems erect or ascending, 1.5-4 dm. long, stout and succulent, glabrous, whitish; leaves alternate, the slender petioles 5-30 mm. long, narrowly oblong to oblanceolate, 1-4.5 cm. long, rounded or emarginate at the apex, attenuate at the base and decurrent, thick, glabrous or nearly so, pale-green; male and female flowers on same plant, occasional flowers appearing perfect, in small dense axillary clusters; peduncles much-thickened and indurate in age;

bracts finally indurate, ovate-triangular, acute; tepals of the pistillate flowers 5, spatulate, 2 mm. long, 1-nerved, indurate at the base, obtuse or acute; style branches usually 3, rarely 2; stamens 3; utricle subglobose, thin-walled, equaling the tepals, smooth, circumscissile at the middle; seed orbicular to obovate, smooth, black, lustrous, 0.6 mm. in diameter. In sandy wastes, upper Rio Grande Plains, Edwards Plateau and Trans-Pecos, throughout year; undoubtedly also adj. Mex.

6. *Amaranthus Berlandieri* (Moq.) Uline & Bray. Plant with deep-green foliage; stems erect or ascending, 1.5-3 dm. tall, slender, branching from the base, pubescent; leaves alternate, crowded, short-petioled, oblong to oblong-lanceolate, 15-25 mm. long, obtuse or notched at the apex, entire, glabrous; male and female flowers on same plant, crowded in small axillary clusters; tepals delicate, about 2 mm. long, conspicuously 3-nerved, narrowed into claws; bracts about half as long as the tepals; stamens 2; utricle turbinate, thin-walled, included, indehiscent; seed about 1 mm. long, obovoid, black, lustrous. In Rio Grande Valley and Plains, and Edwards Plateau, spring-summer; also n.e. Mex.

7. *Amaranthus polygonoides* L. TROPICAL AMARANTH. Plant with bright-green foliage; stems slender, branched at the base, the branches prostrate or ascending, 1-5 dm. long, often slightly villous or pubescent above; leaves alternate, with petioles 2-7 mm. long, rhombic-ovate to obovate, 1-2 cm. long, obtuse and usually emarginate at the apex, narrowed or cuneate at the base, glabrous or sparingly pubescent beneath; male and female flowers on same plant, occasional flowers appearing perfect, in sessile dense axillary clusters; bract lanceolate, acuminate; tepals of the *staminate flowers* oblong and acute; stamens 2 or 3; tepals of the *pistillate flowers* about twice as long as the bracts, spatulate, oblong-cuneate, 3-nerved, connate at the base, with spreading tips, apiculate, white-margined, scarious; utricle included, circumscissile; seed less than 1 mm. long, dark-brown or black, lustrous. In sandy soil and waste grounds in s. and w. Tex.; from Fla. to Tex., s. to n. S.A.

8. *Amaranthus obcordatus* (Gray) Standl. Stems stout, 1.5-5 dm. tall, with ascending branches, glabrous, whitish, often tinged with red; leaves alternate, with slender petioles 5-20 mm. long, few, soon deciduous, pale-green, glabrous, lanceolate or narrowly oblong to linear-oblong, 1-3 cm. long, truncately rounded at the apex, acute or cuneate at the base; male and female flowers on same plant, occasional flowers appearing perfect, in dense clusters arranged in sparsely leafy or naked terminal spikelike panicles; bracts half as long as the tepals or shorter, broadly ovate, acute; tepals of the *staminate flowers* oblong, obtuse; tepals of the *pistillate flowers* 5, spatulate, 2 mm. long, united at the base, rounded or emarginate at the apex, thin, conspicuously veined, often tinged with purple, the blades spreading in age; stamens 3; style branches 3; utricle narrowly oblong, indehiscent; seed obovoid, 0.6-0.8 mm. long, dark-reddish-brown. In Trans-Pecos Tex.; also s. Ariz. to Mex.

9. *Amaranthus chihuahuensis* Wats. Stems leafy up to the tip, stout, erect, 3-6 dm. tall, the branches ascending, sparsely pubescent, pale-green; leaves alternate, numerous, with slender petioles 5-20 mm. long, yellowish-green, glabrous or sparsely pubescent beneath, ovate to ovate-oblong or elliptic, 2-5 cm. long, obtuse at the apex, acute at the base, those about the middle of the plant being largest at about the beginning of the spikes, those above considerably reduced; male and female flowers on same plant, occasional flowers appearing perfect, in dense clusters, some of these axillary, others aggregated into a slender terminal leafy spike; bracts lance-subulate, shorter than the flowers; tepals 5, those of the staminate flowers oblong, acute; tepals of the pistillate flowers spatulate, 2 mm. long, scarious, united and thickened at the base, spreading in age, 1-nerved, the nerve conspicuously excurrent; stamens 5; style branches 3; utricle ovoid, shorter than the tepals, circumscissile; seed orbicular, dark-reddish-brown, 0.8 mm. in diameter. In Trans-Pecos Tex.; also n. Mex.

10. *Amaranthus Torreyi* (Gray) Wats. Stems erect, stout, 3-10 dm. tall, the branches few to numerous, slender, erect, glabrous to somewhat pubescent; leaves alternate, with slender petioles 1-2.5 cm. long, yellowish-green, glabrous, lanceolate to lance-ovate, 3-7 cm. long, acute at the apex and at the base, strongly veined beneath; male and female flowers on same plant, occasional flowers perfect, in dense glomerules, these mostly axillary but sometimes aggregated in a short leafy spike or a rather lax panicle; bracts lance-subulate, pungent-pointed, slightly exceeding the flowers; tepals 5, those of the *staminate flowers* lanceolate to ovate-oblong and spinulose-cuspidate, more or less scarious-

margined; tepals of the *pistillate flowers* spatulate, obtuse, 1.5-2 mm. long, rounded at the apex, united at the base, emarginate or apiculate, thin, 1-nerved, often tinged with purple; stamens 5, sometimes 2 or 3; utricle globose-obovoid, circumscissile, near the middle, shorter than the tepals; seed nearly orbicular, 1 mm. in diameter, black, lustrous. *A. Pringlei* Wats., *A. Bigelovii* Uline & Bray. In sandy soils, rocky hills, fields and canyons in the Trans-Pecos, July-Aug.; w. to Ariz., s. to Mex.

11. *Amaranthus fimbriatus* (Torr.) Wats. FRINGED AMARANTH. Herbage glabrous, purplish (especially the inflorescence); stems several from the base, 3-6 dm. tall, simple or sparingly branched, the branches erect; leaves alternate, linear, 2.5-5 cm. long, 1-3 mm. wide, narrowed below into a short petiole, glabrous; male and female flowers on same plant, occasional flowers perfect, in rather loose clusters or glomerules, about 7 mm. wide, the clusters scattered or mostly approximate and the upper ones aggregated in a long naked terminal spike; bracts ovate, acute, scarious-bordered, shorter than the perianth; tepals of the staminate flowers oblong, obtuse; tepals of the pistillate flowers broadly fan-shaped with a narrow thickened base and fimbriate margin, 2 mm. long; stamens 2 or 3; ovary globose-ovate; style branches 3 or 4; utricle tubercular-rugose at the summit, circumscissile near the apex; seed lenticular, smooth, dark-brown or black, 0.8 mm. in diameter, acute on the margin, lustrous. Sandy places in Trans-Pecos Tex., Sept.-Oct.; s. and e. Calif., e. to Nev. and Ut., s. to Tex., Mex. and Baja Calif.

12. *Amaranthus spinosus* L. SPINY PIGWEED, QUELITE ESPINOSO. Plant weedy, from a long (to 4 dm.) taproot; stems stout and succulent, erect, branched, 3-12 dm. tall, bearing at most nodes a pair of divergent spines 5-10 mm. long; leaves alternate, ovate-lanceolate to ovate, glabrous to sparingly pubescent, 3-10 cm. long, narrowed to an obtuse mucronate tip, broadly cuneate to the long petiole; male and female flowers on same plant, occasional flowers perfect; spikes numerous, 5-15 cm. long, 6-10 mm. thick, the terminal one often wholly or chiefly staminate, the basal part of each and the axillary clusters mostly pistillate; bracts lanceolate or subulate, usually shorter than the tepals; tepals of the *staminate flowers* lance-oblong, acute or short-acuminate; stamens 5; tepals of the *pistillate flowers* 5, oblong or acutish, 1-1.5 mm. long; utricle 1.5-2 mm. long, imperfectly dehiscent or bursting irregularly, the terminal portion spongy and roughened; seed black, nearly round, 0.7-1 mm. in diameter, lustrous. In waste ground, sandy loamy soil in e. third of Tex., w. to Dallas, Travis and Cameron cos., June-Sept.; probably trop. in origin; now abundant in warmer parts of the world, extending to N.Y., Pa., Me. and Man., Ind. and Mo., often adv. farther n.

13. *Amaranthus hypochondriacus* L. PRINCE'S FEATHER. Stems stout, 12-15 dm. tall, glabrous, green, the branches spreading; leaves alternate, with petioles as long as the blades, elliptic to ovate-oblong, subacuminate, 7.5-20 cm. long, cuneate at the base and decurrent upon the petiole; male and female flowers on same plant, occasional flowers perfect, in a panicle, usually red, composed of several to many drooping spikes; terminal spike nodding, 1-3 dm. long, much-exceeding the lateral ones that are divaricate; tepals of the pistillate flowers obovate to spatulate, with overlapping edges, about 2.5 mm. long, shorter than or equaling the utricle; seed large, about 1 mm. broad, ivory, dull-white, light-brown or dark-brown, smooth, the central albumen prominent. *A. leucocarpus* Wats., *A. caudatus* of Am. auth. Cult. by American Indian in Ariz. in 14th century, by Aztecs in 16th century, Holland and India in 18th century; frequently cult. for ornament and as a grain food, occasionally escaped or adv.; Ariz. and Tex., s. through C.A.; also Asia and Uganda.

14. *Amaranthus cruentus* L. CATERPILLAR, PURPLE AMARANTH, AMARANTO ROJO. Stems 5-20 dm. tall, erect, simple or branched, usually villous above; leaves alternate, with petioles 2-20 cm. long, elliptic to rhombic-ovate, 3.5-30 cm. long, green to purplish, sparsely pubescent or glabrate; bracts lanceolate, pungent-tipped, reddish or purplish, often longer than the tepals; male and female flowers on same plant, rarely perfect flowers, in panicles forming erect red or purple spikes; *staminate tepals* oblong-ovate, acute, with an excurrent nerve; *pistillate tepals* short, oblong, obtuse or erose, scarious, purplish or green; stamens 5; style trifid; utricle globose, circumscissile, conspicuously exceeding the perianth; seed 1 mm. wide, rotund, black or brownish, lustrous. *A. paniculatus* L. Frequently cult. and spread as a weed or waif to roadsides and waste places; from s. Que., southw. and westw.; P.R. and Virg. I.

Although said to be introduced and adventive from Asia as a Chinese ornamental, it

evidently originated as a domesticated grain crop in South America or Guatemala, the only regions where it is found in aboriginal cultivation; used as a dye plant, ornamental, potherb and as a grain amaranth.

15. *Amaranthus hybridus* L. GREEN AMARANTH, QUELITE DE COCHINO, QUELITE MORADO. Plants coarse; stems stout, erect, 6-26 dm. tall, usually branched, glabrous to rough-pubescent and usually somewhat villous above; leaves alternate, long-petiolate, rhombic-ovate to lanceolate, acute or rounded at the apex, cuneate or rounded at the base, pubescent or glabrous, darker green above; male and female flowers on same plant, occasional flowers perfect, red or green, in slender spikes 6-12 mm. wide that are in terminal panicles and also axillary; bracts about twice as long as the oblong scarious tepals, spinulose-tipped; tepals of the *staminate flowers* narrowly oblong to ovate, acute, the midvein excurrent; tepals of the *pistillate flowers* 1.5-2 mm. long, oblong or linear-oblong, acute, the nerve usually excurrent; style trifid; utricle subglobose, circumscissile; seed round, 1.1-1.3 mm. in diameter, black, lustrous. *A. chlorostachys* Willd. Mostly in w. half of Tex., May-Oct.; a nat. riverbank pioneer weed, from milder regions of e. N.A. through Mex. and C.A. to northernmost S.A.; reaching the Medit. region about the 18th century; a naturalized weed in w. N.A., e. Asia, Austral. and S. Afr.

Mixes freely with *A. Powellii* and *A. retroflexus* in weed populations, forming partially fertile hybrids; also hybridizes with *A. hypochondriacus* and *A. cruentus*, the grain amaranths.

16. *Amaranthus Powellii* Wats. Stems stout, 3-20 dm. tall, erect, simple or much-branched, green or whitish, glabrous below, usually villous above; leaves alternate, slender petioles 1-5 cm. long, lanceolate or ovate, 1.5-8 cm. long, 5-40 mm. wide, acute to obtuse at the apex, sometimes emarginate, cuneate to acute at the base, yellowish-green or deep-green, glabrous or sparsely pubescent; male and female flowers on same plant, occasional flowers perfect, numerous, in crowded spikelike terminal and axillary clusters 4-25 cm. long and 1-2 cm. thick, with some dense clusters of flowers in the axils of the upper leaves; bracts 2 or 3 times as long as the tepals, lanceolate or ovate, attenuate to a rigid spinose tip, green and indurate along the midnerve, sometimes puberulent; tepals of the *staminate flowers* lance-oblong, scarious, 1-nerved, acute, the midvein excurrent; tepals of the *pistillate flowers* 2-3 mm. long, oblong or lance-oblong, acute, mucronate, thin, usually longer than the utricle; stamens mostly 3; style branches 3, elongate, erect; utricle subglobose, compressed, equaling or shorter than the tepals, rugulose above, dehiscent at the middle; seed obovate to oval, 1-1.2 mm. long, black, lustrous. *A. obovatus* Wats. Pioneer of canyons, desert washes and open wastes from s.-cen. Tex. and Rio Grande Plains to the Trans-Pecos, June-Nov.; ranging through the western Cordilleran system of N.A. and S.A.; absent in the warmer regions of C.A., adv. in e. N.A.; in n. and cen. Eur.; hybridizes with *A. retroflexus* and *A. hybridus* and the grain amaranths.

17. *Amaranthus Wrightii* Wats. Stems stout, 2-10 dm. tall, often simple, sometimes branched at the base and sparsely branched above, the branches strongly ascending, whitish or tinged with red, glabrous; leaves alternate, with slender petioles 5-40 mm. long, lance-elliptic to rhombic-ovate, acutish to obtuse at the apex, sometimes emarginate, 1.2-6 cm. long, 4-30 mm. wide, cuneate to acute or abruptly acute at the base, yellowish-green, paler beneath, glabrous; male and female flowers on same plant, occasional flowers perfect, in dense stout erect terminal simple or branched spikes 4-25 cm. long, these often leafy, interrupted below, with dense clusters of flowers in the axils of the leaves shorter than the petioles; bracts linear-lanceolate or subulate, longer than the tepals, often twice as long, rigid, greenish, pungent; tepals of the *staminate flowers* oblong, acute; tepals of the *pistillate flowers* 1.5-2 mm. long, oblong-linear, narrowed at the base, rounded to truncate and usually emarginate or retuse at the apex or the outermost one rarely pungent, thin, faintly 1-nerved, the nerve usually not exceeding the apex, sometimes ciliate, erect, united at the base, often tinged with red; stamens 3; style branches 3, short; utricle globose, about equaling the tepals, smooth or nearly so, circumscissile at the middle; seed round, 1 mm. in diameter, dark-reddish-brown, smooth and lustrous. Limestone soils in mts. of Trans-Pecos Tex., Aug.-Sept.; Tex., Ariz., w. N.M. and s. Colo.

18. *Amaranthus retroflexus* L. REDROOT PIGWEED, ROUGH PIGWEED, QUELITE. Coarse weedy herb; stems stout, erect, simple or usually branched, 3-30 dm. tall, roughish-

puberulent below and more or less villous-pubescent above, white-striped; leaves alternate, long-petioled, the slender blades 1.5-8 cm. long, usually villous, at least pubescent along the veins beneath; male and female flowers on same plant, occasional flowers perfect, in dense terminal or axillary usually paniculate densely crowded erect spikes 5-20 cm. long and 8-20 mm. thick, dense clusters also present in the axils of the upper leaves; bracts ovate, tapering into a short subulate green tip, usually twice as long as the tepals (at least in age), 1-nerved, sparsely villous; tepals of *staminate flowers* ovate-oblong to lanceolate, acute or acutish, scarious, 1-nerved, the nerve shortly excurrent; tepals of *pistillate flowers* 3 mm. long, linear-oblong, rounded to truncate at the apex, usually emarginate, often mucronate, scarious and whitish except the whitish midnerve, the base thickened in age; stamens 5; style branches 3, rather short; utricle subglobose, more or less rugulose on the upper half, circumscissile at the middle, shorter than the tepals; seeds round, 1 mm. broad, dark-reddish-brown, lustrous. In sandy-clayey soils in Plains Country to s.-cen. Tex. and the Trans-Pecos, June-Oct.; nat. riverbank pioneer of cen. and e. U.S. and adj. regions of s.e. Can. and n.e. Mex.; spread to Near East, N. Afr. and Asia.

Hybridizes freely with *A. Palmieri*, *A. Powellii* and *A. hybridus*, as well as with the grain amaranths.

Var. *salicifolius* I. M. Johnst. Plants often 2-6 dm. tall and more slender than typical plants; leaves lanceolate, often 3 or 4 times longer than broad; inflorescence pallid, the perianth lobes obtuse or retuse rather than acute as in *A. Powellii*. Tex., Ariz. and Mex.

19. *Amaranthus blitoides* Wats. PROSTRATE PIGWEED, QUELITE MANCHADO. Coarse weedy herbs; stems stout, prostrate, much-branched either at ground level or somewhat above, 1.5-6 dm. long, glabrous or sparsely pubescent, pale-green or whitish, rarely tinged with red or purplish; leaves usually numerous, often crowded, with stout petioles 2-20 mm. long, obovate to oval or spatulate to elliptic, 8-40 mm. long, rounded to acutish at the apex, broadly cuneate to attenuate at the base, pale-green, glabrous, prominently veined, the veins whitish beneath, the smaller leaves often white-margined; male and female flowers on same plant, occasional flowers perfect, in dense axillary clusters that are usually shorter than the petioles; bracts oblong to lanceolate, equaling or slightly longer than the tepals, erect, attenuate at the apex to a short spinose tip, green; tepals 4 or 5, those of the *staminate flowers* scarious, oblong, acute; tepals of the *pistillate flowers* oblong or narrowly oblong, 2.5-3 mm. long, acuminate, 1-nerved, green, white-margined; stamens 3; style branches 3; utricle subglobose, equaling or slightly longer than the tepals, smooth, circumscissile, sometimes tinged with red; seed round, 1.3-1.6 mm. in diameter, black, rather dull. *A. graecizans* of Am. auth. Waste grounds, roadsides, in various soils, throughout much of Tex. but most abundant in the w. half, July-Oct.; Wash. to n. Mex., e. to Kan. and Tex.; also established in e. N.A. from s. Can. southw.; Old World.

20. *Amaranthus californicus* (Moq.) Wats. Stems prostrate from a taproot, stout and rather fleshy, much-branched from the base, 8-50 cm. long, whitish or tinged with red; leaves alternate, numerous, pale-green, with petioles 2-18 mm. long, obovate to oblong, mostly obtuse, prominently mucronate, the veins and margins white, 3-25 mm. long, glabrous, sometimes purplish beneath; male and female flowers on same plant, occasional flowers perfect, in small axillary clusters; bracts lanceolate, acute, subulate-tipped, about equaling the flowers; tepals in *staminate flowers* 3 (or 2), membranous, elliptic-lanceolate to oblong-ovate, mucronate or erosulate; stamens 3 (or 2 or 1); tepals in *pistillate flowers* mostly 1 (or 2 or 3), inconspicuous, one narrowly lanceolate and acute or acuminate, the others usually reduced and scalelike; utricle subglobose, smooth, often tinged with red or purple, tardily irregularly dehiscent; seed dark-reddish-brown, 0.6-0.8 mm. in diameter. *A. microphyllus* Shinn. Moist soils, in beds of dried-up lakes and ponds in Plains Country, July-Sept.; s. Wash. and Alta., s. through Ida. and Ore. to Calif., Nev. and Tex.

21. *Amaranthus pubescens* (Uline & Bray) Rydb. Stems stout, ascending or prostrate, diffuse, spreading from a common rootstock, branches 1-3 dm. long, whitish, densely viscid-pubescent; leaves alternate, with stout petioles 2-10 mm. long, elliptic to oval or obovate, 7-15 mm. long, obtuse or acutish, the midvein excurrent as a spinose awn, cuneate at the base, usually puberulent (at least beneath), thick, conspicuously crispate, strongly nerved, the nerve white beneath; male and female flowers on same plant, occa-

sional flowers perfect, in small dense axillary clusters longer than the petioles; bracts lanceolate or ovate, twice as long as the flowers, with rigid spinose divaricate tips; tepals 3, those of the *staminate flowers* scarious, oblong, acute; tepals of the *pistillate flowers* oblong to elliptic or linear, obtuse or acutish, thick, 1-nerved, green; stamens 3; style branches 2 or 3; utricle globose, about equaling the tepals, circumscissile, thick-walled, slightly rugose; seed rotund, 0.8 mm. in diameter, dark-reddish-brown or black, lustrous. In sandy and alkaline soils in dry open plains and on slopes in the Trans-Pecos, e. to cen. Tex., July-Sept.; s. Colo. to Nev., s. to Tex., Ariz. and N.M.

22. *Amaranthus albus* L. Stems stout, erect, bushy-branched, the branches divaricate or ascending, 2-12 dm. tall, whitish or pale-green, glabrous or sparingly puberulent or villous; leaves alternate, with slender petioles 3-50 mm. long, slender, elliptic to oblong or spatulate to obovate, 1-7 cm. long, cuneate at the base, rounded or mucronate-cuspidate at the apex, prominently veined, the veins white beneath; male and female flowers on same plant, occasional flowers perfect, the staminate ones few, in dense or loose axillary clusters that are usually shorter but sometimes longer than the petioles; bracts green, rigid, 2-4 mm. long, oblong-lanceolate, pungent-pointed and spreading; tepals 3, the *staminate* ones oblong, cuspidate, scarious; *pistillate tepals* oblong to linear, acute, 1-nerved, thin, green along the nerve, often tinged with red; stamens 3; style branches 3; utricle subglobose, circumscissile, rugose, longer than the perianth, sometimes tinged with red; seed lenticular, 0.6-0.8 mm. in diameter, mahogany-colored, lustrous. *A. graecizans* of Am. auth. Waste places and cult. areas throughout most of Tex. but exceedingly rare, Aug.-Dec.; widely distributed throughout N.A.; adv. in Eur., Asia, Afr. and S.A.

23. *Amaranthus viridis* L. Stems slender, erect or prostrate, glabrous, to 1 m. tall; leaves alternate, with petioles 1-2 cm. long, deep-green, broadly ovate or rhombic-ovate, commonly 3-7 cm. long, acute or rounded at the base, deeply emarginate at the apex; male and female flowers on same plant, occasional flowers perfect, in spikes; spikes few to several, the lateral ones ascending, not much shorter than the terminal, forming a panicle 1-2 dm. long; bracts ovate to lanceolate, acute, as long as the tepals or shorter; tepals of the *staminate flowers* oblong, acute; stamens 3; tepals of the *pistillate flowers* 3, oblanceolate, shorter than the utricle, acute; utricle compressed-ovoid, about 1.5 mm. long, very rugose when dry, indehiscent; seed round, sharp-edged, about 1 mm. in diameter, reddish-brown, lustrous. *A. gracilis* Desf. of Am. auth. In waste places and on beaches in s. Tex. and the Rio Grande Plains, Mar.-June; probably nat. of trop. S.A.; W.I.; occasionally adv. in e. U.S.; local in the Gulf States; widely dispersed in trop. regions; also in Old World trop., Eur., Afr., Asia and the Pac. Is.

3. ACNIDA L. WATER-HEMP

Annual herbs; stems erect, glabrous, branched; leaves alternate, petioled, entire; flowers in short panicles that form much more elaborate panicles or spikes; male and female flowers on separate plants; *staminate flowers* with 5 erect membranous or scarious oblong to lanceolate 1-nerved tepals; stamens 5, the anther locules united only at the middle, the anthers linear-oblong; *pistillate flowers* naked, without or with 1 or 2 tepals; ovary flattened, obovate or rotund; style very short or absent; style branches 2 to 5, usually elongate, plumose-hispid; ovule 1; utricle thin-walled or fleshy to somewhat coriaceous, indehiscent, irregularly bursting or circumscissile, usually 3- to 5-angled; seed erect, smooth, reddish-brown or nearly black, lustrous; embryo annular, the endosperm copious.

About half a dozen species in the Western Hemisphere.

1. Plants pistillate (2)

1. Plants staminate (3)

2(1). Tepals completely lacking or irregularly present and rudimentary, less than 1 mm. long and without visible midveins; utricle indehiscent, with conspicuous longitudinal ridges; leaf blade broadly lanceolate . . . 1. *A. cuspidata*.

2. Tepals regularly present and well-developed, at least 1 mm. long and with distinct midveins, 1 or 2, lanceolate to linear; utricle circumscissile, rugose, with faint ridges; leaf blade usually oblong to lanceolate 2. *A. tamariscina*.

- 3(1). Outer tepals without heavy midveins and not appreciably longer than the inner, with excurrent midveins; bracts mostly with slender midribs not over 2 mm. long, the midrib conspicuously excurrent; leaf blades usually lanceolate, more than 1 cm. wide; inflorescence often with several branch thyrses not subtended by leaves 1. *A. cuspidata*.
3. Outer tepals 3 mm. long, with heavy midveins, definitely longer than the inner, the midribs excurrent as rigid spines; bracts with heavy midribs, mostly over 2 mm. long, definitely shorter than the outer tepals; leaf blades usually oblong to linear-oblong 2. *A. tamariscina*.

1. *Acnida cuspidata* Spreng. SOUTHERN WATER-HEMP. Glabrous herb; stems stout, 2-3 (to 9) m. tall, usually much-thickened at the base, smooth, succulent, much-branched above; leaves few to numerous, with slender petioles 2-20 cm. long, narrowly lanceolate to ovate, 6-30 cm. long, 5-14 mm. wide, acuminate or long-attenuate at the apex, rounded to acute at the base, undulate, yellowish or bright-green, prominently veined beneath; inflorescences (thyrses) flexible or moderately stiff, usually 5-10 cm. long, the terminal thyrse often accompanied by leafless branch thyrses and the uppermost of these not subtended by leaves, the branch thyrses somewhat more numerous and more crowded in the male than in the female plants; bracts 1.5-2 mm. long, the midrib moderately heavy in the male and heavy in the female, not conspicuously excurrent in either; *male flowers* with 5 stamens; the 5 tepals approximately equal, 1.2-3 mm. long, the inner emarginate, the outer acuminate with excurrent midveins; *female flowers* without perianth; style branches 3 to 5, short and stout; utricle obovoid to turbinate, 1.5-2.5 mm. long, fleshy, indehiscent, with 3 to 5 prominent longitudinal ridges, not rugose, stramineous; seed flattened, 1-1.25 mm. in diameter, turgid, round, smooth to minutely granulate, dark-reddish-brown to black, lustrous. *Acnida alabamensis* Standl., *Amaranthus australis* (Gray) Sauer. In salt and marshy places, from coastal Tex., n.w. to the Plains Country, May-Aug.; Coastal Plain from Fla. to Tex. and Yuc., W.I., Trin. and Venez.

2. *Acnida tamariscina* (Nutt.) Wood. NUTTALL'S WATER-HEMP. Herb, glabrous or nearly so; stems stout, erect or ascending, simple or branched, 1-2 m. tall; leaves alternate, with slender petioles to 5 cm. long, rhombic-oblong or lanceolate to ovate-lanceolate, to 1 dm. long, attenuate at the base, rounded or obtuse at the apex, sometimes notched, the much-reduced upper leaves narrowly oblong; inflorescence (thyrses) stiff, usually 1-2 dm. long, either all terminal on leafy branches or (if leafless thyrses present) these loosely arranged and each subtended by a leaf; bracts 1.5-2 mm. long, with moderately heavy excurrent midrib in the male, about 2 mm. long, with heavy excurrent midrib in the female; *male flowers* with 5 stamens and 5 tepals; inner tepals about 2.5 mm. long, obtuse or emarginate; outer tepals about 3 mm. long, acuminate, with conspicuous excurrent midveins; *female flowers* with 1 or 2 tepals, the shorter tepal rudimentary, the longer tepal about 2 mm. long, narrowly lanceolate, acuminate, with moderately heavy sometimes branched excurrent midvein; utricle about 1.5 mm. long, circumscissile at the middle, thin, rugose, sometimes with faint ridges corresponding to the 3 or 4 style branches, not angled, often reddish; seed nearly circular, lenticular, about 1 mm. in diameter, dark-reddish-brown. *Amaranthus tamariscinus* Nutt. Sandy fields and wastelands, chiefly in moist soils, swamps, alluvial soils, throughout most of Tex. except extreme w. part, Mar.-Oct.; Ind. to Wisc., S.D. and Colo., s. to N.M., Ark., Tex. and La., occasionally adv. in e. U.S.

4. ACANTHOCHITON TORR.

GREEN STRIPE

A monotypic genus.

1. *Acanthochiton Wrightii* Torr. Annual herb; stems erect, glabrous, 1.5-8 dm. high, with many ascending branches (the lowest ones sometimes decumbent), striate; leaves alternate, with petioles 3-20 mm. long, narrowly lanceolate to linear, 2-8 cm. long, 2-12 mm. wide, rounded at the apex, cuneate or attenuate at base, the veins whitish and prominent beneath, the margins wavy and crispate; male and female flowers on separate plants, in spicate glomerules; *staminate flowers* with bracts 2-3 mm. long that have moderately heavy excurrent midribs; tepals 5, subequal, lance-oblong, 1-nerved, the

inner ones 2.5-3.5 mm. long and emarginate, the outer tepals 3-4 mm. long and acute, all apiculate but the dark midveins not excurrent; stamens 5, the 4-celled anthers distinct; *pistillate flowers* concealed by the large rigid cordate foliaceous bracts; bracts 5 mm. long, recurved, spinulose at apex, the excurrent midribs extremely heavy; tepals usually 5; inner tepals rudimentary and linear, less than 1 mm. long; outer tepals well-developed and broadly spatulate, sometimes 4-5 mm. long, with crenate margins and conspicuous branching venation; ovary ovoid, slightly compressed, the style branches usually 3; utricle about 2 mm. long, circumscissile, somewhat rugose; seed erect, obovoid, 1-1.25 mm. in diameter, lenticular, dark-reddish-brown. *Amaranthus Acanthochiton* (Torr.) Sauer. Dunes, beaches and rocky hills in s.e. Tex. to Plains Country and in igneous soils in mts. of Trans-Pecos, July-Oct.; from w. Tex. to n.e. Ariz. and n. Mex.

5. ACHYRANTHES L. CHAFF-FLOWER

About 100 species, mostly African and Asian.

1. *Achyranthes aspera* L. Annual or perennial herb with decumbent or ascending simple or branched stems, to 1 m. long and pilose; leaves opposite, with petioles 25 mm. long, oval or ovate, 4-20 cm. long, the apex acuminate, the base rounded or narrowed; spikes terminal and axillary, slender, to 3 dm. long, 10-12 mm. thick, loosely flowered below and densely so above, the rachis densely white-villous; flowers perfect, 6-7 mm. long; bracts and bractlets glabrous, ovate, long-aristate; perianth firm, often becoming very hard; tepals 4 or 5, lanceolate, long-acuminate, twice as long as the bracts, 6-7 mm. long, not nerved; stamens 5 or rarely fewer, the filaments filiform-subulate, the anthers 2-celled; style slightly longer than the filaments; utricle oblong, included, truncate at the apex, 6-7 mm. long, membranous, indehiscent, glabrous; seed narrowly oblong, 3 mm. long, fuscous, dull. Waste grounds and wooded areas, only in Hidalgo Co. in the Rio Grande Plains; s. Fla. to Tex.; W.I., C.A. from Mex. to Guat.; Old World trop.; s. coast of Eur. to Afr. and s. Asia.

6. IRESINE P. BR. BLOODLEAF

Annual or perennial herbs and half-shrubs, of varying aspects; stems erect, decumbent or scandent, pubescent or glabrous; leaves opposite, petiolate, entire or serrulate; flowers perfect, usually unisexual (and when so, male and female flowers on same or separate plants), white, scarious, 3-bracted, small or minute, crowded into clusters or spikes aggregated into branching panicles; perianth deeply 5-parted, often bearing long wool; stamens mostly 5, the filaments connate at the base; ovary compressed, the style very short; stigmas 2 or 3, usually filiform, sometimes capitate; ovule 1, pendulous from the apex of an elongate funicle; utricle compressed, subglobose, membranous, indehiscent, very small; seed inverted, smooth; embryo annular, surrounding the farinaceous endosperm; cotyledons narrow; radicle superior.

About 80 species in both hemispheres.

1. Stems conspicuously fruticose nearly throughout, sometimes scandent; tepals of the pistillate flowers about as long as the bractlets 1. *I. Palmeri*.
1. Stems herbaceous throughout, never truly fruticose (2)
- 2(1). Tepals of pistillate flowers faintly 1-nerved, acute, equaling or usually shorter than the utricle; plant perennial with rootstock 2. *I. rhizomatosa*.
2. Tepals of the pistillate flowers 3-nerved, usually obtuse, longer than the utricle; annuals or perennials, herbaceous (3)
- 3(2). Annual; tepals of the pistillate flowers obtuse or acutish; lower leaves similar to the upper ones, acuminate, inconspicuously nerved, thin 3. *I. Celosia*.
3. Perennial; tepals of the pistillate flowers acute or acuminate; lower leaves much broader than the upper ones, obtuse or acutish, conspicuously nerved, with coarse whitish hairs, thick and succulent 4. *I. heterophylla*.

1. *Iresine Palmeri* (Wats.) Standl. PALMER'S BLOODLEAF. Perennial weak shrub, scandent or decumbent; stems much-branched, the branches ascending, slender or stout, sharply angulate, glabrous or sparsely puberulent when young; leaves opposite, with petioles 2-6 mm. long, lanceolate to narrowly ovate or lance-oblong, 1.2-6 cm. long, 5-17 mm. broad, acute to acuminate or rarely obtuse at the base, thick, bright-green, glabrous; male and female flowers on separate plants; pistillate flowers in short or elongate very narrow sparsely leafy panicles; spikelets loosely flowered, sessile or pedunculate; tepals of the pistillate flowers about as long as the bractlets, oval, 1 mm. long, obtuse, sparsely pilose, obscurely veined; bracts and bractlets orbicular, stramineous or fuscous, strongly concave; staminodia lacking; style very short, the stigmas elongate and stout; utricle subglobose, 1 mm. long, reddish-brown. In thickets and groves in the Brownsville region, spring-fall; also Mex.

2. *Iresine rhizomatosa* Standl. Perennial herb, stoloniferous with slender horizontal rhizomes; stems erect, usually simple up to the inflorescence, 5-15 dm. tall, sparsely pubescent or glabrous, pilose at the slightly swollen nodes, the internodes 5-14 cm. long; leaves opposite, thin, bright-green, ovate to ovate-lanceolate, acute to long-acuminate, entire, narrowed at the base, the larger ones 6-15 cm. long and 2-7 cm. broad, with a few short hairs on the upper surface along the veins, sparsely pubescent beneath or glabrous; male and female flowers on separate plants; *staminate panicle* often laxly branched, the spikelets longer; bracts and bractlets ovate, silvery-white, shorter than the tepals; tepals silvery-white, ovate-lanceolate, 1.2-1.5 mm. long, 1-nerved, those of the pistillate flowers subtended by long hairs as a white wool; *pistillate panicles* 7-30 cm. long, 2.5-20 cm. broad, much-branched, the branches erect or ascending, pyramidal, the spikelets opposite or alternate, densely flowered, 5-20 mm. long; utricle round, 2-2.5 mm. long, equaling or longer than the tepals; seed suborbicular, 0.5 mm. in diameter, dark-red, lustrous. *I. celosioides* Michx., non L. Sandy alluvial soils, scattered in e. half of Tex., w. to Denton and Comal cos., Aug.-Oct.; Md. to s. Ill. and Kan., s. to e. Va., Ala., La. and Tex.

3. *Iresine Celosia* L. JUBA'S BUSH. Annual herb or the plant persisting for several years, from a vertical root; stems slender or short, usually much-branched, erect or spreading, sometimes clambering over other plants, 4-30 dm. long, glabrous or sparingly villous at the nodes, with short multicellular hairs, swollen at the nodes, the internodes 4-20 cm. long; leaves opposite, ovate to ovate-lanceolate or the upper ones lanceolate, 5-15 cm. long, 1.5-7 cm. broad, acute or acuminate at the apex, rounded or truncate at the base, slightly decurrent, glabrous or slightly villous with short multicellular hairs, often soft-pubescent on both surfaces, with slender petioles 8-65 mm. long; panicles usually broad and much-branched, 14 cm. long, the branches ascending, divergent or reflexed, slightly villous with whitish hairs; spikelets alternate, opposite or verticillate, sessile or pedunculate, usually densely flowered, 5-25 mm. long, often flexuous; male and female flowers on same plant, white to stramineous, the pistillate ones with copious long white wool at the base; bracts about one half as long as the tepals, ovate to ovate-orbicular, obtuse or acute, often pubescent, usually entire; tepals 1-1.5 mm. long, oblong, obtuse or rounded, those of the pistillate flowers conspicuously 3-nerved; utricle shorter than the tepals; seed 1.5 mm. in diameter, broadly obovoid or suborbicular, dark-red, lustrous. In cen. and Trans-Pecos Tex., July-Oct.; mostly along the coast, N.C. to Fla., w. to Tex.; also W.I., cen. and w. Mex. and southw. through C.A. and much of S.A.

4. *Iresine heterophylla* Standl. Perennial herb from long slender branched woody rootstocks; stems herbaceous, stout, erect or ascending, solitary or several from a single base, 5-10 dm. tall, swollen at the nodes, short-villous at the nodes and sparsely pubescent with short soft hairs elsewhere, the internodes 1.5-10 cm. long; leaves opposite, usually asymmetric, with petioles 2-20 mm. long, the uppermost leaves usually sessile or subsessile; blades of the lower leaves broadly rhombic-ovate, 3-6 cm. long, 2-4 cm. wide, rounded or acutish at the apex, more or less decurrent, yellowish-green, scabrous or smooth on the upper surface, pubescent beneath; inflorescence a narrow dense much-branched panicle, 1.5-4 dm. long, 3-9 cm. broad, the branches erect or ascending, sparsely villous; spikelets stout, densely flowered, 4-23 mm. long; bracts one third to one half as long as the tepals, ovate-orbicular, acute, entire; tepals 1-1.3 mm. long, elliptic-oblong,

yellowish-white, acuminate to acutish, those of the pistillate flowers 3-nerved; utricle shorter than the tepals; seed suborbicular, 0.6 mm. in diameter, dark-reddish-brown, lustrous. In humus on and among boulders, dry rocky hills, sand-gravel and ledges in the Trans-Pecos and Edwards Plateau, May-Oct.; Tex. to Ariz., s. to C.A.

7. DICRAURUS Hook. f.

A monotypic genus. (*Dicrairus*, orthogr. err.).

1. *Dicraurus leptocladus* Hook. f. Perennial shrub 2-10 dm. tall, with numerous simple or sparsely branched stems from a woody base; branches slender, ascending, rigid, often spinescent in age, subangulate, densely villous-sericeous; leaves mostly alternate, with petioles 1-2 mm. long, ovate to ovate-lanceolate or ovate-oblong, 7-25 mm. long, 3-9 mm. wide, acute to acuminate or rarely obtuse, thick and firm, sparsely sericeous on the upper surface or glabrate, densely villous-sericeous beneath or glabrate in age; panicles axillary or terminal, 2-15 cm. long, usually dense and congested, leafless or sparsely leafy below; spikelets short, few-flowered, sessile or short-pedunculate; perianth tercte, the 5 segments distinct, 1-nerved; male and female flowers on same plant, occasional flowers appearing perfect; *staminate flowers* with bracts and bractlets less than half as long as the tepals, subscarios, suborbicular, densely short-villous; tepals elliptic-oblong, 2 mm. long, densely villous; stamens united into a cup, the 5 filaments linear and equaling the tepals, the very short staminodia papillose-dissected at the apex; *pistillate flowers* with bracts and bractlets nearly as long as the tepals, suborbicular, white-stramineous, villous; tepals elliptic-oblong, 1.5 mm. long, obtuse, densely pilose with long soft white hairs; style very short, the stigmas elongate; utricle oval, membranous, indehiscent, subcompressed; seed 1 mm. broad, brown. Rocky hillsides and among boulders in the s. Trans-Pecos, July-Dec.; also Mex.

8. GUILLEMINEA H.B.K.

COTTONFLOWER

Perennial herbs, rarely becoming woody, the stems often procumbent, lanate to nearly glabrous; leaves opposite and extremely variable; radical leaves in rosettes, linear to oblanceolate; cauline leaves linear to ovate with a widely winged petiole; inflorescence a single flower or a spike of 2 to 30 flowers; spikes often densely aggregated at the nodes, subtended by small leaves; flowers sessile, with 2 bracts and a bractlet, pedicellate, perfect, 5-merous, the perianth rotate to erect; tepals 5, 2 more concave than the other 3, covered with silky hairs developing from the rigid tissue, the segments with a sterile membranous fringe, trinerved and often chlorophyllous; stamens 5, the filaments united into a tube, either free from the perianth and cuplike around the base of the pistil or adnate to the fused perianth, the anthers unilocular; staminodia and pseudostaminodia absent; style 1, usually short, sometimes extended, the stigmas capitate and always bilobed; utricle membranous, indehiscent; ovary unilocular with a single falsely apically pendulous ovule; endosperm central and farinose; embryo annular, peripheral and the radicle ascending.

Several American species.

1. Filament tube adnate to the perianth (*Guilleminea*) (2)
1. Filament tube free from the perianth (*Gossypianthus*) (3)
- 2(1). Leaves and flowers not densely aggregated at the nodes; mature flowers less than 1.5 mm. long 1. *G. densa* var. *densa*.
2. Leaves and flowers densely aggregated at nodes on the thick stems; flowers 1.8-2.2 mm. long at maturity 1. *G. densa* var. *aggregata*.
- 3(1). Plant not densely pilose; radical leaves usually 1-9 cm. long, 3-6 mm. wide, lanceolate to linear, acute (4)
3. Plant usually densely pilose with long silky hairs; radical leaves usually 2-8 cm. long, 5-15 mm. wide, oblanceolate and acute to spatulate and obtuse (5)

- 4(3). Longest radical leaves 10-25 mm. long; plants low; stems procumbent; cauline leaves often pilose, 5-8 mm. long, 3-4 mm. wide . . . 2. *G. lanuginosa* var. *lanuginosa*.
4. Longest radical leaves usually 40-90 mm. long, often linear; plants large, often with ascendent stems, often nearly glabrous 2. *G. lanuginosa* var. *tenuiflora*.
- 5(3). All leaves very large; cauline leaves 15-20 mm. long, 8-10 mm. wide, spatulate to ovate; radical leaves 3-8.5 cm. long, 6-12 mm. wide, oblanceolate; leaves densely aggregated on thick stems 2. *G. lanuginosa* var. *Sheldonii*.
5. Some cauline leaves small, 7-18 mm. long, 3-13 mm. wide; radical leaves 1.6-6 cm. long, 4-10 mm. wide, spatulate to lanceolate; leaves not densely aggregated 2. *G. lanuginosa* var. *rigidiflora*.

1. *Guilleminea densa* (Willd.) Moq. Radical leaves 20-25 mm. long, 10-13 mm. wide, lanceolate to spatulate, acute, rarely persisting until fruiting; cauline leaves 3-30 mm. long, 1.5-12 mm. wide, lanceolate; flowers rarely more than 10 grouped into a small capitulum or cylindrical spike; perianth to 2.5 mm. long, slightly longer than the bractlets, usually rotate; tepals united into a 5-parted perianth, the tube densely lanate, the lobes with a central nerve less than two thirds the length of the free lobe; tepal lobes hyaline-membranes except the nerve, lance-ovate, acutish, glabrous, scarious, white, the nerve usually without chlorophyll; filament tube barely visible above the level of adnation to the perianth; bracts ovate, acute, scarious, white, glabrous; bractlets oblong-ovate, obtuse; utricle glabrous; seed compressed-ovoid, 0.6 mm. long, brown, lustrous. In dry stony or sandy soil in Trans-Pecos and Plains Country, May-Oct.; Okla. and w. Tex. to s. Ariz. and southw. to s. Mex.; also s. Bol. to n. Arg.; introd. in S. Afr. and Queensl.

We have the following two varieties in Texas.

Var. *densa*. Flowers less than 1.5 mm. long at maturity of fruit and leaves not aggregated at the node. *Brayulinea densa* (Willd.) Small. The most common variety in N.A.

Var. *aggregata* Uline & Bray. Plants larger and more robust; leaves subtending the nodes often very large and ovate; flowers and leaves densely aggregated on thick stems, the flowers 1.8-2.2 mm. long at maturity. Tex. and Mex.

2. *Guilleminea lanuginosa* (Poir.) Hook. f. Stems all originating above ground, rarely flexuous, often procumbent but sometimes ascendent; radical leaves 1-9 cm. long, 3-15 mm. wide, lanceolate to spatulate with a widely winged petiole without chlorophyll, both surfaces either pilose-sericeous or glabrous; cauline leaves with very short petioles, oval to rounded-obovate, 5-20 mm. long and 3-10 mm. wide, pilose-strigose above, densely pilose-sericeous beneath; inflorescence a small spike of 6 to 12 axillary flowers; perianth 2.5-3 mm. long, densely lanate; tepals lanceolate to linear-lanceolate, trinerved, green along the nerves; filaments free, linear, dilated at the base; styles 0.1-0.3 mm. long at maturity of fruit; seed 1 mm. long, brown, lustrous. In dry soil, s. and w. Tex. to Mex.; Hisp.

We have the following varieties in Texas.

Var. *lanuginosa*. Plants rarely larger than 1 dm. tall, with stems flexuous or ascendent; radical leaves 1-2.5 cm. long and 4-6 mm. wide, lanceolate or oblanceolate and acute; cauline leaves 5-8 mm. long and 3-4 mm. wide; marginal membranes on the tepals less than 10 percent of the total area. *Gossypianthus lanuginosus* (Poir.) Moq. in Rio Grande Plains; also Hisp. and Mex.

Var. *rigidiflora* (Hook.) Mears. Plants larger and more robust than those of var. *lanuginosa*; stems thick, never flexuous, the stems (and leaves) usually densely pilose, rarely worn to glabrous by rain and wind; radical leaves 1.6-6 cm. long, 4-10 mm. wide, oblanceolate and barely acute to spatulate and obtuse; cauline leaves 7-18 mm. long, 3-13 mm. wide, lanceolate, the marginal membrane on the tepals wider than in var. *lanuginosa*. *Gossypianthus rigidiflorus* Hook. From s.-cen. and n.-cen. Tex. to the Edwards Plateau and Rio Grande Plains, Apr.-Oct.; Okla. and Tex. to s.w. Chih., s. to cen. Tam.

The most common variety, seems to be intermediate between var. *lanuginosa* and var. *Sheldonii*. It occurs where both the others do but not where the others occur together.

Var. *Sheldonii* (Uline & Bray) Mears. Stems thicker than in the other varieties; radical leaves 3-8.4 cm. long, 6-12 mm. wide, lanceolate to oblanceolate; cauline leaves 1.5-2 cm. long, 8-10 mm. wide, ovate and acute to obovate and obtuse, the leaves densely tomentose; tepals with 3 chlorophyllous nerves; flowers sometimes basal and bleached by the weather. *Gossypianthus Sheldonii* Uline & Bray. Prairies, Okla. and n.w. Tex. (to Taylor and Terrell cos.).

Var. *tenuiflora* (Hook.) Mears. Radical leaves 3-9 cm. long, 3-6 mm. wide, linear to lanceolate, acute; cauline leaves 8-18 mm. long, 4-6 mm. wide, lanceolate to oblanceolate, acute, the leaves nearly glabrous at anthesis; nodes of the inflorescences farther apart than in the other varieties; marginal membranes on tepals wider than those of var. *lanuginosa*. *Gossypianthus tenuiflorus* Hook. Blackland Prairies of Okla. and Tex., Post Oak Savannah and Gulf Prairies of Tex., w. to Llano Co.; rare in Ark. and Mex.

9. ALTERNANTHERA FORSK. CHAFF-FLOWER

Annual or perennial herbs; stems decumbent or prostrate, erect or ascending; leaves opposite, sessile or petioled, with narrow or broad blades; flowers perfect, in sessile or peduncled headlike spikes that are silvery or white; tepals 5, unequal or equal, 2 more concave than the others; stamens usually 5, sometimes 3, the filaments partially united into a cuplike tube, the staminodia equal to or surpassing the filaments and the 1-celled anthers; ovary 1-celled, the style variable in length, the stigma capitate; ovule solitary; utricle flattened, indehiscent; seed lenticular, smooth.

About 200 species, mostly in tropical and subtropical regions.

- 1. Heads pedunculate; peduncles about 5 cm. long; flowers sessile or nearly so; tepals glabrous; spikes 12-14 mm. in diameter; leaf blades narrow, to 11 cm. long, nearly glabrous5. *A. philoxeroides*.
- 1. Heads seemingly sessile or nearly so; peduncles at most 1 cm. long (2)
- 2(1). Staminiodia equaling the filaments, laciniate at the apex; stamen tube and style elongate; stems erect; leaf blades much longer than broad, the margins undulate or crispate, often variegated4. *A. Bettzickiana*.
- 2. Staminiodia shorter than the filaments, entire or denticulate; stamen tube and style very short; stems prostrate (3)
- 3(2). Tepals never with rigid spinose tips, 3-5 mm. long, sparsely pilose or glabrate; leaf blades twice as long as broad3. *A. polygonoides*.
- 3. Some of the tepals with rigid spinose tips (4)
- 4(3). Tepals 5-7 mm. long, sparsely villous; leaf blades usually as broad as long; staminodia dentate1. *A. pungens*.
- 4. Tepals 3-5 mm. long, densely villous; leaf blades longer than broad; staminodia usually entire2. *A. caracasana*.

1. *Alternanthera pungens* H.B.K. Herbaceous plants with prostrate stems 3-8 dm. long, villous with obscurely scaberulous white hairs; leaves opposite, with margined petioles 2-5 mm. long, orbicular to broadly oval, as broad as long, 1.3-5 cm. long, rounded at the apex, apiculate and mucronate, firm, prominently veined, appressed-pilose when young but soon glabrate; heads solitary, axillary, sessile, 8-10 mm. long; bracts and bractlets lance-oblong, equaling the perianth, attenuate to an aristate apex; tepals oblong or ovate-oblong, 5-7 mm. long, acuminate to a long-aristate rigid tip, 3-nerved; filaments linear, the staminodia slightly shorter, triangular, remotely dentate; style short; utricle strongly compressed, truncate; seed 1.5 mm. long, dark-brown. Sandy soils, rare along the coast, summer; Venez. to Bol. and Urug.; Cuba and Jam.; adv. to e. Tex. and e. Mex., s. Fla. and Ala.

2. *Alternanthera caracasana* H.B.K. VERDOLAGA DE PUERCO, MATT CHAFF-FLOWER. Perennial herb from an elongate tuberous root; stems branched at the base, 1-5 dm. long, forking, sometimes hirsute; leaves somewhat clustered, spatulate to suborbicular, 8-20 mm. long, narrowed into a short petiole, obtuse or abruptly pointed; flower clusters

axillary; tepals unequal, 3-5 mm. long, lanceolate, awn-tipped, the shorter one copiously pubescent with barbed hairs, all 1-nerved; staminodia nearly as long as the filaments, entire (at least above); utricle ovoid, included, with a sharp wing below the apex; seed ovate-orbicular, 1-1.5 mm. long, reddish-brown, lustrous. *A. peploides* (H. & B.) Urban, *A. repens* of Am. auth. In waste places and cult. grounds, from s.-cen. and n.-cen. Tex. and Rio Grande Plains through Edwards Plateau to the Trans-Pecos, Apr.-Nov.; S.C. to Fla., w. to Tex. and Calif.; S.A.

3. *Alternanthera polygonoides* (L.) R. Br. SMOOTH CHAFF-FLOWER. Perennial or annual herb with glabrous or sparingly pilose stems, striate, the branches procumbent or creeping, often rooting at the nodes, 1-8 dm. long; leaves opposite, with petioles 5-10 mm. long (densely white-villous at the base), spatulate to elliptic, glabrous on the upper surface, densely villous beneath, becoming glabrate, 6-25 mm. long, 3-11 mm. wide; flowers solitary or glomerate in dense sessile globose axillary heads 8-12 mm. in diameter; bracts and bractlets half as long as the tepals, ovate, acute, mucronate, glabrous; tepals bright-white, 3-nerved, elliptic to lanceolate, about 3-5 mm. long, somewhat longer than the bracts, pilose below or glabrate; stamens 5, the filaments subulate, the tube very short; staminodia much shorter than the filaments, ovate, toothed at the apex; style very short; utricle globular to obcordate, included, half as long as the tepals; seed orbicular, 1 mm. broad, dark-brown, lustrous. *Achyranthes polygonoides* (L.) Lam. Fields, old lake beds, waste grounds and roadsides in coastal and s. Tex., all year; N.C. to Fla., w. to La. and Tex., on ballast in N.J.; s. to Mex., C.A. (Pan.) and S.A. (Braz.); W.I., Bah. I., Gr. Ant., Guadeloupe and Grenada.

4. *Alternanthera Bettzickiana* (Regel) Standl. Perennial herb or flowering as an annual; stems striate, green or purplish-red, erect or ascending, 1-4 dm. tall, much-branched, villous when young, soon glabrate, the nodes swollen; leaves opposite, green or usually purplish-red, often variegated, rhombic or obovate, 4 cm. long or less, the apex acuminate, the margins crispate or undulate, the petioles as long as or shorter than the blades; flowers whitish, in sessile axillary heads, usually solitary, shorter than the peduncles; bracts and bractlets broadly ovate, acuminate, the lower ones laciniately lobed, glabrous; tepals oblong-lanceolate, acute or acuminate, twice as long as the bracts, 3-nerved, sparsely pilose; staminodia laciniate at the apex, as long as the filaments; filament tube and style elongate; utricle ovoid. Widely planted for ornament, locally escaped from cult.; probably nat. of Braz.; known also in W.I., s. Mex. and trop. Am.

5. *Alternanthera philoxeroides* (Mart.) Griseb. ALLIGATOR-WEED. Perennial aquatic to semiterrestrial herb; stems simple or branched, 3-10 dm. long, the branches glabrous, ascending, prostrate or decumbent, stoloniferous, forming mats, stout, the ascending portion 1-6 dm. long, often rooting at the nodes; leaves opposite, thick and fleshy, glabrous, linear to linear-lanceolate or obovate, 2-11 cm. long, 5-20 mm. broad, usually acute or mucronulate at the apex, entire, narrowed to the sessile base; spikes simple, axillary or terminal, subglobose or cylindric, on peduncles 2-7 cm. long, glabrous or pubescent in lines; flowers sessile in the bractlets, with a sweet resinous odor; bracts one fourth as long as the tepals, broadly ovate, glabrous; perianth silvery-white; tepals at least 4, glabrous, 5-6 mm. long, nearly equal, obscurely 4-veined, lanceolate to ovate-oblong, acute, firm, serrulate near the apex; filaments linear-subulate; staminodia narrow, usually entire, exceeding the anthers, half as long as the tepals, ligulate, lacerate at the apex; style elongate, the stigma entire. *Achyranthes philoxeroides* (Mart.) Standl. In waste places, in ponds, streams, along some rivers, becoming a noxious weed, in s.e. Tex., Mar.-Aug.; on Coastal Plain, N.C. to Fla., w. to La. and Tex., s. throughout C.A. to S.A., where it is nat. from Col. to Braz. and Arg.

This plant, primarily in conjunction with the highly productive water-hyacinth (*Eichhornia crassipes*) and several aquatic species of *Ludwigia*, is rapidly clogging the streams, canals, ponds and other such places in coastal Texas.

10. FROELICHIA MOENCH

SNAKE-COTTON. COTTON-WEED

Annual, biennial or perennial herbs with semiwoody taproots; stems erect or procumbent, woolly to silky or pubescent, simple or branched; leaves opposite, sessile or petiolate, the blades entire; flowers perfect, sessile, spicate on elongated peduncles, with scarious

bracts; perianth tubular, the tube lanate, 5-lobed, the lobes glabrate, longitudinally crested or tubercled in the fruit; stamens 5, the filaments united to form an elongate tube, bearing 5 oblong 1-locular anthers and as many sterile ligulate appendages; ovary ovoid, the style elongate, the stigma capitate; ovule 1, pendulous from the apex of an elongate funicle; utricle ovoid, membranaceous, indehiscent, included in the tube of the filaments; seed inverted, lenticular or obovoid, smooth; embryo annular, with farinaceous endosperm and a superior radicle.

About 20 species, mostly in warm regions in America.

1. Calyx tube (at maturity, i.e., surrounding mature fruit) with lateral rows of distinct spines; plants slender, much-branched (2)
1. Calyx tube (at maturity) with lateral deeply dentate to entire crests; plants stout, sparsely branched (3)
- 2(1). Stems densely white-lanate; faces of the calyx tube tuberculate 1. *F. gracilis*.
2. Stems pubescent with short mostly appressed brownish hairs; faces of the calyx tube each with one or more sharp spines 2. *F. Braunii*.
- 3(1). Calyx crests deeply dentate (4)
3. Calyx crests merely erose or crenulate, or entire (5)
- 4(3). Pubescence on the upper part of the stem of brownish hairs; one or both faces of the calyx tube with 1 or 2 tuberculate or spinose ridges; annual 3. *F. floridana*.
4. Pubescence on the stems white-lanate; one or both faces of the calyx tube with a basal spine; perennial 5. *F. arizonica*.
- 5(3). Annual; leaf blades narrowly oblong or lanceolate, their pubescence fulvous; sides of the calyx tube with 1 or 2 crests 4. *F. Drummondii*.
5. Perennial; leaf blades (at least the upper ones) ovate-orbicular or oval, their pubescence white or gray; sides of the calyx tube naked .. 6. *F. interrupta*.

1. *Froelichia gracilis* (Hook.) Moq. Annual herb with slender stems 1-2 mm. thick, simple or much-branched at the base, the branches 2-6 dm. tall, ascending or procumbent, densely or sparsely villous-tomentose, sometimes viscid above; leaves short-petioled, more numerous at base of plant and often clustered, linear-lanceolate to lanceolate-elliptic, 3-12 cm. long, 2-7 mm. broad, acute or acuminate at the apex, cuneate at the base, sericeous or tomentose; spikes slender or stoutish, 1-3 cm. long, 7-8 mm. thick; bracts and bractlets acuminate, stramineous, fuscous or blackish; calyx tube with 2 lateral rows of distinct spines at maturity, the side of the tube tuberculate near the base; calyx lobes oblong-linear, acute; seed lenticular, 1.5 mm. in diameter, yellowish-brown, lustrous. On gravel and in sandy soils throughout most of Tex. except extreme e. part, Mar.-Nov.; Ia. to Colo., s. to Ark., Ariz., Tex. and Mex.; adv. eastw. to N.Y., N.J., Md., Va., Ky. and O.

2. *Froelichia Braunii* Standl. Annual herb with slender stems, erect or ascending, simple or branched at the base, pubescent with short-appressed brownish hairs, somewhat viscid above, usually villous-tomentose near the base; leaves opposite, the petioles of the lower leaves often half as long as the blades, the upper leaves short-petioled; blades linear to linear-elliptic or narrowly lanceolate, 2-12 cm. long, 2-22 mm. broad, acute to long-acuminate at the apex, acuminate or attenuate at the base, canescent to sericeous-tomentose beneath with brownish or grayish hairs; spikes dense, stout, 5-20 mm. long; bracts and bractlets acute or acuminate, fuscous or stramineous; calyx tube with 2 lateral rows of distant spines at maturity, the side of the tube with one or more sharp spines; calyx lobes lance-oblong, acute; seed 1.5 mm. long, brown, lustrous. Dry soils, Tex.; adv. n. to St. Louis, Mo. and in Ill.

3. *Froelichia floridana* (Nutt.) Moq. Annual herb, tall and wandlike, the stems erect, rather stout, 4-18 dm. tall, to 7 mm. thick, usually simple at the base and sparsely branched above, the branches puberulent or tomentulose with short often viscid whitish or brownish hairs; leaves opposite, short-petiolate, oblanceolate to spatulate or oblong, 3-10 cm. long, 1-2 cm. wide, obtuse to acute at the apex, cuneate at the base, broadest

below the middle, canescent to subscabrous on the upper surface, sericeous-tomentose beneath; spikes dense, 1-10 cm. long, 1-1.3 cm. thick, whitish; bracts acuminate or cuspidate, fuscous to stramineous or blackish; one or both faces of calyx tube with 1 or 2 tuberculate or spinose ridges; calyx lobes oblong, obtuse, greenish-white or pinkish; seed 1.5 mm. long, brown. In sandy soils, throughout Tex., May-Nov.; s. Ga. and Fla. to Miss. and Tex., n. to Del., Md. and N.J.

Var. *campestris* (Small) Fern. Branches sericeous-tomentose with white or brownish hairs, slightly viscid above; leaves canescent or silky on the upper surface, sericeous-tomentose beneath with usually fulvous hairs; peduncles lanate with hairs commonly 2 mm. long and its leaves chiefly spatulate; one or both faces of the calyx tube with a basal spine. Dry fields and hillsides, plains, Minn., Ill., Ind., Wisc. to Neb., Okla., Colo. and Tex.

4. *Froelichia Drummondii* Moq. Annual herb with stout stems, erect or ascending, 3-12 dm. tall, simple or branched at the base, the branches mostly simple, sericeous-lanate, with brownish hairs, often viscid above; leaves opposite, the petioles of the lowest leaves half as long as the blades, the upper leaves short-petioled; blades oblong to oblong-lanceolate, 5-14 cm. long, 1-4 cm. broad, obtuse at the apex, acute or acuminate at the base, canescent on the upper surface, densely sericeous-tomentose beneath with brownish hairs; bracts broadly ovate, acuminate, fuscous or stramineous, the bractlets fuscous or stramineous; calyx tube narrowly winged at maturity, the wings erose, the sides of the tube with one or two low dentate ridges; calyx lobes lance-oblong, acutish; seed 1.5 mm. long, fuscous. Considered by many workers to be merely a race of *F. floridana*. In dry sandy soils, s. Okla. and Tex.

5. *Froelichia arizonica* Thornb. Perennial herb with a rather fleshy taproot; stems stout, usually several, erect, simple or branched, 4-12 dm. tall, with 2 pairs of leaves on the stem below the inflorescence, the base of the stems persistent, becoming woody and forming a small sparsely and strictly branched caudex, sericeous-tomentose with white hairs; leaves opposite, few on the stems, usually crowded at the base; basal leaves to 1 dm. long, 6-27 mm. broad, elliptic to obovate or oval, tapering into the short petiole, acuminate at the base; upper leaves often narrowly oblong, sericeous-tomentose with whitish or grayish hairs; spikes stout, dense, 4 cm. long; bracts broadly ovate, acute, usually fuscous, the bractlets fuscous to rarely stramineous; calyx tube narrowly winged, the wings dentate, one or both sides of the tube with short thick crests or merely tuberculate; calyx lobes narrowly oblong, obtuse or acutish; seed 1.5 mm. long, brown. Dry stony places, hillsides, in calcareous and volcanic areas along arroyos, in Trans-Pecos Tex., fall; from Tex. and s. Ariz., s. to Mex.

6. *Froelichia interrupta* (L.) Moq. TEXAS SNAKE-COTTON. Perennial herb from a woody root, branched at the base; stems rather slender, ascending or decumbent, 3-10 dm. long, simple or sometimes branched, thinly white-tomentose or silky, slightly viscid above; leaves opposite, the petioles of the lower leaves to as long as the blades, those of the upper leaves shorter to sessile; blades oval to ovate-orbicular, rarely oblong to elliptic, 2.5-10 cm. long, 8-38 mm. broad, obtuse to rarely acute at the apex, rounded or obtuse at the base, rarely acute, scaberrulous or canescent on the upper surface, sericeous or floccose-tomentose beneath with whitish or grayish hairs; spikes lax; bracts acute or acuminate, stramineous or fuscous; calyx tube naked, but the calyx deltoid in outline, nearly as broad as long, broadly winged laterally, the thin wings entire or crenulate; calyx lobes lance-oblong, obtuse; seed 1.5 mm. long, brown. Trans-Pecos Tex. to Mex.; W.I.; Col. to Parag. and Chile.

11. PHILOXERUS R. BR.

About 10 species, mostly in coastal regions of the tropics.

1. *Philoxerus vermicularis* (L.) R. Br. SILVERHEAD. Perennial or annual herb, somewhat succulent; stems prostrate, branched, 1-18 dm. long, the branches prostrate or ascending to sometimes 1-5 dm. tall; leaves opposite, thick and fleshy, subterete, linear to linear-oblong or oblong to clavate, 15-55 mm. long, 2-12 mm. broad, acutish or blunt at the apex, narrowed to the sessile base, villous in the axils of the leaves, otherwise glabrous; spikes or heads solitary, subglobose to cylindric, densely many-flowered, bright-white, 13 mm. long, 5-11 mm. thick, obtuse, the rachis lanate; flowers perfect, white; bracts broadly

ovate, chartaceous, 1-nerved, acute or obtuse; bractlets ovate-oblong, slightly shorter than the tepals, acute, glabrous; perianth compressed, thickened at the base, 5-parted, the segments obtuse; tepals 3.5-4 mm. long, obtuse, the outer ones oblong and glabrous, the inner lanceolate and usually lanate near the base; stamens 5, the filaments subulate and connate below, the oblong anthers 2-celled; utricle compressed, broadly ovoid, coriaceous, indehiscent; seed orbicular, 0.8-1 mm. broad, dark-brown, lustrous. Saline soils and dunes along coasts, wet sands, in Rio Grande Plains, summer-fall; Fla. to Tex., s. through Mex. to Pan.; Col. to Braz.; W.I.; Virg. I.; w. coast of trop. Afr.

12. TIDESTROMIA STANDL.

Annual or perennial erect or prostrate herbs, sometimes suffruticose at the base, branched; stems with branched or stellate hairs; leaves opposite, petiolate, the blades broad, the margins entire; flowers perfect, minute, glomerate in the axils of the leaves; bracts and bractlets hyaline and pubescent; perianth 5-parted, the outer 3 segments wider than the inner 2, 1-nerved, membranaceous, ovate-lanceolate, the leaves subtending the inflorescence or glomerules becoming indurate and more or less connate in age to form a sort of involucre; stamens 5, hypogynous; filaments connate at the base, forming a short cup, with or without intervening lobes or staminodia; anthers 2-celled, appearing 1-celled after dehiscence; ovary globose, the style short, the capitate stigma simple or 2-lobed; ovule 1, suspended from the apex of a slender funicle; utricle slightly compressed and glabrous, indehiscent; fruiting calyx not winged, crested or spiny.

About 7 species in southwestern United States and Mexico.

- 1. Annuals, usually prostrate; staminodia very short or absent (2)
- 1. Perennials, erect, ascending or prostrate (3)
- 2(1). Foliage gray-green with stellate hairs 1. *T. lanuginosa* var. *lanuginosa*.
- 2. Foliage yellowish-green, fleshy, nearly glabrous; stems very brittle 1. *T. lanuginosa* var. *carnosa*.
- 3(1). Staminodia absent; plants prostrate, the apex of the caudex with white tomentose gemmae 2. *T. gemmata*.
- 3. Staminodia present; plants erect or ascending (4)
- 4(3). Staminodia acute, nearly half as long as the filaments; leaves basically oblong, the veins prominent 3. *T. oblongifolia*.
- 4. Staminodia very short and broad, sometimes emarginate; leaves basically ovate, the veins not prominent 4. *T. suffruticosa*.

1. *Tidestromia lanuginosa* (Nutt.) Standl. var. *lanuginosa*. ESPANTA VAQUEROS. Annual herb, 10-15 cm. tall, to 1 m. across; foliage gray-green to ashy-white; stems repeatedly forked, the branches 1-6 dm. long, prostrate, decumbent or ascending, turning dull-reddish; leaves with the petioles equaling or shorter than the blades, broadly obovate to rhombic-ovate, 5-30 mm. long, round or obtuse at the apex, cuneate or rounded at the base, both surfaces dense with stellate hairs that disappear from the older stems; glomerules axillary, few-flowered, subtended by small leaves; perianth 1-3 mm. long, 3 times longer than the bracts; flowers and fruits inconspicuous; seed 5 mm. long. Dry ground, along roadsides, clay banks, limestone-sandy soils, gypsum and gravel washes from coastal Tex. through the Rio Grande Plains to the Plains Country and Trans-Pecos, Mar.-Oct.; S.D. and Kan. to Ut. and Nev., s. to Tex., Ariz. and n. Mex.; adv. in waste ground and along railways in Ill. and Mo.

Var. *carnosa* (Steyerm.) Cory. Annual herb; herbage very fleshy, yellowish-green, nearly glabrous; stems more brittle than in the typical variety, glabrescent up to the floriferous branchlets; cauline and involucre leaves small, 4-13 mm. long, 3-9 mm. broad, fleshy (except the uppermost involucre leaves), all the leaves glabrescent. Gypseous saline Upper Cretaceous clays of Brewster Co., s. into Mex.

2. *Tidestromia gemmata* I. M. Johnst. Perennial herb arising from a strong root whose deep apex is beset with conspicuous white tomentose gemmae, occasionally forming a compact lax caudex; stems densely covered with hairs, prostrate or decumbent, reddish, 1-1.5 dm. long, 1.5-2.3 mm. thick, the internodes 1-2.5 cm. long; young leaves white or

cinereous, the older ones yellowing; lower leaves conspicuously petiolate, the blade 12-15 mm. long and 1-1.6 mm. broad, prominently veined beneath, obtuse or rounded at the apex, truncate or obtuse at the base, contracted abruptly into a petiole 4-8 mm. long; upper leaves numerous, ovate, sessile, reduced gradually downward; glomerules 2- to 4-flowered; flowers milky, 2.5 mm. long; perianth lobes to 2 mm. long, lanceolate-ovate or ovate-oblong, more obtuse than the broad bracts (about twice as long), glabrous downward toward the base, tomentose especially toward the middle; staminal tube 0.6-0.7 mm. long; staminodia none; filaments 0.8-1.2 mm. long, the oblong anthers 0.8-1 mm. long. Gypsiferous shales, sandy soils, hills, breaks and clays in the Plains Country and Trans-Pecos, Mar.-Nov.; also n. Mex.

3. *Tidestromia oblongifolia* (Wats.) Standl. Perennial shrub, densely and closely pubescent throughout with short much-branched hairs; stems erect, 2-6 dm. long, ascending or decumbent, slender or stout, much-branched, sometimes suffruticose at the base; leaves opposite, short-petioled, ovate-orbicular to broadly ovate or oblong, 8-40 mm. long, 3-20 mm. wide, obtuse at the apex, rounded to acute at the base, prominently veined; glomerules few-flowered, the small subtending leaves (in age) usually indurate and united at the base to form an involucre; perianth 1 mm. long, 2 to 3 times as long as the bracts, the lobes oblong or oblong-ovate and obtuse or acutish, densely pubescent above; staminodia acute, about half as long as the filaments; seed 0.5 mm. long. Rocky hillsides and crevices in El Paso Co., Aug.-Oct.; w. Nev. and s.e. Calif. to Ariz. and w. Tex.

4. *Tidestromia suffruticosa* (Torr.) Standl. Perennial shrubby herb; stems erect, much-branched, suffruticose at the base or nearly throughout, densely and finely grayish-pubescent with branched hairs, 1-2.5 dm. tall, the stout branches ascending, often swollen at the nodes; leaves short-petiolate, orbicular-ovate to broadly oval, 4-20 mm. long, 3-12 mm. broad, obtuse or rounded at the apex, rounded or obtuse and asymmetric at the base, the lateral veins not prominent; glomerules few-flowered, the small subtending leaves united and indurate at the base in age; perianth 2 mm. long, the lobes narrowly oblong and obtuse or acutish, glabrous below, densely pubescent above; staminodia very short, rounded, emarginate; seed 0.5 mm. broad. In limestone and gypseous soils and gravels in the Trans-Pecos, June-Sept.; Tex. and s. N.M. to Mex.

13. GOMPHRENA L.

GLOBE-AMARANTH

Annual or perennial herbs; stems erect or prostrate, usually enlarged at the nodes and with various pubescent foliage; leaves opposite, the blades entire, sessile or short-petiolate; flowers perfect, in solitary and sessile heads or in short spikes; calyx deeply 5-parted, the tepals concave, mostly acute, usually woolly; stamens 5, included or exerted, the filaments united to the summit into a slender tube; ovary subglobose, the ovule 1; style 1, short or elongate, the stigmas 2 or 3 and commonly elongate; utricle membranous, indehiscent, more or less flattened; seed sublenticular, smooth, inverted; embryo annular, the endosperm farinaceous, the radicle superior.

About 100 species, mostly in warmer regions of Central America and South America.

1. Bractlets not cristate; plants cespitose, low, with each stem bearing 1 or 2 pairs of leaves; leaves grayish, densely appressed-pilose 1. *G. caespitosa*.
1. Bractlets cristate along the keel (2)
- 2(1). Stigmas short, stout, nearly sessile; perennial from a fleshy fusiform root 2. *G. Nealleyi*.
2. Stigmas filiform, on a long style; annuals and perennials (3)
- 3(2). Heads of flowers 8-15 mm. in diameter (4)
3. Heads of flowers 20-28 mm. in diameter (6)
- 4(3). Crests conspicuously widest at the apex of the bractlets, the flower appearing obtuse or acutish; bractlets equaling or shorter than the flowers; crests narrower than the bractlets 3. *G. dispersa*.
4. Crests widest below the apex of the bractlets (if perceptibly widest anywhere), the flower thus acuminate; bractlets much longer than the flowers; spikes usually solitary, sometimes 2 or 3 together, subtended by 2 to 4 leaves (5)

- 5(4). Crests denticulate, often sparsely so; heads about 10 mm. thick, usually tinged with red or pink; plants usually decumbent or spreading
4. *G. decumbens*.
5. Crests laciniate; heads mostly 15 mm. thick, yellowish-white, rarely reddish; plants usually erect5. *G. nitida*.
- 6(3). Annual; leaf blades mostly oblong to ovate6. *G. globosa*.
6. Perennial from a fusiform root; leaf blades oblanceolate to oblong-linear
7. *G. Haageana*.

1. *Gomphrena caespitosa* Torr. Perennial herb from a perpendicular woody root having a woody branched caudex, densely cespitose; flowering branches stout, 3-15 cm. long, decumbent or ascending, usually simple, densely pilose with white hairs, each stem with one or two pairs of leaves; leaves mostly basal, the petioles equaling or shorter than the blades; blades suborbicular to oval, to 25 mm. long and broad, densely appressed-pilose, rounded or obtuse at the apex, abruptly acute at the base, the stem leaves very short-petiolate and orbicular to broadly oval; peduncles naked, 5-60 mm. long; heads subglobose or short-cylindric, 12-18 mm. thick; bracts white, ovate-oblong, obtuse or acute; bractlets one half longer than the bracts, ovate-oblong, acute or obtuse, often denticulate at the apex, white, hyaline; perianth usually shorter than the bractlets, the lobes oblong or linear-oblong and obtuse, sometimes green along the nerve, otherwise white, the tube densely white-pilose; stamen tube slightly shorter than the perianth; seed reddish-brown, 1.5 mm. long, lustrous. Dry stony plains, hillsides and mt. slopes in the Trans-Pecos, Apr.-June; s.w. N.M., Ariz. and Tex. to Mex.

2. *Gomphrena Nealleyi* Coult. & Fish. Perennial herb from a thick fleshy taproot, villous; stems erect or ascending with tendency to become procumbent, 1-3 dm. long, sparingly forked; leaves opposite, oblong to oblong-spatulate, 2-4 cm. long, 6-15 mm. wide, mucronate, copiously pilose-sericeous on the lower surface, glabrate above, half-clasping at the base, green; peduncle slender, often about as long as the main stem; heads solitary, terminating the long peduncles, ovoid or cylindric-oblong, 1-3 cm. long, often rose-tinged, sessile, subtended by 2 leaflike bracts; bracts of the head ovate, acute or acuminate, yellow-white, 2.5-3 mm. long; bractlets 2 to 2.5 times as long as the bracts, long-acuminate, yellowish-white or pinkish, subcoriaceous, narrowly cristate just below the apex, the crest entire or denticulate; perianth about 5 mm. long, rigid at maturity, whitish, linear-lanceolate, densely woolly below, slightly surpassed by the bractlets, somewhat united at the base; stamen tube usually exerted; stigmas 2, short and sessile; seed globose-ovoid, 1.5 mm. long, reddish-brown, lustrous. In sandy or clayey soils in Rio Grande Plains and coastal Tex., n.e. to Aransas Co., Mar.-Oct.; s.w. Tex. and adj. Mex.

3. *Gomphrena dispersa* Standl. Annual or perennial herb; stems slender, widespreading and rooting at the nodes, ascending or prostrate, branched, appressed-pilose, the branches 2-10 dm. long; leaves opposite, with petioles 2-6 mm. long, oblong to obovate, 1.5-5 cm. long, 5-20 mm. wide, acute or obtuse at the apex, narrowed at the base, bright-green, pilose-sericeous, often glabrate on the upper surface; heads mostly solitary, terminal or axillary, white, subglobose to short-cylindric, 9-13 mm. in diameter, subtended by 2 or 3 acute sessile leaves shorter than the spikes; perianth woolly, about as long as the thin bractlets, densely lanate, the lobes oblong-linear and acuminate or attenuate, white; bracts rounded-ovate, acuminate, white, often denticulate; bractlets 5-6 mm. long, about 3 times as long as the bracts, thin, acute to obtuse, white or rarely purplish-red, narrowly cristate at the apex with the crest extending shortly along the keel, denticulate or laciniate; stamen tube short, commonly included; style long, the stigmas slender; seed 1.5 mm. long, reddish-brown, lustrous. Waste and cult. grounds, coastal Tex., summer-fall; Fla. and Tex. to Mex.; C.A.; Gr. Ant.

4. *Gomphrena decumbens* Jacq. Perennial herb, woolly or villous-woolly; stems branched at the base, the branches procumbent or ascending, 1-4 dm. long, dull-gray or brownish; leaves opposite; blades oblong to spatulate-oblong, 2-4 cm. long, acutish or obtuse and mucronulate, entire, narrowed into a petiolelike base which is partly clasping; peduncles mostly simple; heads subglobose to globose-cylindric, 1-2 cm. long, pearly white or rose, subtended by two leaflike bracts; bracts of the head ovate, acuminate, about half as long as the narrower keeled and crested obtuse bractlets; bractlets 5-6 mm.

long, long-acuminate, thin, yellowish, white or tinged with purplish-red, narrowly cristate below the apex with the crest denticulate to entire; tepals about as long as the bractlets, 1-nerved, the outer obtuse and glabrous, the interior villous and less obtuse, white; stamen tube usually exerted; style slender, the stigmas slender; seed 1.5 mm. long, reddish-brown, lustrous. In sandy soils, dry and waste grounds, coastal Tex., summer-fall; s. Tex. to Mex. and Guat.; trop. S.A.; W.I.

5. *Gomphrena nitida* Rothr. Annual herb; stems 2-7 dm. tall, erect, rarely decumbent, simple or much-branched, the branches slender, pilose-strigose; leaves opposite, short-petioled, usually few (the nodes distant), obovate to oblong or oval, 1.5-6 cm. long, 4-25 mm. broad, green, obtuse at the apex, acuminate at the base, appressed-pilose on both surfaces; spikes subglobose, 12-16 mm. in diameter, usually solitary, terminal, each subtended by 2 sessile acute leaves usually shorter than the spike; bracts ovate-triangular, acuminate, white; bractlets twice as long as the bracts, long-acuminate, yellowish-white or tinged with red, cristate from below the apex nearly to the base with the crest laciniate-dentate; perianth much shorter than the bractlets, very lanate, the lobes linear and long-attenuate, white; stamen tube usually included; style elongate, the stigmas slender; seed 1.5 mm. long, brown. Dry stony soils from Rio Grande Plains to the Trans-Pecos, fall-winter; s.w. N.M. and s.e. Ariz. to Tex., s. to Mex.

6. *Gomphrena globosa* L. COMMON GLOBE-AMARANTH. Annual herb; stems stout, usually much-branched, sometimes simple, to 1 m. tall, pubescent to appressed-pilose-strigose, swollen at the nodes, purplish; leaves opposite, with petioles 5-20 mm. long, oblong or elliptic, 3-10 cm. long, acute at the apex, narrowed or obtuse at the base, bright-green, appressed-pilose on both surfaces; heads terminal, peduncled, subglobose, white, yellow, red or purple, 2-2.5 cm. in diameter, subtended by 2 or 3 short leafy bracts; bractlets acute or acuminate, 7-12 mm. long, much-surpassing the very woolly perianth; perianth densely lanate, the lobes lance-subulate, 1-nerved, scarious, white or purplish, green along the nerve; stamen tube longer or shorter than the perianth, the free part of the filaments oblong; style elongate, slender, the stigmas linear, erect; seed ovoid or sublenticular, yellowish, lustrous. Waste grounds in n.-cen. and s.-cen. Tex., July-Sept.; nat. of s. Asia and widely cult.; commonly escaped in most trop. regions, occasionally northw.; Tex. and Mex., through C.A.; W.I.; S.A.

7. *Gomphrena Haageana* Kl. Perennial herb from elongated tuberous roots; stems 2-7 dm. tall, simple or much-branched, the branches erect, pilose or appressed-pilose; leaves opposite, subsessile or with petioles to 2 cm. long, loosely pilose, oblanceolate to oblong-linear, 2-10 cm. long, 3-10 mm. wide, acuminate at the apex, mucronate, attenuate at the base, green, appressed-pilose or loosely pilose, rarely glabrate; heads large, globose or short-cylindric, 2-2.8 cm. in diameter, on elongate peduncles, with subtending sessile leaves shorter than the head, these linear-lanceolate to ovate and long-acuminate; bractlets 2 to 3 times as long as the bracts, 1-1.5 cm. long, very broadly cristate along the keel with the crest serrulate; perianth up to equaling the bractlets, the lobes lance-linear and acuminate, the tube densely lanate; stamen tube slightly shorter than the perianth, rarely longer; filaments with the free part elongate; style elongate, the stigmas short, subdivaricate; seed 1.5 mm. broad, lenticular, brownish-red, lustrous. *G. tuberifera* Torr. In w. Edwards Plateau, summer-fall; also Mex.

FAM. 63. NYCTAGINACEAE JUSS.⁵⁴

FOUR-O'CLOCK FAMILY

Annual, biennial or perennial herbs, shrubs or trees, from a fleshy or woody taproot; stems erect or scandent, procumbent or decumbent, dichotomously or trichotomously branched, glabrous or pubescent, often swollen at the nodes, sometimes armed with spines; leaves mostly opposite, sometimes alternate or verticillate, exstipulate, sessile or petiolate; blades entire or sometimes dentate or lobed, raphidiferous; flowers perfect or unisexual (then plant usually dioecious), regular, sometimes dimorphous, usually arranged in paniculate or corymbose cymes, sometimes solitary, racemose, spicate, umbellulate or capitata, usually bracteate or variously involucrate; involucre of free or connate segments, often calyxlike and enclosing one to many flowers, persistent or deciduous, often

⁵⁴ Contributed by Clyde F. Reed; cf. his treatment in C. L. Lundell, *Flora of Texas II*: 151-220. 1969 for complete synonymy.

accrescent in age, green or brilliantly colored; perianth inferior, simple, herbaceous or corollalike, small or large, usually campanulate or funnellform, persistent or deciduous in fruit and usually accrescent, enclosing the pericarp, the tube short or often elongated, usually indurate at the base in age, the limb persistent or deciduous, truncate or 3- to 5-dentate or -lobed, the segments usually induplicate-valvate; stamens 1 to many, hypogynous; filaments usually united at the base, unequal, filiform; anthers included or exerted, dorsifixed near the base, didymous, opening by lateral slits; ovary included in the perianth tube, sessile or stipitate, 1-celled, membranaceous, usually attenuate at the apex; style short or elongate, sometimes absent, filiform; stigmas simple and capitate, peltate or fimbriate, rarely lateral or the style stigmatose along one side; anthocarp composed of the persistent coriaceous, fleshy or indurate base of the perianth tube enclosing the indehiscent utricle and adherent to it, costate, dentate or alate, often viscous; utricle membranaceous or coriaceous; seed erect, the testa hyaline, the endosperm scanty or abundant and usually farinaceous or fleshy; embryo straight, with broad conduplicate cotyledons (these enclosing the endosperm) or often curved and with broad or narrow cotyledons, the radicle inferior.

Nearly 300 species in about 30 genera, mostly in the American tropics and subtropics.

1. Embryo straight; flowers usually unisexual and cymose; stigma penicillate; trees or shrubs, sometimes armed with spines; leaves opposite; stamens exerted; anthocarp coriaceous, bearing numerous stipitate glands . . . 1. *Pisonia*, p. 576.
1. Embryo curved; flowers perfect; plants usually herbaceous or with vinelike stems (2)
- 2(1). Leaves alternate; perianth changed in fruit, the lower part enlarged and adherent to the fruit, the upper part persistent; flowers in clusters of 3, each adnate to a large colored bract; spiny scandent shrubs 2. *Bougainvillea*, p. 576.
2. Leaves opposite; perianth lobes induplicate-valvate (3)
- 3(2). Stigma linear; inner cotyledon abortive; anthocarp without mucilaginous glands; flowers capitate 13. *Abronia*, p. 597.
3. Stigmas spheric or hemispheric; both cotyledons well-developed; anthocarp often with mucilaginous glands (4)
- 4(3). Flowers involucrate (5)
4. Flowers without an involucre or each flower subtended by 1 to 3 bracts (7)
- 5(4). Involucre polyphyllous, the bracts numerous and surrounding a many-flowered head; anthocarp not winged, merely 10-ribbed; stamens and pistils exerted 3. *Nyctaginia*, p. 576.
5. Involucre gamophyllous; flowers 1 to several (6)
- 6(5). Anthocarp with prominent lateral wings that are often toothed, with 2 rows of glands along the dorsal surface 4. *Allionia*, p. 577.
6. Anthocarp without wings 5. *Mirabilis*, p. 578.
- 7(4). Anthocarp with conspicuous thin membranous wings (8)
7. Anthocarp not conspicuously winged, the wings when present thick and coriaceous (9)
- 8(7). Perianth 4-5 mm. in length; leaves broadly ovate . . . 6. *Ammocodon*, p. 587.
8. Perianth 8 mm. or more in length; leaves linear to lanceolate or ovate 7. *Selinocarpus*, p. 588.
- 9(7). Flowers large, all (except in *A. Wrightii*) 2 cm. long or longer; perianth with a long slender tube and a broad limb, each flower subtended by 2 or 3 small narrow bracts 8. *Acleisanthes*, p. 589.
9. Flowers usually less than 2 cm. long (10)
- 10(9). Anthocarp 5-angled, 5-ribbed or sometimes with low thick wings; perianth campanulate 12. *Boerhaavia*, p. 594.
10. Anthocarp 10-angled or 10-ribbed (11)
- 11(10). Anthocarp asymmetrical; flowers in racemes 9. *Cyphomeris*, p. 591.
11. Anthocarp symmetrical; flowers not in racemes (12)

- 12(11). Anthocarp with conspicuous mucilaginous glands; plants with thin leaves and climbing or reclining stems; flowers in umbels 10. *Commicarpus*, p. 592.
 12. Anthocarp without conspicuous glands; plants erect with usually very thick leaves; flowers irregularly clustered, not in umbels 11. *Anulocaulis*, p. 592.

1. PISONIA L.

About 50 species in the tropics and subtropics.

1. *Pisonia aculeata* L. DEVIL'S-CLAW, COCKSPUR, GARABATO PRIETO. Perennial dioecious shrub, often with a thick trunk, 1-2 m. tall, densely branched; branches stout, elongate, drooping or subscaudent, usually armed with curved sharp spines 6-20 mm. long, the older bark reddish-brown, the branchlets densely puberulent or short-villous or rarely glabrate; leaves mostly opposite, with slender or stout petioles 1-4 cm. long; blades variable, elliptic-oval to ovate-oblong or subrhombic to suborbicular, 2.5-15 cm. long, 1.5-6 cm. wide, abruptly pointed and short-acuminate at the apex, cuneate at the base, thick and leathery, glabrous or pubescent on both surfaces; inflorescence loosely or densely cymose, many-flowered, at anthesis 2-6 cm. broad, the stout peduncles 1-5 cm. long, the pistillate cymes in fruit to 1 dm. broad, pubescence usually viscid, the pedicels in fruit 16 mm. long or less, perianth of 5 united tepals; *staminate perianth* broadly campanulate, 2-4 mm. long, densely puberulent or tomentulose, yellowish-green, the lobes broad; stamens 6, twice as long as the perianth; *pistillate perianth* tubular, 2-3 mm. long, puberulent; anthocarp clavate, 9-12 mm. long, 3-4 mm. in diameter, rounded at the apex, narrowed at the base, thinly coriaceous, 5-angled, each angle with a row of uniseriate or obscurely biseriate glands, the faces glabrate or puberulent; seed cylindric, 7-10 mm. long, 1.5 mm. in diameter, brown. In thickets in Cameron Co. in s. Tex.; from Fla. to Tex. and Mex. s. to Pan.; W.I.; trop. S.A.; on Oceanic Is. and Cont. Is.; trop. Asia.

2. BOUGAINVILLEA COMMERS.

About 18 species, all natives of South America.

1. *Bougainvillea glabra* Choisy. BOUGAINVILLEA. Perennial woody vine, much-branched; stems high-climbing, yellowish- or reddish-brown, puberulent when young but soon glabrate, armed with straight or curved spines 6-12 mm. long; leaves alternate; petioles slender, less than one third the length of the blades; blades broadly ovate to elliptic-ovate or ovate-lanceolate, 4-10 cm. long, 2-5.5 cm. broad, rounded to acute at the base, acute to long-acuminate at the apex, puberulent when young, soon glabrate; inflorescence 3-flowered, on a peduncle 1-2.5 cm. long; bracts purplish-red to red or orange-red, rarely to whitish or yellowish, broadly ovate or oval, subcordate at the base, obtuse to abruptly acute or acuminate at the apex, sparsely pubescent or glabrous; perianth 15-25 mm. long, the tube green, densely puberulent or glabrous, the lower part with prominent obtuse angles; stamens 8; anthocarp turbinate, coriaceous, 7-13 mm. long, 4-5 mm. in diameter, the 5 angles acute; seed with a thin testa adherent to the pericarp. Cult. and planted about homesteads and along roadsides in s. Tex.; widely cult. in trop. and subtrop. N.A. and naturalized in Berm., Cuba, Salvador, Guat. and other trop. areas.

3. NYCTAGINIA CHOISY

A monotypic genus.

1. *Nyctaginia capitata* Choisy. SCARLET MUSK-FLOWER. Perennial herb from a semi-woody taproot to 45 mm. in diameter and 10 cm. long, much-branched from the base; stems erect or decumbent, viscid-puberulent or glabrate in age; branches stout, 1-4 dm. long; leaves opposite; petioles 1-8 cm. long, those of the lower leaves longer than the blades; blades broadly oval to ovate-deltoid or narrowly triangular, 4-9 cm. long, 6-55 mm. broad, subcordate to cuneate at the base and decurrent, usually unequal, rounded to long-attenuate at the apex, thick and slightly fleshy, glaucous beneath, entire or sinuate,

often crispate, copiously viscid-villous when young, often glabrate in age; flowers perfect, in clusters of 8 to 15 per involucre, the clusters 5 cm. or more in diameter, the peduncles 2-14 cm. long; bracts numerous, 6-15 mm. long, the outer ones ovate or oblong and very acute, the inner linear and long-attenuate, densely viscid-villous outside, the limb 10-14 mm. broad; perianth pink to deep-red, funnellform, the tube slender and elongate, constricted above the ovary, abruptly expanded into a 5-lobed induplicate-plicate limb, the lobes entire or emarginate, deciduous; stamens 5 to 8; filaments pubescent; capillary, unequal, dilated and connate at the base, adnate to the perianth tube; anthers didymous, exserted; ovary oblong, the filiform style exserted, the capitate stigma papillose; anthocarp 5-6 mm. long, 4 mm. in diameter, leathery, turbinate, constricted above the base, umbonate at the apex, olive, glabrous, many-ribbed; seed turbinate, 3 mm. long and nearly as broad, abruptly constricted at the base, pale-brown. In sandy or loamy soils, roadsides and fields from coastal Tex. to the Trans-Pecos and Plains Country, spring-fall; from Tex. and s.e. N.M. to Mex.

4. ALLIONIA L.

Annual or perennial herbs; stems prostrate, dichotomously branched, pubescent; leaves opposite, the pair unequal in size, petiolate, entire or subulate; flowers perfect, in axillary paniculate clusters of 3, each cluster subtended by a bract that encloses the fruit; perianth short-funnelform, 4- or 5-lobed, with an oblique tube; stamens 4 to 7; stigmas capitate, the style capillary; anthocarp coriaceous, compressed, the margin entire or dentate, the dorsal face with 2 rows of stipulate glands; seed with the testa adherent to the pericarp; embryo uncinata, the cotyledons broad, enclosing the farinaceous endosperm; radicle slender, elongate and descending.

A small American genus.

- 1. Perennial; outer margins of anthocarps with about 3 broadly triangular nonglandular teeth of each side, usually incurved and covering nearly the entire surface 1. *A. incarnata*.
- 1. Annual; outer margin of anthocarps with several relatively slender gland-tipped teeth on each side, these spreading or moderately incurved 2. *A. Choisyi*.

1. *Allionia incarnata* L. UMBRELLA-WORT, TRAILING ALLIONIA, HERBA DE LA HORMIGA. Perennial herb, from a woody root; stems 2-10 dm. long, slender or stout, sprawling or decumbent, rarely erect, densely villous-viscid or glandular-puberulent, rarely glabrate, often tinged with red, the internodes short or usually elongated; leaves 1-4 cm. long, petioled, oval to ovate or oblong, subcordate or rounded at the oblique base, the apex rounded to acute, entire or sinuate, paler below, villous-viscid or glandular-puberulent (at least when young); involucre on long or short peduncles, the lobes 4-6 mm. long and obovate-orbicular; perianth 5 mm. long or more, purplish-red or pink to rose-magenta or rarely white; anthocarp 3-4.5 mm. long, the inner side 3-nerved, the incurved margins with 3 or rarely 5 broad teeth on each side, rarely entire, glandular within. Dry hills, flats, valleys, dry sandy or gravelly soils, on limestone areas, from coastal Tex. to the Trans-Pecos and Plains Country, Apr.-Sept.; from s.e. Calif. and Nev. to s. Ut. and Colo., s. to Tex., Baja Calif. and cen. Mex. (Pue.); Hisp.; Venez. to Arg. and Chile.

2. *Allionia Choisyi* Standl. SMOOTH UMBRELLA-WORT. Plants annual northward, perennial southward, glabrous or with some viscid indument; stems reddish, 2-8 dm. long, slender, puberulent or villous above, little-viscid, often glabrate below; leaves opposite, unequal, with petioles 3-18 mm. long; blades 1-4 cm. long, ovate-oval or oval to oblong, subcordate to broadly cuneate at the base, rounded or obtuse to nearly acute at the apex, whiter below, puberulent or glandular-puberulent at first, usually soon glabrate; involucre saccate, 5-7 mm. long, puberulent and usually short-villous, often viscid; perianth pink to rose-red, 4 mm. long or less; anthocarp pale-brown or olive, 3-4 mm. long, 3-costate on the inner surface, shallowly rugose, the margin spreading or somewhat incurved, each with 5 to 8 long slender gland-tipped teeth, with about 6 glands in each row. Dry sandy ground in w. Tex., spring-summer; from s.e. Ariz. and N.M. southw. into Mex.; W.I.

5. MIRABILIS L. FOUR-O'CLOCK

Perennial herbs, usually from large tuberous roots; foliage glabrous or pubescent to glandular or hispid; stems erect or sprawling, simple or branched from the base, the branches forking; leaves opposite, fleshy, sessile or petioled, various in shape from linear to lanceolate, obovate, rotund, cordate or elongate, glabrous to pubescent, green or glaucous; involucre axillary or terminal, or both, 1- to 10-flowered, 5-lobed, sometimes enlarged and papery in fruit; perianth colored, the tube elongated and constricted above the ovary, the limb expanding, campanulate to salverform or funnelform, deciduous; stamens 3 to 6, unequal in length; filaments filiform, incurved, united into a fleshy cup at the base; anthocarp conspicuously 5-angled or 5-ribbed, glabrous or pubescent; seed filling the pericarp to which the testa adheres; endosperm mealy.

About 60 species, entirely American.

1. Anthocarp smooth or somewhat 5-angled but not ribbed; involucre not papery or membranaceous and slightly or not enlarged in fruit (2)
1. Anthocarp with 5 prominent ribs; involucre enlarged and papery or membranaceous in fruit (*Oxybaphus*) (6)
- 2(1). Involucre rotate, slightly enlarged in fruit, 3-flowered; stamens 3 (*Allioniella*) 1. *M. oxybaphoides*.
2. Involucre campanulate, not enlarged in fruit (3)
- 3(2). Involucre containing several flowers longer than 25 mm., with a broad limb; fruit dark-brown or black, not angled; stamens 5 (*Quamoclidion*) 2. *M. multiflora*.
3. Involucre 1-flowered; perianth funnelform, with a long slender tube abruptly dilated into the limb; stamens 5 (*Eu-Mirabilis*) (4)
- 4(3). Perianth 7-17 cm. long, white tinged with pink or purple, the tube long-tubular; anthocarp oblong to ellipsoid, 8 mm. long, obtusely 5-angled, tuberculate, densely puberulent between the tubercles 5. *M. longiflora*.
4. Perianth 3-6 cm. long (5)
- 5(4). Perianth 3-5 cm. long, lavender-rose; lobes of involucre lanceolate, 2-3 mm. wide in flower, to 5.5 mm. in fruit; anthocarp 8-9 mm. long, pubescent with rather sparse and weak hairs 3. *M. Lindheimeri*.
5. Perianth 4-6 cm. long, rose-white to yellow; lobes of involucre broadly lanceolate or ovate, 3-4.5 mm. wide in flower, to 7 mm. in fruit; anthocarp 10 mm. or more long, glabrous, often with irregular or roughened surface . 4. *M. Jalapa*.
- 6(1). Anthocarp glabrous (7)
6. Anthocarp more or less pubescent, sometimes with only sparse pubescence of short hairs (11)
- 7(6). Angles of anthocarp covered with coarse distinct tubercles (8)
7. Angles of anthocarp continuous, smooth (9)
- 8(7). Stems glabrous up to the inflorescence; leaf blades of the lower leaves broadly cordate-deltoid 6. *M. glabrifolia*.
8. Stems densely viscid-pilose below; leaf blades ovate . . . 7. *M. rotata*.
- 9(7). Leaf blades linear, 2-7 mm. wide; stems glabrous . . 8. *M. glabra*.
9. Leaf blades lanceolate or broader, 10-40 mm. wide (10)
- 10(9). Stems glabrous 9. *M. exaltata*.
10. Stems densely short-pilose 10. *M. Carletonii*.
- 11(6). Leaves sessile or nearly so, sometimes attenuate to a short stout petiole; blade not sharply differentiated from the petiole (12)
11. Leaves all conspicuously petioled except the uppermost; blades obtuse to cordate at the base and sharply differentiated from the petioles (24)
- 12(11). Leaf blades linear or lance-linear (13)
12. Leaf blades lanceolate or broader (16)

- 13(12). Perianth deep-bright-red, the tube about 4 times as long as the involucre, much longer than broad11. *M. coccinea*.
13. Perianth pink or purplish-red, the tube about twice as long as the involucre, usually broader than long, campanulate (14)
- 14(13). Plant low; stems much-branched and diffuse; inflorescence cymose14. *M. diffusa*.
14. Plants tall, erect, stout; stems simple or sparsely branched; inflorescence paniculate (15)
- 15(14). Stems densely hirsute or long-villous (at least at the base), glaucous12. *M. gausapoides*.
15. Stems glabrous below or nearly so, the upper internodes glabrous or short-pubescent13. *M. linearis*.
- 16(12). Inflorescence axillary; lobes of the involucre broadly ovate or ovate-orbicular, usually shorter than the tube, acute or acutish at the apex (at least in fruit), pilose with white hairs (17)
16. Inflorescence not axillary (19)
- 17(16). Stems hirsute in lines below; leaf blades acute or acutish at the base, linear-lanceolate to broadly lanceolate15. *M. aggregata*.
17. Stems glabrous below (18)
- 18(17). Stems slender, sparingly branched; leaves glabrous; blades linear-lanceolate to oblong-lanceolate, narrowly cuneate at the base, essentially sessile, ciliate; fruit 5-6 mm. long16. *M. decumbens*.
18. Stems stout, much-branched; leaves conspicuously ciliate; blades rounded or subcordate at the base, much longer than the petioles, these long-pilose with white hairs; fruit 3.5-4 mm. long17. *M. ciliata*.
- 19(16). Stems densely hirsute (at least near the base), the middle nodes sometimes glabrate but the nodes always hirsute; leaves sessile or with petioles to 5 mm. long (20)
19. Stems puberulent or glabrate, or sometimes pilose or hirsute above but not near the base (21)
- 20(19). Leaf blades lanceolate to broadly ovate or ovate-oblong, to 10 cm. long; involucre 3-flowered; lower internodes hirsute with brownish hairs 1.5-2.5 mm. long18. *M. hirsuta*.
20. Leaf blades lanceolate to narrowly oblong-lanceolate, to 7 cm. long; involucre 2-flowered19. *M. eutricha*.
- 21(19). Stems densely puberulent throughout; leaf blades ovate to ovate-deltoid20. *M. gigantea*.
21. Stems glabrate below or puberulent only in lines (22)
- 22(21). Stems glabrescent; leaf blades oblong-ovate; anthocarp 4-angulate, rugose21. *M. pauciflora*.
22. Stems glabrate below; leaf blades mostly lanceolate; angles of fruit strongly tuberculate or composed of distinct tubercles (23)
- 23(22). Branches of the inflorescence alternate, forming a cyme; perianth rose; leaf blades thin, tapering at both ends, more or less pubescent22. *M. pseudaggregata*.
23. Branches of the inflorescence opposite or alternate, forming a panicle; perianth white to pink; leaf blades thin to thick, acute to acuminate or blunt-pointed23. *M. albida*.
- 24(11). Anthocarp with 4 conspicuous thick winglike tuberculose ridges forming angles; stems slender, erect, with 1 to 6 nodes produced below ground24. *M. collina*.
24. Anthocarp prominently 5-angulate, the angles smooth or tuberculate; stems usually stout, erect or decumbent and sparsely branched; involucre much-acrescent in fruit, the lobes equal or nearly so (25)

- 25(24). Involucres at anthesis usually glabrous except at the base (there short-pilose or puberulent), the lobes glabrous or nearly so (26)
25. Involucres at anthesis densely viscid-pilose outside, in fruit usually less than 15 mm. broad (27)
- 26(25). Lobes of involucres 15-20 mm. broad in fruit; larger leaf blades 5-12 cm. long, 2.5-10 cm. wide; stems 3-10 dm. tall, 2-6 mm. thick near the base, normally erect with 8 or 9 internodes (the internodes 6-20 cm. long), branches few 25. *M. nyctaginea*.
26. Lobes of involucres to 10 mm. long in fruit; larger leaf blades 2-5 cm. long, 1-3 cm. wide, obtuse; stems 8-12 dm. tall, erect at first, becoming freely branched and half-decumbent, with 8 to 14 internodes; internodes 2-9 cm. long on erect plants, to 23 cm. long on half-decumbent plants ... 26. *M. dumetorum*.
- 27(25). Stems densely puberulent, pilose or pilose below over the whole surface with stiff hairs; leaf blades usually twice as long as broad, ovate or ovate-oblong and obtuse at the base; plant tall, erect, simple or sparsely branched below 27. *M. coahuilensis*.
27. Stems glabrous below and puberulent in lines, very rarely pilose with weak soft viscid hairs (28)
- 28(27). Blades of the upper leaves about as broad as long, rounded or very obtuse at the apex; involucres 10-14 mm. long in fruit 28. *M. Grayana*.
28. Blades of upper leaves usually twice as long as broad or longer, lance-oblong to linear, commonly long-acuminate to attenuate at the apex; involucres rarely over 8 mm. long in fruit 29. *M. oblongifolia*.

1. *Mirabilis oxybaphoides* (Gray) Gray. SPREADING FOUR-O'CLOCK. Perennial herb from a thick fleshy root; stems usually 3-6 dm. tall, ascending or decumbent, much-branched, usually forming clumps, viscid-pubescent to glabrate, the branches swollen at the nodes; leaves opposite, with slender or stout petioles 1-4 cm. long; blades 1.5-7 cm. long, 1.5-6 cm. wide, deltoid or ovate, often broadly so, usually cordate at the base or sometimes truncate, acute at the apex, entire or undulate, viscid-pubescent to glabrate; inflorescence cymose or axillary; involucres 5-6 mm. long in anthesis, subrotate, deeply 5-cleft; perianth 7-9 mm. long, white to pink or purple, sparsely hairy or glabrate; anthocarp 2.5-3 mm. long, smooth or obscurely ridged transversely or black-spotted. Dry hillsides and valleys in the Trans-Pecos; from s. Colo. w. to Ut. and Nev., s. to Tex., Ariz. and Mex.

2. *Mirabilis multiflora* (Torr.) Gray. COLORADO FOUR-O'CLOCK. Perennial herb from a long pithy root 3-6 dm. long; stems erect to spreading or decumbent, 3-6 dm. long, forming clumps to 1 m. in diameter, usually stout, densely leafy, glaucous, pubescent, often viscid to glabrate, the branches ascending; leaves opposite, with slender or stout petioles about half as long as the blades or shorter; blades 3-7.5 cm. long, 15-75 mm. broad, broadly ovate to reniform-orbicular or ovate-oblong, cordate or rounded at the base, acute to rounded and apiculate at the apex, thick and succulent, glabrous to pubescent, often glandular; peduncles slender or stout, 0.5-6 cm. long, solitary in axils and cymose at the ends of branches, the leaves of the inflorescence reduced; involucres 15-35 mm. long, campanulate, usually 6- to 8-flowered, glabrous to glandular-puberulent or short-villous and viscid, green or tinged red; involucre lobes 5, equaling or shorter than the tube, ovate-orbicular to triangular, rounded and apiculate to very acute; perianth 2-6 cm. long, trumpet-shaped, rose-colored to violet or purplish-red, shallowly 5-lobed, glabrous or glandular-puberulent outside, the tube 4-7 mm. thick, expanding into a shallowly 5-lobed limb 2-3 cm. broad; stamens 5, equaling the perianth or slightly exserted; anthocarp 6-10 mm. long, oval, obtuse at each end, smooth or slightly furrowed at the base, dark-brown to nearly black, glabrous. *Quamoclidion multiflorum* Torr. Dry slopes and plains, gypseous soils, on granite, rocky and sandy soils, limestone areas in w. Tex., spring to fall; from Colo. and s. Ut., s. to Tex., Ariz., N.M. and Mex.

3. *Mirabilis Lindheimeri* (Standl.) Shinners. Perennial herb or shrub, with a long turniplike woody tuberous root; stems rather slender, glabrous, usually several, becoming bushy-branched, 5-20 dm. tall; leaves opposite, with slender glabrous petioles half as

long as the blades or longer; blades broadly deltoid-ovate to ovate, thin, short-acuminate or acute, truncate to rounded or narrowed at the base, slightly decurrent upon the petioles; involucre in clusters of about 3 or sometimes solitary, mostly pediceled; perianth lavender-rose, 3-5 cm. long, remaining open overnight and into the next morning, the limb 25 mm. wide, with prominent rounded lobes, the tube almost or quite glabrous; involucre lobes lanceolate to lanceolate-ovate, 2-3 wide at anthesis, to 5.5 mm. in fruit, minutely puberulent, not usually ciliate; stamens about as long as the perianth; anthocarp 8-9 mm. long, ovoid, with 5 inconspicuous broad ribs, not angled, smooth, not tuberculate, pubescent with rather sparse weak hairs. *M. Jalapa* subsp. *Lindheimeri* Standl. Mostly on Edwards Plateau, extending n.e. on the Austin Chalk to Dallas; endemic.

4. *Mirabilis Jalapa* L. COMMON FOUR-O'CLOCK. Perennial herb, with large tuberous woody or fleshy roots; foliage deep-green, glabrous to slightly pubescent or rarely short-villous, often viscid but not glandular; stems erect, 4-10 dm. tall, much-branched, the branches erect or ascending, slender or stout; leaves opposite, with slender petioles about one half as long as the blades (0.3-5 cm. long), the uppermost blades nearly sessile; blades ovate to ovate-deltoid, 4-14 cm. long, 2-8.5 cm. broad, acuminate, sparingly ciliate, entire, truncate or cordate at the base, bright-green, glabrous or rarely pubescent; peduncles 1-2 mm. long, cymosely glomerate at the ends of the branches; inflorescence with numerous reduced leaves; involucre campanulate, 7-15 mm. long, pubescent to glabrous or short-villous, 1-flowered; involucre lobes linear-lanceolate to ovate-lanceolate and twice as long as the tube, acute, usually ciliate, bristle-tipped; perianth trumpet-shaped, 4-6 cm. long, deep-red to purple or white (to many other colors in cult. forms and variegated), more or less blotched, the edge notched, glabrous or sparsely villous outside, the tube 2.5 mm. thick, gradually dilated upward, the limb 2-3.5 cm. broad and shallowly 5-lobed, the lobes broadly rounded; stamens 5, equaling the perianth or slightly exserted; anthocarp ovoid to obovoid or oval, dark-brown to black, 8-10 mm. long, 5-angled, wrinkled-tuberculate, verrucose or rugose, glabrous or puberulent. On plains and prairies, often spread from cult. in w. Tex., spring and summer, until frost; from Tex. through Mex. to C.A. and S.A.; widely cult. as an ornamental and escaping.

5. *Mirabilis longiflora* L. SWEET FOUR-O'CLOCK. Perennial herb; stems erect, 5-15 dm. tall, much-branched, the branches erect or ascending, densely viscid-puberulent or short-villous, the internodes usually longer than the leaves; leaves opposite, with slender petioles less than 1 cm. long in the lowest leaves, the upper leaves sessile or subsessile; blades cordate-ovate to narrowly deltoid-ovate or lance-ovate, 6-11.5 cm. long, 3-7 cm. wide, cordate at the base, acute to long-attenuate at the apex, thin, bright-green, densely viscid-puberulent or rarely glabrate; inflorescence of numerous dense axillary or terminal leafy glomerules, these sometimes subtended by long linear bractlike leaves; involucre on peduncles to 3 mm. long, campanulate, 1-1.5 cm. long, densely glandular-villous with short hairs; involucre lobes slightly unequal, equal to or longer than the tube, triangular to narrowly triangular-lanceolate, very acute to long-attenuate; flowers nocturnal; perianth white to pink or magenta to purplish-red, 7-17 cm. long, densely viscid-villous outside, the very slender tube about 2 mm. in diameter, abruptly expanded into a shallowly 5-lobed limb 2-3 cm. broad; stamens 5, exserted 2-5 cm. or less; anthocarp oblong to ellipsoid, 8 mm. long, 5 mm. broad, constricted at both ends, obtusely 5-angled, tuberculate, densely puberulent between the tubercles. *M. Wrightiana* Gray. In Trans-Pecos Tex. and s. Ariz. to Mex.

6. *Mirabilis glabrifolia* (Ort.) I. M. Johnst. FLAT-TOP FOUR-O'CLOCK. Perennial herb; stems few or solitary, erect or ascending, slender, commonly supported by bushes, 3-10 dm. tall, sparsely branched below, glaucous, glabrous or puberulent, the elongate internodes puberulent or short-villous; leaves usually below the middle of the plant and frequently crowded at the base, with slender petioles 0.5-6 cm. long and glabrous; blades ovate to oblong, truncate, rounded or cordate at the base, 2-8 cm. long, 1-3.5 cm. broad, obtuse or acute at the apex, entire or subsinate, thick and succulent, green on the upper surface, often glaucous beneath, glabrous or obscurely puberulent; inflorescence cymose-paniculate, much-branched, the branches slender, viscid-pilose with short fulvous hairs; bracts few and very small; involucre usually numerous, slender-pedunculate, viscid-pilose, about 4 mm. long at anthesis, 6-10 mm. long in fruit, the short lobes rounded-oval; flowers usually solitary in the involucre, rarely 2 or 3; perianth sparsely pilose, 6-10 mm.

long, the limb 10-12 mm. broad; stamens 3, exserted; anthocarp broadly obovoid, 3.5 mm. long, dark-grayish, glabrous, densely covered with short rounded tubercles; seed oval-obovoid, 2.5 mm. long, pale-brown. *M. corymbosa* Cav. From s.w. Tex. to s. Mex.

7. *Mirabilis rotata* (Standl.) I. M. Johnst. Perennial herb from a taproot; stems few, subsimple, sparingly branched, the branching mostly dichotomous, puberulent throughout but not viscid, almost glabrous below; leaves opposite, with very short petioles or the uppermost leaves sessile; blades ovate, obtuse, cordate at the base, glabrous or the uppermost ones more or less puberulent; inflorescence corymbose to subcymose, the branches slender and covered with reduced bractlike leaves; involucre on slender pedicels 7 mm. long or less, when mature circular in outline or scarcely lobed, sparingly soft-puberulent, about 25 mm. in diameter, ciliolate; perianth purple; anthocarp 4 mm. long, much-narrowed below, obtuse above, 5-ribbed, prominently transversely ridged or tuberculate, glabrous or minutely puberulent. Dry arroyos, gypsum plains, dry open hillsides in Trans-Pecos Tex.; also Mex.

8. *Mirabilis glabra* (Wats.) Standl. SMOOTH FOUR-O'CLOCK. Perennial herb; stems few or solitary, erect, 8-15 dm. tall, usually simple up to the inflorescence or with a few sterile branches below, stout, glaucous, glabrous; leaves distant or crowded below, sessile; blades linear, 5-12 cm. long, 2-7 mm. broad, long-attenuate at the base, gradually narrowed to the obtuse or acute apex, entire, thick and succulent, glaucous beneath, glabrous; inflorescence a loose terminal panicle 1-4 dm. long, much-branched, the branches very slender, opposite, glabrous or sparsely short-pilose with viscid hairs; involucre slender-pedunculate, 3.5 mm. long at anthesis, to 12-15 mm. broad in age, viscid-pilose or glabrous and ciliate, shallowly lobed, the lobes ovate-orbicular and rounded at the apex; flowers usually solitary, sometimes 2 in the involucre, mostly cleistogamous; perianth about 7 mm. long, white or pale-pink, glabrous; stamens 5, short-exserted; anthocarp obovoid, about 5 mm. long, olivaceous, glabrous, the angles acute, narrow, smooth, the sides obtusely short tuberculate or rugose; seed broadly obovoid, 3 mm. long, pale-brown. In dry soils in Trans-Pecos Tex.; from Kan. to Ut., s. to Tex. and Mex.

9. *Mirabilis exaltata* (Standl.) Standl. Perennial herb, from a stout woody root; stems erect, few or solitary, to 1.5 m. tall, nearly simple or sparsely branched below the inflorescence, glabrous throughout, glaucous below, stout, the branches slender, the internodes elongate; leaves opposite; blades narrowly lanceolate, to 7 cm. long and 18 mm. broad, acutish, attenuate at the base to a very short thick petiole or sessile, more or less wavy-margined, glabrous; inflorescence very openly paniculate, the branches slender and opposite; involucre on pedicels about 1 cm. long, mostly glabrous or with a very few minute hairs, 15 mm. in diameter, 3-4 mm. long at anthesis, 10-12 mm. long in fruit, their lobes broadly ovate and rounded, glabrous or with a few minute hairs when young; flowers usually 3 in each involucre; anthocarp obovoid, 4.5 mm. long, obtuse or acutish above, narrowed below, brownish, glabrous, prominently 5-angled, the angles acute, narrow, smooth, the sides transverse-rugulose; seed obovoid, pale-yellow-brown. Restricted endemic centering on the Permian Red Beds area, extending from the Red River to Ward and Comanche cos.; also Okla.

10. *Mirabilis Carletonii* (Standl.) Standl. Perennial herb; stems 6-12 dm. tall, few or solitary, simple or sparsely branched above, densely viscid-pubescent throughout; leaves sessile or subsessile, the petioles not over 4 mm. long; blades 4-8 cm. long, 3 cm. wide or less, deltoid-ovate to broadly ovate or ovate-oblong, sometimes lanceolate, cuneate, subcordate to rounded at the base, obtuse or acute at the apex, thick, short-pilose to puberulent on both surfaces or sometimes glabrate, the margins entire or sometimes wavy; inflorescence paniculate, with subopposite branches and small bracts; involucre 5-6 mm. long at anthesis, enlarging and reticulate in fruit, viscid-pilose, ciliolate, on pedicels about 1 cm. long, these subtended by inconspicuous bracts; flowers usually 3 in each involucre; perianth pink and pubescent; stamens usually 3, exserted; anthocarp obovoid, 5 mm. long, glabrous or rarely pubescent, brown, 5-angled, the angles narrow, acute and smooth, the sides rugulose or obscurely tuberculate, conspicuously raphidulous; seed broadly obovoid, 3-3.5 mm. long, pale-brown. Permian Red Beds area or Rolling Red Plains in s.w. Okla. and adj. Tex.; also Kan. and Colo.

11. *Mirabilis coccinea* (Torr.) B. & H. SCARLET FOUR-O'CLOCK. Perennial herb from an elongate woody root; stems solitary or numerous, erect or ascending, variously

branched, the branches very slender, glaucous, the internodes short or elongate; leaves opposite, sessile, few to numerous; blades filiform or linear, 2-12 cm. long, 1-4 mm. wide, long-attenuate at both ends, thick and succulent, glaucous at least beneath, glabrous; involucre slender-pedunculate, axillary and solitary in young plants and mostly with cleistogamous flowers, in mature plants arranged in loose paniculate cymes, these with slender opposite sparsely short-pilose branches, at anthesis 4-5 mm. long, short-pilose or puberulent, deeply lobed, the oval-ovate lobes acute and slightly accrescent in age; flowers 1 to 3 in each involucre; perianth 15-20 mm. long, scarlet to deep-purplish-red, the tube 3-4 mm. in diameter, gradually widening upward, the limb 11-15 mm. broad, deeply 5-lobed, the lobes retuse; stamens 5, exserted; anthocarp obovoid, 5 mm. long, olivaceous, finely hirtellous, 5-lobed, the angles broad, smooth or tuberculate, the sulci coarsely transversely-rugose; seed broadly obovoid, 2.5 mm. long, yellowish-brown. Dry hillsides in w. Tex., s.w. N.M., s.e. Ariz. and n. Mex.

12. *Mirabilis gausapoides* (Standl.) Standl. Perennial herb; stems solitary or few, erect or decumbent, stout, 3-8 dm. long, sparsely branched, glaucous, densely hirsute at the base, viscid-puberulent or short-pilose above; leaves opposite, distant or crowded, sessile; blades linear to lance-linear, 3-10 cm. long, 1.5-5 mm. broad, attenuate to each end, entire, thick and succulent, glaucous beneath, densely short-pilose or hirsute, rarely glabrate; inflorescence terminal, cymose-paniculate, sparsely branched, the slender branches alternate, viscid-puberulent or densely villous; involucre few, slender-pedunculate, solitary or clustered, at anthesis 3.5-5 mm. long, about 15 mm. broad in age, densely viscid-villous with fulvous hairs, the lobes broadly rounded; flowers usually 3 in each involucre; perianth pink, about 1 mm. long, sparsely short-pilose; stamens 5, exserted; anthocarp obovoid, 4.5-5 mm. long, short-hirtellous, olivaceous, the angles broad, smooth, the sides coarsely transverse-rugose. *M. linearis* var. *subhispidula* Heimerl. In dry soils, N.M. and w. Tex. to Mex.

13. *Mirabilis linearis* (Pursh) Heimerl. Perennial herb from an elongate woody taproot, erect to ascending or procumbent; stems 2-10 dm. tall, simple or branched below, usually glaucous, often very whitish, glabrous or puberulent below, viscid-puberulent or short-villous above; leaves few to many, often crowded, 3-10 cm. long, 1-5 mm. wide, linear to linear-lanceolate, attenuate and sessile or long-cuneate at the base to a short petiole, narrowed to an obtuse or acute apex, thick, gray-green, usually glaucous at least below, glabrous or viscid-puberulent, the margins entire or sparsely dentate; inflorescence axillary or cymose-paniculate; involucre about 4 mm. long at anthesis, densely viscid-villous, usually with 3 flowers; perianth about 1 cm. long, sparsely pilose, purple-red to pink, the limb deeply lobed, the lobes retuse; anthocarp 4.5-5 mm. long, obovoid, brownish-olivaceous, 5-angled, densely pubescent to sparingly strigose, the sides coarsely transversely-rugose; seeds rounded-obovoid, 3 mm. long, pale-yellowish-brown. *M. angustifolia* (Nutt.) MacM., *Oxybaphus linearis* (Pursh) Robins. Dry ground, limestone, sandy plains, igneous soils, a Great Plains species, rather common in the Panhandle, extending s.e. and s. to Hunt, Jack, Nueces and Kleberg cos., spring-summer; from Minn. and S.D. to Mont., s. to Mo., Tex., Ariz. and Mex.; sometimes adv. eastw.

14. *Mirabilis diffusa* (Heller) Reed. Perennial herb from a rootstock; stems much-branched, prostrate or procumbent, diffusely branched from the base, 2-3 dm. long, terete, glabrous and whitened below, the middle part marked with several lines of short curved hairs, the branches immediately below the inflorescence and the inflorescence itself covered with spreading glandular hairs; leaves sessile, thick and green; blades linear-lanceolate, slightly narrowed at the base, the lowest 5-6 cm. long, the upper ones half as long, all acute, the upper surface provided with a grayish margin, the midvein prominent; inflorescence cymose, densely viscid-hairy; involucre densely viscid-hairy, 8-10 mm. wide in fruit, the triangular-ovate to triangular-lanceolate lobes acutish and 2-3 mm. long; flowers 2 or 3 in an involucre, subsessile; perianth pale-rose to white, 6 mm. long, the lobes broadly obovate; stamens 3, exserted; style exserted, anthocarp inconspicuously ribbed, pubescent. N.D., Kan. and Wyo., s. to Tex., N.M. and Ariz.; June-Aug.

15. *Mirabilis aggregata* (Ort.) Cav. Perennial herb; stems branched from the base, terete, striate, hispid, the branches similar; leaves opposite, lanceolate, undulate, the margins hispidulous, obsolete denticulate, shining above, glaucous, the petioles short; peduncles axillary, solitary, short, the flowers aggregated, perianth usually villous, cam-

panulate, partly closing, 3-flowered, rarely 2- or 4-flowered; flowers sessile, 5-parted, the laciniae ovate and unequal, after anthesis growing upward and in the mature fruit expanded, white-reddish; stamens the length of the perianth; anthocarp borne on reflexed peduncles; nutlets 3, often 2 with the other abortive, large, villous, placed across from each other in the enlarged sinuses of the perianth, at first closing, later spreading open. *Oxybaphus aggregatus sensu Gray*, not Vahl. Mex. and Tex.

A very confused name and species. True *M. aggregata* may be only Mexican.

16. *Mirabilis decumbens* (Nutt.) Daniels. Perennial herb; stems decumbent or ascending, 2-8 dm. tall, simple or tufted or sometimes branched above, sparingly pubescent (at least when young), glabrous in age; leaves essentially sessile; blades oblong to linear-lanceolate or rarely oblong-lanceolate, 2-11 cm. long, thick, sometimes slightly acuminate but rather blunt, ciliate, narrow-cuneate at the base; involucre 2- to 5-flowered, terminating solitary axillary peduncles, 1.5-2 cm. wide, the lobes acute or rarely rounded; perianth sparingly pubescent, about 3 mm. broad; anthocarp narrowly obovoid, 5-6 mm. long, pubescent, with prominent ribs and tubercled faces. In dry sandy and gravelly soils, on plains and prairies, spring-summer; from Man. and N.D. to Mo. and Miss., w. to Colo., Wyo., Tex. and N.M.

17. *Mirabilis ciliata* (Standl.) Standl. FRINGED FOUR-O'CLOCK. Perennial herb, low, from a slender woody root; stems few, 2-4 dm. tall, erect, abundantly dichotomously branched (especially near the base), angled (at least when dry), glaucous, glabrous below, with a few scattered weak hairs above, the lower internodes short, the upper ones elongate; leaves opposite, with stout petioles 7 mm. or less long, with a few scattered stout white hairs; blades linear-lanceolate to ovate-deltoid or deltoid-lanceolate, 5-18 mm. broad, blunt-pointed, rounded, cuneate or attenuate at the base, the margins entire or subundulate, succulent, coriaceous when dry, sparsely pilose with a few conspicuous long soft white hairs or glabrate, long-ciliate at least near the base; inflorescence of numerous small dense cymes or of axillary involucre in young plants, the branches slender, puberulent and pilose; involucre 3-flowered, short-pedunculate, about 4 mm. long at anthesis and to 8 mm. in fruit, densely white-pilose, the short lobes broadly ovate or ovate-orbicular and acute at least in age; perianth about 1 cm. long, very sparsely pilose or glabrous, the limb about 15 mm. broad; stamens 5, exerted; anthocarp broadly obovoid, 3.5-4 mm. long, dark-brown, sparsely and finely pilose, the angles broad, obscurely rugulose, the sides also slightly rugulose; seeds globose-obovoid, 2 mm. long, pale-brown. *M. ciliatifolia* (Weath.) Standl., *Allionia ciliata* Standl. Trans-Pecos Tex. and Mex.

18. *Mirabilis hirsuta* (Pursh) MacM. Perennial herb; stems erect or decumbent, 2-10 dm. tall, solitary or few, simple or sparsely branched below the inflorescence, densely hirsute or long-pilose below and usually up to the inflorescence, sometimes merely puberulent but always hirsute near the nodes; leaves sessile or petioled to 5 mm. long; blades 2-10 cm. long, variable in shape, mostly ovate-oblong, sometimes lanceolate to broadly ovate, cuneate to subcordate at the base, narrowed to an obtuse or acute apex, rarely rounded, densely hirsute to viscid-puberulent or glabrate; inflorescence both axillary and cymose-paniculate; involucre 4-5 mm. long at anthesis, densely to sparsely viscid-pilose, usually 3-flowered; perianth 8-10 mm. long, pink to purplish-red, sparsely pilose; stamens 3 to 5, long-exserted; anthocarp narrowly obovoid, 4-5 mm. long, dark-olivaceous, densely pubescent to short-pilose, 5-angled, the angles broad, smoothish the sides rugose or short-tuberculate; seed obovoid, 3 mm. long, brownish-stramineous. Dry often sandy ground, dry fields and hillsides, w. and n.w. Tex., summer-fall; from Man. and Wisc., s. to Mo., La., Tex. and N.M.; rarely adv. eastw.

19. *Mirabilis eutricha* Shinners. Perennial herb, from a vertical soft-woody oblong or fusiform root 5-12 mm. thick; stems erect, 25-50 cm. tall, hirsute throughout with jointed translucent brownish or yellowish hairs 1-1.5 mm. long and spreading nearly at right angles, simple or sparingly branched near the summit, the middle and lower internodes 3-10 cm. long; leaves very short-petioled or sessile, the narrowly winged petioles to 4 mm. long; blades lanceolate or narrowly oblong-lanceolate, acute, spreading-hirsute on both sides with whitish hairs similar to those on the stem but slightly shorter and stiffer, the larger blades 4-7 cm. long and 6-10 mm. broad, the upper ones gradually reduced; branches of the inflorescence with small leafy bracts 3-5 mm. long and 1.2 mm. wide; involucre solitary and axillary or in a small terminal panicle; peduncles becoming

8-10 mm. long in fruit, spreading-hirsute with hairs like those of the stem; involucre 2-flowered, moderately densely spreading-hirsute outside, 6-7 mm. long in flower, to 13 mm. in fruit, the lobes ovate-triangular and subacute or apiculate; anthocarp obovoid, 5 mm. long, 3 mm. thick, covered with large yellow-green warty tubercles, the tubercles sparsely white-hirsute. Sandy prairies, limestone gravel, on rocky slopes in n.-cen. Tex. (Denton, Taylor and Wise cos.); endemic.

20. *Mirabilis gigantea* (Standl.) Shinn. Perennial herb from an elongate woody taproot; stems erect, finely and densely appressed-puberulent throughout, generally 6-9 dm. tall, simple below or freely branched above; leaves almost sessile or petioled to 1 cm. long; blades thick, the lower ones large, 10.5 cm. long and to 8 cm. wide, broadly ovate, obtuse, truncate at the base, the upper leaves oblong (85 mm. long and to 45 mm. wide), obtuse, broadly cuneate or rounded at the base, prominently veined; inflorescence paniculate, rarely axillary, the branches opposite; involucre usually 3-flowered, about 7 mm. high and 10 mm. wide, on peduncles to 1 cm. long, the broadly ovate lobes obtuse and densely and finely puberulent; flowers about 1 cm. long; perianth rose-pink to light purple; stamens slightly exerted; anthocarp 5 mm. long, 5-ribbed, the ribs tuberculate with the spaces between them puberulent, acutish above, somewhat narrowed below. *Allionia gigantea* Standl., *Oxybaphus giganteus* (Standl.) Weath. Endemic to n.-cen. Tex. from the Red River s. to McLennan Co. and from Dallas to Parker Co.

21. *Mirabilis pauciflora* (Buckl.) Standl. Perennial herb; stems erect, glabrous, 3-6 dm. tall, solitary and simple, rarely if ever branched, leafy to the summit; leaves opposite, the short petioles 1-1.6 cm. long; blades oblong-ovate, acute or subobtuse, 5-8 cm. long, 2.5-5 cm. broad, glabrous; flowers axillary on short peduncles 6-12 mm. long; involucre 1- to 2-flowered, the segments obovate and abruptly acute, pubescent; anthocarp oblong, 4-angulate, rugose. Roadsides, on granite outcrops and on white sandy soils on the Edwards Plateau; also Okla.

22. *Mirabilis pseudaggregata* Heimerl. Perennial herb; stems 5-7 dm. tall, erect or spreading, glabrate or scantily pubescent in the lower part, often opposite and paniculately branched, stout, grayish below, greenish above, striate, suffrutescent at the base, the middle internodes 10-14 cm. long (the basal ones much shorter), smooth at the nodes, the branches erect and oblique, small-leaved in the upper parts; leaves of a pair subequal, the lower ones often with petioles 8-12 mm. long, the others and the upper ones sessile or subsessile; blades subsymmetrical, linear-lanceolate, 5-11 cm. long, 12-28 mm. wide, those in the lowest parts broadest, cuneate near the base, long-narrow at the obtuse apex, the margin slightly indulate, firm, grayish, the primary vein prominent, the secondary veins faint, the bracts in the ultimate ramifications 3-5 mm. long, ovate, more acute and reduced; inflorescence paniculate, more or less divaricate, the branches opposite, the primary branches little to not divided, the ultimate divisions more contracted, densely flowered and more elongated, to 13 cm. long, lacking bracts; involucre on very short peduncles 2-4.5 mm. long, more or less deflexed, 2- or 3-flowered, broadly campanulate, 9-10 mm. wide, 5-6 mm. long, 5-parted (rarely 4-parted), membranaceous; involucral lobes about as long as wide (3-3.5 mm.), ovate-triangular, obtusish to acutish, sparsely hirsute inside, densely so outside; flowers often chasmogamous but sometimes cleistogamous, pink, to 1 cm. long, the part near the ovary broadly obovoid, 1.5 mm. long, 1 mm. wide, hirsute, indistinctly 5-costate, the upper part broadly campanulate, hirsute near the base; stamens 3, to 11 mm. long; anthocarp (very few present) 5 mm. long and 2 mm. wide, oblong, grayish-brown, more or less densely hirsute, truncate at the base, slightly constricted above the base, obtusely conical at the apex, costae entire, barely interrupted, moderately prominent. In Trans-Pecos Tex. and Mex.

23. *Mirabilis albida* (Walt.) Heimerl. WHITE FOUR-O'CLOCK. Perennial herb with glabrous foliage, except the viscid-pubescent inflorescence and upper parts of the stem; stems solitary or few, erect, 2-12 dm. tall, 4-angled below, enlarged at the nodes, whitish, smooth and often very short; leaves opposite, the stout petioles 5 mm. long or shorter to sessile; blades narrowly lanceolate to linear or ovate, 3-12 cm. long, 3-28 mm. broad, blunt or pointed at the apex, attenuate to the petiolelike base or nearly sessile, the margins entire or subsinuate, usually thick and succulent, bright-green on the upper surface, glaucous or whitened beneath, glabrous or slightly pilose; inflorescence of axillary involucre in young plants, cymose-paniculate in mature plants, much-branched, the

branches slender or stout, opposite or alternate, puberulent or short viscid-pilose, with numerous reduced bractlike leaves; involucre 1- to 3-flowered, slender-pedunculate, about 4 mm. long at anthesis, 8-14 mm. long in fruit, densely or sparsely viscid-pilose, the short lobes triangular to rounded; perianth pink, rose or whitish, 8-10 mm. long, sparsely pilose, the ovate lobes shorter than the tube; stamens 3 to 5, exserted; style exserted; anthocarp obovoid, 5 mm. long, dark-olivaceous, with tufts of silvery hairs, the angles broad and coarsely tuberculate or composed of distinct tubercles, the sides also tuberculate; seed obovoid, 3.5 mm. long, pale yellowish-brown. Incl. var. *lata* Shinners and var. *uniflora* Heimerl., *Allionia bracteata* Rydb. In dry soils, meadows, hillsides, May-Nov.; from S.C., Tenn., Ala. and Miss. to Kan., Mo. and Tex.

24. *Mirabilis collina* Shinners. Perennial herb, from a vertical elongate fusiform soft-woody root to 12 mm. thick (located as much as 6 cm. below ground), producing one to several bent or branching below-ground stem bases of 1 to 6 nodes; above-ground stems erect, 25-85 cm. tall, finely and rather densely pubescent throughout with jointed translucent whitish rather viscid or glandular spreading hairs 0.5 mm. long, branching mainly in the middle part, the branches ascending, the middle and lower internodes 3.5-19 cm. long; leaves densely pubescent with hairs like those of the stem, the petioles (3-12 mm. long) usually with some long hairs in addition; blades triangular-lanceolate or elongate-triangular, abruptly contracted to subcordate at the base and short-decurrent on the petioles, the larger ones 3-7.8 cm. long and 16-35 mm. wide, the upper and those in the inflorescence gradually reduced and shorter-petioled; earliest involucre solitary and axillary, later ones in at first congested terminal cymes, ultimately forming an open panicle; peduncles becoming 8-11 mm. long, densely pubescent with mixed long and short hairs spreading at right angles; later involucre 3-flowered, pubescent outside with short hairs like those of the stem, 6-8 mm. long in flower, as much as 12 mm. in fruit, the ovate lobes more or less acute; perianth showy, funnellform, about 8 mm. long, lavender-rose; anthocarp narrowly obovoid, 4.2 mm. long, 1.5 mm. thick, with 4 conspicuous thickly winglike tuberculose ridges forming the angles, the very slender body with small tubercles, the ridges and tubercles sparsely hirsute with whitish hairs. Sandy thickets and on hillsides in e. Tex.; endemic.

25. *Mirabilis nyctaginea* (Michx.) MacM. WILD FOUR-O'CLOCK. Perennial herb; stems several from a thick fleshy taproot, erect, 3-10 dm. tall, with broadly spreading forking branches, glabrous or somewhat hairy, ridged and often purplish; leaves opposite, petioled or the upper ones sessile, entire, glabrous or nearly so, ovate-lanceolate to cordate, 5-12 cm. long; flowers perfect, small, 3 to 5 in an involucre; involucre borne on hairy peduncles that are grouped in umbels in forked terminal clusters, 5-6 mm. long in anthesis, 10-15 mm. long in fruit; involucre lobes 5, obtuse, persistent, short-pilose on the margin, sometimes pilose at the base, becoming enlarged, veiny and colored in fruit; perianth pink to purple or reddish, 5-lobed; stamens 3 to 5, exserted; anthocarp a hard nutlet, 4-6 mm. long, cylindrical-obovoid, pilose, rugose, or warty, 5-ribbed and angled, grayish-brown; seed broadly obovoid, 3 mm. long, pale-brown. *Allionia nyctaginea* Michx., *Oxybaphus nyctagineus* (Michx.) Sweet. Weedy places, in dry soils, limestone gravels, sandy Post Oak Belt and West Cross Timbers, spring-summer; from Mont. to Wisc., s. to Tenn., Colo., Ala., Tex. and Mex.; adv. in Calif. and e. U.S.

26. *Mirabilis dumetorum* Shinners. Perennial herb from a vertical oblong or fusiform pithy root to 14 mm. thick; stems erect or spreading and half-decumbent or leaning on other plants, 8-12 dm. long, glabrous, freely branched throughout in larger plants, the branches elongate to 35 cm. long, more or less pubescent with short incurved whitish hairs; stem internodes 2-9 cm. long on erect plants, to 23 cm. long on large sprawling or semidecumbent ones; leaves glabrous, with petioles 5-12 mm. long; blades broadly ovate or rhombic to ovate-lanceolate or elliptic, obtuse, the larger ones 2-5 cm. long and 1.3 cm. wide, gradually reduced upwards, those in the inflorescence ovate-lanceolate to suborbicular and acute; involucre at first solitary and axillary, in more fully developed plants mostly in an eventually diffuse panicle, 2-flowered, sparsely pubescent to glabrous outside except at the base, 3.5-4.5 mm. long in flower, as much as 7 mm. long in fruit; peduncles becoming 4-6 mm. long, pubescent with short upwardly incurved hairs; anthocarp obovoid, 4-angled, 3.5 mm. long, 2.3 mm. thick, densely covered with mixed coarse and small tubercles, these sparsely hirsute with whitish hairs. Ark. and Okla. to s.-cen. Tex.

27. *Mirabilis coahuilensis* (Standl.) Standl. Perennial herb from a long woody taproot; stems erect, stout, to 1 m. tall, pale below, darker above, pubescence soft and short below, becoming more dense above; leaves opposite, with conspicuous petioles 2 cm. long or less (except those of the inflorescence); blades lanceolate, 5 cm. long, to 17 mm. broad, cuneate or rounded at the base, blunt-pointed, densely soft-pubescent on both surfaces, the margins irregular; inflorescence paniculate, the stout branches opposite, very densely viscid-puberulent throughout, the hairs rather long and spreading, those branches with reduced bractlike leaves 5 mm. long or less and ovate, densely viscid-pubescent; involucre 12 mm. wide or less and 8 mm. high, glandular-villous, on short glandular-villous often bracted peduncles; involucre lobes broadly ovate or orbicular, broadly obtuse, short; anthocarp 4 mm. long, obtuse above, slightly narrowed below, with 5 smooth rather prominent ribs, the spaces between the ribs transversely rugulose and hirtellous. Trans-Pecos Tex. s. into Mex.

28. *Mirabilis Grayana* (Standl.) Standl. Perennial herb; stems erect, 3-12 dm. tall, simple or sparsely branched below the inflorescence, glaucescent, glabrous below or bifariously puberulent; leaves opposite, with slender or stout petioles 5-20 mm. long, the uppermost leaves often sessile; blades deltoid or rounded-deltoid, sometimes ovate, 25-55 mm. long, 15-35 mm. wide, subcordate to truncate or rounded at the base, rounded to obtuse or rarely acute at the apex, entire or subundulate, subcoriaceous when dry, often glaucescent beneath, sparsely pilose or glabrous, often ciliolate; inflorescence cymose-paniculate, usually much-branched, the branches slender and mostly opposite, viscid-pilose, usually with numerous reduced bractlike leaves; involucre numerous, 3-flowered, slender-pedunculate, 4-5 mm. long at anthesis, 10-14 mm. long in fruit, densely viscid-pilose, the lobes rounded-ovate and commonly rounded at the apex or rarely acutish; perianth pink, about 1 cm. long, sparsely pilose; stamens usually 5, exserted; anthocarp broadly obovoid, 4 mm. long, finely pilose, dark-brown, the angles narrow, the sides finely and closely tuberculate; seed broadly obovoid, 2.5-3 mm. long, pale-brown. *Oxybaphus Grayanus* Standl. In w. Edwards Plateau and Trans-Pecos; endemic.

29. *Mirabilis oblongifolia* (Gray) Heimerl. Perennial herb with a long slender woody root; stems erect, 3-10 dm. tall, few or solitary, sometimes decumbent, simple or sparsely branched below the inflorescence, glabrous below or puberulent usually in lines, green or glaucescent below, pilose or short-pilose in the inflorescence, the internodes usually elongate; leaves opposite, the petioles 1-5 cm. long, glabrous or puberulent; blades 3-10 cm. long, 8-55 mm. wide, elongate-deltoid to deltoid-ovate or sometimes ovate-lanceolate, truncate or subtruncate at the base, obtuse to acute or attenuate at the apex, glabrous to sparsely viscid-puberulent, thin, bright-green, commonly ciliolate, the margins entire to crisped or subundulate; inflorescence cymose-paniculate, sparsely to loosely branched, the slender branches alternate, viscid-pilose with fulvous hairs, with a few bractlike leaves; involucre few or numerous, short-pedunculate, 3-5 mm. long at anthesis, about 8 mm. long in fruit, densely viscid-pilose, the hairs often blackish and jointed, the oval-oblong lobes usually longer than the tube and rounded at the apex; perianth 10-12 mm. long, purplish-red to white, sparingly pilose, the limb to 2 cm. broad; stamens 3 to 5, long-exserted; anthocarp obovoid, 3-5 mm. long, minutely pilose, 5-angled, the angles broad and usually tuberculate, the sides coarsely or finely tuberculate, brownish or blackish-olivaceous; seed obovoid, 2.3 mm. long, brownish-tan. *M. comata* (Small) Standl., *M. longiflora* var. *Wrightiana* (Gray) Kearn. & Peeb., *Oxybaphus comatus* (Small) Weath., *Alltonia comata* Small, *A. melanotricha* Standl., *A. pratensis* Standl. Meadows and thickets in the mts., sheltered canyons and slopes in the Trans-Pecos; from Tex. to Ariz. and s. Colo., s. into Mex.

6. AMMOCODON STANDL.

MOONPOD

A small American genus.

1. *Ammocodon chenopodioides* (Gray) Standl. GOOSEFOOT MOONPOD. Perennial herb, from a fleshy fusiform rootstock; stems erect, 1.5-3 dm. tall, dichotomously much-branched, the branches rather stout, densely covered with short appressed inflated white hairs when young, glabrate in age; leaves opposite, with petioles 5-45 mm. long; blades

ovate-oval to ovate-oblong or rarely deltoid or suborbicular, fleshy-thickened, 1.5-5 cm. long, 6-40 mm. wide, rounded to subcordate at the base, broadly rounded to acute at the apex, often abruptly apiculate, flat or crispate, paler beneath, pubescent like the stem when young, becoming glabrate, the veins usually conspicuous beneath, broad and white; inflorescence much-branched, with a few reduced leaves, the umbellules few- or many-flowered; flowers often cleistogamous, on slender pedicels 1-4 mm. long; perianth pink to lavender, campanulate, 4-5 mm. long and just as broad or broader, sparsely puberulent outside, constricted above the ovary, shallowly 5-lobed, the lobes induplicate-plicate; stamens 2 or rarely 3; filaments filiform, short-connate at the base, free from the perianth; anthers didymous and exserted; ovary narrowly oblong, the style filiform and exserted, stigmas peltate and smooth; anthocarp 5 mm. long, compressed, the wings about 2 mm. broad, glabrate, the body sulcate between the wings, sparsely puberulent; seed oblong-cylindric, 2.5 mm. long, pale-brown, lustrous. *Selinocarpus chenopodioides* Gray. Dry rocky and sandy soils, on hills, often on limestone soils in the Trans-Pecos, May-Sept.; from Tex. to s.e. Mex.

7. SELINOCARPUS GRAY MOONPOD

Perennial herbs or low shrubs, erect or decumbent; stems dichotomously much-branched, pubescent; leaves opposite, the pair unequal, petiolate; blades thick and succulent, entire or sinuate; flowers perfect, pseudoaxillary, sessile or short-pedicellate, often cleistogamous, each subtended by 2 or 3 very narrow bracts; perianth tubular-funneliform, the tube elongate or rarely short, not constricted above the ovary, rather abruptly expanded into a broad shallowly 5-lobed limb, the lobes plicate; stamens 5 or 6; filaments filiform, adherent to the perianth tube; anthers didymous, usually exserted; ovary oblong, style filiform, stigma peltate, smooth; anthocarp compressed, broadly 3- to 5-winged, the hyaline wings not veined; seed with the testa adherent to the pericarp; embryo conduplicate, the cotyledons enclosing the farinaceous endosperm, the radicle elongate and descending.

About 8 species in southwestern United States and Mexico.

1. Perianth 8-10 mm. long; leaf blades linear or linear-oblong, sessile or short-petiolate 1. *S. angustifolius*.
1. Perianth 25-45 mm. long (2)
 - 2(1). Leaves sessile or on very short petioles, the blades narrowly ovate-oblong or oblong-lanceolate 4. *S. lanceolatus*.
 2. Leaves long-petioled (at least the lower ones), the blades ovate to orbicular (3)
 - 3(2). Upper leaves much-reduced, bractlike; anthocarp 9-10 mm. long 2. *S. parvifolius*.
 3. Upper leaves not reduced; anthocarp 6-7 mm. long ... 3. *S. diffusus*.

1. *Selinocarpus angustifolius* Torr. Perennial herb; stems erect, 1-4 dm. (to 1 m.) tall, fruticose and much-branched at the base, rather sparsely slender-branched above, whitish, glandular-puberulent, with numerous short white appressed flat hairs, glabrate in age, the internodes longer than the leaves; leaves opposite, with petioles to 2 mm. long; blades often sessile; oblong-linear or lance-linear, 8-18 mm. long, 1-3 mm. broad, acute to rounded and apiculate at the apex, thick and fleshy, puberulent, covered with numerous short white appressed hair when young; flowers few, nocturnal, often cleistogamous, on pedicels 2 mm. long or shorter, the bractlets minute and subulate; perianth orange or brownish to greenish, 8-10 mm. long, glandular-puberulent outside, the tube 3 mm. long, the limb 7-8 mm. broad; stamens 5; anthocarp 5.5-7.5 mm. long, the 5 wings 2-2.5 mm. wide, the costate body puberulent and truncate at both ends. In loose volcanic soils, gravelly tablelands and rocky hillsides in the Trans-Pecos, Apr.-Nov.; also Mex.

2. *Selinocarpus parvifolius* (Torr.) Standl. Perennial herb, suffrutescent at the base, much-branched; stems erect, 2-4 dm. tall, the branches stout, glandular-puberulent and bearing numerous short flat white appressed hairs, glabrate in age, glaucous; leaves opposite, the stout petioles 3-6 mm. long; blades oval to ovate-oval, 1-2.2 cm. long, 5-10

mm. broad, obtuse or acute at the base, obtuse or rounded at the apex, thick and fleshy, crispate, puberulent; inflorescence repeatedly dichotomous, dense, bearing numerous orbicular or ovate-orbicular petiolate bractlike leaves 2-3 mm. long; flowers numerous, terminal, short-pedicellate, subtended by broadly ovate minute bracts; perianth 3-4 cm. long, densely glandular-puberulent, the tube very slender, the limb about 13 mm. broad, greenish-yellow; anthocarp 9-10 mm. long, the 5 wings 3-4 mm. broad, the striate body finely glandular-puberulent. In sandy, limestone or gypseous soils in the Trans-Pecos, Apr.-Sept.; endemic.

3. *Selinocarpus diffusus* Gray. SPREADING MOONPOD. Perennial shrub from stout woody roots; stems erect or decumbent, 1-3 dm. tall or long, much-branched from the base and also above, branches rather slender, covered with short appressed inflated white hairs and very sparsely glandular-puberulent or hirtellous, very leafy; leaves opposite, with slender or stout petioles 3-25 mm. long; blades oval to ovate-oblong, 12-25 mm. long, 6-15 mm. broad, rounded to acute at the apex, thick and fleshy, flat or crispate, densely covered with short appressed inflated white hairs when young or glandular-puberulent and scabrous, sometimes glabrate in age; flowers often all cleistogamous, short-pedicellate, the linear-subulate bracts 3-6 mm. long; perianth 35-45 mm. long, densely glandular-hirtellous outside, the tube very slender, the limb 15 mm. broad, pale-greenish-yellow; stamens 5, slightly exserted; anthocarp 6-7 mm. long, the 5 wings 2-3 mm. long, glabrate, the body subtruncate at both ends, puberulent; seed narrowly elliptic, 4.5 mm. long, light-brown. In dry sandy or gypseous soil in n.-cen. and w. Tex. to s. Ut. and Nev.; spring-summer.

4. *Selinocarpus lanceolatus* Woot. GYP MOONPOD. Perennial herb; stems erect or decumbent from a woody base, 1.2-3 dm. long, much-branched, densely leafy, covered throughout with slender short appressed white inflated hairs or glabrate in age, the branches stout; leaves opposite, with stout petioles to 3 mm. long; blades mostly sessile, lance-oblong to lanceolate, the lowest rarely ovate-oblong or ovate-oval, 1.2-8 cm. long, 3-11 mm. wide, cuneate or obtuse at the base, gradually narrowed to the acute or attenuate or rarely obtuse apex, very thick and succulent, flat; flowers numerous, subsessile, the subulate bracts 3 mm. long or shorter; perianth 3-4 cm. long, the slender tube 1 mm. in diameter, the limb about 1 cm. broad, pale-greenish-yellow to yellow or ivory-green; stamens 5; anthocarp 6-7 mm. long, the wings 2-3 mm. broad, glabrate, the body finely costate, truncate at both ends; seed narrowly oblong, 4 mm. long, pale-brown. In dry alkaline soils, on gypsum hillocks, edge of salt flats in Trans-Pecos Tex. and s. N.M.; June-Sept.

8. ACLEISANTHES GRAY TRUMPETS

Perennial pubescent herbs and low shrubs; stems forking; leaves opposite, thick, the blades unequal, entire, petioled; flowers axillary or terminal, each subtended by 1 to 3 small narrow bracts; perianth white, with a very much-elongated slender tube constricted above the ovary, the spreading limb small and 5-lobed; stamens 2 to 5, unequal; filaments slender, united into a cup at the base; style filiform, the stigmas peltate; anthocarp narrowly ellipsoidal, 5-angled or -ribbed, constricted below the apex; seed filling the pericarp to which the testa adheres, the endosperm mealy.

About 10 species in southwestern United States and Mexico.

1. Anthocarp deeply sulcate, the ribs ending above in conspicuous tubercles or glands (2)
1. Anthocarp not deeply sulcate, 5-angulate, without glands above (3)
- 2(1). Glands of anthocarp on globose tubercles at the summit of the ribs; bracts less than half as long as the anthocarp; leaf blades usually rounded at the apex; stamens 21. *A. Wrightii*.
2. Glands of anthocarp in depressions below the tubercles at the summit of the ribs; bracts equaling or exceeding the anthocarp; leaf blades mostly acute or abruptly acute; stamens 52. *A. acutifolia*.
- 3(1). Leaves of a pair very unequal, the smaller one about one fourth as long as the larger; leaf blades oval3. *A. antisophylla*.
3. Leaves of a pair subequal (4)

- 4(3). Anthocarp densely covered with short flat white appressed hairs; leaf blades ovate or ovate-oblong; perianth 4-5 cm. long4. *A. crassifolia*.
4. Anthocarp glabrous or cinereo-puberulent with slender hairs; leaf blades chiefly deltoid in outline (5)
- 5(4). Perianth 90-170 mm. long; leaf blades mostly acuminate or long-acuminate at the apex5. *A. longiflora*.
5. Perianth 35-55 mm. long; leaf blades mostly acute to rounded at the apex
.....6. *A. obtusa*.

1. *Acleisanthes Wrightii* (Gray) B. & H. Perennial herb from a fruticose caudex; stems erect or ascending, 1-5 dm. long, much-branched from the base, the branches scabrous-pubescent; leaves opposite, a pair unequal; petioles 3-15 mm. long, half as long as the blades; blades oval to ovate or suborbicular to ovate-lanceolate, 1-5 cm. long, 4-20 mm. wide, slightly unequal and obtuse or acute at the base, obtuse and apiculate at the apex, thick and firm, often crispate, paler beneath, glandular-hirtellous or puberulent; flowers axillary, solitary, sessile, usually cleistogamous; bracts linear-subulate, hirtellous, one third as long as the fruit or shorter; perianth of the cleistogamous flowers 5 mm. long, densely glandular-hirtellous, with 2 stamens; anthocarp oblong, 6-7 mm. long, truncate at both ends, strongly 5-ribbed and deeply 5-sulcate, glandular-puberulent, the broad costae smooth with each ending above in a globose glandiferous tubercle. On stony plains and prairies, in w. and s. Tex.; endemic.

2. *Acleisanthes acutifolia* Standl. Perennial herb with a thick woody base; stems ascending or procumbent, much-branched at the base, the branches stout, 1-4 dm. long, puberulent and sparsely glandular-hirtellous, glaucous; leaves opposite, a pair unequal, the petioles 3-8 mm. long, the uppermost leaves sessile; blades oblong-elliptic to oval, 1.2-5 cm. long, 4-20 mm. wide, obtuse to acute at the base, obtuse or acute at the apex, usually crispate, thick and fleshy, glaucescent beneath; flowers axillary, sessile or short-pedicellate, usually solitary; bracts linear-subulate, equaling or slightly longer than the anthocarp; perianth 4-4.5 cm. long, glandular-puberulent or hirtellous outside, the slender tube 1.5 mm. in diameter, the limb 2-2.5 cm. broad; stamens 5, short-exserted; anthocarp oval-oblong, 6 m. long, rounded at the base, constricted and truncate at the apex, glandular-puberulent or glabrous, 5-sulcate, the broad costae flat and smooth with each bearing a gland in a depression below the apex. In s.w. Tex. and Mex.

3. *Acleisanthes anisophylla* Gray. OBLIQUE-LEAF TRUMPETS. Perennial herb, prostrate from a stout or slender fruticose root; stems much-branched from the base, the branches slender, cinereo-puberulent; leaves opposite, a pair unequal, the petioles of the larger leaves 3-10 mm. long; blades oval or oblong-oval to oval-rhombic, obtuse or rounded at the base, unequal and short-decurrent, rounded to obtuse at the apex and apiculate, thick and succulent, flat, minutely puberulent when young, becoming glabrate, the blades of the larger leaves 1-5 cm. long and 6-27 mm. broad; flowers axillary, solitary, sessile; bracts linear-subulate, less than half as long as the anthocarp; perianth 4-5 cm. long; anthocarp 5-angulate, costate, sparsely puberulent and soon glabrate. Prairies in w. Tex.; doubtless also adj. Mex.

4. *Acleisanthes crassifolia* Gray. TEXAS TRUMPETS. Perennial herb, sparsely branched; stems procumbent, 2-5 dm. long, stout, scabrous-pubescent, with flat white appressed hairs, glabrate in age, the internodes longer than the leaves; leaves opposite, a pair unequal; petioles half as long as the blades or shorter, stout, 3-10 mm. long; blades flat, succulent, thick, ovate to oblong-ovate or deltoid-ovate, 1-3.5 cm. long, 2-20 mm. broad, acute or obtuse at the apex and abruptly apiculate, undulate, mostly rounded at the base, scabrous on both sides; bracts linear-lanceolate, long-attenuate, less than half as long as the anthocarp; flowers few, sessile; perianth white, 4-5 cm. long, slender, densely cinereo-puberulent; anthocarp oblong-oval, 6-7 mm. long, 4 mm. in diameter, obtusely 4-angled, truncate at both ends, shallowly 5-sulcate, the ribs broad and flat, densely scabrous-pubescent, with short flat white appressed hairs. In dry soil, along and near the Rio Grande in w. Tex., summer-fall; endemic.

5. *Acleisanthes longiflora* Gray. ANGEL TRUMPETS. Perennial herb from long woody rootstocks; stems more or less branched at the base, prostrate or sprawling over shrubs

to 1 m. tall, scabrous-puberulent or rarely short-hirtellous, glabrate below; leaves succulent, a pair unequal, with stout or slender petioles 3-8 mm. long; blades triangular-lanceolate to deltoid or lanceolate to linear-lanceolate, 15-45 mm. long, 3-35 mm. wide, broadly cuneate at the base and decurrent, acuminate or acute to long-attenuate at the apex, thick, glaucous, often crispate, the margins undulate or when dry apparently coarsely dentate, sparsely cinereo-puberulent when young, soon glabrate; flowers axillary, solitary, sessile or subsessile, fragrant, opening in the afternoon and through the night; bracts linear-subulate, half as long as the anthocarp or shorter; perianth 9-17 cm. long, white tinged with purple, sparsely puberulent outside, the very slender tube 1.5-2 mm. in diameter, pinkish-green outside, white inside, the limb 1.5-2 cm. broad; stamens short-exserted; anthocarp narrowly oblong, 5-10 mm. long, with a constriction above the base, truncate at both ends, 5-angulate, puberulent or rarely short-hirtellous, often glabrate. In sandy soils, dry alkaline soils, in granite, calcareous areas, slopes, talus, roadsides in s. and w. Tex., spring-fall; w. to Riverside Co., Calif., s. to Mex.

6. *Acleisanthes obtusa* (Choisy) Standl. Perennial herb or climbing vine, often reaching the tops of small trees, easily propagated from root divisions; stems slender, glabrous or puberulent near the nodes, diffusely branched, the branches prostrate or spreading, 1-4 dm. long or vinelike; leaves opposite, a pair unequal, with petioles 5-20 mm. long, often as long as the blades; blades deltoid-ovate, to 60 mm. long, 15-45 mm. broad, truncate or subcordate at the base, subtruncate to broadly rounded or acute at the apex, rather thin, bright-green, sparsely cinereo-puberulent when young, becoming glabrate; flowers fragrant, opening in the afternoon, in large clusters, axillary or in short-pedunculate 3-flowered cymes; bracts linear-subulate, usually equaling the anthocarp; perianth white to pink, tinged with purple, 35-45 mm. long, sparsely cinereo-puberulent outside, the limb 2 cm. broad; stamens slightly exserted; anthocarp narrowly oblong, 5-6 mm. long, truncate at both ends, obtusely 5-angulate, cinereo-puberulent or short-villous. *A. Berlandieri* Gray, *A. Greggii* Standl. In dry soils in s.w. Tex. and Mex.; summer-fall.

9. CYPHOMERIS STANDL.

Perennial herbs, suffrutescent at the base; stems erect or ascending, more or less pubescent, much-branched, the upper internodes each with a glutinous area along the middle; leaves opposite, the pairs unequal, petiolate; blades broad or narrow, succulent, entire or sinuate; flowers perfect, in elongate spikelike terminal and axillary racemes, pedicellate, each pedicel subtended by a narrow caducous bract; perianth broadly tubular-funnelform, deep bright-red, the very short tube slightly curved and constricted above the ovary, the limb somewhat oblique, shallowly 5-lobed, induplicate-plicate; stamens 5; filaments capillary, exserted, unequal, connate at the base; anthers didymous; ovary fusiform, asymmetrical, the filiform style exserted, the stigma capitate; anthocarp clavate, stipitate, gibbous, pendent or refracted, finely striate vertically, glabrous; seed with a thin testa adherent to the pericarp; embryo uncinat, the cotyledons broad, enclosing the farinaceous endosperm, the radicle elongate, descending.

A small genus in southwestern United States and Mexico.

1. Anthocarp 10-12 mm. long; leaf blades glabrous or sparsely puberulent when young, the uppermost usually linear or nearly so 1. *C. gypsophiloides*.

1. Anthocarp about 7 mm. long; leaf blades permanently and densely puberulent, the uppermost ones as broad as the lower 2. *C. crassifolia*.

1. *Cyphomeris gypsophiloides* (Mart. & Gal.) Standl. RED CYPHOMERIS. Perennial herb, suffruticose at the base; stems erect or ascending, much-branched, the branches slender, glaucous, rarely puberulent below; leaves opposite, the slender petioles 5-25 mm. long; blades narrowly deltoid or lanceolate to ovate-deltoid, the upper ones usually linear, 2.5-7 cm. long, 3-30 mm. broad, subcordate to acute at the base, gradually narrowed to an acute or obtuse apex, entire or rarely slightly sinuate, green above, glaucous beneath, glabrous or sparsely puberulent when young; flowers in slender racemes 5-16 cm. long, the flowers remote, on pedicels 1 mm. long; bracts lanceolate or linear, 4-7 mm. long, glabrous; perianth red, 7-9 mm. long, 3 mm. broad, glabrous; stamens long-exserted;

anthocarp 10-12 mm. long, slender-stipitate, 2-2.5 mm. thick; seed obovoid, about 4 mm. long, rounded at the apex, acuminate at the base, brown. Dry rocky slopes and plains in the Trans-Pecos, summer-fall; also s. N.M., s. to Mex.

2. *Cyphomeris crassifolia* (Standl.) Standl. **SINUATE-LOBED CYPHOMERIS**. Perennial herb, suffruticose below, much-branched; stems 6-10 dm. tall, erect, the branches slender, pale-green, finely and sparsely puberulent, the branches of the inflorescence glabrous; leaves opposite, the petioles 5-25 mm. long; blades rhombic to broadly oblong or rhombic-ovate, 1.5-3 cm. long, 1-2 cm. broad, truncate to rounded or broadly cuneate at the base, obtuse at the apex, coarsely sinuate-lobate, green above, paler beneath, densely and finely puberulent; flowers in racemes 5-10 cm. long, on pedicels 1 mm. long; bracts lance-linear, 4-5 mm. long, green, glabrous; perianth pink, 6-7 mm. long, glabrous, the tube very short, the limb 7 mm. broad; stamens 5, long-exserted; anthocarp 7 mm. long, short-stipitate, 2 mm. thick in the widest part. In s. Tex. and Mex.

10. COMMICARPUS STANDL. WARTCLUB

About 16 species, mainly tropical and subtropical in both hemispheres.

1. *Commicarpus scandens* (L.) Standl. **CLIMBING WARTCLUB, PEGA-POLLA**. Perennial herb; stems decumbent or clambering over vegetation, elongated or often vinelike, glabrous or obscurely puberulent about the nodes, pale, slender, much-branched, to 3 m. long; leaves opposite, the slender petioles 1-2.5 cm. long; blades ovate to broadly cordate-ovate or rhombic-orbicular, rather thin and fleshy, bright-green, paler beneath, 1.5-6 cm. long, 1-4.5 cm. broad, acute to acuminate or obtuse at the apex, cordate or truncate at the base; flowers umbellate on slender peduncles 2-4.5 cm. long, the slender pedicels 5-10 mm. long, glabrous; bracts lanceolate or oblong, 2-3 mm. long, green, ciliolate, caducous; perianth greenish-yellow, short-funnelform, 3-4 mm. long and broad, glabrous or obscurely puberulent; stamens 2 or rarely 3, exserted; filaments slender, unequal, connate at the base; anthers didymous; ovary oblique, stipitate, attenuate to a slender style, the stigma peltate; anthocarp 7-10 mm. long, 2 mm. in diameter, narrowly clavate-cylindric, glabrous, bearing a few or numerous glands irregularly scattered along the costae; seeds with the thin testa adherent to the pericarp. Thickets, hillsides, canyons and arroyos from coastal Tex. and the Rio Grande Valley and Plains to the Trans-Pecos, throughout the year; from Tex. to s.e. Ariz. and Baja Calif., s. to Guat., W.I., Bah. I., Col. and Venez. to Peru.

11. ANULOCAULIS STANDL. RINGSTEM

Perennial or biennial gypsophilous herbs from long thick taproot; stems erect, branched, more or less pubescent, the internodes usually with a viscid ring; leaves opposite, petiolate, few, borne near the base of the stem; blades broad, coriaceous, glandular-dentate or denticulate; flowers perfect, bracteate, umbellate or in axillary glomerules or racemose, the inflorescence much-branched, the small bracts scarious or coriaceous; perianth funnel-form, the elongate tube constricted above the ovary, the limb campanulate and 5-lobed; stamens 3 or 4, exserted, the unequal filaments filiform and connate at the base; anthers didymous; styles filiform, the stigma peltate; anthocarp coriaceous, turbinate or biturbinate, 10-striate, glabrous; seed with the thin testa adherent to the pericarp; embryo uncinata, the broad cotyledons enclosing the copious endosperm, the radicle elongate, descending.

About 5 species in southwestern United States and Mexico.

- 1. Limb of perianth as well as the lobes reflexed; anthocarp turbinate 4. *A. reflexus*.
- 1. Limb of perianth funnelform, the lobes ascending (2)
- 2(1). Perianth villous, 8-10 mm. long; leaf blades long-villous beneath, at least when young; flowers mostly in sessile axillary clusters; biennial, no woody caudex 1. *A. eriosolenus*.
- 2. Perianth usually glabrous, 25-35 mm. long; leaf blades glabrous or nearly so; perennials from a woody caudex (3)

- 3(2). Perianth 3-3.5 cm. long, greenish-white suffused with pink toward the limb; anthocarp turbinate 2. *A. gypsogenus*.
 3. Perianth 2.5-3 cm. long, yellow-green; anthocarp biturbinate (4)
 4(3). Perianth glabrous 3. *A. leiosolenus*.
 4. Perianth villous 3. *A. leiosolenus* var.

lasianthus.

1. *Anulocaulis eriosolenus* (Gray) Standl. BIG BEND RINGSTEM. Biennial (or perennial) herb, never forming a gnarled or woody caudex, the stems and leaves usually flushed with pink or rose; stems erect, 2-10 dm. tall, sparsely branched below, the branches very stout, glabrous, with conspicuous glutinous bands at the middle of the stem internodes; leaves opposite, the stout petioles 1-4 cm. long; blades orbicular-oval to ovate-oval, 2.2-10 cm. long, 2-7 cm. wide, cordate or subcordate at the base, rounded at the apex, coriaceous, glandular-denticulate, sparsely scabrous above with stout conic hairs having dark glandular bases, similarly pubescent beneath with longer hairs, glabrate in age; inflorescence paniculately much-branched, the slender branches naked; flowers in axillary and terminal few-flowered clusters, on slender pedicels 2-4 mm. long; bracts ovate-oblong to lance-oblong, 2-3 mm. long, acuminate, scarious, glabrous, usually ciliolate; perianth pink, sometimes white, 1 cm. long, the slender tube long-villous, very abruptly expanded into a nearly rotate limb 1 cm. broad; stamens 5, short-exserted; anthocarp turbinate, 5 mm. long, the summit broadly obtuse or retuse. *Boerhaavia eriosolena* Gray. Bluffs, gypsum-philous soils, in Trans-Pecos Tex. and Mex., throughout the year.

2. *Anulocaulis gypsogenus* Waterfall. GYP RINGSTEM. Perennial herb from a woody root; stems erect, 8-12 dm. tall, glabrous, usually with an irregular glutinous band on each of the internodes; leaves opposite, mostly free from the crowded lower nodes, thus appearing basal; blades ovate-cordate to reniform-cordate, 7-19 cm. long, 6-23 cm. wide, coriaceous, pallid, glabrous; inflorescence in panicles about two thirds the height of the plant, closely several-flowered; floral bracts ovate to ovate-lanceolate, acuminate at the tips; perianth large, 3-3.5 cm. long, greenish-white suffused with pink toward the limb, the lower part tubular, the upper one third funnellform, 5-lobed, the lobes 4 mm. long, each lobe deeply bifid, with a prominent midvein extending through the tube to the triangular sinus; stamens 3, unequal, exserted, 4-6.5 cm. long, the bases of the filaments unequally united into a short hypogynous tube about as long as the ovary; style filiform, extending about 1 cm. beyond the stamens, the stigma minutely capitate; anthocarp turbinate, 5-7 mm. long, 4-5 mm. wide, surrounded just below the middle with a reflexed wing about 1 mm. wide, the lower part of the fruit narrowly conical, the upper part hemispherical, prominently 10-ridged. Obligate gypsophile. Permian gypsum beds of Culberson and Reeves cos., Tex., in adj. Eddy Co., N.M. and as far n. as the gypsum deposits of the Comanchean Bluffs, e. of Roswell, Chaves Co., N.M., June-Nov.

3. *Anulocaulis leiosolenus* (Torr.) Standl. Perennial herb; stems erect, 6-10 dm. tall, sparsely branched below, the branches stout, glaucous and glabrous; leaves opposite, coriaceous, 1 or 2 pairs at the base of the stem; blades reniform to broadly oval or ovate-oval, 3-15 cm. long, 3-12 cm. broad, deeply cordate to truncate at the base, broadly rounded at the apex, yellow-green on the upper surface and when young tomentulose, beneath glaucescent and tomentulose or villous when young but early glabrate and glandular-tuberculate; inflorescence much-branched, the stout branches naked, the flowers fasciculate or in dense spikes and short-pedicellate; bracts minute, ovate, coriaceous, glabrous; perianth yellow-green, 2.5-3 cm. long, glabrous, gradually dilated above into a narrow limb; stamens 5, short-exserted; anthocarp biturbinate, 5-6 mm. long, glaucous, in age developing at the middle a rigid horizontal wing 6-7 mm. in diameter; seed biturbinate, 3 mm. long, pale-brown. Alkaline soils, in gypsum habitats in Hudspeth Co., Tex. and Mex., Aug.-Nov.

Var. *lasianthus* I. M. Johnst. This variety differs from the typical form by having the perianth puberulent or villous instead of glabrous. Isolated in the Big Bend region, Tex.

4. *Anulocaulis reflexus* I. M. Johnst. Perennial herb; stems erect, 3-10 dm. tall, arising from an erect woody caudex, the branches numerous, very smooth, pale, rigid and ascending, the branches glutinous; leaves opposite, in 2 or 4 pairs at the base, 5-15 cm. long, coriaceous, rigid and brittle when dry; blades cordate or cordate-reniform, 4-11 cm. long, 4.5-9 cm. broad, acute to obtuse or rounded at the apex, the margins more or less

irregularly sinuate, obtuse, denticulate, with brown glands, glandular-tuberculate, the tubercles brown; flowers in a nodding lax inflorescence, rarely congested; perianth rose to flesh-pink, the rarely curved tube about 1 cm. long from the base and gradually widening from about 1 mm. at the base to about 2.5 mm. above, the throat exvaginate (being inside out and reflexed and sheathing the upper 1-3 mm. of the perianth tube), the 5 lobes short to elongate, oblong, 5-10 mm. long and about 2.5 mm. wide, reflexed and parallel the commonly somewhat curved tube; perianth parts after anthesis subtubular, erect, 10-14 mm. long, persistent; stamens 3, unequal, about 1 cm. long, exerted and showy; anthocarp turbinate, 6 mm. long, to 4.5 mm. in diameter, narrowly 5-winged around the middle, the lower part conic and 5-costate, the upper part mainly conic-hemispherical and 10-costate. On gypseous shales, in regions between *A. leiosolenus* and its var. in Tex. and Mex., May-Sept.

12. BOERHAAVIA L. SPIDERLING

Perennial or annual herbs, slender, often diffuse; stems branched and forking, variously pubescent or glandular, often with villous areas in the internodes; leaves opposite, petiolate, the pair subequal, entire or sinuate; flowers perfect, very small to 1 cm. broad, bracteate, cymose-paniculate to racemose, on jointed pedicels; perianth corollalike, campanulate or nearly rotate, constricted above the ovary, the limb shallowly 5-lobed, deciduous; stamens 1 to 5, exerted or inclined; filaments unequal, capillary, connate at the base; anthers didymous; ovary oblique, stipitate, the style filiform, the stigma peltate; anthocarp ovoid or obpyramidal, 3- to 5-angulate (5- to 10-ribbed), rarely 3- to 5-winged, glabrous or pubescent, symmetric; seed with the thin testa adherent to the pericarp; embryo uncinata, the cotyledons enclosing the scanty endosperm, the radicle elongate and descending. Also spelled *Boerhavia*.

About 40 species, mostly tropical and subtropical.

1. Anthocarp pubescent; perennials (2)
1. Anthocarp glabrous (3)
 - 2(1). Flowers capitate or glomerate, sessile or short-pedicellate; anthocarp 5-sulcate, densely glandular-puberulent1. *B. coccinea*.
 2. Flowers solitary on long slender pedicels; anthocarp 5-angulate, short-pilose to puberulent or very rarely glabrate2. *B. gracillima*.
 - 3(1). Plants perennial (Doubtful cases should be keyed under both alternatives) (4)
 3. Plants annual (5)
 - 4(3). Leaf blades suborbicular to broadly ovate; flowers in terminal cymes; stamens 5; perianth 8-13 mm. broad3. *B. anisophylla*.
 4. Leaf blades linear to linear-lanceolate; flowers cymose; stamens 3 or 5; perianth 6-14 mm. broad4. *B. linearifolia*.
 - 5(3). Flowers not racemose; stamens equaling or slightly exceeding perianth (6)
 5. Flowers racemose; anthocarp rounded at the apex; stamens included (8)
 - 6(5). Branches of inflorescence glandular-villous; bracts large, as long as the anthocarp, persistent5. *B. purpurascens*.
 6. Branches of inflorescence puberulent or glabrous; bracts very small, much shorter than the anthocarp, often deciduous; anthocarp not winged but 5-angled (7)
 - 7(6). Anthocarp 3-4 mm. long; perianth 1-1.5 mm. long, white tinged with pink; flowers umbellate-cymose; leaf blades broadly ovate to rhombic or deltoid-ovate to oblong6. *B. erecta*.
 7. Anthocarp 2.2-2.7 mm. long; perianth 1.5-2 mm. long, pink; flowers cymose-paniculate or in few-flowered simple umbels; leaf blades oval or broadly oblong to lanceolate or linear7. *B. intermedia*.
 - 8(5). Anthocarp 4-angulate; bracts persistent, equaling the fruit; stamens 3 or 48. *B. Wrightii*.
 8. Anthocarp 5-angulate; bracts deciduous, small; stamens 1 or 29. *B. spicata*.

1. *Boerhaavia coccinea* Mill. SCARLET SPIDERLING. Perennial herb from a stout or slender fleshy or woody root; stems few to numerous, ascending to procumbent or decumbent, 2-15 dm. long, sparsely branched below, green or brownish, minutely puberulent to viscid-puberulent below (especially at the nodes), densely glandular-puberulent to slightly viscid or glabrate above; leaves opposite, the slender or stout petioles 3-40 mm. long and usually villous; blades suborbicular or broadly oval to ovate-oblong, 15-55 mm. long, 8-50 mm. broad, subcordate to truncate or rounded at the base, rounded to acute at the apex, entire to sinuate, thin or rarely coriaceous, bright-green above, pale beneath, epunctate or brown-punctate, glabrous or obscurely puberulent, villous-ciliate, sparsely villous beneath along the veins or often densely hirsute or hirtellous throughout and viscid; inflorescence of lax terminal and axillary cymes, these much-branched, the slender branches ascending or divergent, glabrous, puberulent or densely glandular-puberulent; flowers subsessile to short-pedicellate, in glomerules of 2 to 4 on the ends of filiform peduncles 3-10 mm. long; bracts minute, lanceolate or ovate, viscid-puberulent, deciduous or persistent; perianth purplish-red to reddish-green, 2 mm. broad, minutely glandular-puberulent; stamens 1 to 3, short-exserted; anthocarp narrowly obovoid, 2.5-4 mm. long, rounded at the apex, densely glandular-puberulent or glandular-pilose, 5-sulcate, the angles and sulci smooth. *B. caribaea* Jacq. Waste places, fields and river banks, Pen. Fla., to s. and w. Tex. and s.e. Calif., southw. through Mex. and C.A. to n. and w. S.A.; throughout W.I.; adv. on ballast in e. N.C.; Bah. I.; Virg. Is.; trop. Afr.

2. *Boerhaavia gracillima* Heimerl. Perennial herb, forming bushes to 1 m. in diameter, from a thick woody deep taproot; stems numerous, decumbent or procumbent, 3-15 dm. long, much-branched, the branches slender, minutely and obscurely puberulent or glabrate, very rarely pilose, glaucous or pale-brown; leaves opposite, the stout petioles 3-25 mm. long; blades broadly rhombic to elliptic-oblong or broadly ovate or oval, 24 mm. long, 1.3-5 cm. wide, subcordate or rounded at the base, rounded to acute or abruptly acuminate at the apex, thick and firm, bright-green or glaucous, whitish beneath, epunctate, entire to slightly sinuate, prominently veined, glabrous or puberulent when young; inflorescence of numerous axillary and terminal cymes, these much-branched, the branches very slender, divergent, glabrous; flowers single, usually on elongate filiform pedicels 5-10 mm. long; bracts 1 or 2 at the base of each flower, minute, lanceolate, glabrous, deciduous; perianth deep purplish-red to wine-red, 5-9 mm. broad, puberulent outside or very rarely glabrate; stamens 2 or 3; anthocarp narrowly oblong-obovoid to clavate, 3.5-4 mm. long, rounded at the apex, short-pilose, puberulent or glabrate, 5-angulate, the angles narrowly rounded, smooth, the sulci smooth. Dry plains, fields, rocky hillsides in Trans-Pecos Tex. and s. N.M. and Ariz. to Baja Calif. and s. Mex.

3. *Boerhaavia anisophylla* Torr. Perennial herb from a thick woody root; stems few to many, ascending or procumbent, 1.5-5 dm. long, sparsely branched, the branches slender, grayish, densely puberulent below and hirtellous or glandular-puberulent above; leaves opposite, the stout petioles 2-10 mm. long; blades oval to broadly deltoid or oval-ovate to oblong, 1-3 cm. long, 5-20 mm. wide, cordate or rounded at the base, broadly rounded to obtuse or rarely acute at the apex, entire or sinuate, coriaceous, green above, glaucous below, scaberulous or short-hirtellous, glabrate in age, minutely brown-punctate beneath; inflorescence cymose, much-branched, the branches slender, glandular-puberulent, the flowers subsessile or short-pedicellate, in few-flowered glomerules; bracts lanceolate or ovate, acuminate or attenuate, thin, persistent, purplish-red to pink or white, ciliate; perianth bright-purplish-red to pink or white, 8-13 mm. broad, puberulent outside; stamens 5; anthocarp obovoid-oblong, rounded at the apex, glabrous, 5-angulate, the angles broad, rounded, smooth, the narrow sulci smooth. Dry rocky hillsides, on limestone boulders, Trans-Pecos Tex. and Mex.

4. *Boerhaavia linearifolia* Gray. Perennial low shrubs from a stout woody taproot; stems few to many, slender, diffusely branched at the base, the branches erect or ascending, 3-9 dm. tall, puberulent, hirsute, more or less glandular-viscid or glabrate; leaves opposite, sessile or nearly so; blades linear-lanceolate to lanceolate, 1-3 cm. long, acute at the apex, rounded at the oblique base, usually revolute, either green on both surfaces or green above and paler beneath, usually brown-dotted, thinly coriaceous, glandular-hirtellous or glabrate; inflorescence cymose, much-branched, nearly naked, the slender branches glandular-puberulent to glabrous; peduncles slender; flowers solitary, on pedicels 1-3 mm. long; bracts minute, persistent, lanceolate, attenuate, brown-dotted; perianth purple or red-purple to pink or magenta, 6-9 mm. long, the rotate limb 6-14 mm. broad,

the tube glabrous to sparingly pubescent outside; stamens 5, cream-color, exserted; anthocarp oblong, rounded at the apex, 3 mm. long, 5-angulate, the angles broad, rounded, smooth, the sulci broad and smooth. *B. Lindheimeri* Standl., *B. tenuifolia* Gray. In arid places, rocky bluffs, open draws in deserts, limestone hills in s. and w. Tex., spring-summer; also s.w. N.M. and Mex.

5. *Boerhaavia purpurascens* Gray. PURPLE SPIDERLING. Annual herb; stems erect, 2-5 dm. tall, much-branched below, the branches slender, brown-punctate, puberulent below, densely viscid-villous or glandular-hirtellous above; leaves opposite, the slender petioles 4-22 mm. long; blades oval to oblong, the uppermost ones lanceolate or linear-oblong, 1.2-3 cm. long, 7-20 mm. broad, rounded or obtuse at the base, broadly rounded to very acute at the apex, often apiculate, entire or subsinuate, thin, bright-green above, paler beneath, often brown-punctate, glabrous or obscurely puberulent; inflorescence cymose-paniculate, sparsely branched, the branches ascending, densely glandular-villous with short hairs; flowers short-pedicellate or sessile, densely cymose-glomerulate at the ends of long slender peduncles; bracts oblong or obovate, equaling or exceeding the fruit, persistent, thin, purplish-red, glandular-villous and long-ciliate; perianth 3-4 mm. long, pink, glandular-punctate; stamens 3, equaling the perianth; anthocarp obovoid, 2.5-3 mm. long, rounded at the apex, acute at the base, stramineous, glabrous, 5-angulate, the angles low, acute, smooth, the sulci broad and smooth. Dry gravelly plains and hill-sides in Trans-Pecos Tex. to s.e. Ariz. and Mex.

6. *Boerhaavia erecta* L. Annual or perennial herb, roughish pubescent or glabrous; stems erect or decumbent, 2-12 dm. tall, simple below or branching at the base, the branches decumbent or spreading, often tinged with red, finely puberulent below, the middle internodes often with brown viscid bands, the uppermost internodes glabrous or minutely puberulent; leaves opposite, the slender petioles 4-40 mm. long, about half as long as the blades; blades mostly broadly ovate-rhombic or deltoid-ovate, 2-8 cm. long, 1.4-5 cm. broad, acute or obtuse and apiculate at the apex, the margins entire to repand or undulate, truncate to rounded or acute at the base, bright-green above, paler beneath or glaucous, usually brown-punctate, the uppermost blades smaller and lanceolate or linear; inflorescence cymose, much-branched, the branches slender, erect or ascending, usually glabrous, rarely with viscid internodes; flowers 2 to 6 in a cluster, on pedicels 1-5 mm. long, irregularly umbellate-cymose or subracemose at the ends of long slender peduncles; bracts minute, linear or lanceolate, reddish, persistent; perianth white or tinged with pink to purple, 1-1.5 mm. long, the tube glabrous or glandular-punctate, the limb campanulate, sparingly pubescent; stamens 2 or 3, exserted; anthocarp green, glabrous, narrowly obpyramidal, 3-4 mm. long, 1-1.5 mm. broad at the truncate apex, 5-angled, the angles obtuse or acute and smooth, the sulci coarsely transverse-rugose. In dry fields, on banks and in cult. grounds, from S.C. to Fla., w. to Ark., Tex. and s. Ariz., s. to Mex., through C.A. to S.A. (Venez. and Col.), W.I., Berm.; spring to fall.

7. *Boerhaavia intermedia* M. E. Jones. Annual herb, young plants tend to be erect, older ones become decumbent; stems erect or procumbent, 2-5 dm. tall, much-branched near the base, the branches slender, elongate, loosely ascending, minutely puberulent, often brown-punctate or tinged with red, the middle and upper internodes usually with viscous rings; leaves opposite, the slender petioles 3-25 mm. long; blades of the lower leaves mostly oval or broadly oblong, the others oblong to ovate or lanceolate to linear, 15-45 mm. long, 3-15 mm. broad, rounded or obtuse at the base, broadly rounded to long-attenuate at the apex, rather thin, glabrous or when young obscurely puberulent, entire or subsinuate, green above, paler or often white beneath, frequently brown-punctate (especially on the upper leaves); inflorescence cymose-paniculate, much-branched, the branches slender and ascending, the internodes usually with viscous rings; flowers on slender unequal pedicels 1-3 mm. long, in few-flowered usually simple umbels at the ends of long slender peduncles; bracts minute, lanceolate, glandular-punctate, persistent; perianth 1.5-2 mm. long, pink or whitish, often glandular-punctate; stamens 2 or 3, equaling or slightly longer than the pericarp; anthocarp narrowly obpyramidal, 2.2-2.7 mm. long, yellowish-green or stramineous, glabrous, truncate at the apex, 5-angulate, the angles smooth and obtuse, the sulci narrow and transverse-rugulose. Dry plains and fields, limestone soils on flats, sandstone hills with some volcanic ash, gypseous and carbonaceous soils in w. Tex. to s.w. Calif., s. to Baja Calif., Dgo., Coah. and Chih.

8. *Boerhaavia Wrightii* Gray. Annual herb; stems erect, 2-6 dm. tall, much-branched, the branches slender or stout, ascending, densely puberulent below and often short-

villous, densely glandular-puberulent and villous above; leaves opposite, the petioles 5-20 mm. long; blades ovate to narrowly oblong or lanceolate, the uppermost ones linear, 2-4.5 cm. long, 3-25 mm. broad, truncate or rounded at the base, obtuse or rounded to long-attenuate at the apex, sinuate or entire, rather thin, green above, paler beneath, brown-punctate, puberulent; inflorescence cymose-paniculate, much-branched, the branches slender, glandular-puberulent to viscid-villous or glandular-hirtellous; flowers on pedicels about 1 mm. long, in dense or somewhat interrupted glabrous racemes; bracts about as long as the fruit, persistent, ovate-orbicular or ovate, abruptly acuminate or long-cuspidate, purplish, short-villous and ciliate; perianth pink, 1.5 mm. long; stamens 3 or 4, included; anthocarp broadly oblong, rounded at the apex, 2 mm. long, over 1 mm. thick, glabrous, usually 4-angulate, the angles broad, acute, smooth, the sulci broad and rugulose. Dry gravelly hillsides, limestone soils, Trans-Pecos Tex. and Nev. to s.e. Calif., s. to Son.

9. *Boerhaavia spicata* Choisy. Annual herb; stems erect or procumbent, 2-6 dm. long, much-branched, the branches slender or stout, puberulent to sparsely glandular-hirtellous or densely viscid-puberulent, often tinged with red; leaves opposite, the slender to stout petioles 5-35 mm. long; blades deltoid-ovate to ovate or lanceolate, 1-4.5 cm. long, 4-25 mm. wide, truncate to obtuse at the base, obtuse to rounded or acute at the apex, margins entire to deeply sinuate, green above, paler beneath, usually brown-punctate, puberulent, viscid-puberulent or glabrate; inflorescence racemose to cymose-paniculate, much-branched, the branches slender, glabrous with viscid internodes; flowers with slender pedicels 1-2 mm. long, in short dense or remotely-flowered racemes; bracts inconspicuous, deciduous, pink, broadly ovate to lanceolate, thin, ciliate; perianth minute, pink or rose-violet to rose-lavender or ivory and whitish, 1-1.5 mm. long, puberulent or glabrous; stamens 1 or 2, included; anthocarp narrowly obovoid, 2.5 mm. long, rounded at the apex, acute to acuminate at the base, stramineous, 5-angulate, the angles thin to thick, acute, the sulci broad, open and rugulose. *B. Torreyana* (Wats.) Standl. In sandy and gravelly soils, plains, hillsides and canyon floors, from cen. Tex. to s.e. Calif., s. to Mex.

13. ABRONIA JUSS. SAND VERBENA

Annual and perennial herbs; stems branched, erect or prostrate, sometimes cespitose and apparently acaulescent, pubescent with viscid hairs, leafy or scapose; leaves opposite, the pair usually unequal, petiolate; blades succulent, entire or sinuate-lobed; flowers perfect, capitate, few to many in each head, the heads long-pedunculate, each subtended by usually 5 distinct scarious bracts; perianth funnel-form to salverform, the slender tube elongate and constricted above the ovary, the limb 5-lobate, withering and often persistent after anthesis; stamens usually 5, with linear-oblong included anthers; ovary ovoid, the style filiform, the stigma fusiform, included; anthocarp turbinate or biturbinate, or fusiform, coriaceous or indurate, eglandular, deeply lobed or winged, the wings or lobes 2 to 5; seed adherent by the testa to the pericarp; one of the cotyledons broad, concave, enclosing the farinaceous or mealy endosperm, the other abortive, making the seed appear monocotyledonous, the radicle exterior, elongate and descending.

A North American genus of about 35 species.

1. Anthocarp fusiform, with 2 to 4 large thin reticulate-veined vertical wings, these completely encircling the body and extended above and below it, the body glabrous or sparsely pubescent, coriaceous, spongy or indurate, often costate between the wings; stems more or less pubescent (*Tripterocalyx*) (2)
1. Anthocarp turbinate or biturbinate, coriaceous or indurate, eglandular, deeply lobed or with 2 to 5 wings; stems villous or puberulent (*Eu-Abronia*) (3)
- 2(1). Perianth about 15 mm. long, the limb greenish; anthocarp 1.5-3 cm. long, the body not costate; peduncles short, always shorter than the subtending leaves; perianth densely glandular-pubescent; bracts 6-10 mm. long, lanceolate to lance-ovate1. *A. micrantha*.
2. Perianth 20-35 mm. long, the limb pink; anthocarp 2-3.5 cm. long, the body 3-costate between the wings; stems sparsely pubescent with short conic or very stout hairs; perianth viscid-puberulent; bracts 12-22 mm. long, ovate or lance-ovate2. *A. carnea*.

- 3(1). Annual; perianth usually purplish-red, sometimes white inside but always reddish outside; bracts 6-12 mm. long, narrow, lanceolate or lance-linear; leaf blades usually longer than broad, ovate or oblong to lanceolate-oblong 3. *A. angustifolia*.
3. Perennials; perianth white or rarely purplish-red; bracts usually large and broad; leaf blades mostly ovate-oblong or deltoid-ovate to lanceolate or elliptic (4)
- 4(3). Anthocarp narrowly turbinate; flowers in heads to 5 cm. in diameter; bracts oblong to obovate, 10-16 mm. long, broadly rounded to acutish; perianth orchid-color, 18-25 mm. long, to 10 mm. wide; leaves ovate to suborbicular 4. *A. Ameliae*.
4. Anthocarp biturbinate; flowers in heads to 3 cm. wide; bracts ovate to oval or obovate, acute or acuminate (5)
- 5(4). Bracts 10-20 mm. long; anthocarp 5-10 mm. long; perianth 10-30 mm. long, the limb white or purplish-red and 7-10 mm. long; leaves deltoid to oblong or lanceolate 5. *A. fragrans*.
5. Bracts 5-8 mm. long; anthocarp less than 7 mm. long; perianth 13-15 mm. long, the limb white and 6-7 mm. long; leaves mostly elliptic or lanceolate 6. *A. Carletonii*.

1. *Abronia micrantha* Torr. Annual herb, much-branched; stems stout, 2-5 dm. long, ascending or procumbent, glaucescent, scabrous or viscid-puberulent with short stout hairs, becoming glabrate; leaves opposite, the petioles 1-5 cm. long; blades lance-oblong to ovate or rhombic-ovate, 2.5-6 cm. long, 1-3 cm. wide, broadly cuneate to truncate at the base, narrowed to an obtuse apex, green above, glaucous beneath, scaberulous when young, becoming glabrate, scaberulo-ciliate; peduncles 1-2.5 cm. long, much shorter than the subtending leaves; bracts lanceolate to lance-ovate, 6-10 cm. long, long-attenuate, glabrous or viscid-puberulent, ciliate; perianth about 15 mm. long, viscid-puberulent outside, the limb 3-4 mm. broad, greenish-white; anthocarp 1.5-3 cm. long, usually 3-winged, retuse or rounded at the apex, the body very thick, loosely spongiöse, coarsely rugose or nearly smooth, glabrous or obscurely puberulent, the thin wings finely veined and scaberulo-ciliate; seed narrowly oblong, 6-8 mm. long, obtusely 3-angled, brown. In sandy soils, from w. Kan. to N.D., Mont., Nev., Ut., n. N.M. and n. Tex.

2. *Abronia carnea* Greene. WINGED SAND VERBENA. Annual herb; stems stout, glabrous below, viscid-pubescent above with short conic hairs, erect or ascending, 2-6 dm. long, sparingly branched; leaves opposite, the petioles 2.5-5 cm. long, as long as the blades; blades oblong to oblong-lanceolate or narrowly ovate, 4-7.5 cm. long, 15-35 mm. broad, obtuse or acutish at the apex, the margin undulate, truncate to rounded or acutish at the base and usually unequal, bright-green above, glaucous beneath, scabrous beneath when young, glabrate in age; peduncles 3-11 cm. long; bracts lanceolate or ovate-lanceolate, acute, 12-22 mm. long, abruptly attenuate, very thin, usually glabrous, ciliate; flowers crowded in a head; perianth bright-pink, 2-3.5 cm. long, gradually enlarged upward, viscid-puberulent or short-villous outside, the limb 8-13 mm. broad, the lobes deeply bilobate; anthocarp conspicuous, 2-3.5 cm. long, the 2 to 4 (usually 3) thin membranous wings sharply veined, completely surrounding the achene, scaberulo-ciliate, suborbicular to oval in outline, the body hard and rigid, 3-costate between each pair of wings, glabrous or obscurely puberulent, the terminal flowers of each head rarely producing an elliptic-fusiform exalate fruit; seed narrowly oblong, 8-9 mm. long, rounded at the apex, acute at the base, pale-brown. *Tripterocalyx cycloptera sensu* Standl., non *Abronia cycloptera* Gray, 1853. In dry places, early spring to late summer; Colo., Tex., N.M., Ariz. and Mex.

3. *Abronia angustifolia* Greene. Annual herb, much-branched; stems ascending or decumbent, 1-5 dm. long, densely viscid-puberulent or short-villous, the branches stout or slender; leaves opposite, the slender petioles 1-7.5 cm. long; blades variable in outline, mostly ovate-oblong to lance-oblong, 1.5-5 cm. long, 5-30 mm. wide, subcordate to narrowly cuneate at the base, obtuse to attenuate at the apex, entire or undulate, rarely shallowly lobed, viscid-puberulent or glabrate, often glaucescent beneath; peduncles 2-7 cm. long, viscid-puberulent or densely viscid-villous; bracts lanceolate or lance-linear, 6-12 mm. long, attenuate, greenish, viscid-puberulent; perianth 15-20 mm. long, viscid-villous or puberulent outside, the limb 6-8 mm. wide, purplish-red; anthocarp

about 6 mm. long, broadly turbinate, deeply lobed, thin-walled, villous above, the lobes acutish, ending above the flat disks; seed lance-oblong, 1.5-2 mm. long, dark-brown or black, lustrous. *A. Torreyi* Standl. In sandy soils, Trans-Pecos Tex. to s. Ariz. and s. into Mex.

4. *Abronia Ameliae* Lundell. AMELIA'S SAND VERBENA. Perennial coarse herb, spreading; stems to 6 dm. high or long, viscid throughout, thick, villous, the hairs variable in length and gland-tipped; leaves opposite, the petioles 1-8.5 cm. long, the lower ones exceeding the blades; blades fleshy, drying chartaceous and brittle, concolorous, ovate to elliptic or orbicular, 3-8 cm. long, 2-6 cm. wide, rounded at the apex, subcordate or subtruncate and decurrent at the base, margins conspicuously sinuate, sparsely viscid-pubescent on both surfaces with short hairs, costae and veins nearly plane; peduncles rather slender, viscid-puberulent, 2.5-12 cm. long; bracts 5 to 7, pale greenish to orchid-color, thin, oblong to elliptic or obovate, 10-16 mm. long, 5-10 mm. wide, the apex broadly rounded and acutish, viscid-villous outside; flowers numerous, forming heads 5 cm. in diameter; perianth orchid-color (tube and limb), 18-25 mm. long, viscid-villous, the tube slender, the limb 1 cm. wide; stamens 5, included; anthocarp narrowly turbinate, 7-9 mm. long, 3-4.5 mm. wide at the apex, 5-winged, not narrowed at the apex, attenuate at the base, the apex rounded or truncate, reticulate-veined, glabrous or with a few scattered hairs at the apex only; seed oblanceolate-oblong, about 25 mm. long. In sandy live oak belts and breaks, in deep sands and along roadsides, from the Rio Grande Plains to the Panhandle, e. to Leon Co., Mar.-June; endemic.

5. *Abronia fragrans* Hook. SNOWBALL, SWEET SAND VERBENA. Perennial herb from an elongate woody root; stems few or numerous, 2-10 dm. long, erect or procumbent, branched, often whitish in color, viscid-puberulent or villous below, rarely glabrate, densely viscid-villous above; leaves opposite, 2-9 cm. long, variable in shape, mostly ovate-oblong or narrowly deltoid-ovate, truncate to rounded or rarely subcordate at the base, rounded or acute at the apex, viscid-puberulent to glabrous; bracts 1-2 cm. long, 4-12 mm. wide, oval-ovate to obovate, acute or acuminate; flowers in heads, numerous in each involucre, fragrant, nocturnal; perianth viscid-puberulent, 1-3 cm. long, the tube gradually enlarged upward, white tinged with pink or lavender, or sometimes greenish to reddish; anthocarp 5-10 mm. long, longer than wide, usually biturbinate and pubescent, narrowing both ways from the middle, the lobes narrowly 5-winged, the wings not prolonged over the top or crested or coarsely wrinkled; seed obovate, 2.5-3 mm. long, dark-brown, lustrous. *A. robusta* Standl., *A. speciosa* Buckl., *A. texana* Standl. Dry ground, grows wherever sandy soils are found in Tex., especially from Rio Grande Plains to the Trans-Pecos, Mar.-Aug.; from S.D. to Ida., s. to Tex. and Mex.

Selections for color made by Edward Lasater of Falfurrias, who by publications made this species a favorite among floriculturists and horticulturists.

6. *Abronia Carletonii* Coult. & Fish. Perennial herb; stems 2-5 dm. tall, few to many, ascending or procumbent, stout or slender, whitish, viscid-puberulent; leaves opposite, the petioles 1-2 cm. long, shorter than the blades, puberulent; blades 1-4 cm. long, 4-10 mm. wide, rounded to cuneate at the base, thick and succulent, puberulent or glabrous, concolorous; peduncles slender, 2-5 cm. long, viscid-puberulent; bracts 5-8 mm. long, ovate or oval-ovate, acute or attenuate at the apex, scarious; perianth whitish or rose-colored to white, viscid-puberulent or short-villous, the tube slender, the limb 6-7 mm. broad, white; anthocarp biturbinate, 4-5 mm. long, the lobes compressed and coarsely reticulate-veined, narrowed but sometimes subtruncate above and compressed at the apex, brownish-olivaceous or stramineous; seed elliptic-oblong, 2 mm. long, nearly black, lustrous. *A. Nealleyi* Standl. Open dry ground in the Trans-Pecos; also e. Colo.

FAM. 64. BATACEAE MEISN.

SALTWORT FAMILY

Maritime somewhat woody-succulent dioecious plants; leaves opposite, exstipulate, fleshy, semiterete, linear to clavate, smooth and glabrous, entire, with a small basal loose flange; flowers small, crowded in axillary sessile or short-peduncled conelike spikes; *staminate spikes* with persistent imbricate scales each subtending a flower; calyx cup-shaped, 2-lobed; corolla absent; stamens 4 or 5, inserted at base of calyx; filaments thick,

alternating with staminodia; *pistillate inflorescence* conelike, 4- to 12-flowered, the scales deciduous, the flowers each consisting of merely a 4-celled ovary with a sessile stigma; ovule 1 in each cell; fruit a fleshy cone.

A monotypic family. Also spelled Batidaceae.

1. BATIS L.

Characters of the family. Monotypic. A second species of dubious merit has been described recently from the Old World.

1. *Batis maritima* L. VIDUILLUS. Plant pale-green, shrublike, strong-scented, with spreading or prostrate often creeping stems to 15 dm. long, the stem commonly rooting at tip and forming large colonies; leaves curved, to 25 mm. long; spikes ovoid-cylindric, 5-10 mm. long; bracts reniform to suborbicular, often apiculate; fruit ovoid to oblong-ellipsoid, 1-2 cm. long, short-stalked, drooping. In salt flats and along muddy flats of the seashore in s. Tex., June-Aug.; widespread on coastal strands in this hemisphere and in H.I.

FAM. 65. PHYTOLACCACEAE R. BR.

POKEWEED FAMILY

Herbs, shrubs, vines or trees, with alternate entire or somewhat undulate mostly exstipulate leaves and perfect or unisexual flowers; calyx 4- or 5-parted, its segments imbricated in bud; petals wanting; stamens as many as the calyx segments and alternate with them, sometimes more numerous, hypogynous or epigynous in *Agdestis*, the filaments distinct or united at base; anthers 2-celled, the sacs longitudinally dehiscent, often nearly separated; ovary several-celled in most of the genera; fruit various.

About 100 species in 12 or more genera, mostly in the tropics.

- 1. Ovary inferior or mostly so; leaves cordate at base; plants scandent; fruit dry, 1-seeded 1. *Agdestis*, p. 600.
- 1. Ovary superior; leaves not cordate; plants usually shrubby (2)
- 2(1). Stems woody, persistent; branches spinose; flowers in abbreviated racemes mostly less than 1 cm. long 2. *Phaulothamnus*, p. 601.
- 2. Stems more or less herbaceous, from a perennial rootstock; branches not spinose; flowers in conspicuous elongated lax racemes or spikes (3)
- 3(2). Flowers subsessile, appressed to the rachis; fruit dry 3. *Petiveria*, p. 601.
- 3. Flowers noticeably pedicellate, not appressed to rachis; fruit baccate (4)
- 4(3). Fruit simple; stamens 4; plant rarely more than 1 m. tall 4. *Rivina*, p. 601.
- 4. Fruit compound; stamens 6 or more; plant much more than 1 m. tall 5. *Phytolacca*, p. 601.

1. AGDESTIS DC.

A monotypic American genus. Considered by some authors to be a member of the Basellaceae; by others to comprise a separate family, Agdestidaceae. Frequently cultivated.

1. *Agdestis clematidea* DC. HIERBA DEL INDIO, ROCKROOT. Plants scandent, climbing to 15 m. or more, the stems copiously branched and mostly herbaceous; roots large, gray, turbinate; leaves long-petioled, ovate to reniform, broadly cordate to somewhat truncate at base, obtuse and apiculate at apex, to about 9 cm. long and wide; panicles many-flowered, mostly about 1 dm. long; flowers perfect, white or greenish-white, stellate, about 12 mm. across, with a slight fetid odor; sepals 4 or 5, oblong to oval, 4-6 mm. long, spreading, persistent and becoming papery; stamens 14 to 20, the filaments slender and the anthers narrow; ovary inferior or mostly so, the style short and the stigmas narrow and introrse; achene turbinate, 1-seeded, the elliptic wings about 6 mm. long and 3 mm. wide. Waste places in e.-cen. Tex., July-Sept.; also Fla. and the Am. trop.

2. PHAULOTHAMNUS GRAY

A monotypic American genus. Placed by some authors in the segregate family Achatocarpaceae.

1. *Phaulothamnus spinescens* Gray. SNAKE-EYES, PUTIA. A diffusely branched erect glabrous shrub to 25 dm. tall, with gray spreading spinescent branches; leaves alternate, deciduous (in ours), spatulate to oblanceolate, rounded to somewhat retuse and mucronate at apex, to 35 mm. long and 12 mm. wide above the middle; flowers sessile, small, unisexual, as many as 12 in short bracteate racemes; calyx segments 4, imbricated and persistent, suborbicular to obovate, concave, with scarious margins, about 2 mm. long; stamens about 12; ovary 1-celled; stigmas 2, filiform; fruits globose, slightly compressed, thin-coriaceous, juicy, transparent, indehiscent, 1-seeded, about 5 mm. in diameter. In clayey soils in s. Tex., Aug.-Sept.; also n. Mex.

3. PETIVERIA L.

A monotypic American genus. Placed by some authors in a separate family, Petiveriaceae.

1. *Petiveria alliacea* L. GARLIC-WEED, HERBA DE LAS GALLINTAS. Perennial erect herbs with the odor of garlic, to 1 m. high; stem slender, ascending or erect, more or less herbaceous, simple or sparsely branched, puberulent to glabrate; leaves short-petiolate, alternate, elliptic to rarely obovate, essentially glabrous, acute to acuminate at apex, to 15 cm. long and 7 cm. wide; stipules minute; spikes to 4 dm. long, bracted, puberulent; flowers subsessile, perfect; calyx 4-parted, the segments linear, 3-4 mm. long, spreading and whitish in flower, erect and greenish in fruit; stamens 4, the filaments subulate, the anthers linear and deeply cleft at apex and base; achenes about 8 mm. long, cuneate, striate, apically notched, appressed to the axis of the spike, the 6 terminal reflexed bristles about 4 mm. long; seed solitary, linear. In dense thickets and open woods in extreme s. Tex., June-Aug.; also Fla. and trop. Am.

4. RIVINA L.

About 5 species in tropical and warm-temperate regions. Placed by some authors in the Petiveriaceae.

1. *Rivina humilis* L. PIGEON-BERRY, ROUGE-PLANT, CORALITO. Stems from a thick perennial rootstock, glabrate or rarely prominently pubescent, erect or becoming vinelike with spreading branches, to 15 dm. tall, usually much smaller; leaves petiolate, alternate, bright-green, ovate to ovate-lanceolate, acute to acuminate at apex, broadly rounded to truncate at base, to 15 cm. long and 9 cm. wide, commonly undulate; pedicels 2.5-4 mm. long, with a minute bracteole just beneath the calyx; flowers white, greenish or rose-color, in axillary or terminal racemes; sepals 4, cuneate to linear-oblong, 2-2.5 mm. long, partly enclosing the simple fruit or reflexed at maturity; stamens 4; berry red or orange-color, 2-3.5 mm. in diameter. *R. laevis* L., *R. portulacoides* Nutt. In moist or alluvial soils, chaparral hills, usually in partial shade of trees or shrubs, in cen., s. and w. Tex., rare eastw., Mar.-Oct.; from Fla. to Tex. and Ark., throughout trop. Am.

Two strikingly distinct forms sometime occur together—plants with reddish-purple flowers and red fruits; plants with white flowers and deep orange-color fruits. The red fruits contain a dark-red juice that yields a dye.

5. PHYTOLACCA L.

About 35 species in tropical and warm-temperate regions.

1. *Phytolacca americana* L. POKEWEEED, POKEBERRY. Plant glabrous, with an unpleasant odor and a large poisonous perennial rootstock (to 15 cm. in diameter) from which arise stout purplish leafy stalks to 3 m. tall; leaves typically elliptic-lanceolate but sometimes ovate-lanceolate, cuneate or sometimes broadly rounded at base, acuminate at apex, to about 25 cm. long and 1 dm. wide; pedicels about 1 cm. long, with 1 or more bracteoles

about the middle; sepals 5, white or pinkish, suborbicular, petaloid, 2-3 mm. long; stamens and styles 10, the ovaries green; berries in long lax racemes, dark-purple, 8-10 mm. in diameter. *P. decandra* L., *P. rigida* Small. Throughout most of Tex. in rich low ground, especially in recent clearings and along roadsides, July-Oct.; from Fla. to Tex., n. to N.E., s. Que., N.Y. and s. Ont.

The very young sprouts, when *properly* and *safely* prepared, are used as a potherb; otherwise, they should not be eaten. *Phytolacca rigida* is described as having permanently erect, not nodding, fruiting racemes and a berry longer, not shorter, than its stalk.

FAM. 66. AIZOACEAE RUDOLPHI CARPET-WEED FAMILY

Annual or perennial often succulent herbs with stems mostly prostrate or ascending; leaves opposite or whorled, entire, with the base of the petioles sometimes dilated; stipules none or (when present) scarious; flowers solitary or clustered in the axils, regular and perfect; calyx 4- or 5-lobed or -parted, the tube free or adnate to the ovary; petals none (in ours); stamens few to many, inserted on the floral cup or hypogynous, the 2-celled anthers oblong or linear; ovary 1- to 20-celled, superior or only half-superior in *Sesuvium*; styles as many as the cells of the ovary; fruit a thin-walled capsule, dehiscent loculicidally or septicidally; seeds mostly numerous.

A family of 130 or more genera and about 1200 species, mainly of the Southern Hemisphere and tropical regions.

- 1. Leaves whorled; capsule dehiscent by valves (2)
- 1. Leaves opposite, commonly unequal; capsule circumscissile (3)
- 2(1). Plants glabrous; flowers with a filiform pedicel; sepals distinct to base; seeds without a strophiole1. *Mollugo*, p. 602.
- 2. Plants tomentulose; flowers essentially sessile; calyx cleft only to middle; seeds with a strophiole2. *Glinus*, p. 603.
- 3(1). Stipules present; ovary 1- or 2-celled; seeds several .3. *Trianthema*, p. 603.
- 3. Stipules none; ovary 3- to 5-celled; seeds numerous ...4. *Sesuvium*, p. 604.

1. MOLLUGO L. CARPET-WEED

Annual nonsucculent profusely branched herbs; leaves rosulate, verticillate or opposite; flowers small, perfect, apetalous, axillary or cymose, with a long filiform pedicel; calyx 5-parted, persistent, the sepals scarious-margined; stamens 3 to 5, rarely more, hypogynous; ovary 3-celled, superior; capsule ovoid to ellipsoid, thin-walled, 3-valved, loculicidally dehiscent; seeds numerous, not strophiolate.

About 20 species, mostly natives of tropical and subtropical regions.

- 1. Stem leaves all linear; sepals with reticulate nerves; stamens usually 5; seeds 0.4 mm. long or less, finely reticulate1. *M. Cerviana*.
- 1. Stem leaves with some spatulate or narrowly oblanceolate; sepals with 3 parallel strong nerves; stamens 3 or 4; seeds 0.5 mm. long or more, provided with several parallel ridges2. *M. verticillata*.

1. *Mollugo Cerviana* (L.) Sér. **THREADSTEM CARPET-WEED.** Annual herb with numerous ascending filiform branches to 2 dm. long; leaves glaucous; basal leaves forming a rosette, linear-spatulate to narrowly oblanceolate, to 15 mm. long and 3 mm. or more broad; stem leaves whorled, linear, to 2 cm. long and 1.5 mm. broad; flowers verticillate, with capillary pedicels often longer than the leaves; sepals elliptic to elliptic-obovate, about 1 mm. long, reticulate-nerved; stamens usually 5; capsule subglobose, 1.5-1.8 mm. in diameter; seeds finely reticulate. A weed of warm-temp. and trop. regions that occurs in sandy fields of s. Tex. and on dunes and in dry canyons of the Trans-Pecos, Aug.-Sept.

In Texas, this plant occurs in sandy desert brushlands usually distant from habitations, and it has all the appearance of being a native species.

2. *Mollugo verticillata* L. **INDIAN CHICKWEED.** Annual herb, glabrous throughout; stems dichotomously branched, prostrate or ascending, to 2 dm. long; leaves verticillate, 3 to

6 in a whorl, spatulate to narrowly oblanceolate or sometimes linear, obtuse at apex, narrowed to a short petiole, to 3 cm. long and 1 cm. wide; flowers 2 to 5 from each node, with filiform pedicels to 14 mm. long; sepals oblong or elliptic, to 2.5 mm. long and 1 mm. broad; stamens usually 3; capsule ovoid to ellipsoid, slightly exceeding the sepals; seeds minute, reniform, dark-reddish-brown, smooth and shining, ridged along the back and sides or rarely without ridges. In waste places and cult. grounds, open sandy woods and brushlands, and on dunes throughout Tex., year around; throughout temp. and trop. Am.

2. GLINUS L.

Annuals with the general habit of *Mollugo*, pubescent or glabrous; leaves verticillate, unequal, entire; flowers in dense glomerules in the leaf axils of upper nodes, on short peduncles; calyx free from the ovary, the 5 sepals distinct; petals none; stamens 3 to 10 or rarely more; ovary superior; fruit a loculicidal 3-valved capsule; seeds numerous, minute, smooth or tuberculate, with a distinct strophiole, the funiculus large, coiled about the seed.

A genus of 12 species, widely distributed in tropical and warm temperate regions.

1. Seeds blackish-brown, tuberculate 1. *G. lotoides*.
 1. Seeds reddish or light-brown, smooth or sometimes pebbly
 2. *G. radiatus*.

1. *Glinus lotoides* L. Plants cinereous-tomentose with branched hairs; stems diffusely branched from the base, prostrate or ascending, to about 35 cm. long; leaves pseudoverticillate, narrowly to broadly obovate, rounded or abruptly acute at the apex, narrowed below to a slender petiole of about equal length, to 25 mm. long and 15 mm. broad; flowers stoutly pedicellate or essentially sessile, in axillary glomerules; sepals lanceolate, stellate-tomentose, to 7 mm. long and 3 mm. broad; stamens 5 to 10; capsule ellipsoid, to 4.5 mm. long; seeds black, tuberculate. Waste places in e.-cen. Tex.; an Old World species that has become introd. in various parts of N.A.

2. *Glinus radiatus* (R. & P.) Rohrb. Annual herb with stellate-tomentose foliage; stems to 5 dm. long; leaves with slender petioles to 6 mm. long, elliptic to obovate or broadly spatulate, rounded to acute or apiculate at apex, to 25 mm. long and 15 mm. wide; flowers in clusters of 10 or more; calyx lobes oblong-elliptic to lanceolate, about 2.7 mm. long, stellate-tomentose; stamens 3 to 5, shorter than the calyx lobes; filaments filiform, about 1 mm. long; anthers about 0.5 mm. long; capsule ellipsoid, 3-3.5 mm. long; seeds numerous, brown, smooth and shining, sometimes pebbly, about 0.4 mm. long. *G. Cambessedesii* Fenzl. In muddy or sandy soils in s. and e. Tex., Apr.-Oct.; from Tex. through Mex. and the W.I. to S.A.

3. TRIANTHEMA L.

About 20 species, with all but ours in tropical and temperate regions of the Old World.

1. *Trianthema Portulacastrum* L. HORSE PURSLANE, VERDOLAGA BLANCA. Annual succulent herb, glabrous, branching from the base; branches decumbent, sometimes to 1 m. long; leaves opposite, in unequal pairs, broadly obovate to suborbicular-obovate or the smaller ones narrower, rounded to notched or apiculate at the apex, the blades to 4 cm. long and 3 cm. wide, with smaller ones on the axillary branchlets; petioles about equaling the blade, dilated at the base; stipules scarious, entire; flowers sessile and usually solitary in the leaf axils, partly concealed in the petiolar sheath; calyx lobes 5, ovate-lanceolate to lanceolate, concave, about 2.5 mm. long, pinkish-purple within, with a dorsal mucronation near the apex; petals none; stamens 5 to 10, perigynous, alternating with the calyx lobes when the same number; ovary superior; capsule about 4 mm. long, cylindrical, somewhat curved, the winged appendages at the apex prominent; seeds reniform, black, rough, about 2 mm. in diameter. In sandy soils of thickets, on dunes and in waste grounds along streams, mostly in s. and w. Tex., May-Oct.; from Fla. to Calif., s. through Latin Am.; also Old World trop.

4. SESUVIUM L. SEA PURSLANE

Annual or perennial succulent herbs or undershrubs, with prostrate or ascending to suberect stems and branches; leaves opposite, fleshy, without stipules, the petiole often dilated and sometimes connate at the base; flowers solitary in the leaf axils, sessile or with short stout pedicels; calyx tube turbinate, adnate below to the ovary; calyx lobes 5, usually horned on the back near the apex; petals none; stamens 1 to many, perigynous, sometimes slightly united into phalanges, the filaments filiform; ovary half-superior, 2- to 5-celled with as many styles; capsule membranaceous, 2- to 5-celled, ovoid, circumscissile; seeds stalked, usually many in each cell, minute, smooth or rarely rugose.

About 10 species widely distributed but mainly maritime or in saline soils in warm temperate, tropical or subtropical America.

1. Stamens 5 (2)

1. Stamens numerous (3)

2(1). Seeds smooth; in southeast corner of Texas1. *S. maritimum*.

2. Seeds conspicuously rugose; in extreme south Texas ...2. *S. trianthemoides*.

3(1). Flowers all distinctly pedicelled; stems rooting at nodes3. *S. Portulacastrum*.

3. Flowers both sessile and with stout inconspicuous pedicels; stems not rooting at nodes (4)

4(3). Distribution in west and northwest Texas; leaves mostly oblanceolate; plants usually drying light-brown4. *S. verrucosum*.

4. Distribution primarily on or near the coast in south Texas (*S. erectum* extending inland along the Rio Grande in Trans-Pecos region); plants drying blackish or dark-gray (5)

5(4). Plants prostrate to decumbent densely covered with crystalline globules; leaves sessile, mostly all linear-oblong5. *S. sessile*.

5. Plants typically erect to erect-spreading, sometimes decumbent, sparsely covered with crystalline globules; leaves mostly oblanceolate .6. *S. erectum*.

1. *Sesuvium maritimum* (Walt.) B.S.P. Plant glabrous and succulent throughout; stems prostrate, procumbent to ascending at tips, freely branched, sometimes forming mats to 2 m. in diameter; leaves spatulate to narrowly oblanceolate or obovate, rounded to obtuse at the apex, tapering at base to a short clasping petiole, to about 25 mm. long; flowers usually solitary in leaf axils, sessile; calyx lobes ovate to ovate-oblong, obtuse, with a subapical dorsal prolonged appendage, pink or purplish within, 2-3 mm. long; stamens 5; capsule ovoid, about 4 mm. long; seeds brownish-black, smooth and somewhat iridescent, 1 mm. long or less. On sea beaches and low sandy banks near and along the coast in s.e. Tex., flowering the year around; from N.Y. to Fla. and Tex.; also W.I.

2. *Sesuvium trianthemoides* Correll. Plant annual, fleshy, brown when dry, branched from the base, the herbage with scattered large crystalline globules; stems to 35 cm. long or more, the internodes 4-5 cm. long; leaves opposite, oblanceolate to spatulate, obtuse at apex, at least 3 cm. long (including the petiole) and 1 cm. wide above the middle, tapered below into a conspicuous petiole; petiole broadly scarious-winged at base and clasping; flowers solitary in the axils of leaves and branches, sessile; calyx lobes triangular-ovate, subacute at apex, strongly nerved, about 3.5 mm. long, with hyaline margins, the dorsal apical appendage small; stamens 5, with slender filaments about 1 mm. long; ovary ovoid, 2-celled; styles 2, about 0.5 mm. long; capsule ovoid-ellipsoid, pointed at apex, 4-5 mm. long, circumscissile; seeds about 10 in each capsule, about 1.5 mm. long, conspicuously rugose with brownish granular irregular ridges, with additional light patches extended in irregular lines from the hilum. In dunes of s. Tex., June-Aug.; endemic.

3. *Sesuvium Portulacastrum* L. CENICILLA. Glabrous fleshy perennial herb; stems trailing, much-branched, often rooting at the nodes, sometimes forming patches 2 m. across; leaves narrowly oblong to oblanceolate or elliptic-obovate, to 6 cm. long and 25 mm. broad, obtuse-rounded to abruptly acute at apex, tapered into a clasping base (with these commonly overlapping); flowers pedicelled, solitary in the leaf axils; calyx lobes

broadly ovate-lanceolate to lanceolate, to 1 cm. long and 6 mm. broad, hooded, pink-purple within, often strongly veined, with a subapical dorsal prolonged appendage; stamens numerous, the filaments about 5 mm. long, the oblong-elliptic anthers about 1 mm. long; ovary ovoid-globose, about 3 mm. long and thick; styles sometimes distinct to base; capsule conic, about 1 cm. long and 5-6 mm. in diameter; seeds black, smooth and lustrous, 1.2-1.5 mm. long. On beaches and in sand or clay dunes along the coast in Tex., rarely inland, flowering the year around; from Fla. to Tex., s. to S.A.; also the Old World trop.

4. *Sesuvium verrucosum* Raf. Freely branched prostrate perennial herb; stems to 9 dm. long, smooth and usually more or less finely verrucose with crystalline globules, when dry brownish-tan to light-grayish-tan in color; leaves oblanceolate to oblong-ovate or sometimes with some linear-oblong, rounded to somewhat subacute at apex, tapered into an expanded scarious clasping base, to 3 cm. long and 1 cm. wide above the middle, those of the branchlets mostly shorter than the internodes; flowers subsessile or with a short stout pedicel; calyx lobes broadly ovate-elliptic to ovate-lanceolate, 4.5-7 mm. long, hooded, with a subapical dorsal prolonged appendage; stamens numerous; capsule conic, about 5 mm. long and 3 mm. in diameter; seeds black, smooth and lustrous, about 1 mm. long. In saline and alkaline soils about lakes, in creek bottoms and on mud flats and clay dunes in w. and n.w. Tex., Apr.-Aug.; a plant of the interior from Mo. and Ark. to Tex., N.M., Ariz. and Calif.; also n. Mex.

5. *Sesuvium sessile* Pers. Succulent sprawling much-branched perennial that spreads by rhizomes, forming mats to 6 dm. or more in diameter, the herbage densely covered and almost completely concealed by crystalline globules, when dry dark-gray to almost blackish; stems prostrate and ascending at tips; leaves essentially sessile, linear to narrowly linear-oblong or some narrowly oblanceolate, obtuse at apex, to 3 cm. long, mostly less than 3 mm. wide, those of the branchlets longer than the internodes; flowers sessile or with short stout pedicels; calyx lobes mostly oblong-elliptic, obtuse, 4-7 mm. long, the outer surface densely covered with crystalline globules, pink within, with a subapical dorsal prolonged appendage; stamens numerous, the anthers pink; capsule triangular-ovoid, about 4 mm. long and 3 mm. wide at base; seeds dark-brown, about 1 mm. long. In moist saline soils about lakes and lagoons, on flats and clay dunes and in open grassy woodlands in extreme s. Tex., very rare inland, flowering the year around; from Tex. to Calif., s. to S.A.

6. *Sesuvium erectum* Correll. Perennial, typically erect to erect-spreading or sometimes decumbent, more or less adorned throughout with crystalline globules; when dry brownish-black to dark-gray; stems to 5 dm. or more long; leaves linear-oblong to oblanceolate or spatulate, obtuse at apex, tapered below to a clasping base, to 4 cm. long and 8 mm. wide; flowers numerous, in the axils of leaves and branches, sessile or with pedicels rarely to 5 mm. long; calyx lobes broadly elliptic to ovate-lanceolate, obtuse to subacute at apex, rose-purple within, 4-8 mm. long, with a subapical dorsal appendage about equal to or greatly exceeding the sepal apex; styles 3 to 5, conspicuous, typically black when dry; stamens numerous; capsule ovoid, blunt and truncate at apex, about 5 mm. long and 3 mm. in diameter; seeds black, plump, about 1 mm. long. Along canals, on shell deposits, and about ponds and in depressions in dunes and sand hills on and near the coast in s. Tex. with an extension inland along the Rio Grande to the Trans-Pecos, Apr.-July; undoubtedly also in n.e. Mex.

FAM. 67. PORTULACACEAE JUSS.⁵⁵

PURSLANE FAMILY

Annual or perennial herbs or rarely shrubs, glabrous or rarely pilose at the nodes, more or less succulent; leaves opposite, alternate or in basal rosettes, entire, often fleshy; stipules scarious, lacerate or modified into hairs, or none; flowers solitary, racemose, paniculate or cymose, terminal or axillary, perfect, regular or nearly so; sepals (sometimes interpreted as bracts) usually 2, persistent or deciduous, scarious or herbaceous; petals (sometimes called sepals) usually 4 or 5, often fugacious or dehiscent; stamens inserted with the petals, sometimes adnate at the base, of the same number as the petals or usually more; filaments filiform; anthers 2-celled, dehiscent longitudinally; ovary 1-celled, superior

⁵⁵ Ref.: Percy Wilson in N. Am. Fl. 21: 279-336. 1932.

or (in *Portulaca*) partly or wholly inferior; styles 2 to 7, more or less united; ovules 2 to many, on a central or basal placenta; fruit a loculicidal or circumscissile capsule, the valves as many as the styles; seeds 3 to many or (by abortion) 1 or 2, mostly round-reniform, compressed, lenticular, the testa often crustaceous and sometimes strophiolate.

A family of at least 19 genera and more than 350 species that are worldwide in distribution.

1. Ovary partly or wholly inferior; capsule circumscissile . . . 1. *Portulaca*, p. 606.
1. Ovary superior; capsule valvate, splitting from the top downward (2)
- 2(1). Sepals deciduous; seeds wingless 2. *Talinum*, p. 608.
2. Sepals persistent (3)
- 3(2). Plants shrubby, the base and older stems woody and dry; capsules with 6-valved endocarp; seeds uncinatate or arcuate; distribution in Trans-Pecos Texas 3. *Talinopsis*, p. 610.
3. Plants herbaceous throughout, succulent; capsules without endocarp; seeds orbicular; distribution in eastern third of Texas 4. *Claytonia*, p. 610.

1. PORTULACA L.⁵⁶ PURSLANE

Diffuse or ascending annual or perennial succulent herbs; leaves alternate or opposite, flat or terete, often in whorls around the flowers; stipules scarious or none, or reduced to hairy tufts; flowers perfect, solitary or crowded at the top of the stem and branches, of various colors; calyx 2-cleft; petals 4 to 6, usually 5; stamens 8 to many, inserted at the base of the petals; ovary partly or wholly inferior; styles 3 to 9; ovules numerous; capsule 1-celled, membranous, circumscissile, many-seeded; seeds reniform or cochleate, with a smooth or minutely tuberculate or sometimes echinate testa.

About 200 species of world-wide distribution, mostly tropical and subtropical.

1. Lower valve of capsule with an expanded circular membranaceous wing just below its rim; annual 1. *P. umbraticola*.
1. Capsule rim without a subtending wing (2)
- 2(1). Leaf axils and inflorescence glabrous or inconspicuously short-pilose; leaves obovate-cuneate to spatulate, thick but flat; annuals (3)
2. Leaf axils and inflorescence conspicuously villous with long white kinky hairs; leaves linear to narrowly oblanceolate, terete to subterete (4)
- 3(2). Seeds usually iridescent, when viewed at low magnification with minute ridges converged into peglike projections that are not crowded, very nearly to fully 1 mm. in greatest diameter; style lobes usually 3 or 4 . . . 2. *P. retusa*.
3. Seeds dark-brown, rounded tuberculate, the tubercles crowded, usually distinctly less than 1 mm. in diameter; style lobes usually 5 or 6 3. *P. oleracea*.
- 4(2). Plant perennial, the taproot and roots tuberous-thickened; stems mostly strictly erect or ascending, more or less woody at base; petals copper-colored or bronze, 7-12 mm. long; capsules mostly more than 3.5 mm. in diameter 4. *P. suffrutescens*.
4. Plants annual, the taproot not tuberous-thickened; stems mostly decumbent or spreading-ascending; petals seldom more than 6 mm. long; capsules less than 3.5 mm. in diameter (5)
- 5(4). Petals yellow to bronze, less than 3 mm. long; capsules 2 mm. or less in diameter 5. *P. parvula*.
5. Petals red-purple, 3 mm. or more long; capsules more than 2 mm. in diameter 6. *P. mundula*.

1. *Portulaca umbraticola* H.B.K. A glabrous prostrate to erect or ascending fleshy annual, with angled stems; leaves rather few, the blades flat, sessile, the lower spatulate

⁵⁶ Ref.: C. Diego Legrand in An. Mus. Hist. Nat. (Montevideo) 7: 1-147. 1962.

or obovate and obtuse to rounded, the upper oblanceolate to oblong and often acute, 1-3 cm. long, 2-11 mm. broad; flowers clustered at the ends of the branches; sepals ovate, obscurely carinate; corolla yellow or orange and partly red; petals spatulate or obovate, acutish or cuspidate; stamens 7 to 27; styles 3 to 6; capsule circumscissile at the middle or above, the rim crowned by a narrow wing, the lid flattish; seeds gray, tuberculate. *P. lanceolata* Engelm., *P. coronata* Small. In sandy soils in prairies, mesquite thickets and salt marsh areas throughout most of Tex., Mar.-Nov.; from Tex. to Ariz. and Baja Calif.; also Ga., Cuba and Jam.

2. *Portulaca retusa* Engelm. Plant glabrous, rather stout, annual, similar to *P. oleracea* in habit but rather more slender and open; leaves cuneate to cuneate-obovate, mostly retuse or emarginate at apex, some of them rounded or nearly truncate at apex, to 25 (rarely 35) mm. long and 1 (rarely 2) cm. broad above the middle; sepals (in bud) obtuse, carinate-winged; corolla yellow, usually 2.5-4 mm. long; stamens 7 to 19; style lobes 3 or 4; capsules 5-6 mm. high; seeds about 1 mm. wide, iridescent, conspicuously echinate-tuberculate or sharply granulate. In gravelly soils, on clay mounds and ledges in s. and w. Tex., June-Sept.; from Ark. and Tex. to Ut. and Ariz.

3. *Portulaca oleracea* L. PURSLANE, VERDOLAGA. Glabrous fleshy annual, with often stout prostrate or ascending branches, the branches spreading radially and 0.6-3 dm. or more long; axillary hairs few and inconspicuous; leaves alternate, the flat blades obovate-cuneate or spatulate, 6-30 mm. long, 0.2-13 mm. broad, occasionally larger, rounded or nearly truncate at the apex; buds flattened, acute; flowers clustered or solitary, sessile, the hairs surrounding them inconspicuous or wanting; sepals broadly ovate to orbicular, 2.8-4.5 mm. long, 2.8-3.8 mm. broad, keeled, acutish; corolla yellowish; petals 3-4.6 mm. long, 1.8-3 mm. broad; stamens 6 to 10; style lobes 4 to 6; capsule 5-9 mm. high, circumscissile at or about the middle; seeds black, 0.7-0.8 mm. (rarely 1 mm.) wide, granulate. On grassy slopes, dunes and in salt marshes and dry soils of perennial pools throughout most of Tex., May-Nov.; in temp. and trop. regions of the world.

4. *Portulaca suffrutescens* Engelm. Erect or ascending herb to 3 dm. high, with creeping tuberous-thickened rootstocks and often rather few hairs in the axils of the leaves, sometimes rather woody at the base; leaves alternate, short-petioled; blades terete, linear, to 25 mm. long and 1.8 mm. broad, often persistent; flowers terminal, in clusters of 2 or 3, surrounded with rather long pale-brown hairs and an involucre of 6 to 8 leaves; sepals broadly triangular-ovate or suborbicular, 6-7 mm. long, 5-8 mm. broad; corolla copper- or buff-colored; petals obcordate or emarginate, 7-12 mm. long; stamens numerous; style lobes 5 or 6; capsule with a stipe about 2 mm. long, subglobose, 3.5-4.2 mm. in diameter, circumscissile a little below the middle, the upper half vernicose and greenish-tan; seeds black, somewhat iridescent, 0.5 mm. wide, rounded-tuberculate. In sandy gravelly soils along streams and on flats in the Trans-Pecos, with an apparently disjunct station on the Edwards Plateau (Colorado River, Austin, Travis Co.), May-Sept.; from Ark. and Tex. to Ariz. and Mex.

5. *Portulaca parvula* Gray. Plant prostrate or ascending from a slender annual root; stems slender, to 15 cm. long, 1-2 mm. thick, loosely branched; leaves to 13 mm. long and 2 mm. broad, succulent, somewhat compressed; leaf axils with white hairs 3-7 mm. long; inflorescence terminal, a capitate cluster of 2 to 10 flowers, after falling of involucre bracts 3-6 mm. in diameter; involucre bracts 3-8 mm. long; sepals becoming reddish, about 2.5 mm. long; petals yellow, orange or bronze, 2-2.5 mm. long; capsule 1.5-2 mm. thick, the basal portion saucer-shaped and with a stipe 1-1.5 mm. long; seeds about 0.5 mm. in diameter, brownish at first but becoming black when mature, covered with minute crowded flattened stellate roughenings. In sandy or gravelly open or brushy areas in cen. and w. Tex., Mar.-Nov.; from Okla. and Tex., w. to s.e. Ariz. and n. Mex.

6. *Portulaca mundula* I. M. Johnst. CHISME. Plant herbaceous, leafy from a taproot, often thickened, apparently nearly always emerging annually; stems 3 to 6, prostrate or laxly decumbent to laxly ascending, 5-15 cm. long, with upward-directed branches (1-5 cm. long) above the middle which are succulent with decidedly abbreviated internodes; leaves fleshy, alternate, often very numerous and congested, 5-15 mm. long, 0.5-1.5 mm. wide, ascending, linear to oblanceolate-linear; hairs of the leaf axils conspicuously kinky, woolly, often white, often 5-7 mm. long and as long as the shortest leaves or longer; flowers terminal, subsessile, 2 to 8 aggregated in villous heads; leaves of the involucre 6 to 10, linear, 5-12 mm. long, succulent; the calyx on upper part of capsule

often about 4 (rarely to 6) mm. long, the lobes triangular to triangular-oblongate; petals purple, obovate, often to 6 mm. or rarely to 7.5 mm. long, 3-4.5 mm. wide, retuse at the apex; stamens often 10 to 15, rarely to 30; styles 3 to 5, oblongate, about 1.8 mm. long; capsule when ripe ovate-globose, circumscissile below the middle; upper part of capsule shiny and deeply hemispherical, invested with the corolla and calyx and withered coherent stamens; lower part of capsule 2.5-3.5 mm. in diameter, lightly stipitate; seeds black, stellate-tubercular, 0.3-0.5 mm. in diameter. *P. pilosa* of auth., *P. pilosa* L. var. *mundula* (I. M. Johnst.) Legrand. In gravelly or sandy soils on slopes and in arroyos mostly in cen. and Trans-Pecos Tex., less common eastw., spring to fall; from Mo. and Kan. s. to n. Mex.

2. TALINUM ADANS. FLAME-FLOWER

Herbs or shrubby plants, often with fleshy tuberous roots; stems sometimes very short or elongate; leaves fleshy, alternate or nearly opposite, entire, flat or terete; flowers often showy, borne on long- or short-peduncled cymes or sometimes 1 to several in the axils of the leaves; sepals 2, deciduous; petals 5 or more, early-withering; stamens few or numerous; filaments filiform; ovary superior; styles 3, more or less united; ovules numerous; capsule 1-celled, 3-valved; seeds flattened, round-reniform, with a smooth or rigid testa.

About 50 species in the warmer parts of both hemispheres.

1. Leaves flat, mostly more than 15 mm. wide; seeds black, muricate (2)
1. Leaves terete or flat, less than 10 mm. wide (3)
- 2(1). Flowers pink or reddish; leaves abruptly acute to acuminate at apex; bracts of inflorescence linear-lanceolate and acuminate; distribution in brushlands of south Texas1. *T. paniculatum*.
2. Flowers yellow or orange; leaves usually broadly rounded at apex; bracts of inflorescence mostly ovate-elliptic and apiculate; distribution in mountains of Trans-Pecos Texas2. *T. chrysanthum*.
- 3(1). Flowers 1 to 3 in the axils of the leaves (4)
3. Flowers in a terminal cyme (7)
- 4(3). Mature seeds with several concentric subcircular ridges on the sides (5)
4. Mature seeds smooth (6)
- 5(4). Petals yellow; stem slender, suffrutescent at the base, stiff; capsule globose, 4-4.5 mm. in diameter; leaves linear throughout, 1.5 mm. wide or less3. *T. angustissimum*.
5. Petals orange to reddish; stem rather stout; capsule ovoid, 5-7 mm. long, 4.5-5.2 mm. in diameter; some leaves more or less dilated to 2 mm. or more in width4. *T. aurantiacum*.
- 6(4). Sepals oval to orbicular, 3-3.7 mm. long, obtuse or nearly so; leaves 1 cm. long or less5. *T. brevifolium*.
6. Sepals ovate-lanceolate to ovate or ovate-elliptic, 6-8 mm. long, acute; leaves more than 1 cm. long6. *T. pulchellum*.
- 7(3). Stamens 4 to 8; sepals 4 mm. long or less; petals 9 mm. long or less; capsule 3.5-4.5 mm. long, 2.8-3 mm. in diameter7. *T. parviflorum*.
7. Stamens 12 or more; sepals 4.5-8 mm. long; petals 10-15 mm. long; capsule 6-7 mm. long, about 4.5 mm. in diameter8. *T. calycinum*.

1. *Talinum paniculatum* (Jacq.) Gaertn. PINK BABY-BREATH, RAMA DEL SAPO. Herb with tuberous roots; stems simple or branched, rather slender, sometimes woody at the base, 25-75 cm. tall; leaf blades elliptic-rhombic or obovate, 2.7-10 cm. long, 13-47 mm. broad, abruptly acute to acuminate at the apex, rounded or tapering at the base into the petiole; inflorescence a terminal panicle, 7-25 cm. long, the branches cymose; bracts of inflorescence linear-lanceolate, acuminate, to 3 mm. long; pedicels slender, 1-2 cm. long, terete; sepals oval to orbicular, 3-4 mm. long, deciduous; petals oval to obovate-elliptic

or orbicular, obtuse, 3.5-4.8 mm. long, red or pink; stamens 15 to 20; capsule subglobose, 3-4.5 mm. in diameter; seeds black, 0.9-1.2 mm. wide, minutely striolate and occasionally minutely tuberculate, shining. In clay soils in thickets of extreme s. Tex., Apr.-July; in s. U.S., Mex., C.A., W.I. and S.A.; introd. in China.

2. *Talinum chrysanthum* Rose & Standl. Perennial from a thick rather fleshy root; stems stout, to about 1 m. high, reddish, simple or little-branched; leaves numerous, thick and fleshy, obovate to oblanceolate, attenuate or cuneate at base, mostly rounded at apex, 10 cm. long or less; inflorescence an elongated and much-branched panicle; bracts of inflorescence mostly ovate or ovate-elliptic and apiculate, 2 mm. long or less; flowers with pedicels about 15 mm. long; sepals very unequal, almost orbicular; petals bright-yellow or orange-color; capsule obtusely triquetrous, reddish; seeds black and shining, minutely papillose. In igneous soil and on ledges in canyons of the Trans-Pecos, June-Sept.; also N.M.

This plant, in the past, has been combined with *T. paniculatum*. It is probably the same one that occurs west of Texas.

3. *Talinum angustissimum* (Gray) Woot. & Standl. Plant to 4 dm. or more in height, often lower, suffrutescent at the base, the branches slender; leaf blades linear or narrowly linear, 1-6 cm. long, 0.5-1.5 mm. broad, mostly acute at the apex, narrowed at the base; flowers usually solitary in the axils of the leaves; pedicels slender, 1-1.8 cm. long, bracted mostly near the base; sepals ovate to broadly ovate, 6-9 mm. long, 5-6 mm. broad; petals obovate, 10-13 mm. long, 3.5-6 mm. broad, yellow, sometimes tinged with orange; stamens 20 or more; style lobes linear; capsule globose, 4-4.5 mm. in diameter; seeds black, 1.2-1.3 mm. wide, with several concentric subcircular ridges on the side. *T. aurantiacum* β *angustissimum* Gray. In sandy or gravelly soils in arroyos, on plains and slopes in s. and w. Tex., May-Sept.; from Tex. to Ariz. and n. Mex.

Extremes of this plant and *T. aurantiacum* are readily distinguished, but the bulk of the material seen tempts one to unite the two, at least varietally as Gray did in first describing this plant.

4. *Talinum aurantiacum* Engelm. FLAME-FLOWER. Erect or ascending herbaceous plant, 15-35 cm. tall or more, with rather stout stems and tuberous roots; leaf blades linear or linear-lanceolate, 15-55 mm. long, 1.5-3.5 mm. broad, fleshy; flowers solitary in the axils of the leaves; pedicels bracted below the middle, reflexed in fruit; sepals ovate, 6-9 mm. long, 3.2-4.5 mm. broad, cuspidate; petals obovate, 9-13 mm. long, 5-6 mm. broad, orange or reddish; stamens 20 or more; stigmas linear; capsule ovoid, 5-7 mm. long, 4.5-5.2 mm. in diameter; seeds black, 1.3 mm. wide, with several concentric subcircular ridges on the side. On rocky slopes of canyons and mts. in w. Edwards Plateau, the Panhandle and Trans-Pecos, June-Oct.; from Tex. to Ariz. and Mex.

5. *Talinum brevifolium* Torr. Fleshy herb with spreading branches and deep root; leaves crowded; blades subterete, narrowly spatulate to clavate or linear, 4-9 mm. long, 1-1.8 mm. broad, obtuse at the apex; flowers solitary in the axils of the upper leaves, borne on pedicels 3-3.5 mm. long; sepals oval to orbicular, 3-3.7 mm. long, 3.8-4.4 mm. broad; petals obovate, 8-10 mm. long, 4-5 mm. wide, rose; stamens about 20; style as long as the ovary, 3-cleft at the summit; capsule globose-ovoid or globose-ellipsoid, 3.5-3.7 mm. long, 3-3.2 mm. in diameter; seeds nearly smooth, 1-1.1 mm. broad, with grayish pellicle. In sandy gravelly soils of the Trans-Pecos, spring-summer; from w. Tex. to n. Ariz. and s. Ut.

6. *Talinum pulchellum* Woot. & Standl. Perennial herb from a much-branched large fleshy root, glabrous; stems several, leafy, spreading, typically branched and to 1 dm. tall; leaves densely but evenly distributed, not rosettelike, sessile; upper blade linear, nearly terete, acute, to 25 mm. long and 1-2 mm. broad; lower blade shorter, broader and manifestly more flat than the upper ones, subtended by a free flattened margin extending entirely around the base below the point of attachment; peduncles axillary, to 15 mm. long (usually 1 cm. or less), 1- to 3-flowered (usually 3); pedicels to 2 cm. long, each with 2 acute bractlets about 2.5 mm. long inserted below the middle, the cluster subtended by 2 acute bracts 4-5 mm. long; sepals 6-8 mm. long, 2.5-5 mm. broad, acute, ovate-lanceolate to elliptic-lanceolate, hyaline-margined; petals obovate, about 12 mm. long, to 8 mm. broad, spreading, light-rose; stamens 18 or more, with filaments 4-5 mm. long; ovary 1 mm. long or more, ovoid; styles less than 1.5 mm. long, entirely

united and early-deciduous; stigma capitate; fruit elliptical, about 4 mm. long and 3 mm. broad; seeds smooth, slightly angular but not concentrically ridged, about 1 mm. in diameter. *T. Youngæ* C. H. Mull. In canyons of the Trans-Pecos, spring-summer; also N.M.

7. *Talinum parviflorum* Nutt. Herb 5-19 cm. high, with fleshy roots, short-stemmed or subcaulescent; leaf blades terete or nearly so, linear, 1.5-5 cm. long, 0.8-2.5 mm. thick, broadened at the base; inflorescence a cyme, bracted at the forks; peduncles slender, 3-15 cm. long; pedicels slender; sepals ovate or oval-ovate, 2.7-4 mm. long, 1.5-2 mm. broad, deciduous; petals pink or pink-purple, obovate or elliptic, 5.5-7 mm. long, 2.2-2.6 mm. broad; stamens 4 to 8, the anthers oblong, 0.9 mm. long; style longer than the stamens; stigmas subcapitate; capsule ellipsoid, 3.5-4.5 mm. long, 2.8-3 mm. in diameter; seeds 0.8-0.9 mm. wide, smooth. In sandy soil in woods and over rock outcrops throughout most of Tex., Apr.-Aug.; from Ark., Tex. and Ariz., n. to Minn. and N.D.

8. *Talinum calycinum* Engelm. Erect herb with a rather thick reddish-brown fleshy rootstock, the stems 3-10 cm. long; leaf blades subterete, 2.5-7 cm. long, 1-2 mm. thick, acute; inflorescence a cyme, bracted at the forks; peduncle slender, 6-23 cm. long; pedicels slender; sepals ovate to ovate-orbicular, 4.5-8 mm. long, 5-6 mm. broad, often persistent in fruit; petals pink or cerise, broadly obovate, 10-15 mm. long, 5-9 mm. broad; stamens 30 or more; stigma capitate; capsule globose-ovoid, 6-7 mm. long, 4.5 mm. in diameter; seeds black, 1-1.1 mm. wide, smooth. In sandy or rocky soil in scrub oak or brushy areas in n.-cen. and n.w. Tex., May-July; from Ark. and Tex., n. to Mo. and Neb.

3. TALINOPSIS GRAY

A monotypic genus.

1. *Talinopsis frutescens* Gray. Plant shrubby from fibrous and tuberous roots, to 6 dm. high, usually much smaller, with slender somewhat compressed-angipitous young stems and branches, with tufts of hairs at the dilated nodes; leaves opposite or fascicled in the axils, fleshy, linear, terete, to 3 cm. long and 1-2 mm. thick; cymes few-flowered, the branches short and angled; flowers sessile; sepals 2, ovate to ovate-elliptic, 7-8 mm. long, about 5 mm. wide, obtuse, several-nerved, persistent in fruit; corolla purple; petals 5, in aestivation imbricate, oval or somewhat obovate, 9-10 mm. long, 4-5 mm. wide; stamens 20 to 25; anthers oblong, 2-celled; style columnar, shorter than the 1-celled ovary; stigmas 3, dilated; capsule ovoid-conic, sharply tapered at apex, 1-1.5 cm. long, 4.5-5 mm. in diameter below the middle, 3-valved, the valves separating from a thin white papery 6-valved endocarp; seeds arcuate or uncinat, 2 mm. long, 1 mm. thick, brown, the surface granulate. Among boulders and shrubs on mt. slopes and in valleys in the Trans-Pecos, July-Sept.; also N.M. and Mex.

4. CLAYTONIA L.

About 20 species in the Northern Hemisphere.

1. *Claytonia virginica* L. SPRING BEAUTY. Perennial herb with globose corm 1-3 cm. thick; stems single or usually several to many from the corm, 1-3 dm. high, glabrous, succulent, erect or ascending; basal leaves petioled, 6-20 cm. long, the blade as long to twice as long as the petiole, succulent, linear-oblongate, 5-15 mm. wide, indistinctly 3-ribbed, acute at both ends; stem leaves short-petioled, opposite, 9-15 cm. long; raceme 6- to 15-flowered, 4-16 cm. long, often with a single small oval bract below the lowest pedicel; pedicel 1.5-4 cm. long, in fruit recurved; flowers perfect, regular; sepals 2, rounded-ovate or oval, usually obtuse or rounded at the apex, herbaceous, persistent, 5-7 mm. long; petals 5, hypogynous, oval, 9-14 mm. long, rounded to obtuse or rarely retuse at the apex, white or rose-colored with pinkish or purplish veins; stamens 5, opposite the petals and adnate to them at the base; ovary 6-ovuled; styles 3, united to near the apex; capsule about 4 mm. long, rounded-ovoid, membranous, 3-valved, the edges of the valves elastically inrolling at dehiscence; seeds 1 to 6, blackish-brown, orbicular, shining, 2 mm. broad. *C. Simsii* Sweet. In sandy soil in rich woods, thickets and clearings in e. third of

Tex., Feb.-Apr.; from s.w. Que. and w. and s. N.E. to s. Ont. and Minn., s. to Ga., Ala., Miss., La. and Tex.

FAM. 68. BASELLACEAE MOQ.⁵⁷

MADEIRA-VINE FAMILY

Somewhat succulent twining glabrous perennial herbaceous vines, usually with tuberous rootstocks; leaves alternate, sessile or petioled, simple, entire, often fleshy-thickened, exstipulate; inflorescence usually spikelike racemes; floral bracts linear, acuminate-attenuate, often exceeding the pedicel in length; flowers numerous, perfect or unisexual; bracteoles just below the perianth, 2 or (when 4) in 2 decussate pairs and sometimes accrescent and connate at base, the upper pair often tepaloid; perianth segments 5, often colored, usually basally connate, imbricate, often accrescent, more or less persistent in fruit; stamens 5, epitepalous; filaments distinct, inserted on the perianth; anthers 2-celled, dorsifixed, dehiscent lengthwise; ovary superior, 1-celled; stigmas usually 3; fruit indehiscent, surrounded by the persistent usually fleshy-accrescent calyx and eventually the keeled or more or less winged bracteoles; seed solitary, globular.

About 15 species in 4 genera, mostly in Tropical America. A family in much need of an exacting study.

1. ANREDERA Juss.

Characters of the family. A small genus of less than 10 species in the warmer parts of America, from Florida, southern Texas and Mexico to central South America.

- 1. Lower pair of bracteoles connate at the base to form a persistent cuplet at summit of pedicel; upper pair of bracteoles cymbiform, slightly exceeding the tepals, with the dorsal keels narrowly winged below1. *A. baselloides*.
- 1. Lower bracteoles free, caducous (2)
- 2(1). Racemes stout, usually less than 10 cm. long, greatly to only slightly exceeding the subtending leaf; upper bracteoles cymbiform, about as long as tepals, broadly and conspicuously winged on back at maturity2. *A. scandens*.
- 2. Racemes slender, lax, elongated, more than 12 cm. long, much-exceeding the subtending leaf; upper bracteoles concave, dorsally carinate but not broadly winged3. *A. leptostachys*.

1. *Anredera baselloides* (H.B.K.) Baill. Glabrous vine with stout stem and branches; leaves with petioles 8-18 mm. long, cordate to subcordate-ovate, acuminate-mucronate, to about 10 cm. long, 2-3.5 cm. wide, cordate to subcordate at base; peduncles slender, to 25 mm. long; racemes usually much longer than the subtending leaf, simple or compound; pedicels 1-2 mm. long; floral bracts linear-subulate; lower pair of bracteoles minute, triangular, somewhat obtuse and concave, united at base to form a cup; upper pair of bracteoles orbicular-elliptic to ovate-orbicular, about as long as tepals; tepals ovate to elliptic, 1-2 mm. long; filaments subulate; anthers oblong; stigmas mostly subsessile and oblong-obovate. *Boussingaultia baselloides* H. B. K. In thickets and among cedars in s.-cen. Tex., all year; also trop. Am.

2. *Anredera scandens* (L.) Moq. Plant a glabrous diffuse high-climbing vine from a perennial tuberous rootstock, to 1 m. long, the slender stem flexuous; leaves with a petiole to 1 cm. long, ovate to rhombic-ovate or subcordate, subtruncate to tapering at base, to 85 mm. long and 6 cm. wide, usually much smaller, the lower leaves obtuse to shortly acuminate at apex, the upper leaves oblong-ovate and long-acuminate; peduncles 6-12 mm. long, slender, sulcate; racemes rather stout, greatly to only slightly exceeding the subtending leaf, rarely more than 10 cm. long and to about 9 mm. thick, at length pendulous; floral bracts narrowly subulate, shorter than the pedicels; pedicels 1-2 mm. long, thickened at apex; lower bracteoles minute, broadly ovate, acutish; upper bracteoles about 2 mm. long, oblong-elliptic, concave, obtuse, at maturity broadly winged and about 4 mm. long; tepals oblong, somewhat acute, about as long as upper bracteoles; fruit

⁵⁷ Adapted, in part, from C. G. G. J. van Steenis, *Flora Malesiana*, 5:300-304. 1957.

terminating in a thickened style, smooth below, rugose above. *A. vesicaria* (Lam.) Gaertn. f. In thickets and brushlands, palm groves and open woods, on gravelly hills and about fences and hedges in s. Rio Grande Plains and Brownsville area, Sept.-Nov.; also Fla., W.I. and Latin Am.

3. *Anredera leptostachys* (Moq.) Steen. SACASILE. A glabrous vine with slender stems and branches; leaves with petioles about 1 cm. long, ovate to ovate-elliptic or subcordate-ovate, to about 7 cm. long and 5 cm. wide, acute to slightly acuminate at apex, thickish, usually gradually or abruptly narrowed at base; racemes slender, lax, elongated, simple or branched, 12-17 cm. long, about 8 mm. thick, much longer than the subtending leaf; floral bracts linear-subulate, flexuous, about as long as the pedicels; lower pair of bracteoles minute, triangular-subulate, concave; upper pair of bracteoles oblong, slightly keeled below; tepals ovate to oblong, 1-2 mm. long; filaments subulate; anthers oblong. *Boussingaultia leptostachya* Moq. Open woodlands in the Brownsville area, all year; also trop. Am.

FAM. 69. CARYOPHYLLACEAE JUSS.* PINK FAMILY

Annual, biennial or perennial herbs or small woody-based plants, with nodose stems; leaves entire, typically opposite or whorled, often united at base, with or without stipules; flowers regular, perfect or rarely unisexual; sepals 4 or 5, persistent, distinct or united into a tube; petals as many as sepals, rarely fewer or none, often toothed or lobed; stamens usually as many as and alternating with the petals; filaments sometimes cohering at the base; styles 2 to 5, distinct or more or less united; ovary free from the calyx, 1-celled or incompletely 2- to 5-celled at base; capsule few- to many-seeded, opening by 2 to 5 entire or bifid valves; seeds small.

More than 1750 species in about 70 genera, cosmopolitan but most abundant in temperate climates.

1. Stipules none (2)
1. Stipules present (14)
- 2(1). Sepals united (3)
2. Sepals free (7)
- 3(2). Flowers and cymes closely subtended by 2 or 3 pairs of scarious broadly ovate-oblong or obovate bracts 1. *Petrorrhagia*, p. 613.
3. Flowers and cymes without subtending scarious bracts (4)
- 4(3). Styles 2 (5)
4. Styles 3 to 5; calyx always strongly ribbed (6)
- 5(4). Calyx cylindric, not strongly angled; petals appendaged 2. *Saponaria*, p. 613.
5. Calyx ovoid, strongly 5-angled; petals not appendaged . 3. *Vaccaria*, p. 613.
- 6(4). Calyx teeth not exceeding the petals 4. *Silene*, p. 614.
6. Calyx teeth long and narrow, much-exceeding the petals. 5. *Agrostemma*, p. 616.
- 7(2). Petals present (8)
7. Petals absent (12)
- 8(7). Petals more or less deeply bifid (9)
8. Petals entire, emarginate or irregularly toothed (11)
- 9(8). Style 1, 3-cleft; capsule 3-valved 6. *Drymaria*, p. 616.
9. Styles 3 or more; capsule opening by twice as many teeth or valves as there are styles (10)
- 10(9). Styles 5 7. *Cerastium*, p. 618.
10. Styles 3 (or varying from 3 to 6) 8. *Stellaria*, p. 620.
- 11(8). Fewer styles (2 or 3) than sepals 9. *Arenaria*, p. 621.
11. As many styles as sepals (4 or 5) 10. *Sagina*, p. 624.
- 12(7). Leaves linear 10. *Sagina*, p. 624.
12. Leaves not linear (13)

* See Appendix.

- 13(12). Styles 5 7. *Cerastium*, p. 618.
 13. Styles 3 or varying from 3 to 6 8. *Stellaria*, p. 620.
 14(1). Outer three sepals with a setaceous tooth on each side; leaves subulate-setaceous, rigid 11. *Loeflingia*, p. 624.
 14. All sepals entire; leaves not subulate-setaceous or rigid (15)
 15(14). Lower leaves usually in closely approximated pairs resembling whorls of 4; small decumbent herbs with tiny flowers about 3 mm. in diameter; styles joined below 12. *Polycarpon*, p. 624.
 15. At least the lower leaves in opposite pairs; styles free to base (16)
 16(15). Petals minute or lacking; sepals with conspicuous awns; stipules conspicuous, silvery, lanceolate and acuminate-attenuate, usually more than 5 mm. long 13. *Paronychia*, p. 625.
 16. Petals more or less equaling the sepals in length; sepals without awns; stipules small, deltoid to setaceous, acute to attenuate, less than 5 mm. long (17)
 17(16). Style 1; petals 2-cleft 6. *Drymaria*, p. 616.
 17. Styles 3 or more; petals entire (18)
 18(17). Styles 5 14. *Spergula*, p. 629.
 18. Styles 3 15. *Spergularia*, p. 629.

1. PETRORHAGIA (SÉR.) LINK

About 20 species that are native mainly to the Mediterranean region.

1. *Petrorhagia prolifer* (L.) Ball & Heywood. CHILDRING PINK. Slender annual with simple or branched stems to 5 dm. high, glabrous or scabrid; cauline leaves to 4 cm. long and 2 mm. wide, linear-oblong, 3-veined; sheath 1-2.5 mm. long, about as broad as long; largest bracts of the head 6-12 mm. long, 3-8 mm. broad, usually obtuse; calyx 10-13 mm. long, the costae 3-veined, the oblong teeth obtuse; petals pink or purplish, 10-14 mm. long, the obcordate limb 2-3.5 mm. wide; seeds 1.3-1.9 mm. long, 0.8-1.1 mm. broad, reticulate. *Dianthus prolifer* L., *Tunica prolifer* (L.) Scop. Scattered in grasses along roadsides and in fields in e. Tex., spring-summer; a nat. of Eur. and N. Afr. that occurs as an escape in various parts of N.A.

This is an extremely aggressive plant. Since its very recent introduction into Texas, probably in contaminated rye grass seed sown along state right-of-ways, it has spread throughout most of east Texas from northeast Texas, where it was originally discovered. It reproduces abundantly.

2. SAPONARIA L.

About 30 species that are native to Eurasia and northern Africa.

1. *Saponaria officinalis* L. SOAPWORT, BOUNCING-BET. Plant perennial, stout, erect, glabrous, to 6 dm. high; stems simple or sparingly branched, leafy; leaves opposite, oval-lanceolate to elliptic or sometimes ovate, subobtuse to acute at apex, narrowed at base to a short broad petiole, to 8 cm. long and 35 mm. wide, prominently 2- to 5-nerved; flowers showy, in dense terminal corymbs; bracts foliaceous or much-reduced and narrow; calyx tube cylindrical or nearly so, naked, obscurely nerved, to 2 cm. long, the 5 lanceolate teeth about 2 mm. long; petals 5, white or pink, cuneate, notched at apex, well-exserted and spreading, crowned with an appendage at the top of the prominent claw; stamens 10; styles 2; ovary 1-celled or incompletely 2- to 4-celled; capsule included, subcylindric, dehiscent by 4 short apical teeth. In fields and waste places in e. Tex., June-Sept.; a nat. of Eur. that is locally naturalized in various places in temp. N.A.

3. VACCARIA MEDIC.

Four species, natives of Eurasia. Differs from *Saponaria* in the winged calyx tube and absence of coronal scales.

1. *Vaccaria pyramidata* Medic. COW-HERB, COW-CKOCKLE. Annual herb with a slender taproot and glabrous dichotomously branched flowering stems that are 3-6 dm. high; leaves opposite, basal leaves oblong-lanceolate, upper leaves ovate-lanceolate and cordate-clasping, all sessile, acute, glabrous and glaucous; flowers in terminal open cymes, slender-pedicelled; calyx tube inflated, glabrous, with 5 sharp angles or wings and 5 triangular teeth, the intervening parts white and scarious; petals well-exceeding the calyx, pale rose-color, the limb cuneate, rounded or somewhat emarginate, toothed; corona scales lacking; stamens 10; styles 2; capsule globular, 4-celled below, opening by 4 teeth; seeds laterally attached, black, 2 mm. across. *Saponaria Vaccaria* (L.) Britt. In waste places and cult. grounds, especially wheat fields, in n.-cen. Tex., a nat. of Euras. that has become naturalized.

4. *SILENE* L.⁵⁸

CATCHFLY. CHAMPION

Annual or perennial herbs with solitary or clustered stems; leaves opposite or whorled, exstipulate; flowers white, pink or red, solitary or in cymes; calyx cylindrical, ovoid or campanulate, 5-toothed or -cleft, 10- to many-nerved, naked at base; petals 5, usually clawed, the blades often cleft or toothed and usually with a scalelike appendage at the base; stamens 10; styles 3 or rarely 4 or 5; ovary 1-celled or incompletely 2- to 4-celled; capsule dehiscent by 6 or rarely 3 apical teeth; seeds numerous, often papillate or tubercled.

About 500 species of wide geographic distribution, especially the Mediterranean region.

1. Annuals; plants mostly weedy (Doubtful cases should be keyed under both alternatives) (2)
 1. Perennials; plants not weedy (3)
 - 2(1). Plant usually glabrous throughout, at least the calyx without pubescence; stems mostly with sticky mucilaginous bands 1. *S. Antirrhina*.
 2. Plant densely pubescent throughout; stems with mucilaginous bands 2. *S. gallica*.
 - 3(1). Leaves 4 per node on the middle portion of stem; petals not differentiated into blade and claw; petal appendages lacking 3. *S. stellata*.
 3. Leaves always only 2 per node; petals usually differentiated into narrow claw and expanded blade with appendages at or near their juncture (4)
 - 4(3). Blades of petals lance-elliptic, entire; appendages entire, linear, 2-4 mm. long 4. *S. subciliata*.
 4. Blades of petals variously shaped, lobed to laciniate; appendages lacerate, triangular-ovate, mostly not over 2 mm. long (5)
 - 5(4). Stem leaves 1-2.5 cm. long and 1-3 mm. wide; petals 2-lobed 5. *S. Plankii*.
 5. Stem leaves usually more than 2.5 cm. long and 3 mm. wide; petals laciniate 6. *S. laciniata*.

1. *Silene Antirrhina* L. SLEEPY CATCHFLY. Erect or ascending annual, to 8 dm. high, paniculately branched, the slender branches and branchlets of the panicle ascending or sometimes loosely spreading, puberulent to essentially glabrous, commonly with a dark glutinous band below the nodes; basal leaves oblanceolate to spatulate, those of the stem becoming linear to lanceolate or oblanceolate, to 7 cm. long and 15 mm. wide; flowers numerous, slender-pedicelled; flowering calyx fusiform, in fruit becoming ovoid-campanulate, to 1 cm. long, glabrous, with 10 straight nerves, the short triangular apical teeth often purplish; petals small, transient, white to pink or purplish, more or less emarginate, mostly exceeding the calyx by 2-3 mm.; capsule subsessile within the closely embracing calyx, ovoid, to 1 cm. long. A weedy plant that occurs in moist grassy areas, fields, open woodlands and in waste places throughout most of Tex., Mar.-Sept.; from s.w. Que., w. to B.C., s. to Mex.

Occasionally individuals without petals are found.

⁵⁸ Adapted from C. Leo Hitchcock and Bassett Maguire in Univ. Wash. Publ. Biol. 13:1-73. 1947.

2. *Silene gallica* L. FORKED CATCHFLY. Annual or biennial, slender, to 45 cm. high; stems simple and erect to much-branched and decumbent, hirsute to hispid, glandular-pubescent above; basal leaves oblanceolate to spatulate, obtuse and usually mucronate at apex, the upper leaves lanceolate, usually about 25 mm. long and 5 mm. wide; racemes simple, 1 sided, to 15 cm. long, the short-pedicelled flowers in the axils of bracteal leaves; calyx tubular-fusiform, to 1 cm. long, rounded at base, 10-nerved, erect or ascending, villous-hirsute, with long lance-attenuate apical teeth, becoming ovoid-inflated in fruit; petals very small, the white to pinkish limb entire or merely crenate or emarginate, usually slightly longer than the calyx and somewhat twisted; capsules ovoid; seed faces excavated. *S. dichotoma* of Tex. auth. A. Eur. plant that has become naturalized along roadsides and in waste places in the e. third of Tex., Apr.-May; from N.S. and Mich., s.w. to Mo. and Tex.

3. *Silene stellata* (L.) Ait. f. STARRY CAMPION. Perennial with strongly branching crown; stems several, stiffish, puberulent to glabrate, ascending, to 1 m. high, usually much smaller; all except the lowest and uppermost leaves in whorls of 4, ovate to linear-lanceolate, long-acuminate, to 1 dm. long and 4 cm. wide, minutely puberulent beneath, smooth to scabrous above; panicle simple and elongate or with a few elongate ascending branches, with small foliaceous bracts; flowers with slender pedicels to 8 mm. long; calyx campanulate, inflated, somewhat scarious with age, to 12 mm. long, the 10 veins not prominent, glabrous or merely puberulent, the broadly triangular apical lobes 2-3 mm. long; corolla about 2 cm. across; petals white, lanate at base, crownless, with the margins cut into a fringe; capsule nearly globose; seeds dark-purplish-brown, uniformly rugose-papillose, about 1 mm. long. In woods or clearings in the e. third of Tex., May-July; from Mass. to Minn., s. to Ga., Ala., Okla. and Tex.

4. *Silene subciliata* Robins. Perennial; stems few from a branched crown, to 11 dm. high, simple or branched above, glabrous; leaves linear to narrowly oblanceolate, to 18 cm. long and 12 mm. wide, rather fleshy, usually attenuate to the petiolar base, entirely glabrous or with scattered cilia on the margins that may be as much as 3 mm. long; bracts greatly reduced, linear-lanceolate; inflorescence elongate, open, few-flowered, sometimes reduced to a solitary terminal flower, the lower floral branches sometimes nearly 1 dm. long, essentially glabrous; calyx tubular, 10-nerved, glabrous and smooth, to 25 mm. long, the lanceolate ciliate apical lobes about 4 mm. long; corolla scarlet, pilose-woolly at base; corolla blades oblong-elliptic, about 15 mm. long, entire to obscurely toothed, not lobed, the claws narrow and slightly auriculate at top, the margins ciliate; appendages 2, linear, tubular, entire, about 4 mm. long; filaments exerted, hairy at base; carpophores 3-4 mm. long, hairy; styles 3, scarcely exerted; seeds dark-brown, subreniform, about 2 mm. long, dorsally verrucose in lines. In sandy soils in open woodlands and scrub areas in s.e. Tex., July-Oct.; also w. La.

5. *Silene Plankii* Hitchc. & Maguire. Low perennial, from multicapital caudex; stems ascending, 10-15 cm. tall, finely retrorsely grayish-puberulent, becoming glandular in the inflorescence; basal leaves oblanceolate, acute, to 23 mm. long and 4 mm. wide; cauline leaves in 5 to 8 pairs, linear to linear-lanceolate, acuminate, 1-2 cm. long, 1-3 mm. broad, finely glandular-puberulent (especially near the inflorescence); inflorescence few-flowered, often of but a single terminal blossom or on or two flowers developing from lower nodes; calyces 2-2.8 cm. long, tubular, slightly constricted below, glandular-pubescent, 10-nerved; calyx lobes 2-4 mm. long, membranous-margined and ciliate; corolla scarlet, the claws glabrous, to 22 mm. long, gradually and uniformly widened to 3-4 mm. at top, scarcely auriculate but abruptly narrowed to blades; corolla blades 5-8 mm. long, obovate, bilobed one sixth to two thirds its length, the revolute lobes entire or rarely deeply crenate; appendages located about 1 mm. above base of blade, 1-1.5 mm. long, oblong, rather deeply crenate-lacerate; carpophore about 5 mm. long, glabrous; filaments well-exserted; styles 3, exerted 2-4 mm.; ovary 1-celled, mature seeds not seen. On moss-covered ledges in Franklin Mts. of extreme w. Tex., June-Oct., also N.M.

6. *Silene laciniata* Cav. MEXICAN CAMPION. Perennial, from a fleshy deep taproot; stems one to several, to 1 m. high, weak, sometimes scandent, densely retrorsely puberulent and stipitate-glandular, the pubescence more dense in the inflorescence; leaves variable to 8 cm. long and 38 mm. broad, linear to lanceolate or oblanceolate and acute and sessile or broadly elliptic to oblanceolate or obovate, then acute or obtuse, sometimes narrowed

to a distinct petiole, entire to rarely finely toothed, pubescence similar to that of stem; flowers solitary or in few-flowered panicles; pedicels 2-4 cm. long, densely glandular; calyx cylindric-tubular, mostly 15-25 mm. long, puberulent and more or less densely glandular, frequently somewhat zygomorphic; calyx lobes lanceolate to oblong or obovate, acute to rounded, narrowly or broadly scarious-margined; petals scarlet, conspicuous, claws mostly glabrous or sometimes ciliolate, equaling or somewhat exceeding the calyx, the auricles inconspicuous; appendages 2, broad, toothed, 1-2 mm. long, occasionally somewhat tubular, translucent area beneath more or less prominent; corolla blade broadly cuneate to oblong in outline, to 15 mm. long, usually deeply cleft into 4 linear or lanceolate lobes, occasionally bifid or with 5 or 6 lobes; stamens exserted, the filaments glabrous; carpophore glabrous, 2-4 mm. long; styles 3, exserted; capsule oblong-ovoid, to 18 mm. long; seeds reddish-brown, 1.2-1.5 mm. broad, marginal papillae conic, prominent. In rich soil, usually in shaded areas, in mts. of the Trans-Pecos, July-Oct.; from Tex., w. to Calif. and s. in Mex. to Oax. and Ver.

Texas plants have been referred to var. *Greggii* (Gray) Hitchc. & Maguire, which are characterized by larger leaves that are elliptic to broadly lanceolate or oblanceolate and up to 8 cm. long and 38 mm. wide. All leaves except the uppermost are also rather abruptly narrowed to a distinct petiole. The calyx is 2-2.5 cm. long.

5. AGROSTEMMA L.

Two species that are natives of Eurasia.

1. *Agrostemma Githago* L. COMMON CORN-COCKLE. Rather coarse erect annual to 1 m. high; stems simple or with a few erect branches, densely pubescent throughout with appressed whitish hairs; leaves linear-lanceolate, acute to long-acuminate at apex, to 12 cm. long; flowers solitary and terminal on the stout elongated peduncles; calyx tube ovoid, 1-1.5 cm. long, the 5 linear foliaceous lobes 2 to 3 times as long as the 10-ribbed tube that is narrowed at the throat; petals 5, purple, varying to white or red, clawed, obovate to cuneate, emarginate, not appendaged, a little shorter than the calyx lobes; stamens 10; styles 5; capsule 1-celled; seeds numerous, black. Fields and waste-places in e.-cen. Tex., Mar.-July; adv. from Eur.

6. DRYMARIA R. & S.⁵⁹ DRYMARY

Annual or perennial glabrous or pubescent herbs, occasionally subligneous below, prostrate, spreading or erect; leaves opposite or pseudovercillate, glabrous to villose or glandular, sessile to long-petiolate, usually with persistent or fugacious small stipules; flowers few to many in dichasial cymes, rarely in pseudovercills, in racemes or solitary or clustered in the leaf axils; sepals 5, not connate; petals 3 to 5 or rarely wanting, white, usually 2-cleft, occasionally appendiculate in the sinus, often auriculate; stamens 2 to 5; anthers versatile, 2-celled; filaments flattened, slightly connate at the base, rarely alternating with prominent staminodia; ovary superior, slightly stipitate; carpels mostly 3, the 3 styles more or less united below; ovules few to many, campylotropous on free central placentae; capsule ovoid to spheroid, usually dehiscent into 3 entire valves; seeds 1 to many, cochleate, vermiculiform, hippocrepiform or ampulliform, usually tuberculate, the embryo curved about the perisperm.

A genus of about 50 species, primarily American.

1. Leaves linear (2)
1. Leaves ovate to reniform or broadly elliptic to suborbicular (3)
- 2(1). Leaves mostly pseudovercillate; petals 4-lobed ... 1. *D. molluginea*.
2. Leaves opposite; petals deeply bilobed 2. *D. leptophylla*.
- 3(1). Stems erect-ascending; leaves opposite; inflorescence a lax few-flowered cyme; petals deeply bilobed 3. *D. laxiflora*.
3. Stems mostly prostrate; leaves pseudovercillate; inflorescence umbelloid; petals 4-lobed 4. *D. pachyphylla*.

⁵⁹ Adapted from James A. Duke in *Ann. Missouri Bot. Gard.* 48:173-268. 1961.

1. *Drymaria molluginea* (Lag.) Didr. Slender erect virgate or dichotomously branched annual to 2 dm. high, the internodes shorter to longer than the leaves, glabrous or with sessile glands; leaves mostly pseudoverticillate, glabrous or scantily glandular, to 25 mm. long and 2 mm. broad, linear, obtuse at apex, attenuate to the sessile base; stipules lance-deltoid, 1-2 mm. long; inflorescences of terminal cymose racemes, only the first 1 or 2 branches cymose, subsequent branching tending to be racemose, the peduncle to 3 cm. long; bracts 1-2.5 mm. long; pedicels 2-5 mm. long, glabrous to minutely stipitate-glandular; sepals 2.5-3.5 mm. long, glabrous or minutely glandular, oblong, obtuse and often cucullate at apex, only the midrib prominent; petals 5, to 25 mm. long and 0.7 mm. broad, provided with usually 4 lobules at apex, the outer lobules one third to one half as long as the trunk, the inner lobules occasionally absent or reduced to mere dentations, the subdeltoid trunk laterally denticulate and truncate or tapered to the minute claw; stamens 5, 1.5-2 mm. long, the oblong to suborbicular anthers 0.4-0.5 mm. long; staminodia absent; ovary at anthesis globose, about 2 mm. long; style 2- to 3-cleft nearly to the base, less than 1 mm. long; stylopodium absent; capsule subglobose, 2-3 mm. long, exceeding the sepals; seeds as many as 17, to 1.4 mm. broad, dark-brown or purplish in age, hippocrepiform, dorsally flat, scarcely umbonate ventrally, minutely corrugated or tuberculate, the tubercles broader than long. *D. sperguloides* Gray. In sandy soils in the Trans-Pecos, July-Sept.; from w. Tex. to Ariz., s. to cen. Mex.

2. *Drymaria leptophylla* (Cham. & Schlecht.) Fenzl. Erect delicate usually sparsely branched annual to 2 dm. high, the internodes much longer than the leaves, glabrous to minutely glandular; leaves opposite, rarely pseudoverticillate, glabrous, linear to narrowly oblong, to 25 mm. long and 1 mm. broad, often involute and circinate, obtuse to acute at apex, tapered to the subsessile base; stipules entire, to 0.8 mm. long, acicular, caducous; inflorescences of terminal many-flowered dichasial cymes, the peduncles to 5 cm. long, glabrous to minutely glandular; bracts ovate, to 1.5 mm. long, equaling or exceeding the pedicels; sepals 1.5-3.5 mm. long, narrowly ovate, acute and often somewhat reflexed at apex, 3-ribbed, glabrous or with a few sessile glands; petals 5, to 2.4 mm. long, bifid about half their length, the linear lobes obtuse or acute; stamens 5, to 1.5 mm. long, the suborbicular anthers about 0.2 mm. long, the filaments basally and briefly connate; ovary at anthesis subglobose; style about attaining the anthers, divided nearly to the base; capsule 1.5-2 mm. long; seeds as many as 20, cochleate, 0.5-0.7 mm. long, evenly tuberculate with rounded tubercles. In soil along streams in canyons and on mt. slopes in the Trans-Pecos, Aug.-Oct.; from Ariz. to Colo., s. to w. Tex., s. Mex., and in Baja Calif.

3. *Drymaria laxiflora* Benth. Glabrous to densely stipitate-glandular diffuse to subcespitose perennial, to 3 dm. high, the internodes mostly longer than the leaf blades; leaves opposite, with petioles to 5 mm. long, glabrous to densely stipitate-glandular, ovate to reniform, to 12 mm. long and 14 mm. broad, trinerved, obtuse to acute and mucronulate at apex, marginally entire, mostly truncate to subcordate at base; stipules bifid or trifid, rarely entire, the divisions setaceous, to 3.5 mm. long; inflorescences of lax few-flowered cymes, the peduncles to 4 cm. long; bracts ovate, strongly 1-ribbed, scarious, apiculate, 1.5-3 mm. long, transparent except for the midrib, mostly shorter than the pedicels; pedicels subglabrous to densely stipitate-glandular, 2-6 mm. long; sepals to 6 mm. long and 2.2 mm. broad, glabrous to densely stipitate-glandular, lanceolate to narrowly ovate, trinerved, acute, the midrib occasionally excurrent; petals 5, to 6 mm. long, bifid one half to two thirds their length, the oblong lobes emarginate, with one dichotomous vein, the trunk as long as or longer than the claw; stamens 4 or 5, 2-4 mm. long, the oblong anthers to 0.8 mm. long; ovary at anthesis ellipsoid, exceeded by the anthers; style elongate, trifid for one third to one half its length, slightly exceeding the anthers; capsule 3- or 4-valved, 2-4 mm. long, many-seeded; seeds 0.5-0.7 mm. broad, evenly tuberculate, the dorsal tubercles conical, the facial tubercles substellate. In soil about base of boulders and in crevices in mts. of the Trans-Pecos, July-Oct.; from w. Tex. through Mex. to Guat.

Drymaria gracilis Cham. & Schlecht., of Mexico, has been reported from Texas, doubtlessly based on misdetermined plants of this species which it strongly resembles.

4. *Drymaria pachyphylla* Woot. & Standl. Glaucous subsucculent annual, the vegetative branching largely confined to radially diverging branches from a slender yellowish root-stock or to terminal pseudoverticillate branch systems, the elongate spreading internodes much-exceeding the terminally crowded leaves; leaves pseudoverticillate, with clasping

petioles to 8 mm. long, glaucous, subsucculent, wrinkling in drying, broadly elliptic to suborbicular, obtuse to acutish at apex, tapering to the petiole, to 14 mm. long and 12 mm. broad; stipules absent; inflorescences of terminal and axillary contracted umbelloid verticils subtended by normal foliage leaves and bracts, the pedicels 1-5 mm. long; bracts ovate, obtuse, scarious and almost nerveless, to 1.5 mm. long; sepals subequal, glabrous, glaucous, ellipsoid, obtuse, to 3.3 mm. long and 2 mm. broad, obscurely 3- to 5-nerved, the central portion green, the margins scarious; petals 5, 2.5-3 mm. long, bifid about half their length, with 2 oblong lobules in the cleft, the serrulate trunk tapered to the base, the claw not clearly delineated; stamens 5, to 1.5 mm. long, the oblong anthers about 0.5 mm. long; ovary at anthesis subglobose, the short style bifid or trifid more than half its length and slightly exceeding the anthers; capsule subglobose, 3-4 mm. long, mostly exceeding the sepals; seeds as many as 25, black, vermiculiform, facially gibbous, more or less tessellate, to 1.8 mm. long, about twice as long as broad. On sand-gravel bars and in silty areas along streams in the Trans-Pecos, often as a pioneer on bare areas, Jan.-Oct.; in w. U.S. and n. Mex.

This plant is known to be toxic to sheep and cattle.

7. CERASTIUM L. MOUSE-EAR. CHICKWEED

Annual or perennial pubescent or hirsute herbs, sometimes viscid; flowers white, few to many, borne in terminal dichotomous cymes, glomerules or singly in leaf axils; sepals 5 or rarely 4; petals of the same number as the sepals or rarely wanting, 2-lobed or -cleft; stamens 10 or rarely fewer; styles equal in number to the sepals and opposite them, rarely fewer; capsule 1-celled, cylindrical, often curved, membranaceous, opening at the summit by twice as many teeth as there are styles, many-seeded; seeds rough.

About 60 species that are widely distributed but mostly in temperate zones.

1. Petals equal to or shorter than the sepals (2)
1. Petals slightly to decidedly longer than the sepals (6)
- 2(1). Leaves subcoriaceous, linear to linear-lanceolate, terminated by a long awn, glabrous, appressed to stems 1. *C. Clawsonii*.
2. Leaves herbaceous, mostly elliptic to obovate or oblanceolate, at most acute, more or or less pubescent or glandular-pubescent, not appressed to stem (3)
- 3(2). Capsule teeth at maturity strongly revolute from tip; pedicels usually 2 to 3 times longer than the capsules; stem nearly naked above . . 2. *C. texanum*.
3. Capsule teeth not revolute but the lateral margins often recurved; pedicels usually about equal to or shorter than the capsules; stem more or less leafy above (4)
- 4(3). Flowers arising singly in leaf axils along much of stem and branches 3. *C. axillare*.
4. Flowers concentrated in glomerules and cymes at apex of stem and branches (5)
- 5(4). All floral bracts green and herbaceous; sepals with long hairs noticeably extending beyond their apex; leaves typically obovate . . . 4. *C. glomeratum*.
5. Uppermost floral bracts with whitish scarious margins; sepals without long hairs extending beyond their apex; leaves typically elliptic 5. *C. vulgatum*.
- 6(1). Capsule teeth at maturity strongly revolute from tip; stem nearly naked above 2. *C. texanum*.
6. Capsule teeth not revolute, at most with the lateral margins recurved; stem more or less leafy above (7)
- 7(6). Flowers in glomerules; pedicels shorter than calyx . 4. *C. glomeratum*.
7. Flowers in lax or somewhat compact cymes (8)
- 8(7). Leaves usually 30 mm. long or less; fruiting pedicels about as long as or shorter or rarely longer than the capsules, straight or at most only gently curved 6. *C. brachypodum*.
8. Leaves usually more than 35 mm. long; fruiting pedicels usually much longer than the capsules, rather abruptly curved just below the calyx 7. *C. nutans*.

1. *Cerastium Clawsonii* Correll. Plant with numerous erect stems from a slender root, apparently annual; stems simple or sparsely branched near base, noticeably grooved and ciliated on the ridges; leaves sessile, glabrous, subcoriaceous, opposite, erect and more or less imbricate up the stems, linear to linear-lanceolate, terminated by a long awn, 5-8 mm. long, 1 mm. wide or less, with a keeled central dorsal nerve that is decurrent on the stem; flowers solitary at apex of stems and branches, on rather stout grooved peduncles; sepals elliptic to elliptic-lanceolate, abruptly tapering to a long rigid awn, the broad hyaline margins ciliate, about 8 mm. long and 2 mm. wide; petals broadly cuneate-suborbicular to suborbicular-obovate, slightly emarginate at the broadly rounded apex, concave, shorter than the sepals; styles 5, united for most of their length, to 4 mm. long, the stigmas capitate; stamens 5, the slender filaments to 4 mm. long; anthers linear-oblong, sagittate at base, about 1.5 mm. long; capsule ovoid (immature). Known only from the type locality 3 miles south of Alpine, Brewster Co., Mar.-May.

2. *Cerastium texanum* Britt. Plants annual, glandular-pubescent, viscid, to 3 dm. high; stems several, slender, nearly erect, leafy below, nearly naked and simple to dichotomously branched above; leaves obovate to oblanceolate or spatulate, acute, to 5 cm. long and 1 cm. wide, usually much smaller; flowers few, scattered on upper part of stem; pedicels filiform to 2 cm. long; calyx lobes ovate to lanceolate, acute, 3-5 mm. long, minutely hairy, 1-nerved; petals 5-7 mm. long, bifid, mostly exceeding the calyx; styles 5; capsule 7-8 mm. long, its teeth revolute from apex. In open oak woods on the Edwards Plateau, Mar.-May; w. to Ariz.

3. *Cerastium axillare* Correll. Plant apparently annual, to 3 dm. high, glutinously glandular-pubescent throughout; stems few or many, suberect or ascending, sparsely branched; leaves typically linear-oblanceolate but occasionally linear-elliptic to elliptic-lanceolate, obtuse to subacute, to 3 cm. long and 8 mm. wide; flowers produced singly in leaf axils along much of main stem and branches; pedicels slender, 1 cm. long or less; sepals elliptic, 4-5 mm. long, obtuse to subacute, densely glandular-pubescent (especially on lower half), with scarious margins, noticeably exceeding the petals; petals elliptic-oblanceolate in outline, 3-4 mm. long, divided to near the middle into linear-lanceolate subacute lobules; capsule about twice as long as the calyx; seeds reddish-brown, tuberculate, about 0.5 mm. in diameter. On open-forested slopes, rocky hills and in grasslands in the mts. of the Trans-Pecos, Apr.-Sept.; also Chih.

This species is distinguished from *C. brachypodum* and *C. vulgatum* by having its flowers produced singly in leaf axils along much of the main stem and branches instead of being produced in apical cymes as in those species. The plant is also densely glandular-pubescent, and the small, deeply lobed petals are conspicuously exceeded by the sepals.

4. *Cerastium glomeratum* Thuill. Erect or ascending viscid annual, simple to freely branched below, to about 3 dm. high; leaves elliptic to narrowly oblong-obovate, rounded to obtuse at apex, hairy on both sides, the median leaves to 3 cm. long; bracts very small, herbaceous; inflorescence at first glomerate, in maturity looser but with the terminal clusters dense; pedicels in anthesis shorter than calyx, in fruit shorter than to but slightly exceeding the calyx; sepals ovate-lanceolate, sharply acute, firm, with scarious margins, 3-5 mm. long, with long hairs noticeably extending beyond their apex; petals oblong, deeply notched, narrow, their margins not meeting, slightly exceeding sepals, rarely wanting; stamens 10, the filaments glabrous; capsules slender, slightly curved, 5-9 mm. long; seeds minute, pale-brown, finely muricate. *C. viscosum* L. *nom. rej.* A nat. of Eur. that has become naturalized in fields, cleared woodlands, along roadsides and in disturbed and waste places, in the e. third of Tex., Feb.-May; from Fla. to Tex. and Calif., n. to N.E., N.Y., O., Ill., S.D. and B.C.

5. *Cerastium vulgatum* L. COMMON MOUSE-EAR. Short-lived matted perennial with depressed basal leafy offshoots; flowering stems to 65 cm. high, hirsute to rarely glandular, the median internodes becoming as much as 12 cm. long; leaves of the season in 3 to 7 pairs, oblanceolate to oblong or narrowly oval, conspicuously white-hirsute on both surfaces, the median leaves to 4 cm. long and 15 mm. wide; bracts similar to leaves but smaller, broadly scarious at summit and margin; inflorescences 3- to many-flowered, forming terminal ultimately very dichotomous cymes, at first rather compact, in fruit with the lower pedicels divergent or reflexed and 2 to 4 times the length of the calyx; sepals 5-7 mm. long, ovate-lanceolate to elliptic-lanceolate, obtuse to acute, scarious-margined, hirsute but glabrous at tip; petals 4-5 mm. long, narrow, about equaling or somewhat

exceeding the sepals, cleft for about 1 mm. at apex, with ciliate claw; capsule narrowly cylindrical, curved, 9-12 mm. long; seeds to 0.9 mm. in diameter, reddish-brown, bluntly tuberculate. *C. triviale* Link. A nat. of Euras. that has become naturalized in fields, along roadsides, and about old homesteads, uncommon in Tex., spring-summer.

The var. *holosteoides* Fries is a glabrescent plant or with minute lines of hairs on the stems; the elliptic to oblong leaves are dark-green, ciliate and round-tipped.

6. *Cerastium brachypodum* (Engelm.) Robins. Annual, pale-green, finely pubescent or puberulent and sometimes viscid, to about 3 dm. high, sparsely branched; leaves linear-oblong to oblanceolate, obtuse to subacute, seldom more than 25 mm. long; flowers in more or less open dichotomous cymes; pedicels about equaling but sometimes shorter than or a little exceeding the capsules, erect or somewhat deflexed, straight or at most gently curved, not hooked below the calyx; calyx about 4 mm. long, the lobes elliptic and acute, very sparsely glandular-puberulent; petals elliptic in outline, about 6 mm. long and 2 mm. wide, exceeding the sepals, notched for about 1 mm. at the apex, the lobules triangular-lanceolate and acute; capsules 2 to 3 times as long as the calyx. Incl. var. *compactum* Robins. In open woods, prairies and meadows, and on slopes, mainly in cen. Tex. but extending s. and w., Feb.-Apr.; from Ga., n. to Va., Tenn., Ill., N.D., Alta. and Wash., w. to Ariz. and Mex.

This species is similar to *C. nutans* but it is a smaller plant and it does not have its pedicels abruptly curved or hooked just below the flowers as in that species.

7. *Cerastium nutans* Raf. Weak annual, the simple or loosely rather flaccid viscid-pilose stem to 6 dm. high, the median internodes to 1 dm. long; leaves oblong-lanceolate to narrowly obovate, acute or acutish, thin, the median leaves to 8 cm. long and 15 mm. wide; bracts similar to leaves but smaller, herbaceous; inflorescence loose, simple to dichotomous, 1- to many-flowered; pedicels filiform, ascending or spreading-ascending, with hooked tips, in fruit to 55 mm. long; sepals 2-5.5 mm. long, oblong-lanceolate, thin, blunt, pilose; petals narrowly obovate, wanting in cleistogamous flowers, with glabrous claws, cleft nearly to middle, exceeding calyx; capsule curved, to 13 mm. long; seeds about 0.5 mm. in diameter, reddish-brown, bluntly papillate. In alluvial soils, on rich wooded slopes and on calcareous rocks, uncommon in Tex., spring-summer; from s.w. Que. and N.E. to B.C., s. to Fla. and w. to Ariz.

8. STELLARIA L. CHICKWEED. STARWORT

Low often diffusely branched annuals or perennials with solitary or cymose flowers; sepals usually 5; petals white, of the same number as the sepals or rarely none, 2-cleft or -parted; stamens 10 or less, hypogynous; ovary 1-celled, many-ovuled; styles 3 or rarely 4 or 5, usually opposite the sepals; capsule ovoid to globose or oblong, 1-celled, dehiscent by twice as many valves as there are styles; seeds several to many, smooth or roughened.

About 120 species that are widely distributed.

- 1. Leaves ovate to ovate-elliptic, typically cuneate or somewhat rounded at base; distribution in eastern third of Texas1. *S. media*.
- 1. Leave ovate to triangular-ovate to subreniform, typically truncate to cordate at base (2)
- 2(1). Seeds with margins coarsely rounded-tuberculate; distribution in mountains of Trans-Pecos Texas2. *S. cuspidata*.
- 2. Seeds with marginal papillae that are peglike; distribution Edwards Plateau and south Texas3. *S. prostrata*.

1. *Stellaria media* (L.) Cyr. COMMON CHICKWEED. Weak annual or perennial with trailing, matted or loosely ascending terete stems, pubescent in lines, to 8 dm. long; lower and median leaves ovate to elliptic, with rounded bases and often ciliate petioles, the blade to 4 cm. long; upper leaves sessile; pedicels subcapillary, ascending to recurved; calyx usually pilose or villous (especially at base); calyx lobes oblong-lanceolate, obtuse to acute, to 6 mm. long; petals shorter than the calyx, 2-parted, sometimes wanting; stamens 3 to 10; capsule ovoid, equaling or exceeding the calyx; seeds tuberculate, about

1 mm. long. A Euras. plant that has become naturalized in waste places, damp woods, thickets and about old homesteads, in the e. third of Tex.

2. *Stellaria cuspidata* Willd. MEXICAN STARWORT. Plants flaccid, usually forming mats over rocks and soil, commonly glutinous to the touch; stems weak, dichotomously branched, glandular-pubescent or rarely subglabrous, to 7 dm. or more long; leaves with slender pilose petioles to 15 mm. long, membranous, triangular-ovate to ovate-oblong, truncate to cordate at base, acute to acuminate at apex, ciliate to subglabrous, to 3 cm. long and 2 cm. wide, usually much smaller; inflorescence leafy, laxly few-flowered; flowers with filiform pilose pedicels to 17 mm. long; sepals ovate-elliptic to elliptic, obtuse to subacute, with scarios margins, 4-6 mm. long, pubescent; petals white, 7-8 mm. long, narrowly cuneate, deeply notched at apex; capsule ovoid-ellipsoid, 6-7 mm. long, the partitions strongly revolute at apex; seeds with margins coarsely rounded-tuberculate. In moist soil in shade and on north-facing ledges, crevices, and at base of cliffs in mts. of the Trans-Pecos, Mar.-Oct.; also n. Mex.

3. *Stellaria prostrata* Baldw. LLOVISNA. Much-branched decumbent annual with glabrous or glandular-puberulent weak stems to about 6 dm. long; leaves broadly ovate to deltoid, acute to acuminate at apex, usually cordate or truncate at base, the blade usually 1-2 cm. long, rarely to 5 cm. long, equaled or surpassed by the slender but margined ciliate petiole; inflorescence open, leafy; pedicels subcapillary, 1-2 cm. long, a cending or erect; sepals ovate to elliptic-lanceolate, obtuse to subacute, to 4 mm. long, surpassed by the petals; capsule ovoid, somewhat longer than the calyx; seed obovoid, 0.7-0.8 mm. long, reddish-brown, papillate, the marginal papillae conspicuous and peglike. *Alsine Baldwinii* Small. Usually in moist soil in shaded areas along streams among brush and in groves in the South Plains, Edwards Plateau and Rio Grande Plains, Feb.-May; from Fla. to Ga. and Tex.

Stellaria crassifolia Ehrh., the linear-leaved northern "fleshy stitchwort" has been reported from the Gulf Coast of Texas, but we have not seen specimens from the state and are doubtful of its actual occurrence in Texas.

9. ARENARIA L.⁶⁰ SANDWORTS

Small usually tufted annual or perennial herbs; stems slender or wiry; leaves sessile to subpetiolate, exstipulate; flowers mostly white, in terminal cymose or capitate inflorescences or rarely axillary and solitary; sepals 5; petals 5 or sometimes wanting, entire to slightly notched or even bifid; stamens 10; styles 2 to 5, usually 3; ovary 1-celled, usually many-ovuled; capsule ovoid to spherical or ellipsoid, splitting into as many or twice as many valves as there are styles; seeds few to many, globose or reniform, often flattened.

About 150 species of wide geographical distribution, mainly in North Temperate Zone.

1. Capsules dehiscent by 6 (rarely 4 or 5) valves or teeth (2)
1. Capsules dehiscent by 3 valves or teeth (8)
- 2(1). Annuals, erect, slender, branching (3)
2. Perennials (Doubtful cases should be keyed under both alternatives) (5)
- 3(2). Sepals obscurely 3- to 5-nerved, puberulent; leaves ovate, 3-5 mm. long; stems uniformly puberulent 1. *A. serpyllifolia*.
3. Sepals prominently 1-nerved or rarely 3-nerved in *A. Benthamii*, usually glabrous; leaves lanceolate to elliptic-oblancheolate, usually more than 5 mm. long; stems glabrous or puberulent in lines (4)
- 4(3). Sepals noticeably dorsally keeled; distribution confined to igneous soils in mountains of Trans-Pecos Texas 2. *A. ludens*.
4. Sepals not prominently keeled; widely distributed in limestone areas mostly in west-central Texas 3. *A. Benthamii*.
- 5(2). Leaves with a distinct herbaceous blade, ovate or obovate to narrowly lanceolate or oblancheolate (6)
5. Leaves narrowly linear and more or less pungent, setaceous or subulate (7)

⁶⁰ Adapted from Bassett Maguire in Am. Midl. Nat. 46:493-511. 1951.

- 6(5). Plant glandular-pubescent throughout or glabrate below; stem strongly angled, the branches often spreading at right angles; leaves on main stem noticeably larger than those on the branches 4. *A. Jamesiana*.
6. Plant at most only minutely pubescent; stems terete, the branches erect-spreading; leaves similar in size throughout 5. *A. lanuginosa*.
- 7(5). Plants low, matted, mosslike, to 2 cm. high; leaves 4 mm. long 6. *A. livermorensis*.
7. Plants more than 5 cm. high; leaves 50-100 mm. long .. 7. *A. Fendleri*.
- 8(1). Perennial 8. *A. stricta*.
8. Annuals (9)
- 9(8). Sepals typically elliptic-lanceolate, acute, strongly 3- to 5-ribbed 9. *A. patula*.
9. Sepals typically ovate, obtuse, not prominently ribbed .. 10. *A. Drummondii*.

1. *Arenaria serpyllifolia* L. THYME-LEAVED SANDWORT. Annual, the stems simple to intricately forking, to 2 dm. high; branches cinereous-puberulent; leaves ovate, sessile, acute to acuminate, ciliate, scabrous, to 7 mm. long; inflorescence a leafy nearly regular panicle of dichotomous cymes; pedicels straight, to 1 cm. long; fruiting calyx 3-4 mm. long, 2-3 mm. broad at base, composed of lanceolate to ovate-lanceolate acuminate 3-nerved scabrous sepals; petals oblong, shorter than the sepals; capsule ovoid to flask-shaped, its 2-cleft olive valves hard and resistant; seeds globose-reniform, opaque, strongly rugose, about 0.6 mm. long. Fields, roadsides and open flats in sandy or rocky soils in e. and cen. Tex., Mar.-July; a Eur. adv. that has become naturalized from Fla. to Tex., n. to Que., Tenn. and Mo.

2. *Arenaria ludens* Shinners. Plant apparently annual, to 45 cm. high, commonly branched from the base; stems slender and erect or spreading, puberulent in lines; leaves opposite, ciliate at base, usually obovate-lanceolate on lower part of stem to linear-lanceolate above, acute to subacuminate, to 2 cm. long and 4 mm. wide; inflorescence few-flowered, laxly cymose, the bracts small; pedicels puberulent, to 2 cm. long; sepals ovate-lanceolate to narrowly lanceolate, acuminate, 3-4 mm. long, scarious, with a green dorsal keel along the solitary nerve that is sometimes ciliate below the middle; petals white, oblong, obtuse, about equal to or somewhat shorter than the sepals; capsule ovoid, with 4 or 6 valves; seeds dark-brown to blackish, about 0.5 mm. in diameter. In igneous soil on cliffs and ledges, and about springs, in the mts. of the Trans-Pecos, Aug.-Oct.; also n. Mex.

This species is closely allied to *A. Benthamii*. Its apparent geographical separation and its occurrence in igneous, not limestone, soils as well as its narrow dorsally keeled sepals set it apart from that species. It is also closely related to *A. lanuginosa*, but it is a more delicate plant with smaller flowers and vegetative parts.

3. *Arenaria Benthamii* Fenzl. Slender spreading or suberect annual, branched from the base, to 5 dm. high, the branches finely pubescent in lines; leaves elliptic-lanceolate to oblanceolate, acute and apiculate, often punctate, narrowed to a sessile more or less ciliate base, to 2 cm. long, usually much smaller, the floral leaves much-reduced; pedicels filiform, several to many times exceeding the sepals; sepals ovate to ovate-lanceolate, acute to acuminate, 3-4 mm. long, the margins scarious; petals elliptic, obtuse, much shorter than the sepals; capsules ovoid, 6-toothed, 3-4 mm. long; seeds dark-brown, minutely tuberculate. On open limestone slopes, among boulders and in open woodlands in n.-cen., cen. and s. Tex., w. to the e. Trans-Pecos, Mar.-July; also Okla.

4. *Arenaria Jamesiana* (Torr.) Shinners. STICKY STARWORT. Plant perennial, glandular-pubescent throughout or glabrate below; stems strongly angled, diffusely branched, erect or ascending, to 35 cm. high; leaves elongated, lanceolate to linear-lanceolate, attenuate to an acute apex, smooth, to 1 dm. long and 15 mm. wide near the closely sessile or clasping base, the leaves on main stem noticeably larger than those of the branches; flowers in loose leafy-bracted terminal or axillary cymes; pedicels about 8 mm. long; sepals herbaceous, oblong-lanceolate, subacute, 4-5 mm. long, scarious-margined; petals retuse to bifid at apex, sometimes cleft for half their length, much-exceeding the sepals; capsule ovoid, shorter than calyx, 6-toothed. *Stellaria Jamesiana* Torr. Rare under conifers

at high elev. in the mts. of the Trans-Pecos, Aug.-Oct.; from w. Tex., w. to Calif. and Wash.

5. *Arenaria lanuginosa* (Michx.) Rohrb. Perennial with more or less creeping subterranean stems; flowering stems lax, weak and reclining or sometimes trailing, to about 6 dm. long, with lines of minute pubescence; leaves thin, lanceolate to narrowly elliptic or linear-oblancoate, acute or pungent, narrowed to a somewhat ciliate base, to 3 cm. long and 8 mm. wide, more or less punctate; flowers axillary, subtended by leafy bracts; pedicels slender, puberulent, to 4 cm. long; sepals lanceolate, acute to acuminate, 3-4 mm. long, somewhat dorsally keeled along the solitary midnerve; petals white, about half as long as sepals, sometimes wanting; capsules about 5 mm. long; seeds smooth, shining, black, flattened, about 1 mm. in diameter. *A. alsinoides* Willd. In loam of damp woods, shaded ditches and other such places mainly in e., cen. and w. Tex., uncommon, June-Oct.; from Fla. to Tex. and Mex., n. to Va.; also W.I. and S.A.

Plants that occur in Culberson and Jeff Davis counties are referable to var. *cinerascens* (Robins.) Shinn. They are somewhat more rigid than in var. *lanuginosa*, grayish throughout with a fine pubescence, and leaves pungent. Also, their flowers have petals that are about half as long as the sepals.

6. *Arenaria livermorensis* Correll. Plants low, perennial, matted, mosslike, to 2 cm. high, mostly much smaller; stems filiform, branched near base, the internodes alternately grooved on opposite sides, often ciliate; leaves opposite, linear, pungent, about 4 mm. long and 1 mm. wide, rigid, prominently 1-nerved, the margins bristly-ciliate, usually with a fascicle of smaller leaves or a short leafy branchlet in leaf axils; flowers solitary in upper leaf axils; pedicel filiform, 6-10 mm. long, usually puberulent; sepals lanceolate, acute to acuminate, concave, 1-nerved, about 3 mm. long; petals absent; stamens about 8, the filaments arising from a fleshy lobulate disk; styles 3, separate to the base; capsule ovoid, 6-toothed, about 1 mm. long; seeds 5, subglobose, brownish, smooth, about 0.5 mm. in diameter. In crevices of cliffs and on bare walls, rare in the Davis Mts. of the Trans-Pecos, Aug.-Oct.; endemic.

7. *Arenaria Fendleri* Gray. Plant grasslike, rather pale and glaucous, finely glandular-pubescent above; stems often numerous, erect, leafy, to about 3 dm. high, closely aggregated at the apex of a thick branched woody rootstock; basal leaves setaceous, gramineous, ciliate or smooth, to 2 dm. long, somewhat pungent; cauline leaves gradually shorter, connate and sheathing at the base; inflorescence dichotomously cymose, glandular-pubescent, few- to many-flowered; pedicels about 1 cm. long at anthesis, glandular; sepals lanceolate to linear-lanceolate, attenuate, glandular, about 6 mm. long; petals obovate, white or pale-yellow, usually exceeding the sepals; capsules ellipsoid, exceeded by the sepals. On ledges and in crevices of cliffs and boulders at high elev. in the mts. of the Trans-Pecos, July-Sept.; from Tex., w. to Wyo., Ut. and Ariz.

8. *Arenaria stricta* Michx. ROCK SANDWORT. Loosely tufted perennial, becoming diffuse, to 3 dm. high, glabrous throughout; stems filiform, wiry, branching from the marcescent leafy base; leaves subulate-setaceous to -linear, strongly ribbed, rigid, the principal ones to 15 mm. long, usually subtending conspicuous dense fascicles of shorter leaves; loosely cymose above, to 30-flowered; sepals firm, ovate to lanceolate, acuminate, strongly 3- to 5-ribbed, 4-5 mm. long; petals oblong-obovate, to twice as long as the sepals; capsule slenderly ovoid, about equaling or slightly overtopping the calyx, the valves entire; seeds nearly black, rugose, 1 mm. long. On rocky hills from s.-cen. Tex. to the High Plains, Apr.-June; from O. to Neb., s. to Ark. and Tex.

Most of our material is referable to var. *texana* Robins. [*A. texana* (Robins.) Britt.], a usually more rigid plant that is 1-2 dm. high; leaves 5-10 mm. long, connate at the enlarged nodes; inflorescence denser; sepals lanceolate, almost cartilaginous, the edges inrolled.

9. *Arenaria patula* Michx. Diffusely branched annual with capillary stems to 3 dm. high; leaves slightly fleshy, linear-filiform to linear-lanceolate, to 4 cm. long and 3 mm. wide; pedicels divergent, to 45 mm. long, often glandular; sepals elliptic to lance-attenuate, acute at apex, often somewhat glandular, to 6 mm. long, strongly 3- to 5-ribbed; petals obcordate, to 3 times the length of the sepals; capsule about equaling or exceeding the calyx, its blunt valves entire; seeds 0.5-0.6 mm. long. In sandy, clayey or gravelly soil in prairies, meadows, fields and on rock outcrops, mostly in e. Tex., Mar.-May; from Ala., Tex. and Ark., n. to e. Kan., O. and Minn.

Var. *patula* may be distinguished from var. *robusta* not only by its smaller more compact size, seldom attaining more than 15 cm. in height, but by its narrower leaves (1.5 mm. wide or less), prominently 5-ribbed sepals, capsules mostly shorter than the calyx, and its corolla scarcely exceeding the calyx.

Var. *robusta* (Steypm.) Maguire is a larger more open plant with wide leaves, 3-ribbed sepals, capsules commonly exceeding the calyx, and corolla prominently exceeding the calyx.

10. *Arenaria Drummondii* Shinnars. Plant annual, to about 2 dm. high, the simple or sparsely branched stems and inflorescence mostly glandular-pubescent; leaves linear to linear-oblong or rarely linear-oblongate, obtuse, essentially glabrous, somewhat succulent, to 35 mm. long and 7 mm. wide, the upper leaves much-reduced but not scarious; flowers large for the plant, in dichotomous racemes; pedicels horizontally spreading, to about 25 mm. long, usually becoming reflexed in age; sepals ovate to elliptic, obtuse, scarious-margined, 5-7 mm. long; corolla white, sometimes greenish at base; petals obcordate, more or less deeply notched at the apex, to 15 mm. long, usually much-exceeding the calyx; capsule ovoid, vermucose, tan-color, about as long as the calyx; seeds muriculate, brownish. *Stellaria Nuttallii* T. & G., not *Arenaria Nuttallii* Pax. In sandy soils mostly in open grassy woodlands in e., s.-cen. and s. Tex., Feb.-June; also Okla.

10. SAGINA L. PEARLWORT

About 25 species that are native to the Northern Hemisphere.

1. *Sagina decumbens* (Ell.) T. & G. Plant annual, usually without a basal rosette; stems capillary, erect, ascending or rarely decumbent, simple or slightly forking, to 17 cm. high; leaves linear-subulate, often spreading-recurved, slenderly mucronate, exstipulate; pedicels filiform, axillary, straight, not hooked after anthesis, glabrous or glandular-pubescent above, to 25 mm. long; sepals 4 or 5, oblong to elliptic, obtuse, with scarious margins, to 2.5 mm. long, closely appressed-ascending; petals none or 1 to 5 and rudimentary or sometimes equaling or slightly exceeding sepals; stamens 3 to 10; styles as many as sepals and alternate with them; capsule slenderly ovoid, 2-3.5 mm. long, 1-2 mm. thick, its valves as many as sepals and opposite them, mostly recurved at apex after dehiscence; seeds reddish-brown, delicately marked with slender ridges, 0.2-0.3 mm. long. In moist or dryish fields, along paths and in open places in woods in e., cen. and s. Tex., Feb.-June; from Fla. to Tex., n. to e. Mass., s. Vt., s. N.Y., Ky., Ill., Mo. and e. Kan.

11. LOEFLINGIA L.

About 7 species in both hemispheres.

1. *Loeflingia squarrosa* Nutt. Small globose plants that are to 15 cm. high and about as wide, more or less glandular-pubescent throughout; stems diffusely much-branched from the base, somewhat rigid, spreading or ascending, often recurved; leaves crowded, subulate-setaceous, 4-6 mm. long, rather rigid and straight or recurved; stipules ovate-lanceolate to linear, much longer than wide; flowers inconspicuous, axillary, sessile, solitary or in fascicles; sepals 5, similar to the leaves but a little shorter, carinate, recurved and conspicuously awned (the 3 outer with a setaceous tooth on each side); petals minute, 3 to 5, sometimes wanting; stamens 3 to 5; style very short or lacking; stigmas 3; ovary 1-celled, triangular; capsule slender, 3-valved, shorter than or equaling the sepals; seeds several, obovate. *L. texana* Hook. Dry soils or loose sands in e., cen. and w. Tex., Feb.-May; from Tex. to Neb. and Calif.

12. POLYCARPON L. POLYCARP

About 16 species of wide distribution in temperate and tropical regions.

1. *Polycarpon tetraphyllum* L. Stems diffusely much-branched from the base, ascending or prostrate, to 15 cm. long, glabrous; leaves opposite or often in fours, flat, broadly oval to obovate, to 15 mm. long and 8 mm. wide, obtuse to rounded at apex, rather

abruptly narrowed to a short petiole; stipules and bracts scarious, lanceolate-acuminate; flowers numerous, small, cymose; sepals 5, scarious-margined, 2-3 mm. long, the prominent keel obscurely serrulate; petals 5, white, very thin, oblanceolate, smaller than the sepals; stamens 3 to 5; styles simple, short, 3-cleft; ovary 1-celled; capsule ovoid, 3-valved; seeds ovoid. In sandy or silty soils along beaches, edge of woods and along beaten paths in cen. and s. Tex., Mar.-July; an adv. from Eur.

13. PARONYCHIA MILL.⁶¹

WHITLOW-WORT

Low tufted annual or perennial dryish herbs, often with a woody base; leaves opposite, sessile, provided with usually conspicuous scarious stipules; flowers small, clustered or scattered in dense or loose cymes or in the forks of the stem, subtended by scarious bracts; calyx 5-parted, the lobes awn-tipped to mucronate or cuspidate; petals none or reduced to setiform staminodia; stamens 2 to 5, inserted at base of calyx; style 2, united nearly to stigmas; utricle membranous, mostly included in calyx, 1-seeded.

About 55 species in temperate and tropical regions of both hemispheres.

1. Plants annual or biennial; branches typically lax and widespreading (2)
1. Plants perennial; branches typically straight and erect or erect-ascending, rarely prostrate (8)
 - 2(1). Leaf blades flat, at least some 2 mm. broad or more (3)
 2. Leaf blades needlelike, always less than 2 mm. broad (5)
 - 3(2). Sepals concolorous, with only a short cusp or mucro on the back of the hood 1. *P. fastigiata*.
 3. Sepals with a distinct white margin, bearing a well-developed white awn at the summit (4)
 - 4(3). Main stem usually branched well above the base, the stoutish branches erect-spreading; distribution Aransas County and eastward 2. *P. Drummondii*.
 4. Main stem usually branched at or near the base, the slender branches commonly spreading on ground; distribution Aransas County and southward 3. *P. Jonesii*.
 - 5(2). Calyx of uppermost flowers noticeably exceeded by the subtending leaves 4. *P. setacea*.
 5. Calyx of uppermost flowers longer than the subtending leaves (6)
 - 6(5). Flowers mostly solitary and separate; calyx (including awn) usually 2 mm. long or less 5. *P. Lindheimeri*.
 6. Flowers mostly clustered; calyx (including awn) more than 2 mm. long (7)
 - 7(6). Plant glabrous, the branches erect-spreading; endemic to the Davis Mts. in Trans-Pecos Texas 6. *P. monticola*.
 7. Plant pubescent or puberulent, the branches widespreading or sprawling; endemic to central Texas 7. *P. chorizanthoides*.
 - 8(1). Sepals with conspicuous white margins and a white awn (9)
 8. Sepals without white margins and a white awn (10)
 - 9(8). Plants spreading, the elongate branches prostrate; leaves spreading, exceeding the stipules; calyx awn about 1 mm. long; in Rio Grande Plains 8. *P. Maccartii*.
 9. Plants pulvinate, the short branches erect or erect-ascending; leaves ascending, shorter than the stipules; calyx awn 1.5-2 mm. long; in Trans-Pecos Texas 9. *P. Wilkinsonii*.
 - 10(8). Plants densely pulvinate; calyx much-exceeded by the bracts or subtending leaves 10. *P. sessiliflora*.
 10. Plants not pulvinate; calyx usually exceeding the bracts or subtending leaves, rarely shorter in *P. Jamesii* (11)

⁶¹ Adapted partly from E. L. Core in Am. Midl. Nat. 26:369-397. 1943.

- 11(10). Sepals narrowly triangular-lanceolate, prominently 3-ribbed, 3-4.5 mm. long (12)
11. Sepals oblong to oblong-elliptic, not noticeably ribbed, usually less than 3 mm. long (13)
- 12(11). Plants strictly erect, when mature reddish-brown . . . 11. *P. Parksii*.
12. Plants mostly weakly ascending; when mature yellowish-green 12. *P. virginica* var. *scoparia*.
- 13(11). Plants completely glabrous; flowers mostly solitary and separate 13. *P. nudata*.
13. Plants scabrous to puberulent or pubescent; flowers mostly clustered (14)
- 14(13). Plants densely short-pubescent throughout; calyx awns short, erect or even turned inward; endemic to the Rio Grande Plains . . . 14. *P. congesta*.
14. Plants scabrous to puberulent or rarely short-pubescent; calyx awns usually prominent and spreading; mostly north of the Rio Grande Plains 15. *P. Jamesii*.

1. *Paronychia fastigiata* (Raf.) Fern. Annual; stem erect, branched well above the base, low and spreading, to 3 dm. tall; branches slender, densely disposed, wiry, short-jointed, pubescent; leaves flat, thickish, oblanceolate to linear-elliptic, to 15 mm. long and 3 mm. wide, pale-green, acute; stipules narrow, slender-tipped; cymes compact; sepals ovate, acute, 3-ribbed, with very narrow or obscure margins, less than 1 mm. long, slightly mucronate; styles 2, very short; utricle obovoid, flat-topped, shorter than the calyx. *Anychia dichotoma* of auth., not Michx. Dry woods or sandy openings in e. Tex., June-Aug.; from Fla. to Tex., n. to Mass. and Minn.

Those plants with bracts longer, not shorter, than the flowers are segregated as var. *paleacea* Fern.

2. *Paronychia Drummondii* T. & G. Annual or biennial; mainstem erect, the branches spreading, minutely pubescent, 10-25 cm. high, branching above into numerous cymes; leaves linear-oblong to oblanceolate, acute, the uppermost short-mucronate, to 25 mm. long and 2 mm. broad or more, ciliate, appressed-pubescent on both surfaces, rigid, attenuate to the sessile base; stipules lanceolate, long-acuminate, silvery, shorter than the leaves; calyx turbinate at the base, with a ring of hooked hairs; sepals cuneate, about 1.5 mm. long, red-brown with broad white margins, dilated into a white hood above, the back produced into a short somewhat recurved horn. In sandy soil in dry oak and pine woods and in loose sand of dunes in s.e. Tex. from Aransas Co. eastw., Apr.-Oct.; endemic.

A recent worker has divided this species into two subspecies as shown in the following key:

1. Leaves often strigose; flowers (1.75-) 2-2.25 (-2.5) mm. long; sepals with a conspicuous hood and awn; receptacle densely hairy; style 0.45-0.6 mm. long and shortly bilobate; ovary slightly papillose subsp. *Drummondii*.
1. Leaves mostly more or less glabrous; flowers 1.5-1.6 (-1.75) mm. long, often glabrous on the sepals but with a ring of hairs in the perigynous zone; hood tip short and the awn 0.25-0.3 mm. long; ovary papillose; style to 0.35 mm. long and often deeply 2-cleft subsp. *parviflora* Chaudhri.

3. *Paronychia Jonesii* M. C. Johnst. Annual herbs, taproot very slender; main stem slender, erect, only 1-2 cm. long, producing above several slender prostrate pseudodichotomous olive-brown pubescent branches as much as 5 dm. long; leaves oblanceolate, apically rounded, basally very long-attenuate, covered with fine white antrorse somewhat viscid spreading hairs, to 4 cm. long and 8 mm. broad; stipules scarious; cymes dense and with numerous minute bractlike leaves; sepals strigose, about 1.5 mm. long, linear-obovate, erect, cucullate and crested dorsally by a divergent mucro less than 0.5 mm. long, with white scarious margins; petals reduced to minute setaceous staminodelike rudiments a third the length of the calyx lobes. In loose coarse sand on dunes and open hills, and in sandy loam of mesquite plains in s. Tex. from Aransas Co. southw., Mar.-Dec.; endemic.

4. *Paronychia setacea* T. & G. Annual; stem glabrous to very rarely finely pubescent throughout, erect to erect-ascending, sometimes glaucous, 12-30 cm. high, branching into the many times dichotomous diffuse cyme; leaves subulate-setaceous, erect or nearly so, 5-30 mm. long, less than 1 mm. wide; stipules shorter than the leaves, lanceolate, attenuate into a long point; uppermost flowers usually much shorter than the subtending leaves; sepals about 2 mm. long, brownish to yellowish-green, oblong-linear, strigose-hirsute at the base, minutely scarious on the margin, the tip hooded and produced into a straight whitish or yellowish awn sometimes about as long as the body of the sepal. On rocky hills, flats, gravel and in sandy or silty soils from s.-cen. Tex., w. on the Edwards Plateau to the Trans-Pecos and s. to the Rio Grande Plains, Apr.-Aug.; endemic.

Those plants with bracts distinctly longer than the flowers are segregated as var. *longibracteata* Chaudhri.

5. *Paronychia Lindheimeri* Engelm. Plant annual or biennial, often glaucous; stems slender, wiry, glabrous or (at most) minutely scabrous, erect to widespreading, to 3 dm. high, much-branched from near base into dichotomous diffuse cymes; leaves sessile, setaceous or filiform, cuspidate, to 15 mm. long, less than 1 mm. wide; stipules narrowly lanceolate, silvery, shorter than the leaves; cymes open; calyx short-pubescent at the base; sepals oblong, slightly hooded within, 1.7-2 mm. long, terminating in a short cusp. In rocky, sandy or gravelly soil and on or about boulders on the Edwards Plateau, with isolated stations in e. and Trans-Pecos Tex., July-Nov.; also s.e. N.M.

Those plants with bracts as long as or longer than the flowers are segregated as var. *longibracteata* Chaudhri.

6. *Paronychia monticola* Cory. Annual, erect, open, as wide as high, glabrous; stems 10-15 cm. tall, 1-1.5 mm. thick, slender, branching at the base or to 3 cm. above the base, more or less repeatedly dichotomous; leaves setaceous, glabrous, shorter than the internodes, 1 cm. long or less; with the stipules lanceolate, silvery, 4 mm. or less long; the cymes loose, with exception of the uppermost the pedunculate cymes divided into 2 parts with a single flower in the axil of the branches, sessile or shortly pedicellate; inflorescences with 2-bracteolate branches, with the bracts agreeing with the leaves, the upper ones small, the last ones shorter than the calyx; calyx greenish-yellow, strigose at the base; sepals oblong, cucullate within, 2-2.5 mm. long, the apical seta 0.25 mm. long or shorter. Rare on summit of the Davis Mts. in the Trans-Pecos, Aug.-Oct.; endemic.

7. *Paronychia chorizanthoides* Small. Annual; stems slender, minutely pubescent or puberulent, 1-2.5 dm. tall, commonly forking near the base; leaves linear-filiform, 5-20 mm. long, less than 2 mm. broad, acute; stipules lanceolate, silvery, acuminate; flowers creamy-white, short-pedicelled or nearly sessile, in clusters; calyx urn-shaped, strigose at the base which is finally much-enlarged; sepals ovate or ovate-lanceolate, about 1.5 mm. long, with a stout midrib, abruptly contracted into rather stout erect or ascending to spreading prominent cusps that are sometimes as long as the body of the sepals. Dry black calcareous soil or sandy-gravelly slopes in s.-cen. Tex. and Edwards Plateau, June-Nov.; endemic.

8. *Paronychia Maccartii* Correll. Perennial (or biennial?), branched from the base; stems weak, prostrate, puberulent, laxly branched; leaves flat, linear-oblong to linear-lanceolate, to 1 cm. long and 1.5 mm. wide, tipped with a prominent white awn, minutely puberulent, with age becoming conduplicate and recurved, usually slightly exceeding the narrowly attenuate silvery stipules; flowers clustered, exceeding the silvery bracts; sepals purplish-brown, conspicuously white-margined, about 3 mm. long (including the apical white recurved awn), adorned on inner surface with a tuft of hairs at base of awn, noticeably pubescent at the swollen base on outer surface; style short. In hard-packed brick-red sand in Webb Co. in the Rio Grande Plains, Mar.-Apr.; endemic.

This is a laxly branched, prostrate plant with distinctive leaves and calyx.

9. *Paronychia Wilkinsonii* Wats. Perennial, with numerous stems from a branching caudex, puberulent throughout, 4-8 cm. high, with many short internodes; leaves flat, linear to linear-subulate, nerveless, attenuate from near the base to the prolonged apex, 4-8 mm. long, exceeding the internodes, to 1 mm. wide, densely puberulent; stipules narrow, scarious, bilobed, as long as the leaves, finally widespreading; flowers in close terminal cymes; bracts shorter than or about equaling the flowers; sepals about 3 mm. long, densely puberulent, the white awns at least half as long as the body of the sepal

and soon widespreading; fruit globose. On novaculite ridges in Brewster Co. in the Trans-Pecos, June-Oct.; also Chih.

Similar in habit and appearance to *P. sessiliflora* of the Texas Panhandle and northward but the white widespreading sepal awns are quite striking in contrast to the brown suberect awns of that species.

10. *Paronychia sessiliflora* Nutt. Plants yellowish-green, arising from a ligneous perpendicular caudex often 1 cm. thick; stems very densely cespitose, 4-10 cm. high, much-branched and crowded; leaves linear-subulate, 4-6 mm. long, chartaceous, spinulose-tipped, often ciliolate, imbricated, the lower erect, obtuse, the upper longer, recurved-spreading, arcuate or ascending, acute or mucronate; stipules subulate, 2 cleft, bicarinate; slightly shorter than the leaves; flowers terminal, solitary (or paired), sessile; bracts carinate, usually equaling the flowers; sepals oblong-linear, 3-nerved, pubescent at the base, 2-3 mm. long, red-brown with narrow scarious margins, arched at the summit within, with divergent setaceous awns often half as long as the body of the sepal. On bare stony hillsides, breaks and ravines in the High Plains, May-Aug.; from Tex. and N.M., n. to Sask. and Alta.

11. *Paronychia Parksii* Cory. Perennial plants becoming reddish-brown with age, densely cespitose, with rigid tight entirely erect stems, inflorescence not included, unbranched, 35-55 cm. tall, to 2 mm. thick, rough and puberulent; leaves subulate, mucronate, 2-2.5 cm. long, 1 mm. wide or less, the lower smaller, the higher longer than the internodes, puberulent and scabrous; stipules linear-lanceolate, long drawn out and silvery, divided to the apex more or less deeply, 6-10 mm. long; cymes 6 to 8 times divided, spreading, clustered and erect, many-flowered; bracts conforming with the leaves, the upper ones equaling the calyx; calyx to 1.5 mm. wide at the base, beyond the center scarcely 0.75 mm. wide, rough; sepals linear, 3-nerved, cuspidate, greenish-yellow, 4-5 mm. long, with a point 1 mm. long or longer, within subcucullate, with a short rough edge. On rocky soil in cen. Tex., July-Sept.; endemic.

This plant appears to be little more than a habit variation of *P. virginica* var. *scoparia*. It is here maintained until further study is made on this genus.

12. *Paronychia virginica* Spreng. var. *scoparia* (Small) Cory. Perennial plants that become yellowish to yellowish-brown with age, from a thick procumbent ligneous base; stems densely cespitose and branching from the base, erect to ascending, nearly simple above, 1.5-4 dm. high, glabrous or minutely puberulent, rigid, wiry; leaves subulate, mucronate, 15-25 mm. long, about 1 mm. wide, exceeding the internodes, erect, 2-sulcate beneath, glabrate or nearly so; stipules linear-lanceolate, long-attenuate, silvery, entire, the adjacent ones more or less united, 8-13 mm. long; cymes many times dichotomous, diffuse, fastigiate, many-flowered; bracts similar to the leaves; sepals linear, 3-ribbed, cuspidate, slightly cucullate at the apex within, yellowish to brown, with a narrow scarious margin, glabrous or sparsely pubescent, about 3 mm. long. *P. dichotoma* (L.) Nutt. On limestone hills and outcrops in the e. Edwards Plateau and n.-cen. Tex., July-Nov.; from cen. Tex., n. through e. Okla. to w. Ark.

13. *Paronychia nudata* Correll. Perennial to 25 cm. high, glabrous throughout except for the basal part of calyx; stems erect or erect-ascending, wiry, branched above, often somewhat glaucous; leaves linear, sharp-pointed, incurved-appressed against stem, to 15 mm. long, becoming greatly abbreviated in the cymose inflorescences; stipules silvery, narrowly triangular-lanceolate and long-attenuate, much shorter than the leaves; flowers solitary, conspicuously exceeding the ovate silvery bracts and greatly reduced adjacent leaves to stand exposed; sepals white or yellowish, 2.5-3 mm. long including the short slightly spreading yellowish apical awn. On limestone ledges and canyon walls, rare in w. Edwards Plateau and the Trans-Pecos, May-Aug.; endemic.

The glabrous and often glaucous stems, leaves abruptly and conspicuously abbreviated in the inflorescence, and essentially naked flowers are distinctive characteristics of this species. It superficially resembles *P. Jamesii*.

14. *Paronychia congesta* Correll. Perennial, about 1 dm. high, all parts (except the scarious stipules and bracts) densely covered with short often porrect hairs; stems clustered, simple or more or less branched, both stems and branches provided at their base with numerous congested imbricate leaves and bracts; leaves linear, sharp-pointed,

typically appressed to stem, those on middle of stem 5-6 mm. long, usually about equal in length to the lanceolate silvery stipules; flowers in clusters at apex of branchlets, noticeably exceeding the bracts and leaves; calyx lemon-yellow; sepals about 2.5 mm. long including the short erect apical spine; style about 0.5 mm. long. On rocky slopes of breaks on Rio Grande Plains, May-July; endemic.

The dense vestiture of short hairs, the numerous, congested imbricate leaves and bracts at the base of the stems and primary branches, the flowers exceeding the bracts and leaves, and the short erect calyx awn are distinctive characteristics of this species.

15. *Paronychia Jamesii* T. & G. Perennial; stems caespitose, much-branched from the base, minutely scabrous to short-pubescent or rarely subglabrous throughout, to 3 dm. high, erect or somewhat spreading, more or less dichotomously branched above, woody below; leaves sessile, linear-subulate, mucronate or cuspidate, to 2 cm. long, less than 1 mm. wide; stipules silvery, linear-lanceolate, setaceous, to 1 cm. long; cymes dichotomous, few-flowered, crowded, the branches ascending or spreading, with a central subsessile flower in each group; sepals strigose-pubescent at the base, linear-oblong, with an ascending or spreading cusp, hooded within at the summit 2-3 mm. long (including the cusp), typically exceeding the subtending leaves; utricle ovoid, less than 1 mm. in diameter. *P. Wardii* Rydb. On rocky slopes and breaks, dunes, sandhills and hard clayey soils, in dry areas on the Edwards Plateau, w. to the Trans-Pecos and n. to the High Plains, May-Nov.; from Tex. to Neb., Colo., Ariz. and Mex.

This species is widespread in the western half of Texas which no doubt accounts, in part, for its perplexing variability. In habit its stems may be weakly ascending to strictly erect and the glaucous to shining green plant may be merely scabrous to densely short-pubescent. The length of the typically spreading calyx awns is also most variable. The calyx usually exceeds or is equal to the subtending leaves, but plants with the calyx exceeded by the leaves are found mainly in west and northwest Texas and are segregated as var. *praelongifolia* Correll. The plants may represent juvenile specimens or new growth as they flower mostly from May to July, but they may also represent a genetical variation.

A recent work segregates as var. *parviflora* Chaudhri those plants with flowers 1.5-1.75 mm. long, and as var. *hirsuta* Chaudhri those plants with stems densely short-hirsute, leaves shortly appressed-pubescent and sepals hirtellous.

14. SPERGULA L.

An Old World genus of several species.

1. *Spergula arvensis* L. CORN-SPURRY. Annual herbs similar to *Spergularia*; stems slender, erect or ascending, branching from the base, to 45 cm. high, essentially glabrous or more or less glandular-pubescent; leaves in whorl-like fascicles at the nodes, mostly narrowly linear, blunt at apex, somewhat fleshy, channeled beneath, to 5 cm. long; stipules minute, connate; flowers white, in loose terminal paniculate cymes; pedicels slender, often reflexed in fruit; sepals and petals 5; sepals ovate, obtuse, 3-5 mm. long, scarious-margined; petals obovate, entire, usually about equaling the sepals; stamens 5 or 10; styles 5, short, alternate with the sepals; capsule ovoid-conical, exceeding the sepals, dehiscent by 5 valves that are opposite the sepals; seeds black, roughened, compressed, acutely angled. A widespread Eur. weed, usually in cult. ground, in n.e. Tex., Mar.-July; from Nfld. to Alas., s. to Va., Mo., Tex. and Calif.

15. SPERGULARIA J. & C. PRESL⁶² SAND-SPURRY

Low branching annual or perennial herbs; leaves opposite or sometimes fascicled, linear to filiform, fleshy or setaceous; stipules scarious; flowers pink or whitish, in terminal racemose bracted or leafy cymes; sepals 5; petals 5, fewer or sometimes wanting, entire; stamens 2 to 10; ovary 1-celled, many-ovuled; styles 3; capsule 3-valved to the base;

⁶² Adapted partly from Ruth P. Rossbach in *Rhodora* 42:57-83, 105-143, 158-193, 203-213. 1940.

seeds reniform-globose or compressed, smooth or roughened, often finely sculptured and sometimes echinate or winged.

About 40 species mostly in saline soils, widely distributed.

1. Plant glabrous throughout; cyme much-compounded; sepals to 1.6 mm. long; mature capsules 1.4-2.6 mm. long; seeds 0.4 mm. long or less, never winged 1. *S. platensis*.
1. Plant more or less glandular-pubescent (at least in the inflorescence); cyme lax; sepals 1.6 mm. long or more; mature capsules 3 mm. long or more; seeds 0.5 mm. long or more, wingless or sometimes winged (2)
- 2(1). Seeds smooth or (at most) minutely papillose, usually dull in appearance 2. *S. marina*.
2. At least some seeds minutely echinate, more or less silver-tinged 3. *S. echinosperma*.

1. *Spergularia platensis* (St.-Hil. & A. Juss.) Fenzl. Annual diffusely branched plants, often forming depressed mats 2-3 dm. across, glabrous throughout, the ultimate branches filiform; leaves narrowly linear to filiform, mucronate, 1-3 cm. long, scarcely 1 mm. wide; stipules deltoid, acuminate, 1-3 mm. long; flowers numerous, in open cymes; pedicels filiform, 2-8 mm. long; sepals broadly lanceolate, 0.8-1.5 mm. long; petals white, minute or rarely none; stamens 5; capsule 1.5-2.5 mm. long; seeds brown, minute, less than 0.5 mm. long, strongly rough-tuberculate, not winged. *Spergula platensis* (St.-Hil. & A. Juss.) Shinners. In low wet saline soils in n.-cen. and s. Tex., Mar.-June; a nat. of S.A., introd. in Calif. and Tex.

2. *Spergularia marina* (L.) Griseb. SALT-MARSH SAND-SPURRY. Annual erect or more often diffuse fleshy plants with branches to 35 cm. long, usually more or less glandular-pubescent; leaves rarely fascicled, linear, bluntly mucronate, to 4 cm. long and 1.5 mm. wide; stipules triangular, about as long as broad or slightly longer, 2-4 mm. long; cymes usually lax, the lower and sometimes the upper bracts foliaceous and elongate or the upper much-abbreviated; sepals ovate to ovate-lanceolate, blunt, 2.5-5 mm. long, much-exceeding the white or pink petals; stamens 2 to 5; capsule ovoid, equaling or exceeding the calyx, 3.5-6.5 mm. long; the lower fruiting pedicels to 1 cm. long; seeds pale-brown or reddish, opaque, not sculptured, smooth or minutely papillose, 0.5-0.9 mm. long, wingless or with a thin friable wing. *S. salina* J. & C. Presl. In saline or brackish soils in depressions in dunes and on flats from e. Tex. along the coast to s. Tex. and apparently isolated along the Rio Grande near El Paso, Mar.-June; from Fla., n. to Que., B.C. and Ill., w. to Tex., Calif. and Wash.; also Euras.

3. *Spergularia echinosperma* Čelak. Annual diffuse plants with stems to 2 dm. long, usually more or less glandular-pubescent throughout; leaves linear, to 35 mm. long and 1.4 mm. wide, usually not fascicled or with only one leaf in the axil; stipules deltoid, 1.4-2.4 mm. long; cymes laxly flowered; sepals ovate, 2.4-3.6 mm. long; petals pink or rosy at the apex, 1.6-2.8 mm. long; stamens as many as 4; styles 3, separated to the base; mature capsule 3.4-5 mm. long, exceeding the calyx by 0.4-1.8 mm.; fruiting pedicels filiform, reflexed or not, 5-11 mm. long; seeds 0.5-0.8 mm. long, deep reddish-brown or nearly black with a silvery tinge, rounded in outline, surface always roughened, echinate, with or without a broad scarious white wing. *S. salsuginea* var. *bracteata* Robins. In salt marshes and flats and in dune pockets in e. Tex., along the coast to Corpus Christi, apparently isolated near Ft. Stockton, Feb.-June; introd. into s. U.S. from the Old World.

FAM. 70. NYMPHAEACEAE SALISB.

WATER-LILY FAMILY

Aquatic perennial herbs with horizontal rhizomes and peltate or cordate leaves floating or emersed, the submerged leaves (when present) capillary-dissected; vernation involute; flowers axillary, solitary, perfect; sepals usually 3 to 6, green to petaloid, free or slightly united, hypogynous; petals 3 to many, showy and inserted on the surface of the ovary, sometimes transitional to stamens; stamens 3 to many, extrorse or introrse; pistils 1 to several; fruit a many-seeded berry or nut, or 1- to 3-seeded, small and indehiscent.

About 75 species in several genera of wide geographic distribution.

1. Carpels united either along their sides or along the outer margins by adnation to a cuplike "receptacle;" stigmas radiate; ovules numerous in each cell; stamens numerous, introrse; fruit an irregularly dehiscent berry, ripening in the water; leaves with a basal sinus (2)
1. Carpels free or (in *Nelumbo*) embedded in the receptacle; ovules solitary or 1 to 3 in each carpel; stamens hypogynous, few to many (3 to 36) and extrorse or slightly introrse, or very numerous and extrorse; fruits leathery or hard, indehiscent; floating or emersed leaves peltate and lacking a sinus (3)
- 2(1). Perianth widespreading, composed of 4 sepals and 12 to 32 showy white, pink, blue or yellow petals; carpels sunken in a cup-shaped fleshy receptacle or hypanthium on the outer surface of which the petals and stamens are inserted, prolonged upward into slender incurved projections (carpellary styles); seeds arillate 1. *Nymphaea*, p. 631.
2. Perianth subglobose, composed of 6 concave yellow (green- or red-tinged) sepals and numerous scalelike or stamenlike "petals" inserted with the numerous stamens on the receptacle beneath the ovary; carpels completely united, the stigmas radiate and sessile on a disk; seeds not arillate 2. *Nuphar*, p. 632.
- 3(1). Perianth of numerous segments, the flowers large and showy; receptacle large, top-shaped, with the many uniovulate carpels sunken separately in cavities on the upper side, only the stigmas protruding; receptacle becoming enlarged greatly in fruit, the carpels maturing into nuts; stamens very numerous, extrorse, hypogynous; all leaves floating or emergent on strong petioles, centrally peltate, large, glaucous; plants lacking mucilage 5. *Nelumbo*, p. 633.
3. Perianth composed of 6 to 8 segments, the flowers small; receptacle small, with 4 to 18 free superior carpels; fruit small, 1- to 3-seeded; leaves all floating or submersed; plants more or less coated with mucilage (4)
- 4(3). Plants with dissected opposite submersed leaves and small peltate floating leaves; perianth petaloid, white or purplish; stamens 3 to 6 . . . 3. *Cabomba*, p. 632.
4. Plants with only undivided alternate peltate floating leaves; sepals persistent, the petals dull-purple; stamens 18 to 36; plants heavily coated (especially on lower leaf surface) with mucilage 4. *Brasenia*, p. 633.

I. NYMPHAEA L. WATER-LILY. WATER-NYMPH

Plants with floating leaf blades and white, pink, blue or yellow flowers; leaves subpeltate, cleft at the base; sepals 4, nearly free, spreading; petals few to many, spreading, the inner petals passing into stamens, the outer petals about as large as the sepals, all borne with the stamens on the hypanthium that encloses the ovary; ovary 12- to 35-celled, the concave summit tipped by a globular projection at the center around which are the radiate stigmas that project at the margin to extend as linear and incurved sterile appendages; fruit depressed-globose, usually covered with the persistent petal- and stamen-bases, maturing under water; seeds enveloped by a saclike aril.

About 50 species, widely dispersed in the tropics.

1. Corolla yellow; rootstock stoloniferous at the apex 1. *N. mexicana*.
 1. Corolla white, pinkish, blue or violet; rootstock not stoloniferous (2)
 - 2(1). Corolla white or pinkish; outer stamens not appendaged at the apex; carpels united at sides; styles subulate; flowers floating 2. *N. odorata*.
 2. Corolla blue or violet; outer stamens with the connective produced into an apical appendage; carpels free at the sides; styles mere blunt protuberances; flowers raised on peduncle above surface of water 3. *N. elegans*.
1. *Nymphaea mexicana* Zucc. YELLOW WATER-LILY, LAMPAZO AMARILLO. Rootstock warty with the persistent petiole bases; leaves oval to suborbicular, to 2 dm. wide, glabrous, bright-green above, purple or crimson on the lower surface; flowers 6-10 cm. wide; sepals lanceolate to narrowly elliptic-lanceolate; petals usually about 25, bright-yellow, more elliptic than the sepals; stamens 50 to 60, the petaloid stamens mostly 2-2.5 cm. long; anthers of the inner stamens 4-6 mm. long; styles 7 to 9; berry ovoid, 2-

2.5 cm. long; seeds 4-5 mm. in diameter. In lakes, ponds and slow streams in e. and s. Tex., spring-summer; also s. Fla. and Mex.

2. *Nymphaea odorata* Ait. WHITE WATER-LILY, ALLIGATOR-BONNET, NINFA ACUÁTICA. Rhizome stout, horizontal, elongate, mostly 2.5-3 cm. thick; leaves arising along the rhizome, suborbicular, to 25 cm. wide, with a narrow sinus, green above, green tinged with red or purplish-red and obscurely veined on the lower surface; flowers very fragrant; sepals often purplish on back, elliptic to ovate or ovate-lanceolate, to 8 cm. long and 25 mm. wide; petals usually more than 25, white, elliptic or slightly broadened upward, thickish; stamens mostly more than 70, the petaloid stamens 3-4 cm. long; styles mostly about 20; berry depressed-globose, mostly 2.5-3 cm. in diameter; seeds ellipsoid, about 2 mm. long. Incl. var. *villosa* Casp. and var. *gigantea* Tricker, *N. spiralis* Raf., *N. lekophylla* (Small) Cory, *Castalia odorata* (Ait.) Woodv. & Wood, *C. lekophylla* Small. In ponds, lakes, slow streams and ditches in s.e. Tex., Mar.-Oct.; from Fla. to Tex., n. to e. Can. and Man.

3. *Nymphaea elegans* Hook. BLUE WATER-LILY, LAMPAZOS. Rootstock stoutish; leaves ovate to oval-orbicular, to 2 dm. wide, usually much smaller, undulate-sinuate or nearly entire, usually dark red-purple and somewhat veiny on the lower surface; flowers usually raised on a slender peduncle 1-2.5 dm. above the water; sepals mostly lanceolate, 4-5 cm. long; petals 6 to 10, lanceolate or sometimes ovate-lanceolate, blue or pale-violet; stamens numerous; styles 15 to 25, mere blunt protuberances; berry depressed-globose, 1.5-3 cm. in diameter; seeds 1-1.5 mm. in diameter. *Castalia elegans* (Hook.) Greene. In ponds, pools and ditches in s. Tex., Apr.-July; also s. Fla. and Mex.

2. NUPHAR SM.⁶³

About a dozen or more species and their variants in the North Temperate Zone.

1. *Nuphar luteum* subsp. *macrophyllum* (Small) E. O. Beal. YELLOW COW-LILY, SPATTERDOCK. Perennial aquatic with procumbent branching cylindrical rhizomes; leaves spirally arranged, with a deep sinus at the base; petioles and peduncles with numerous minute air-cavities; exposed leaves floating or emergent and erect, broadly ovate to suborbicular, to 3 dm. long or more and 25 cm. wide, with overlapping to divergent basal lobes, glabrous to more or less pubescent on lower surface; submersed leaves (when present) thin and translucent, essentially like the floating ones in size and shape; petioles terete to more or less flattened above, glabrous to pubescent; flowers to 45 mm. across, and 25 mm. high; sepals 6, roundish, concave, the inner portion green to yellow, rarely red-tinged; petals numerous, small and thickish, stamenlike or scalelike, truncate to emarginate, inserted with the numerous short stamens on the receptacle under the ovary, not surpassing the disklike 5- to 25-rayed sessile stigma, mostly persistent and at length recurved; anthers 3-7 mm. long, yellow, sometimes red-tinged; fruit ovoid, slightly constricted below the entire to crenate stigmatic disk; stigmatic rays 5 to 23, mostly ending 1-2 mm. from the disk margin; stigmatic disk sometimes red-tinged; seeds numerous, broadly ovoid, 4-6 mm. long, 3.5-5 mm. wide. *Nymphaea microcarpa* Mill. & Standl., *N. ovata* Mill. & Standl., *N. puberula* Mill. & Standl., *Nuphar advena* of Tex. auth., *N. advena* β *tomentosa* Nutt., *N. microcarpum* (Mill. & Standl.) Standl., *N. ovatum* (Mill. & Standl.) Standl., *N. puberulum* (Mill. & Standl.) Standl. In water or on mud in ponds, shallow lakes, streams and springs, mostly on the Edwards Plateau and in e. Tex., Mar.-Oct.; throughout most of e. N.A.; also n. Mex. and Cuba.

Beal, the latest monographer of *Nuphar*, placed all Texas material in subsp. *macrophyllum*. We have found no reason to differ from his conclusions.

3. CABOMBA AUBL.

About a half dozen species in the warmer parts of the Western Hemisphere.

1. *Cabomba caroliniana* Gray. FANWORT. Delicate aquatic herbs rooting in mud; stems slender, branched, to 2 m. long or more, with a thin gelatinous coating; submersed leaves opposite or whorled, with petioles to 3 cm. long, rounded in outline, to 6 cm. wide, palmately dissected into linear-filiform segments; floating leaves few, alternate,

⁶³ Ref: E. O. Beal in Jour. Elisha Mitchell Sci. Soc. 72:317-346. 1956.

peltate, entire, linear-elliptic, mostly slightly constricted at the middle, often bifid at one end, usually pubescent beneath, to about 2 cm. long; flowers solitary on long slender axillary peduncles, to 12 mm. long, white or cream-color, with yellow spots at base and sometimes pink-tinged at tips; sepals 3; petals 3, oval, biauriculate above the abbreviated claw; stamens 6, the short anthers extrorse; carpels 2 to 4, with small terminal stigmas; fruit 3-seeded, indehiscent. In lakes, ponds and quiet streams mainly in e. Tex., Apr.-July; from Fla. to Tex., n. to Va., s. Ill. and e. Mo., somewhat naturalized farther n.

4. BRASENIA SCHREB.

A monotypic genus of wide distribution.

1. *Brasenia Schreberi* J. F. Gmel. PURPLE WEN-DOCK, WATER-SHIELD. Rootstock slender, creeping in mud; stems slender; leaves alternate, long-petioled, centrally peltate, floating, broadly oval to suborbicular, rounded at both ends, entire or rarely very shallowly crenate, thickish, smooth on upper surface, gelatinous on lower surface, to 10 cm. long; flowers axillary, small, dull-purple, emergent; sepals and petals 3 or 4 each, linear-oblong, 1-1.5 cm. long; stamens 18 to 36, the filaments filiform, the anthers slightly introrse; pistils 4 to 18, separate, the stigmas linear; fruits clavate, coriaceous, indehiscent, 6-8 mm. long. *B. purpurea* Casp. In lakes, ponds and slow streams in e. Tex., Apr.-May; from Fla. to Tex., n. to P.E.I., s. Que., s. Ont. and Minn., w. to s. B.C. and Ore.

The stems, petioles and lower surface of the leaves are heavily coated with a viscid, gluey jelly.

5. NELUMBO ADANS. SACRED BEAN

Represented in both hemispheres by one species each.

1. *Nelumbo lutea* (Willd.) Pers. YELLOW LOTUS, WATER-CHINQUAPIN, POND-NUT. Aquatic herb with slender rhizomes rooted in mud; leaves orbicular, centrally peltate, floating or mostly raised above the water on long stout petioles, to 7 dm. in diameter, with the center depressed or cupped; peduncles stout, rising to about 1 m. above the water surface, the solitary pale-yellow flower to 25 cm. broad; sepals and petals numerous, commonly 20 or more, scarcely differentiated, the outermost (external in the bud) green and sepaloid; stamens numerous, spirally inserted and closely surrounding the pistils; anthers extrorse, tipped with a slender hooked appendage; fruiting receptacle prolonged, obconic, to 1 dm. in diameter, the numerous 1-ovuled ovaries sunk in small pits on its flat truncate summit; fruit nutlike, indehiscent, each separately embedded in the accrescent receptacle, about 1 cm. in diameter. In quiet water of ponds and sluggish streams in the e. third of Tex., May-July; from Fla. to Tex., n. locally to s. N.E., N.Y., s. Ont., Minn. and Ia.

The farinaceous storage tubers along the rhizome are edible as well as the seeds.

FAM. 71. CERATOPHYLLACEAE S. F. GRAY HORNWORT FAMILY

Submersed aquatic rootless herbs, with a slender primary stem and scattered lateral branches; leaves whorled, sessile, finely dissected; flowers minute, unisexual, without a perianth, solitary and sessile in leaf axils, subtended by an 8- to 12-cleft involucre in place of a calyx; stamens 12 to 16, the filaments short, the rather large anthers terminating in 2 or 3 sharp points; pistillate flower consisting of a simple 1-celled ovary with a suspended orthotropous ovule; fruit an achene, beaked by the slender indurated style.

A monotypic family.

1. CERATOPHYLLUM L. HORNWORT. COON-TAIL

Characters of the family; plants olive-green; leaves usually 1- to 4-dichotomously dissected into filiform to narrowly linear divisions.

About 10 species that are widely dispersed.

1. Leaves usually forked 1 or 2 times, the divisions conspicuously serrate on one side; achenes without lateral spines 1. *C. demersum*.
1. Leaves usually forked 2 to 4 times, the divisions entire or only obscurely serrulate; achenes with 3 to 5 lateral spines 2. *C. echinatum*.

1. *Ceratophyllum demersum* L. COMMON HORNWORT. Plants entirely submersed; lowest leaves of seedling simple; stems prolonged, sometimes to 3 m. long, branched and forming large masses, brittle or somewhat cordlike and flexuous; leaves as many as 12 in a verticil, finely dissected into capillary to linear and flattened serrate divisions, very variable as to the length, breadth and toothing of the leaf divisions, usually about 15 mm. long; achene compressed, ellipsoid, wingless, smooth, 4-6 mm. long, with 2 basal spines 2-5 mm. long; style 4-6 mm. long. In quiet waters of lakes, ponds and slow streams throughout Tex. but mostly in the e. part of state, summer; from Que. to n. B.C., s. to Mex.; also Old World.

2. *Ceratophyllum echinatum* Gray. Plants entirely submersed, closely resembling *C. demersum*; lowest leaves of seedling cleft; stems prolonged and branched; leaves usually with entire capillary divisions, 1.5-2 cm. long, the uncleft base somewhat expanded; achene narrowly winged by the confluent bases of the lateral spines, with a somewhat tuberculate surface, 5-7 mm. long; style 5-10 mm. long. *C. demersum* var. *echinatum* Gray. In quiet waters of streams, lakes and pools, mostly in e. Tex., summer; from Fla. to Tex. and Mex., n. to s.w. N.B., s. Me., N.Y., O., Mich., Ill. and Minn.

FAM. 72. RANUNCULACEAE JUSS.

CROWFOOT FAMILY

Herbaceous or occasionally woody plants; leaves basal, alternate or in a few genera opposite or whorled; flowers hypogynous, regular or irregular (in *Delphinium*), with all parts free and distinct or the pistils connate in *Nigella*; sepals present, usually imbricate, varying from petaloid to small and caducous; petals present or absent; stamens usually numerous; pistils 1 to many, simple; ovules 1 to many; style 1; stigma lateral or terminal, usually minute; fruit an achene, follicle or berry.

Perhaps about 1,000 species in about 50 genera of world-wide distribution but mostly in the forested parts of the North Temperate Zone.

1. Flowers with large spurs (2)
 1. Flowers with minute spurs or none (3)
 - 2(1). Flowers regular, with each of the 5 conspicuous petals prolonged backward to form a long spur 3. *Aquilegia*, p. 636.
 2. Flowers irregular, with the upper petaloid sepal prolonged backward to form a long spur 4. *Delphinium*, p. 638.
 - 3(1). Leaves linear, entire, basal; flowers minute, in a tight cylindric spike, with each of the tiny sepals prolonged backward to form a short spur 8. *Myosurus*, p. 648.
 3. Leaves and flowers not as above (4)
 - 4(3). Flowers noted primarily by their numerous stamens or carpels; sepals small, early-deciduous 2. *Thalictrum*, p. 635.
 4. Flowers noted primarily by their expanded sepals or petals (5)
 - 5(4). Cauline leaves (at anthesis) in a dense cluster at the top of the woody stem; wood yellow; flowers purplish-brown; staminodia present 1. *Xanthorrhiza*, p. 635.
5. Leaves, wood and flowers not as above (6)
 - 6(5). Leaves opposite or whorled (7)
 6. Leaves alternate or all basal (8)
 - 7(6). Stems scapose, erect or ascending; leaves with some whorled, distinctly palmately lobed 9. *Anemone*, p. 648.
 7. Stems viny, climbing or scrambling; leaves opposite, not distinctly palmately lobed 10. *Clematis*, p. 650.

- 8(6). Petals red or orange-color; plants escaped from cultivation 7. *Adonis*, p. 648.
8. Petals yellow or white; plants native (9)
- 9(8). Petaloid sepals white; plants terrestrial; leaves not finely dissected; follicles usually 4 5. *Isopyrum*, p. 641.
9. Petals yellow or (if white) the plants aquatic and with finely dissected leaves; achenes more than 4 6. *Ranunculus*, p. 641.

1. XANTHORHIZA MARSH.

A monotypic genus.

1. *Xanthorhiza simplicissima* Marsh. BROOK-FEATHER, YELLOWROOT. Plant low, weak, shrubby, with deep-yellow and bitter bark and long roots, to about 6 dm. high; leaves approximate, 1- or 2-pinnate; leaflets mostly 5, ovate to elliptic, 25-75 mm. long, incised-toothed or divided; flowers polygamous, in compound drooping racemes, appearing along with the leaves from large terminal buds in early spring; sepals regular, 5, spreading, deciduous, ovate to ovate-lanceolate, brownish-purple; petals 5, glandlike; stamens 5 or 10, the filaments stout; pistils 5 to 15, with 2 pendulous ovules; follicles elliptic, 1-seeded, 3-4 mm. long, the short style becoming dorsal. In damp woods, thickets and on wooded stream-banks, rare in s.e. Tex., Mar.-May; from N.Y., s. to Fla. and Tex.

2. THALICTRUM L.⁶⁴

MEADOW-RUE

Plants herbaceous, perennial, often polygamous or dioecious; leaves alternate, rather large, twice or thrice ternate with numerous usually cleft or shallowly lobed leaflets, the basal leaves long-stalked; petioles dilated at base; flowers mostly unisexual, small, greenish or yellowish, usually in terminal panicles; sepals 4 or 5, caducous, petaloid or greenish; petals none; stamens numerous, exserted, the filaments filiform or slender-clavate; stigma unilateral; achenes 4 to 15, with longitudinal grooves or ribs extending from base to apex, sometimes inflated.

About 150 species, mostly in the Northern Hemisphere.

1. Leaflets usually rather thick and rigid, mostly longer than wide, entire to usually acutely 3-lobed with the lobes entire; polygamo-dioecious 1. *T. dasycarpum*.
1. Leaflets usually thin and flaccid, about as wide as long or wider, typically 3-lobed with the lobes obtuse to rounded and often notched or crenate; dioecious, rarely polygamous (2)
- 2(1). Distribution confined to Trans-Pecos Texas; plants usually more or less puberulent and stoloniferous; carpels wide-curved or compressed 2. *T. Fendleri*.
2. Distribution in east Texas; plants glabrous, never stoloniferous; carpels erect, the ventral surface symmetrical, neither compressed nor curved (3)
- 3(2). Mature carpels ovoid; stigma 0.5-1 mm. long; plants rigid, erect, with black roots 3. *T. texanum*.
3. Mature carpels ellipsoid; stigma 1.3-3 mm. long; plants decumbent, with brown roots 4. *T. arkansanum*.

1. *Thalictrum dasycarpum* Fisch. & All. PURPLE MEADOW-RUE. Caudex short and thick, erect; stem to 2 m. high, often purple; upper leaves sessile or subsessile, their ovate to suborbicular stipules brown; leaflets firm, obovate in outline, to about 55 mm. long and 4 cm. wide, with veins prominent beneath, provided on lower surface with a fine non-glandular pubescence or glabrous, or sometimes glaucous; inflorescences corymbose-paniculate; sepals lanceolate to narrowly ovate, acuminate, commonly slender-tipped, 3-5 mm. long; filaments filiform, 4-7 mm. long, soon drooping and entangling; anthers

⁶⁴ Adapted from Bernard Boivin in Contr. Gray Herb. 152. 1944.

oblong-linear, 1.5-3.2 mm. long, with subulate tip only 0.1-0.2 mm. long; stigma 2-5 mm. long, about equaling the ovoid to lanceolate body of carpel. In meadows, swamps and damp thickets, on rich wooded slopes or along wooded streams in e. third of Tex. and the n. Panhandle, Mar.-July; from Ont. to Alta., s. to O., Ind., Ill., Mo., Kan., La., Tex., N.M. and Ariz.

The var. *hypoglaucom* (Rydb.) Boivin (*T. hypoglaucom* Rydb.) is an entirely glabrous plant with somewhat thinner leaves that are glaucous on the lower surface, often longer stigmas (2.5-5 mm.), longer filaments (4-7 mm.) and a more elongate receptacle than in var. *dasycarpum*.

2. *Thalictrum Fendleri* Engelm. Plant always more or less pubescent, rarely subglabrous or even glabrous, never waxy nor blue nor glaucous, the stem sometimes purplish, to 15 dm. high, more or less stoloniferous; sepals erose, the staminate ovate to elliptic and 3-5 mm. long, the pistillate ovate to rhombic or broadly lanceolate and about 1.5 mm. long; filaments 4-7.5 mm. long, deep-yellow; anthers oblong to linear, pale- or deep-yellow, 2.2-3.4 mm. long, with acumen to 0.8 mm. long; stigma 1.5-4 mm. long; ovary (densely) green, with the ventral surface ovate to lanceolate, often densely pubescent; mature carpel spreading, ovate to lanceolate, green to brown, more or less pubescent to sometimes glabrous, with a stipe to 2 mm. long, the ventral surface to 9 mm. long and 4.5 mm. wide, with lateral nerves rarely branching and sinuate, never minutely sinuate nor anastomosing nor reticulate, with the nerve curved ventrally rather than dorsally. On moist shaded canyon slopes in mts. of the Trans-Pecos, June-Sept.; from Tex., w. to Ore., Wyo. and Ariz.; also n. Mex.

3. *Thalictrum texanum* (Gray) Small. HOUSTON MEADOW-RUE. Plant rigid, erect, to 45 cm. high, with roots becoming black when dry, not ribbed but irregular; sepals of male flowers 1.7-3 mm. long, of female flowers 0.7-1.5 mm. long; filaments about 1.5 mm. long; anthers 1.4-2 mm. long; stigma 0.5-1 mm. long; mature carpels ovoid, with stipe 0.1-0.3 mm. long, the ventral surface 2.7-3.7 mm. long and 1.4-1.6 mm. wide, with an acute apex, rounded at base, 6- to 8-nerved in fruit. In s.e. Tex., Mar.-May; apparently endemic.

4. *Thalictrum arkansanum* Boivin. Plant decumbent, 2-4 dm. high, with a fascicle of thickened brown roots, ribbed; sepals of male flowers ovate to elliptical and 2-3 mm. long, of female flowers ovate and 1-1.5 mm. long; filaments 2-3 mm. long; anthers 1.8-2.3 mm. long, with the acumen 0.1-0.4 mm. long; stigma 1.5-3 mm. long; mature carpel sessile, with the ventral surface ellipsoid, 3.5-4.5 mm. long, 1.5-2 mm. wide, 10- to 12-nerved in fruit. Rare in low rich woods in n.e. Tex., Mar.-Apr.; also Ark. and Okla.

3. AQUILEGIA L.⁶⁵ COLUMBINE

Perennial herbs from a stout caudexlike rhizome; leaves petiolate, 2 or 3 times ternately compounded; flowers regular, few but conspicuous; sepals 5, short-clawed at base, petal-like, soon deciduous; petals 5, the terminal portion expanded, prolonged backward from the base below the flower into an elongate hollow spur that secretes nectar from an internal gland at its apex; stamens numerous, separate but often more or less connivent, the innermost staminodal; filaments elongate; anthers oval; pistils usually 5, erect, each prolonged into a slender style; fruit a several-seeded slender-beaked follicle.

About 100 species in the North Temperate Zone.

1. Flowers red and yellow, nodding; on Edwards Plateau . 1. *A. canadensis*.
1. Flowers yellow, erect or nearly so; in Trans-Pecos Texas (2)
- 2(1). Sepals about 17 mm. wide; petal blade about 2 cm. long and 16 mm. wide; leaves biternate; in Sierra Vieja Mts. 2. *A. Hinckleyana*.
2. Sepals 5-10 mm. wide or (if wider) the spur more than 1 dm. long; leaves often triternate (3)
- 3(2). Spurs to 4 cm. long; sepals to 2 cm. long; in Guadalupe Mts. 3. *A. Chaplinet*.
3. Spurs much more than 4 cm. long; sepals 2 cm. long or more (4)

⁶⁵ Adapted mainly from P. A. Munz in *Gent. Herb.* 7:1-150. 1946.

- 4(3). Petal blade 8-16 mm. long; spurs 4-9 cm. long, rarely longer; flowers clear-yellow; petioles to 2 dm. long; leaflets about 4 cm. long or less; in Davis Mts. 4. *A. chrysantha*.
4. Petal blade 15-30 mm. long; spurs 10-15 cm. long; flowers pale-yellow; petioles to 3 dm. long; leaflets usually more than 4 cm. long; in Chisos Mts. 5. *A. longissima*.

1. *Aquilegia canadensis* L. WILD COLUMBINE. Stems mostly 2-5 dm. high, branched above, rather sparsely pilose throughout to almost glabrous, slightly glandular; leaves biternate or sometimes triternate, bright-green and glabrous above, glaucous and somewhat pilose beneath; leaflets 1-3 cm. long, usually cleft to below the middle and the main divisions mostly 3-10 mm. wide; flowers nodding, 3-4 cm. long, 2-3 cm. wide; sepals ovate to ovate-lanceolate or ovate-oblong, red or sometimes greenish, 1-2 cm. long, 5-8 mm. wide, acute to acuminate; petal blades yellow, 5-6 mm. long, rounded and truncate; spurs red, 18-25 mm. long, slender or stoutish, narrowed gradually at half their length; styles 12-15 mm. long; follicles 1.5-2 cm. long, slightly spreading at tips. *A. phoenicantha* Cory, *A. australis* of auth. On mossy boulders and ledges in ravines and canyons of the Edwards Plateau, Mar.-May; from Can., s. to Ga., Ala., Tenn., Ark. and Tex.

Our plant is usually referred to var. *latiuscula* (Greene) Munz (*A. latiuscula* Greene) with basal leaves bi- or triternate and leaflets mostly cleft to below the middle, blade of petals 5-6 mm. long and spur 18-22 mm. long.

2. *Aquilegia Hinckleyana* Munz. Stems 5-7 dm. high, glabrous and glaucous below, glandular-pubescent and freely branched in the inflorescence; basal leaves biternate, glabrous and pale-green above, glabrous and more glaucous beneath; petioles glabrous, rather slender, 2.5-3 dm. long, the glaucous primary petiolules subglabrous and 2.5-5 cm. long, the secondary petiolules to 25 mm. long and sparingly pilose; leaflets suborbicular, rather thin in texture, 2-4 cm. long, cleft to about the middle, each segment then with 2 or 3 rounded-oblong teeth or lobes; cauline leaves several, gradually reduced upward; pedicels to about 7 cm. long; flowers suberect, golden-yellow, subglabrous; sepals spreading, ovate, obtuse, about 25 mm. long and 17 mm. wide; petal blades spatulate-obovate, rounded-truncate, about 2 cm. long and 16 mm. wide; spurs slender, straight or slightly curved, about 4 cm. long and 5 mm. wide at base, then gradually narrowed to almost filiform tube and slightly enlarged tip; stamens exerted 6-7 mm.; staminodia 12-14 mm. long, abruptly narrowed at apex; follicles 2-2.5 cm. long, glandular-puberulent, with slightly flaring tips; styles almost glabrous, filiform, about 2 cm. long; seeds about 1.5 mm. long. Apparently endemic to the Capote Falls region in Presidio Co. where it occurs on dripping cliffs about the falls, Mar.-Nov.

3. *Aquilegia Chaplinei* Standl. Stems 2-5 dm. high, glabrous except for the glandular-pubescent upper parts, openly branched; basal leaves biternate to triternate, glabrous and somewhat glaucous above, glabrous to somewhat pubescent and more glaucous beneath; petioles very slender, glabrous, 5-12 cm. long, the primary petiolules glabrous and 1-4.5 cm. long, the secondary petiolules to 2 cm. long; leaflets cuneate-obovate to suborbicular, thickish in texture, 1-1.5 cm. long, cleft to or below the middle, each segment then with 2 or 3 rounded oblong teeth or lobes; cauline leaves several, gradually reduced upward; pedicels to about 1 dm. long; flowers suberect, pale-yellow, somewhat pubescent; sepals spreading, broadly lanceolate, acute or obtuse, 13-16 mm. long, 4-6 mm. wide; petal blades oblong, truncate-rounded, 8-10 mm. long; spurs yellow, slender, straight or spreading, 3-4 cm. long, about 4 mm. wide at base, then gradually narrowed to almost filiform tube and slightly enlarged at tips; stamens exceeding petal blades by almost 1 cm.; anthers pale, about 1 mm. long; staminodia 7 mm. long, plane, rather abruptly narrowed at tip; follicles 18-22 mm. long, glandular-pubescent, with slightly flaring tips; styles pubescent, about 15 mm. long; seeds almost 2 mm. long. On boulders, in shaded crevices and in limestone soils in canyons, mostly along streams, apparently endemic in the Guadalupe Mts. in N.M. and Tex., Apr.-Oct.

This species is near to *A. chrysantha* but it has smaller flowers with a much shorter spur.

4. *Aquilegia chrysantha* Gray. Stems 4-12 dm. high, glabrous at base and glandular-pubescent above or throughout, usually much-branched above; basal leaves mostly triternate, rather thin, glabrous and light-green above, glaucous and glabrous to pubescent

beneath; petioles slender, 5-20 cm. long, glaucous, glabrous or pubescent; primary petiolules 2-5 cm. long, the secondary petiolules about half as long and the tertiary to 25 mm. long; leaflets cuneate-obovate to orbicular-obovate, to 45 mm. long, usually much smaller, cleft to middle or beyond, the main divisions with 2 or 3 round-oblong lobes; cauline leaves well-developed; pedicels to about 1 dm. long; flowers erect, clear golden-yellow throughout, somewhat glandular-pubescent; sepals spreading, lanceolate to ovate-lanceolate, usually acuminate, 2-3.5 cm. long, 5-10 mm. wide; petal blades oblong-obovate, usually rounded at apex, spreading, 8-16 mm. long; spurs usually spreading, 4-7 cm. long, 4-6 mm. wide at base, gradually narrowed to an almost filiform tube with slight apical thickening; stamens usually exceeding petal blades by 8-10 mm.; anthers 1.5-2 mm. long; staminodia 9-12 mm. long, very little crinkled, subacuminate; follicles glandular-pubescent, 2-3 cm. long, the tips spreading; styles pubescent, 12-18 mm. long; seeds about 2 mm. long. With the exception of a possible station at Cat-tail Falls, Chisos Mts., this species, in Tex., seems to be confined to the Davis Mts. where it occurs among boulders and in sheltered crevasses, July-Aug.; from Ariz., Colo., N.M. and Tex., s. to n. Mex.

5. *Aquilegia longissima* Gray. LONGSPUR COLUMBINE. Stems 5-12 dm. high, often forming large clumps, glabrous below and glandular-pubescent above or glandular-pubescent throughout, open-branched above; basal leaves triternate, rather thin, light-green and glabrous to slightly pubescent above, glaucous and glabrous to pubescent beneath; petioles slender, 2-3 dm. long, glabrous to pubescent; primary petiolules 3-5 cm. long, the secondary petiolules 1-5 cm. long and the tertiary to 15 mm. long; leaflets much as in *A. chrysantha*, 15-45 mm. long; cauline leaves well-developed; pedicels to 2 dm. long; flowers erect, pale-yellow, somewhat glandular-puberulent; sepals spreading, lanceolate, acuminate, 25-35 mm. long, 6-13 mm. wide; petal blades spreading almost horizontally, spatulate to spatulate-obovate, 1.5-3 cm. long, rounded to emarginate; spurs filiform, pendent, mostly 9-15 cm. long, 2-3 mm. wide at base, the tips about 1.5 mm. thick; stamens 5-12 mm. longer than petal blades; anthers 1.5 mm. long; staminodia 12-14 mm. long, rather plane, subacuminate; follicles glandular-pubescent, about 25 mm. long, with spreading tips; styles 16-26 mm. long; seeds almost 2 mm. long. Along streams and in wet places among boulders, on ledges and in sheltered crevices in canyons of Chisos Mts. in the Trans-Pecos, June-Nov.; also n.e. Mex.

4. DELPHINIUM L.⁶⁶ LARKSPUR

Annual or usually perennial herbs, with erect to virgate or ascending stems from a usually tuberiform or rhizomatous rootstock; leaves palmately or rarely pinnately cleft or divided; flowers commonly showy, morphologically very similar in our species, in terminal racemes or panicles; sepals 5, irregular, petal-like, the upper one prolonged into a spur at the base; petals 4 or rarely 2 (united into one), irregular, the upper pair continued backward into long spurs that are enclosed in the spur of the calyx, the lower pair with short claws; stamens usually numerous; pistils 3 or fused into 1, forming many-seeded follicles.

This is a complex genus of about 150 species mostly in the North Temperate Zone. Many species and hybrids are valued as ornamentals, and many of the species are known to be poisonous to livestock. The complexity of the genus is emphasized by the existence of multiple hybrids. This fact should be considered when identification of our plants is undertaken.

- 1. Naturalized annuals; upper leaves sessile; petals 2, united into one body; carpels single (2)
- 1. Native perennials; upper leaves petioled; petals 4, distinct; carpels in threes (3)
- 2(1). Floral bracts short, not exceeding the pedicels; flowers blue 1. *D. Ajacis*.
- 2. Floral bracts conspicuous, long, foliaceous, frequently equaling the flowers; flowers larger, purple 2. *D. orientale*.

⁶⁶ Adapted from Joseph Ewan in Univ. Colo. Stud. D. 2:55-244. 1945; also much appreciated personal help from Dr. Ewan.

- 3(1). Flowers bluish-white, cream to buff or drab-brownish (4)
- 3. Flowers pale- to bright-lively-blue to bluish-purple, occasionally whitish or white tinged lavender (7)
- 4(3). Stems (at least) for the most part close-pubescent with spreading (sometimes glandular) hairs; pubescence in floral rachis similar to that of the stem or sometimes with fine appressed canescent hairs (5)
- 4. Stems and floral rachis closely and finely canescent or pannose with appressed hairs, never glandular; pedicels appressed to rachis, the flowers thus vertical (6)
- 5(4). Leaves rarely (if ever) congested in a basal or sub-basal tuft; pedicels more or less spreading away from the rachis, the flowers thus nearly horizontal
.....3. *D. virescens* subsp.
virescens.
- 5. Leaves mostly in a sub-basal cluster, palmatifid into 3 primary divisions, these shortly but broadly toothed; flowers rather loosely arranged in a raceme
.....3. *D. virescens* subsp.
macroceratilis.
- 6(4). Leaves on lower portion of stem but not basal; sinuses of petals 3-4 mm. deep; mostly in the Panhandle and eastern Trans-Pecos ... 3. *D. virescens* subsp.
Penardii.
- 6. Leaves in a conspicuous strictly basal tuft; floral rachis with same type of pubescence as the stem; sinuses of lower petals 4-6 mm. deep; mostly in the Trans-Pecos and western Edwards Plateau, rarely east to Bexar County
.....3. *D. virescens* subsp.
Wootonii.
- 7(3). Distribution in western Edwards Plateau and eastern Trans-Pecos
.....4. *D. madrense.*
- 7. Distribution east of the Edwards Plateau (8)
- 8(7). Racemes narrow, strict, virgate; leaves numerous, from stem base to raceme, the petioles moderate, subequal; flowers 20 or more, vertical or subvertical against the rachis upon appressed pedicels5. *D. carolinianum.*
- 8. Racemes open to diffuse, even laxly subscaudent at times; leaves mostly 2 to 5, chiefly basal, the petioles to 15 cm. long; flowers less than 20, horizontal or nearly so upon spreading pedicels6. *D. vimineum.*

1. *Delphinium Ajacis* L. ROCKET LARKSPUR, ESPUELA DE CABALLERO. Slender annual to about 1 m. high, the stem simple or with ascending branches; leaves several, short-petiolate to sessile, pinnately or palmately divided into very numerous linear to filiform segments; terminal racemes elongate, spiciform, loosely many-flowered, more or less leafy-bracteate or naked; lowermost bracts palmatifid into filiform dissected divisions, not simple; flowers bright-blue to violet or purple to pink, sometimes white (f. *alba* R. H. Cheney), with slender horizontal spur; lateral sepals rhomboid to ovate or suborbicular, 6-11 mm. wide; petals 2, united; follicles 1, ovoid, 1.5-2 cm. long, pubescent; seeds covered with broken ridges. Along roadsides, in waste places and old fields, mostly in cen. and s. Tex., Apr.-Sept.; a nat. of Eur. that has spread from cult. in various parts of Can., the U.S. and Mex.

2. *Delphinium orientale* Gay. Very similar to *D. Ajacis* but the stems stouter, more robust and more glabrous; racemes more compact, usually conspicuously leafy-bracteate; flowers larger, showy, often dark blue-purple; lateral sepals orbicular, 1-1.2 cm. wide. A nat. of s. Eur. and N. Afr. that has escaped on the Edwards Plateau.

3. *Delphinium virescens* Nutt. WHITE or PLAINS LARKSPUR. Tall or rarely low-growing usually stout virgate perennial from a cluster of several woody-fibrous elongated deep-seated roots; stems simple, erect, variously pubescent throughout, to about 15 dm. tall, usually much smaller; leaves abundant, mostly equably distributed along the stem but sometimes in a basal tuft; blade ample, palmatisect into several pectinate primary segments that are repeatedly palmatifid into linear ultimate segments, variously pubescent, mostly ciliolate; raceme usually densely spicate, often lax or curving at unopened tip; flowers variously disposed, borne well above the foliage on short erect

often closely appressed pedicels, more or less white, greenish or faint-bluish but not at all buff-colored, the bracts obsolete; sepals ovate-oblong to oblong, rounded to truncate at apex, crisped, the spur straight or variously curved; limb of lower petals not much exerted, ovate or somewhat sagittiform, usually lightly comose with white hairs, the sinus closed or open; upper petals bifid, obliquely narrow-ovate, nearly as long as the upper sepals; follicles erect, oblong, venose, often puberulent, the cusp thin; seeds trigonous to wedge-shaped, gray, heavily corrugate-echinate.

When eaten in spring or early summer, the herbage is known to be toxic to cattle. The highly poisonous seeds are seldom eaten by livestock.

This species is represented in Texas by the following variants that are segregated in the key.

Var. *macroceratilis* (Rydb.) Cory (*D. macroceratilis* Rydb.). Leaf blade 4-11 cm. wide; sepals 1-1.5 cm. long, 5-8 mm. wide, the spur 1-2 cm. long; sinus of limb of lower petals 2-3.5 mm. deep; follicles 1-1.4 cm. long. In sandy or rocky soils in pastures, open oak woods and slopes in Edwards Plateau, Rio Grande Plains, s. Blackland Prairies and along s. coast on into n.-cen. Tex., Apr.-May; probably also in s. Okla.

Var. *Penardii* (Kunth) Perry. Leaf blades 6-12 cm. wide; sepals about 15 mm. long and 6 mm. wide, the spur about 2 cm. long; sinus of limb of lower petals open, about 5 mm. deep; follicles 17-23 mm. long. On grassy plains in Panhandle and South Plains, Apr.-June; from Tex., n. to Kan., Neb. and Colo.

Var. *virescens*. Leaf blade 7-8 cm. wide; sepals 1-1.2 cm. long, 5-6.5 mm. wide, the spur about 12 mm. long; sinus of limb of lower petals closed or open, 3-4 mm. deep; follicles 15-19 mm. long. Uncommon on hills, prairies, in fields and along ditches from e. Edwards Plateau and n.-cen. Tex. to the Panhandle, Apr.-July; from Tex., n. through cen. U.S. to Can.

Var. *Wootonii* (Rydb.) Ewan. Leaf blades 3-5 cm. wide; pedicels strongly ascending; sepals 12-14 mm. long, 3.5-7 mm. wide, the spur 1.4-2 cm. long; sinus of limb of lower petals close and pilose, 3-5 mm. deep; follicles 12-18 mm. long. On grassy flats, limestone outcrops and caliche grasslands, mostly in w. Edwards Plateau and Trans-Pecos, rare in the Rio Grande Plains, South Plains and Panhandle, Apr.-May; from Tex., to Okla., Colo. and Ariz.

4. *Delphinium madrese* Wats. Graceful slender or subscapose perennial from a slender elongated vertical root crown; stems simple or rarely branching above, 2-6 dm. high, thinly hirsutulose throughout with white curling hairs up to hoary-canescence pedicels; leaves many, with petioles 5-10 cm. long, now green and evident at anthesis, now withering and inconspicuous, mostly lower cauline but sometimes in a basal tuft, 2-4 cm. wide, pentagonal, the primary divisions not approximate, cuneate-obovate, trifid or pinnatifid into a few short abruptly acute ultimate segments, ciliate and thinly hairy on both surfaces; racemes more or less interrupted and spicate, 10- to 14-flowered; bracts linear-subulate, inconspicuous; flowers variable, small, usually rich bright-blue; sepals ovate-oblong to ovate-lanceolate, obtuse to subacute, 9-12 mm. long, 5-7 mm. wide, very thinly hairy on the back; spur 1-1.3 cm. long, nearly straight; limb of lower petals deltoid-rounded, barbate with long hairs, deeply bifid, the lobes sharply acute or rounded, ciliate, the sinus closed or nearly so and 3-3.5 mm. deep; upper petals entire or merely notched; follicles short-ovate, 9-10 mm. long, puberulent, the thin cusp erect or spreading; seeds angulate-ovoid, 1-2 mm. long, acute, verrucose-echinate, not wing-margined, smoky-gray. Rocky areas in draws, canyons and in shallow ditches in Kinney, Val Verde and Terrell cos., Mar.-May; also n.e. Mex.

5. *Delphinium carolinianum* Walt. BLUE LARKSPUR. Slender virgate perennial from a cluster of shallowly-seated short-tuberiform roots; stems simple, to about 1 m. high, puberulent throughout or glandular above and glabrate at base, wholly straw-colored or bluish above; leaves rather equably cauline and of nearly uniform size, evident at anthesis or sometimes withering, 3-7 cm. wide, palmatisect into numerous linear ultimate segments, the primary divisions obscure, glabrate above, more or less thinly puberulent beneath; raceme narrow-spicate, often dense but opening out rather slowly, the flowers usually rich dark-blue or paler and merely bluish-white, on erect pedicels 2-5 (or rarely 7) mm. long, the subulate bracts inconspicuous; sepals ovate- to obovate-oblong, rounded or blunt to acute at apex, 12-15 mm. long, 5-7 mm. wide, the spur 13-18 mm. long; blade

of lower petals included, often paler or whitish, broadly to narrowly ovate in outline, erosulate and fimbriate, scantily bearded with spreading white hairs, the open sinus 3.5-5 mm. deep; upper petals short-included, nearly truncate at tip, merely emarginate; follicles slender, oblong, a little tapering, more or less flaring at tips, 12-15 mm. long, faintly venulose, glabrate in age, the cusp 2-3 mm. long; seeds oblong to quadrate, 1-2 mm. long, light-gray, verrucose-echinate with prominent thin scalelike processes. In dry open woods, sandhills, brushlands, fields and barrens in the Edwards Plateau to n.e. Tex., Apr.-July; from Tex., e. to Ga. and Tenn., n. to Ill.

6. *Delphinium vimineum* D. Don. Tall slender virgate perennial from an unbranched shallowly-seated cornlike narrowly vertical root; stems simple, to 15 dm. tall, finely pubescent to close-villous throughout (especially in inflorescence), at times somewhat glandular; leaves predominantly toward stem base, rather scattered but ample, thin, flaccid, 4-8 cm. wide, palmatifid into 3 or 5 primary segments that are undivided and cuneate-oblong or bifid to pinnatifid into short bluntish ultimate segments, subglabrous above, closely soft-pubescent beneath; racemes loose-interrupted, 3- to 12-flowered, not stiffly spicate; flowers varying in size, usually rather showy, bluish-purple, borne on rather long more or less spreading pedicels, the bracts filiform or almost wanting; sepals broadly ovate, bluntish or rounded, often crisped, 11-15 mm. long, 6-8 mm. wide, the spur straight or a little upcurved and 11-15 mm. long; limb of the lower petals quadrate or ovate, the sinus nearly closed and 2-4 mm. deep; upper petals subrhomboidal, entire, short-included; follicles erect, oblong, 15-16 mm. long, obscurely veiny, short-pubescent, the erect cusp thin and 3.5 mm. long; seeds small, 1.2 mm. long, smoky-brown, wedge-shaped, heavily echinate. In sandy open soils, meadowlands, open grassy woods mainly on the Edwards Plateau eastw. in Tex., Apr.-July; probably in La. and s.w. Ark.

5. ISOPYRUM L.

About 30 species in the North Temperate Zone.

1. *Isopyrum biternatum* (Raf.) T. & G. FALSE RUE-ANEMONE. Slender glabrous perennial 1-3.5 dm. high, with copious slender fibrous roots (some here and there moniliform-thickened); leaves ternately decomposed; leaflets 1-2.5 cm. long, cuneate-obovate or roundish, commonly 3-lobed; flowers solitary, paniced or cymose, usually white; sepals 5 or 6, petaloid, white, deciduous, elliptic to somewhat obovate, 9-12 mm. long; petals none; stamens many; filaments clavate; carpels 2 to 20, sessile or stipitate, several-ovuled; follicles 3 to 6, commonly 4, sessile, about 3-ovuled and 2- or 3-seeded, obliquely ovate in outline, divaricate at maturity, about 5 mm. long (including the subulate-pointed persistent style); seeds smooth, with a prominent raphe. Shady and moist grounds, "Texas, Wright," possibly in n.e. Tex., Mar.-May; from Ont. to Wisc. and s. to Fla. and Tex.

6. RANUNCULUS L.⁶⁷

CROWFOOT. BUTTERCUP

Annual or perennial herbs of various aspects; cauline leaves alternate; flowers regular, perfect, solitary or somewhat corymbed; sepals 3 to 5 or rarely more, green or yellowish; petals commonly 5, more or less in some species, plane or concave, mostly yellow or white, rarely reddish or green, each with a nectariferous pit or scale on inner surface at or near base; stamens mostly numerous, rarely as few as 5; filaments slender; anthers oblong or linear; pistils numerous in a globose to ovoid or cylindrical head; ovule 1; style long or short, straight, curved or hooked; fruit an achene.

About 400 species mostly in colder regions or at high altitudes in the tropics. It is reported that all of the species are acrid or even poisonous.

1. Achenes roughly transversely ridged; petals not glossy, white, the claws sometimes yellow; aquatic plants (2)
1. Achenes or utricles not transversely ridged (except in *R. sceleratus* which has 40 or commonly 100 to 300 minute beakless achenes in an elongate head); petals usually glossy, yellow or rarely red, white or green (3)

⁶⁷ Adapted from Lyman Benson in Am. Midl. Nat. 40:1-261. 1948.

- 2(1). Style largely deciduous after flowering, the achene beak 0.3 or rarely 0.5 mm. long; achenes mostly 30 to 45 or 80 1. *R. subrigidus*.
2. Style persistent after flowering, the achene beak 0.7-1.1 mm. long; achenes about 7 or commonly 15 to 25 2. *R. longirostris*.
- 3(1). Pericarp striate, the nerves 3 or more on each face (these sometimes branched), the ovary wall thin and usually fragile at fruiting time 3. *R. Cymbalaria*.
3. Pericarp not striate nor nerved, thick and firm (4)
- 4(3). Leaves (both cauline and basal) entire, dentate, serrulate or wavy; dorsiventral measurement of the achene not more than twice or thrice the lateral; nectary scale forming a pocket (5)
4. Leaves (either the cauline or the basal) lobed, parted or divided (6)
- 5(4). Petals 5 to 9, large and conspicuous, about twice as long as the sepals; styles in anthesis 0.5 mm. long, filiform, deciduous in fruit; head of achenes hemispheroidal or ovoid 4. *R. laxicaulis*.
5. Petals 1 or 3, minute and inconspicuous, shorter than or equal to the sepals; styles in anthesis 0.1-0.2 mm. long 5. *R. pusillus*.
- 6(4). Achenes covered with spines, hooks or papillae, or with papillae produced into hooked hairs, rarely smooth in *R. Sardous*; dorsiventral measurement of the achene 3 to 6 times the lateral; receptacle in fruit 1 to 3 times its length in anthesis (7)
6. Achenes smooth, sometimes hairy (10)
- 7(6). Petals 1-4 mm. long; mature achenes papillate, the papillae produced into slender hooked spines; nectary scale usually free laterally (8)
7. Petals at least 4 mm. long; mature achenes with stout spines on the face to very rarely glabrous (9)
- 8(7). Flowers pediceled; sepals and petals each 5; achenes about 1.5 mm. wide, the beak prominent 6. *R. parviflorus*.
8. Flowers sessile; sepals and petals each 3; achenes 1 mm. wide or less, the beak minute 7. *R. platensis*.
- 9(7). Mature achenes sparsely papillate or smooth; nectary scale free laterally 8. *R. Sardous*.
9. Mature achenes with stout spines on the faces; nectary scale forming a pocket, much narrower than the adjacent petal surface 9. *R. muricatus*.
- 10(6). Style and achene beak practically lacking, if otherwise, the achene with a corky thickening on the margin of the body; nectary scale either with the gland in a pocket on its ventral surface or else the scale forked and prolonged anteriorly on the surface of the petal or surrounding the gland; aquatic or palustrine plants 10. *R. sceleratus*.
10. Style and achene beak present, the achene neither corky-keeled nor with corky thickening on the margin of the body; nectary scale ventral to the nectary, covering it, apically truncate or rounded (11)
- 11(10). Nectary scale attached to the petal laterally and forming a pocket; dorsiventral measurement of the achene 1 to 2.5 times the lateral; receptacle in fruit (in most species) 3 to 15 times its length in anthesis; sepals usually tinged dorsally with purple or lavender 11. *R. abortivus*.
11. Nectary scale free laterally for at least two thirds its length, not forming a pocket (except in *R. recurvatus* var. *recurvatus*); dorsiventral measurement of the achene 3 to 15 times the lateral; receptacle in fruit (in most species) 1 to 3 times its length in anthesis; sepals usually not lavender- nor purple-tinged but sometimes markedly so (12)

- 12(11). Achene beaks regularly recurved or curved or clearly falcate or hooked at the apices, 2 mm. or less long, usually shorter than the bodies or sometimes equaling them (13)
- 12. Achene beaks not regularly curved or recurved or markedly hooked (if hooked at all, for only about 0.1 mm.), essentially straight (or sometimes bent in pressing), 1.5 or usually 2-4 mm. long, practically always equaling or exceeding the bodies (14)
- 13(12). Petals (when fully expanded) usually 8-18 mm. long, large and conspicuous, about 1.5 to 3 times as long as the sepals12. *R. repens*.
- 13. Petals minute, 2-4 or rarely 6-7 mm. long, shorter than or slightly exceeding the sepals13. *R. recurvatus*.
- 14(12). Achenes 35 or mostly 40 to 130; sepals 6 or mostly 8-10 mm. long; petals 8 to 1814. *R. macranthus*.
- 14. Achenes 10 to 30 or 35; sepals 6-8 mm. long; petals 5 or sometimes more (15)
- 15(14). Stems rooting at the nodes when the plants are in moist ground (as normally they are); plant usually stoloniferous and fibrous-rooted; upper leaves mostly simple; achenes broadly winged on keel, 3.5-4.5 mm. wide15. *R. carolinianus*.
- 15. Stems never rooting; plant with cluster of fleshy roots at base of stem; upper leaves compound; achenes scarcely winged, 1.5-2.5 mm. wide16. *R. fascicularis*.

1. *Ranunculus subrigidus* Drew. Glabrous or essentially glabrous aquatic perennial with filiform roots; stems submersed, rooting at the lowest nodes, to about 6 dm. long, branching, with large air chambers in the cortex; leaves cauline, all submersed and finely dissected into filiform divisions, once- or twice-trichotomous then dichotomous, the leaf as a whole globular, usually not fully collapsing when withdrawn from the water (but sometimes so), usually circinate, 1-2 cm. long, 1.5-3 cm. broad, much shorter than the adjacent internodes; petioles developed only occasionally, the first leaf divisions arising within the stipular leaf base (the leaf base dilated and the ends usually free); pedicels stout, 2-4 cm. long in flower, about 1 cm. longer and markedly recurved at the bases in fruit, glabrous; sepals 5, light-green, spreading, elliptic, 3-5 mm. long, deciduous before the corolla; petals 5, white or the bases yellow, 5-9 mm. long, 2-4 mm. broad, narrowly obovate, the nectary scale nearly or fully obsolete; stamens 5 to 10; achenes 30 to 80, in a globose-ovoid head 4-6 mm. long and 4-5 mm. in diameter, obovoid, 1-1.5 mm. long, roughly transversely-ridged, glabrous, hispidulous or glabrate, the style largely deciduous, the achene beak 0.2-0.5 mm. long; receptacle subglobose, 1 mm. long in flower, 1-1.5 mm. long in fruit, hispidulous. *R. circinatus* Sibth. var. *subrigidus* (Drew) L. Benson. In ponds, lakes or pools, often brackish, in the Rio Grande Valley, spring-summer; from Can. s. to cen. Mex.

2. *Ranunculus longirostris* Godr. WHITE WATER-CROWFOOT. Similar to *R. subrigidus*; leaves firmer, often stiff, the stipular base larger and from three fourths to entirely adnate to the very short petiole; pedicels appearing to be axillary (actually terminal, the stem sympodial), 1-5 cm. long, apparently not recurved in fruit, glabrous; sepals yellowish-green or purplish, spreading, narrowly elliptic, 3-4 mm. long, 1-1.5 mm. broad, early-deciduous; petals 5, white, obovate, 4-9 mm. long, 2.5-6 mm. broad, the nectary scale reduced to a very shallow pocket or a lunate ridge along the base and sides of the gland or wholly absent, the glandular area only 0.2-0.3 mm. in diameter; stamens 10 to 20; achenes 7 to 25 in a subglobose cluster or head 3-5 mm. long and 4-6 mm. in diameter, obovoid, 1.3-1.7 mm. long, roughly transversely-ridged, glabrous or hispidulous, the margin evident, the slender beak 0.7-1.1 mm. long and straight; receptacle globose or pyriform, 1 mm. long in flower, 1-2 mm. long in fruit, densely hispid. Floating in water of streams and lakes, often forming large mats, from the Rio Grande Plains to the Panhandle, Apr.-June; from Can., s. to N.M., Tex., Ark., Ala. and Del.

3. *Ranunculus Cymbalaria* Pursh. Glabrous or sparingly hirsute palustrine perennial; scapes erect, to 3 dm. high, branched or unbranched, with filiform stolons several dm. long, not fistulous; basal leaves with petioles 2-5 cm. long, simple, ovate or reniform to

trapezoidal or rectangular, to 35 mm. long and 2 cm. broad, crenate to dentate or sometimes merely 3-toothed or -lobed at the rounded to truncate apices, cordate to rounded or truncate at base, the stipular leaf bases 2-9 mm. long; pedicels 1-3 cm. long in flower and 2-6 cm. long in fruit, usually pubescent; sepals 5, greenish-yellow, spreading, elliptic, 2-5 mm. long, 1.5-3 mm. broad, glabrous, thick, promptly deciduous; petals 5 or up to 12, bright-yellow, narrowly obovate, 2-8 mm. long, 2-3 mm. broad; nectary scale over-arching the nectary, truncate, the margins free from the blade of the petal; stamens 10 to 30; achenes as many as 300 (usually much fewer) in a cylindroid head 3-13 mm. long and 3-6 mm. in diameter, cuneate-oblong, thin-walled, 1.5-2.3 mm. long, each face with about 4 longitudinal striations or branched nerves, glabrous, the margins noticeable, the triangular beak about 0.3 mm. long and not curved; receptacle cylindroid, 2-3 mm. long in flower, 4-7 mm. long in fruit, hairy. In mud, especially of brackish streams and marshes, in the Panhandle, May-July; across Can. to Alas. and Sib., s. to the Andes of S.A.

The following two variants are found in Texas.

Var. *Cymbalaria*. Stems and petioles mostly 0.5 mm. thick; scapes 2.5-11 cm. high, usually branched; basal leaves cordate to ovate or reniform, 5-22 mm. long, 4-20 mm. broad, crenate or sometimes merely 3-lobed at the apices in some of the leaves, thin; sepals and petals 3-5 mm. long; stamens usually 15 to 25; achenes 40 to 150 in a cylindroid head 3-8 or 13 mm. long and 3-4 or 6 mm. in diameter.

Var. *saximontanus* Fern. Stems and petioles mostly 1 mm. thick; scapes 5-30 cm. high, usually branched; basal leaves cordate to ovate or rarely reniform, 12-40 mm. long, 10-33 mm. broad, mostly crenate, thick; sepals and petal 4-8 mm. long; stamens usually 20 to 35; achenes 100 to 300 in a head 5-12 mm. long and 3-5 mm. in diameter.

4. *Ranunculus laxicaulis* (T. & G.) Darby. Glabrous palustrine annual with filiform roots; stems erect or reclining, rooting adventitiously at only the lowest nodes, 1-5 dm. long, freely branching, fistulous; stem and axis of panicle often proliferating late in season by flabelliform leafy offshoots; basal leaves with petioles 1-7 cm. long or longer when in water, simple, ovate to oblong, to 45 mm. long, 6-18 mm. broad, dentate to serrulate or entire, truncate or rounded at base, truncate or obtuse at apex; the stipular leaf bases about 1 cm. long; upper cauline leaves alternate, sessile, linear or lanceolate to oblanceolate or very narrowly elliptic, acute, 15-35 mm. long, 2-6 mm. broad, dentate; pedicels to 2 cm. long in flower and 6 cm. long in fruit; sepals 5, greenish-yellow, spreading, ovate, 1.5-3 mm. long, about 1.5 mm. broad, glabrous or sparsely hairy, promptly deciduous; petals 5 or rarely as many as 10, yellow, 3-9 mm. long, 1.5-2.5 mm. broad; nectary scale glabrous, forming a pocket 0.3-0.5 mm. long, truncate or prolonged a little on the margins; stamens 10 to 30; achenes 15 to 50 in a hemispheroidal head 2 mm. in radius or an ovoid head 2-4 mm. long and 2-2.5 mm. in diameter, obovate to subglobose, 0.6-0.7 mm. long, smooth and glabrous, the margin inconspicuous, the style about 0.5 mm. long; receptacle pyriform or spheroid, 1.5-2 mm. long in flower, 1.5-3 mm. long in fruit, glabrous. *R. texensis* Engelm., *R. pusillus* of auth., not Poir. Boggy shores of lakes, in depressions, ditches and marshes in s.e. Tex., Mar.-May; from Fla. to Tex., n. to Conn., Ind., Ill., Mo. and Kan.

5. *Ranunculus pusillus* Poir. Glabrous palustrine annual with filiform roots; stems reclining, usually rooting at the lowest nodes, 1-5 dm. long, freely branching, fistulous; basal and lower cauline leaves with petioles 1-6 cm. long, simple, oblong to ovate or rarely cordate, to 5 cm. long, 5-15 mm. broad, entire or a little irregular, truncate or rounded at base, truncate to rounded or acute at apex, the stipular leaf bases to 1 cm. long; upper cauline leaves alternate, sessile, linear or lanceolate to oblanceolate or very narrowly elliptic, 1-5 cm. long, 2-5 mm. broad, entire or sometimes dentate; pedicels to 15 mm. long in flower and 6 cm. long in fruit, glabrous; sepals 5, greenish-yellow, spreading, ovate, 1-2 mm. long, 0.8-1 mm. broad, glabrous or sparsely hairy, promptly deciduous; petals 1 to 3 or rarely 5, yellow, obovate, 1.5-2.5 mm. long, 1 mm. broad; nectary scale glabrous, forming a pocket 0.2 mm. deep, truncate; stamens 5 to 10; achenes as many as 125 in a hemispheroid head about 4 mm. in diameter or an ovoid head 2-4 mm. long and 2-2.5 mm. in diameter or a cylindroid head 5-8 mm. long and 2-3 mm. in diameter, oblong-obovate, about 1 mm. long, smooth (with fine reticulations) or slightly or markedly papillate, glabrous, the margin inconspicuous, the style in anthesis 0.1-0.2 mm. long, the achene beak 0.1-0.2 mm. long; receptacle pyriform or spheroid,

1.5-2 mm. long in flower, 1.5-3 mm. long in fruit, glabrous. Incl. var. *angustifolius* (Engelm.) L. Benson, *R. tener* Mohr. In shallow water and mud of ditches, marshes, bogs, seepage areas and ponds in prairies, open woods and thickets in the e. fourth of Tex., w. to Burnet Co., Mar.-May; from Calif. to Mo. and N.Y., s. to Tex. and Fla.

6. *Ranunculus parviflorus* L. Hirsute terrestrial annual; stems erect, not rooting, 1-3 dm. long, freely branching and diffuse, not fistulose, thinly hirsute; basal leaves with petioles 3-6 cm. long, simple, reniform, 1.5-2 cm. long, 2-2.5 cm. broad, 3-parted or -divided and again lobed, cordate at base, rounded at apex, the ultimate lobes acute, hirsute with fine hairs, pilose, the stipular leaf bases about 1 cm. long; cauline leaves alternate, short-petioled, similar to the basal, the bracts 3-parted; pedicels 1-4 mm. long in flower, 3-18 mm. long in fruit, pubescent; sepals greenish-yellow, spreading, narrowly ovate, about 1 mm. long, less than 1 mm. broad, densely pubescent, promptly deciduous; petals 5, yellow, narrowly elliptic, 1-2 mm. long, less than 1 mm. broad, the truncate nectary scale glabrous and free laterally; stamens about 10; achenes 10 to 20 in a globose head about 4 mm. in diameter, obovate, 1.5 mm. long, with reddish-brown papillae covering both faces of the pericarp which are produced into minute slender hooks, the margin strongly marked, the deltoid beak recurved and 0.5 mm. long; receptacle globose, less than 1 mm. long in flower, 1-1.3 mm. long in fruit, glabrous. On moist hardwood slopes, in grassy copses and along ditches in e. fourth of Tex., Mar.-June; a nat. of the Old World that is naturalized in various parts of N.A.

7. *Ranunculus platensis* Spreng. Plant very similar to *R. parviflorus* except for the sessile flowers, smaller achenes and more shallowly and broadly toothed leaves. In sandy bottomland woods and thickets in s.e. Tex., Mar.-Apr.; recently introd. into La. and s.e. Tex. from s. S.A.

8. *Ranunculus Sardous* Crantz. Hirsute terrestrial perennial with filiform roots; stems suberect, not rooting, 1-5 dm. long, branching freely, not fistulose, hirsute; basal leaves with hirsute petioles 3-16 cm. long, pinnately compound, broadly cordate in outline, 2-3 cm. long, 2-2.5 cm. broad, the 3 leaflets parted and lobed, the ultimate segments deltoid, pubescent, cordate to truncate at base, rounded at apex, appressed-pubescent, the stipular leaf bases 1-1.5 cm. long; cauline leaves alternate, the bracts of about 3 linear divisions, sessile; pedicels 3-5 cm. long in flower, 2-6 cm. long in fruit, thinly appressed-hairy; sepals greenish-yellow, reflexed, ovate-attenuate, 3-5 mm. long, 1.5-2 mm. broad, pilose, promptly deciduous; petals 5, yellow, 8-9 mm. long, 5-7 mm. broad, the truncate nectary scale glabrous and free laterally; stamens 25 to 50; achenes 12 to 25 in a subglobose head 4-6 mm. long and 5-8 mm. in diameter, nearly circular, 2-3 mm. long, usually sparsely papillate or some achenes of the same plant smooth, glabrous, the margin strongly marked, the deltoid beak 0.3 mm. long and curved at the tip; receptacle pyriform, 1 mm. long in flower, 2 mm. long in fruit, covered with long white hairs. Moist grassy slopes in e. Tex., Apr.-June; a nat. of the Old World naturalized mostly about seaports in N.A.

9. *Ranunculus muricatus* L. Glabrous terrestrial annual or sometimes perennial; stems reclining or erect, not rooting, 2-5 dm. long, 2-5 mm. in diameter, freely branching, not markedly fistulose; basal leaves with petioles 4-15 cm. long, simple, broadly cordate to reniform or semicircular, 2-5 cm. long, 2-6 cm. broad, deeply 3-parted, the parts again shallowly crenately lobed, cordate to truncate at base, rounded at apex, the stipular leaf bases 1 or 2 cm. long; cauline leaves alternate, similar to the basal; pedicels 5-20 mm. long in flower, 2-6 cm. long in fruit, glabrous; sepals greenish, spreading, ovate, mucronate, 4-7 mm. long, 2-3 mm. broad, with a few bristles, promptly deciduous; petals 5, yellow, obovate, 5-8 mm. long, 3-4 mm. broad, the truncate nectary scale glabrous and forming a pocket that is much narrower than the adjacent part of the petal; stamens few; achenes 10 to 20 in a globose cluster 1-1.3 cm. in diameter, obovate, about 5.5 mm. long, covered with stout curved spines, glabrous, the margin very prominent, keeled, spineless, produced into the stout falcate beak 2-2.5 mm. long; receptacle subglobose, about 1 mm. long in flower, 2 mm. long in fruit, hispid. On grassy banks, along roads, in sandy marshes, and in wet soil about ponds and along streams, often in shallow water, in e. fourth of Tex., Mar.-May; a nat. of the Old World that is naturalized in various parts of N.A.

10. *Ranunculus sceleratus* L. Glabrous or rarely hirsute palustrine or rarely aquatic annual or short-lived perennial; stems erect, rarely rooting, to 1 m. long, profusely branching, fistulose, inflated; basal leaves with petioles rarely to 25 cm. long, simple, reniform,

to 6 cm. long and 1 dm. broad, deeply 3-parted or -divided, the primary parts or divisions lobed to parted or divided, the ultimate lobes obtuse or rounded, the sinuses rounded, cordate at base, rounded at apex, the broad stipular leaf bases 5-10 mm. long; cauline leaves alternate, the bracts often oblanceolate and entire, sessile; pedicels to 2 cm. long in flower, 1-3 cm. long in fruit; sepals 5, greenish-yellow, spreading, ovate, 2-3 mm. long, 1.5-2 mm. broad, pilose or glabrous, persisting later than the corolla; petals 5, light-yellow, obovate, 2-5 mm. long, 1-3 mm. broad; nectary scale glabrous with the margins prolonged along the blade of the petal, sometimes 1 or both with a free flap at the tip or the scale often completely surrounding the nectary; stamens 10 to 25; achenes 40 to 300 in a cylindroid head 3-10 mm. long and 2-6 mm. in diameter, obovoid, 0.8-1 mm. long, often with minute irregular transverse ridges in the central unthickened portion of each face, the periphery of the pericarp at least somewhat corky-thickened, the surface often with ridges or a circle of "pin-prick" depressions at the inner margin of the thickened zone, glabrous, the marginal keel obscure, the style and the achene beak almost lacking, not recurved; receptacle obovoid or cylindroid, 1-2 mm. long in flower, 2.5-9 mm. long in fruit, pubescent or sometimes glabrous. Borders of lakes, streams and marshland in s.e. and s. Tex., Mar.-June; from Wash. to N.E., s. to Tex., La. and Ga.

The acrid sap of this species is said to raise blisters on human skin.

11. *Ranunculus abortivus* L. Glabrous terrestrial biennial with filiform roots, sometimes enlarged at the base; stems erect or suberect, not rooting, to about 5 dm. long, branching, fistulous, striate; basal leaves with petioles 4-11 cm. long, simple or rarely some trifoliate, reniform to orbicular in outline, to 9 cm. long and 1 dm. broad, usually much smaller, crenulate to crenate or crenately lobed; stipular leaf bases scarious, 1-2 cm. long; cauline leaves alternate, sessile, the bracts deeply once- or twice-parted to form 3 or 5 elliptic lobes or rarely cuneate or obovate and apically shallowly lobed or toothed; flowers as many as 50, with pedicels to 15 mm. long in flower and 9 cm. long in fruit, glabrous; sepals 5, yellowish, spreading, elliptic, 3-5 mm. long, 1-2 mm. broad, glabrous, deciduous after anthesis; petals 5, elliptic, 2.5-3.5 mm. long, 1.3-2 mm. broad, the glabrous nectary scale forming a pocket and emarginate; stamens 15 to 20; achenes 10 to 35 in an ovoid head 3-6 mm. long and 2.5-4 mm. in diameter, discoid-obovate, 1.4-1.6 mm. long, smooth, glabrous, the margin inconspicuous, the beak minute; receptacle fusiform-cylindroid, about 2 mm. long in flower, 2-4 mm. long in fruit, sparsely villous or sometimes glabrous. In moist ground in open areas or rich woodland in e. Tex., Mar.-May; transcontinental from N.S. to Alas., s. to Wash., Colo., Tex. and Fla.

12. *Ranunculus repens* L. CREEPING BUTTERCUP. Hirsute terrestrial or palustrine perennial; stems prostrate to suberect, rooting at least at the lower nodes, commonly but not always with some stoloniferous, to 9 dm. long, branching, not fistulous, hirsute to glabrous or nearly so; leaves compound, deltoid-cordate in outline, to 11 cm. long and 13 cm. broad, usually much smaller, pinnate with 3 sessile or petiolulate leaflets that are cuneate to subtruncate or sometimes rounded or subcordate at the base and lobed and toothed (but acute in outline) at apex, sometimes the leaflets tending to be rounded, the middle petiolule to 4 cm. long, the lateral petiolule to 2 cm. long, the petioles 4-25 cm. long, hirsute to subglabrous, the stipular leaf bases 6-20 mm. long; cauline leaves alternate, like the basal; pedicels 2-10 cm. long in flower, 4-15 cm. long in fruit, pubescent; sepals 5, greenish, spreading, 5-7 mm. long, 3-4 mm. broad, pilose, promptly deciduous; petals 5 or rarely the staminodia forming a "double" flower, cuneate-obovate, 7-13 mm. long, 5-10 mm. broad, the glabrous truncate nectary scale free laterally for two thirds of its length and 1-1.3 mm. long; stamens 50 to 80, the number reduced in "double" flowers; achenes 20 to 25 in a subglobose head 6-7 mm. in diameter, obovoid-discoid, 2.5 mm. long, smooth, glabrous, the margin prominent, the recurved beak stout and 1 mm. long; receptacle subglobose-ovoid, 1-2 mm. long in flower, 3 mm. long in fruit, pubescent or rarely glabrous. This Old World species sometimes occurs as an escape, especially the garden form, var. *pleniflorus* Fern.

13. *Ranunculus recurvatus* Poir. Hirsute terrestrial perennial; stems erect, commonly forming a nearly spherical bulbous base 5-10 mm. in diameter, not rooting, 1.5-7 dm. long, branching mostly above, the lowest internode elongated, fistulous, markedly villous-hirsute or rarely glabrous, the hairs rarely appressed; basal leaves with glabrous or hirsute petioles 5-10 cm. long, simple, cordate-reniform in outline, to 75 mm. long and

9 cm. broad, usually much smaller, 3-cleft to deeply 3-parted with the parts either crenately lobed or toothed, cordate at base, the parts rounded or angled at apex, nearly glabrous or hirsutulous or hirsute; stipular leaf bases deltoid, 1-1.8 cm. long, 5-9 mm., broad, thin; cauline leaves similar to the basal but not usually larger, as deeply parted as the deepest of the basal; pedicels 1-8 mm. long in flower, 1-5 cm. long in fruit, sparsely appressed-pubescent; sepals 5, greenish, reflexed almost their whole length, ovate-acute, 4-5 mm. long, 2-2.5 mm. broad, sparsely pilose dorsally, promptly deciduous; petals 5, narrowly elliptic, 2.5-3.5 mm. long, 1.2 mm. broad; nectary scale forming an obdeltoid pocket, the apical margins truncate or sometimes proliferated into a flat scale not forming a pocket; stamens 10 to 25; achenes 10 to 25 in a globose head 5-7 mm. in diameter, discoid, 1.5-2 mm. long, minutely reticulate-pitted, glabrous, the margin with a minute keel, the recurved beak slender and 1.2-1.4 mm. long, the tip hooked; receptacle broadly or narrowly pyriform, 1 mm. long in flower, 3 mm. long in fruit, conspicuously hispid, densely so at the apex. In swamps, woods and bottomland thickets in n.e. Tex., Mar.-June; from Ont. and Nfld., s. to Fla. and Tex.

14. *Ranunculus macranthus* Scheele. LARGE BUTTERCUP. Strongly hirsute to subglabrous terrestrial perennial with stout roots; stems reclining to suberect, not rooting, to 1 m. long, usually much smaller, fistulous, densely hirsute; basal leaves with hirsute to glabrous petioles to 3 dm. long, compound and dissected or sometimes simple and merely lobed, oblong-ovate in outline, 4-23 cm. long, 3-25 cm. broad, usually of 3 to 7 leaflets that are truncate or obtuse at base and acute or barely obtuse at apex, appressed-hispidulous; pedicels to 11 cm. long in flower and 3 dm. long in fruit, appressed-pubescent; sepals 5, yellowish-green, reflexed, ovate-attenuate, 6-10 mm. long, 3-5 mm. broad, appressed-pilose dorsally, promptly deciduous; petals 8 to 18, yellow, oblanceolate or rarely obovate, sometimes emarginate, 1-2 cm. long, 2.5-10 mm. broad; achenes 35 to 130 in a subglobose or cylindroid head 7-14 mm. long and 7-10 mm. in diameter, elliptic-oblong to obovate, 2.5-4 mm. long, smooth, glabrous, the margin keeled, the straight beak slender and 3-5 mm. long; receptacle cylindroid, 2-3 mm. long in flower, 5-12 mm. long in fruit, hairy but the hair often sparse. In swamps, wet soil in drainage areas, wet woods along creeks, on mud flats about pools and seepage slopes in cen., s. and w. Tex., Mar.-June; in s.w. U.S. and Mex.

15. *Ranunculus carolinianus* DC. Tufted perennial with thick fibrous roots, subglabrous to spreading-pubescent (especially on stem), after flowering developing long trailing or repent leafy branches; earliest basal leaves small, ovate, simple or 3-lobed or 3-cleft; later leaves larger, long-petioled, with 3 mostly petiolulate rhombic cuneate 3-cleft or 3-divided and sharply toothed leaflets; flowering stems slender, flexuous, subglabrous, pilose or spreading-hirsute, elongating to 5 dm. long, finally producing trailing branches; flowers 1 to 10; sepals 3.5-5 mm. long, promptly reflexed; petals oblong, 8-12 mm. long, 2.5-7 mm. broad; fruiting head subglobose, 7-13 mm. in diameter, with only 10 to 20 achenes; fruiting receptacle 4-5 mm. long; achenes obliquely rounded-ovate, with body 3.5-5 mm. long, the marginal wing 0.5-1 mm. wide and separated from the face by a high acute ridge; beak submarginal, erect, lance-subulate, 1.5-2.5 mm. long, with short deciduous terminal stigma. *R. septentrionalis* Poir. var. *pterocarpus* Benson. Low woods, swamps, thickets and shores in e. fourth of Tex., Feb.-Apr.; from Fla. to Tex., n. to Md., W.Va., s. Ind., s. Ill., Mo. and Neb.

Those plants with noticeably spreading-pubescent stems are segregated as var. *villicaulis* Shinnars.

16. *Ranunculus fascicularis* Muhl. PRAIRIE BUTTERCUP. Appressed-pubescent terrestrial perennial; roots filiform or fusiform-tuberous, to 5 mm. in diameter; stems weak, erect or suberect, often scapose, not rooting, silky-canescens, 1-3 dm. long, not fistulous; basal leaves with petioles about 1 dm. long, compound or at least the early ones 3-parted, ovate-oblong in outline, 25-55 mm. long, 2-4 cm. broad, distinctly longer than broad, sometimes the leaf partly bipinnate, the 3 or 5 leaflets or divisions simple and rounded to deeply 3- to 7-parted and again angularly toothed, the ultimate parts blunt or rounded at the apices; stipular leaf bases 15-35 mm. long; cauline leaves usually 1 or 2, alternate, much-reduced; pedicels 1.5-6 cm. long in flower, 2.5-9 cm. long in fruit; sepals 5, greenish-yellow, spreading, ovate-attenuate, 6-8 mm. long, 2-3 mm. broad, usually silvery-pubescent, promptly deciduous; petals 5 or sometimes up to 9, yellow, obovate-oblanceo-

late, 7-15 mm. long, 3-6 mm. broad, the truncate nectary scale glabrous and free almost its whole length; stamens usually 40 to 50; achenes 10 to 30 in a subglobose head 4.5-8 mm. long and 6-10 mm. in diameter, obovate-orbicular but with a short flat stalk, the main body 1.5-3 mm. long, smooth, glabrous, the margin keeled but usually not prominent, the straight beak slender and 2-2.3 mm. long; receptacle fusiform or obovoid, 1.5-2.5 mm. long in flower, 3-7 mm. long in fruit, sparsely hispidulous. In sandy soil in shallow water, low pinelands, meadows and seepage slopes in e. Tex., Feb.-May; widespread in e. N.A., w. to Tex. and Kan.

The two following varieties are found in Texas:

Var. *apricus* (Greene) Fern. (*R. apricus* Greene). Stems 1-3 dm. long; leaflets or leaf segments oblanceolate to narrowly elliptic, shallowly few-toothed apically or entire; petals 5.

Var. *cuneiformis* (Small) L. Benson. Stems 18-25 cm. long; petals 7 to 9, 13-15 mm. long when fully expanded; achenes 3 mm. long, 2.5 mm. dorsiventrally, the margin 0.5 mm. broad, distinctly marked; endemic in Kerr Co.

7. ADONIS L.

About 20 species native to Europe and Asia.

1. *Adonis annua* L. PHEASANT'S-EYE. Annual 2-6 dm. high, the erect stems much-branched; leaves alternate, dissected, 2-5 cm. long; flowers solitary and terminal, deep-red with dark center, not opening wide, about 2 cm. across; sepals 5 to 8, broad; petals 6 to 8, obovate, somewhat erose at the apex, concave, deciduous, not much-exceeding the calyx; stamens many; filaments filiform; pistils many, the ovary 1-ovuled; head of achenes cylindrical, 1-2 cm. long; achenes glabrous, 3-5 mm. long. A cult. plant from Euras. that has become established in our flora in the e. third of Tex., spring-summer.

8. MYOSURUS L. MOUSETAIL

Very small annual herbs, with fibrous roots; leaves in a radical tuft, linear to filiform or at first spatulate, entire; scapes simple, one-flowered, the yellowish or whitish flower succeeded by the slender spike or (in depauperate specimens) oblong head of carpels; sepals 5, spurred at the base; petals 5, small and narrow, raised on a slender claw at the summit of which is a nectariferous pit; stamens 5 to 20; achenes numerous, somewhat 3- or 4-sided, apiculate, crowded on a very long and slender spikelike receptacle, the seed suspended.

About 15 species of local occurrence but widely distributed. It is highly probable that additional species will be found in the state.

1. *Myosurus minimus* L. Leaves narrowly linear to filiform, blunt, 3-10 cm. long; scape 3-15 cm. long; sepals oblong, 2-3 mm. long; spurs slender, acute, 1-3 mm. long; petals linear to narrowly spatulate, sometimes wanting, 2-3 mm. long; fruiting spike 2-5 cm. long, 2-3 mm. thick; mature carpels somewhat quadrate, with broader usually rhomboidal and flat back, traversed by very low keel, ending in a short and appressed or often obsolete pointed tip. In damp argillaceous or calcareous soils, fallow fields, throughout the state but mostly in cen. Tex., Mar.-July; from Fla. to Tex., n. to e. Va., s. Ont., Ill., Minn. and Sask.; also Euras.

Plants in Trans-Pecos Texas approach *M. aristatus* Benth. in having a more prominent achene beak. *Myosurus cupulatus* Wats., with its prominent keel extended from the cuplike dorsum of the achenes, has been reported from Texas, but we have seen no material from the state.

9. ANEMONE L. ANEMONE

Erect perennial herbs; leaves compound or divided, all basal except for several which are opposite or whorled to form an involucre that subtends or is remote from the flower; peduncles 1-flowered, solitary or umbellate; sepals 4 to 20, petaloid, usually showy; petals none; stamens and pistils numerous; fruit a compact or elongate head of numerous flattened ribless pubescent or glabrous achenes, with styles short or elongated.

About 150 species that are widely distributed in temperate or cold regions in both hemispheres.

1. Style at maturity attenuate-filiform, 2-4 cm. long; sepals usually 25 mm. long or more; confined to northwestern part of state 1. *A. patens* var. *Wolfgangiana*.
1. Style at maturity 4 mm. long or less; sepals very rarely more than 25 mm. long (2)
- 2(1). Plant with a tuber and slender rhizomes or stolons; flowering stem glabrous or essentially so below the involucre; tips of the achenes filiform, straight, noticeably projecting beyond the wool; in eastern fourth of Texas 2. *A. caroliniana*.
2. Plant without rhizomes or stolons; spinescent tips of achenes more or less sigmoid, not noticeably projecting beyond the wool (3)
- 3(2). Flowering stems shaggy-pubescent to the very base, always 1-flowered; fruiting spike usually 20 mm. long or more; achenes embedded in wool; distribution throughout most of Texas 3. *A. heterophylla*.
3. Flowering stems glabrescent toward base, typically 2- or more-flowered; fruiting spike usually about 15 mm. long; achenes thinly silvery-pubescent to entirely glabrous and vernicose; endemic to Edwards Plateau 4. *A. edwardsiana*.

1. *Anemone patens* L. var. *Wolfgangiana* (Bess.) Koch. PASQUE-FLOWER, PRAIRIE-SMOKE, HARTSHORN-PLANT. Plant silky-villous, glabrate in age; scape to 4 dm. high, from a brown crown; leaves ternately divided, the lateral divisions 2-parted, the middle ones stalked and 3-parted, the segments and those of the sessile cuplike involucre deeply cleft into linear or narrowly lanceolate acute lobes; flowers erect; sepals 5 to 7, blue to purple or white, to 4 cm. long, widespreading in anthesis; stamens usually accompanied by minute or indistinct glandlike staminodia; carpels numerous in a head, with a long hairy style (in fruit) 2-4 cm. long and plumose as in *Clematis*. *A. ludoviciana* Nutt. On prairies and on exposed slopes in n.w. Tex., Apr.-June; from Arct. n.w. Am., s. to n. Mich., Ill., Mo., Tex., N.M., Ut. and Wash.

The inclusion of this species has as its basis a report of its occurrence in Texas. It may occur in the Panhandle.

2. *Anemone caroliniana* Walt. Stem slender, simple, to 3 dm. high, from a small globular tuber that also produces rhizomes or stolons; radical leaves once or twice 3-parted or -cleft; involucre low on the stem, 3-parted, its cuneate divisions 3-cleft; sepals 10 to 20, linear-oblong, white to roseate or lavender-blue to deep-violet, 1-2.2 cm. long; fruiting head ellipsoid, 1-1.5 cm. long; style about the length of the ovate rather turgid achene, erect, its slender tip projecting from the wool. Mostly sandy soils in e. fourth of Tex., Feb.-Apr.; from Fla. to Tex., n. to N.C., Ind., Wisc., Minn. and S.D.

Our plants have a small tuber from which are produced not only the stem and basal leaves but also one or more prominent succulent rhizomes or stolons. Because of this rhizomatous nature some question arises as to whether or not our plant is correctly referable to this species. For the present it is maintained here by tradition.

3. *Anemone heterophylla* Nutt. Plant to 3 dm. high, from an oblong tuberous root; leaves usually appressed-pubescent or at least ciliate-hirsute, 3-foliolate; leaflets petiolulate or sessile, broad, ovate to ovate-oblong or obovate, crenate-dentate or shallowly and obtusely cleft; involucre very dissimilar, borne at or above the middle of the 1-flowered stem, subsessile, its three leaves short, once- (or more rarely twice-) palmatifid-cleft to below the middle, its linear segments mostly entire; sepals 10 to 20, usually white within, blue-lavender to violet without; head of fruit cylindrical, 2-4 cm. long; style not half the length of the orbicular flat achenes, at length inflexed, completely covered by the wool of the achene. *Anemone decapetala* Ard. var. *heterophylla* (Nutt.) Britt. In calcareous clays or in sandy clays throughout much of Tex., including the Trans-Pecos, Feb.-Apr.; from Ala. to Tex., Okla. and Ark.

4. *Anemone edwardsiana* Tharp. Corms brown, oblong-obovate, 2-4 cm. long, 1-2 cm. thick; leaves several, 3-foliolate, glabrous, the petioles 8-15 cm. long; petiolules to 25 mm. long; leaflets reniform in outline, to 25 mm. broad, deeply 2- to 4-cleft, the lobes coarsely crenate; scapes 2-5 dm. tall, glabrous below, upwardly increasingly appressed

silvery-pubescent to become densely so just beneath flowers; primary involucre bracts 3, each 2-5 cm. long, 3-cleft into linear-oblong divisions, with the lateral divisions occasionally again 2-cleft, sparingly soft-pubescent; lateral branches potentially 3 (one in each bract axil), each with 2 bracts similar to those of the primary involucre except smaller and more densely pubescent, each having a potential bractless flower stalk in its axil; maximum potential number of flowers on each compound scape 10 (1 on the central scape and 3 each on the 3 lateral branches); central flowers 2.5-3 cm. broad, the others smaller; sepals whitish to greenish-white, sometimes reddish- or purplish-tinged on back; fruiting head oblong-elliptic, 1.5-3 cm. long, 6-8 mm. thick; achenes tan-color, broadly ovate, plump, margined, each with a short erect beak and a tuft of fine basal hairs as long as the pubescent to glabrous body. *A. tuberosa* of auth., not Rydb. Rich moist soil along limestone ledges in crevices of boulders and in shaded locations at the bases of bluffs on the Edwards Plateau, Feb.-May; endemic.

Those plants with achenes and receptacle entirely glabrous and vernicose are segregated as var. *petraea* Correll. This plant grows wedged in crevices of boulders and ledges below Edge Falls in Kendall County.

10. CLEMATIS L.⁶⁸

CLEMATIS

Herbaceous perennial vines that climb by twining of the petiolules or erect suffrutescent herbs; leaves opposite, simple or variously compound; flowers solitary or in panicles, terminal or axillary, often nodding; sepals usually 4, rarely 5 or 6, thin to coriaceous, white to variously colored, valvate in the bud, the margins often induplicate; petals none or small, transitional into stamens; stamens numerous, with adnate anthers; achene bodies compressed, usually more or less rimmed; achene tails plumose to pubescent or nearly naked.

About 250 species widely distributed in temperate and subtropical regions, with several in temperate regions.

1. Flowers relatively small; sepals mostly less than 15 mm. long, white or whitish, in cymose panicles (2)
1. Flowers large; sepals mostly more than 15 mm. long, variously colored, solitary and mostly nodding on rather long peduncles (4)
- 2(1). Leaflets entire or rarely with an entire lobe, coriaceous; some or all flowers perfect; sepals tomentose on back along margins, glabrous in center 1. *C. dioscoreifolia*.
2. Leaflets more or less coarsely toothed, herbaceous to subcoriaceous; flowers unisexual; sepals dorsally sericeous (3)
- 3(2). Panicles many-flowered; leaflets usually 50-75 mm. long; sepals about 8 mm. long; achene tails about 4 cm. long; confined to the forest region of east Texas .. 2. *C. virginiana*.
3. Panicles sparsely flowered; leaflets to about 35 mm. long; sepals about 12 mm. long; achene tails becoming 8 cm. long or more; distribution west of east Texas 3. *C. Drummondii*.
- 4(1). Sepals thin, petaloid; petaloid staminodes present .. 4. *C. alpina*.
4. Sepals thick, leathery; without petaloid staminodes (5)
- 5(4). Leaves glaucous (especially on lower surface); achene tails always plumose (6)
5. Leaves not glaucous; achene tails plumose to subglabrous (8)
- 6(5). Plants confined to Edwards Plateau; sepals carmine-red; leaflet tips blunt, rounded or emarginate 5. *C. texensis*.
6. Plants confined to extreme east Texas; sepals lavender to purplish; leaflet tips acute to rounded, not emarginate (7)

⁶⁸ Adapted partly from R. O. Erickson in Ann. Missouri Bot. Gard. 30:1-62. 1943.

- 7(6). Leaves membranaceous, not conspicuously reticulate-veined; sepals reddish-purple or purplish; achene tails tawny-plumose 6. *C. glaucophylla*.
7. Leaves coriaceous, reticulate-veined; sepals blue-lavender, commonly greenish or whitish toward the tip; achene tails silvery- or pale yellowish-plumose 7. *C. versicolor*.
- 8(5). Leaves not conspicuously reticulate-veined (9)
8. Leaves more or less distinctly and usually strongly reticulate-veined (10)
- 9(8). Sepals with wide undulate or crisped margins; achene tails finely appressed-pubescent, not plumose 8. *C. crispa*.
9. Sepals without a margin or narrow-margined; achene tails plumose 9. *C. Viorna*.
- 10(8). Achene tails plumose (11)
10. Achene tails partially glabrous to long silky-pubescent but not plumose (12)
- 11(10). Leaflets coriaceous, extremely strongly and closely reticulate-veined, more or less rounded at apex 10. *C. reticulata*.
11. Leaflets thinner, more finely and distantly reticulate-veined, acute to acuminate at apex 11. *C. Beadlei*.
- 12(10). Filaments and usually the anthers consistently densely pilose; achene tails noticeably tapered from base to apex and silky-pubescent to the tip or nearly so, very rarely glabrous above the middle; leaves usually pinnate; leaflets 4-10 cm. long; sepals usually ovate, without a margin or sometimes moderately margined; distribution east of Trans-Pecos Texas 12. *C. Pitcheri*.
12. Filaments and anthers glabrous or very rarely somewhat pilose at their apex; achene tails abruptly filiform and glabrous or nearly so beyond the middle, shortly pubescent below the middle; leaves usually pinnate-ternate; leaflets mostly 4 cm. long or less; sepals lanceolate, moderately margined; rarely east of Trans-Pecos Texas 13. *C. filifera*.

1. *Clematis dioscoreifolia* Lévl. & Van. High-climbing glabrous vine, to 3 m. long or more; leaflets usually 5, coriaceous, triangular-ovate to broadly ovate, obtuse to acuminate, rounded to cordate at base, to 3 cm. long or more, the margins mostly entire, the terminal leaflet conspicuously long-petiolulate; flowers numerous, in corymbiform panicles; sepals white, 10-15 mm. long, densely tomentose along margins on back; achenes minutely appressed-silky; styles 2-3 cm. long, plumose. Climbing on trees and shrubs in s.e. Tex. (Hardin Co.), well-established, July-Sept.; nat. of Japan, frequently cult. and occurring as an escape.

2. *Clematis virginiana* L. VIRGIN'S-BOWER, DEVIL'S DARNING-NEEDLE. Plant almost glabrous; leaves simply 3-foliolate, very rarely pinnately 5-foliolate; leaflets thin, ovate, often subcordate, 5-7.5 cm. long, incisely few-toothed or somewhat lobed, glabrous or sparingly pilose and glabrate on lower surface; panicles corymbiform, with numerous creamy-white flowers; sepals 6-12 mm. long; anthers 0.6-1.5 mm. long; achenes brown or rufescent, pilose or villous-hirsute, the styles 1-3 cm. long. Low grounds, thickets and borders of woods, edge of swamp forests, commonly climbing in trees, in e. Tex., July-Sept.; from e. Can. to Man., s. to Ga., Ala., Miss., La., Tex. and e. Kan.

3. *Clematis Drummondii* T. & G. TEXAS VIRGIN'S BOWER, BARBAS DE CHIVATO, OLD MAN'S BEARD. Plant cinereous-pubescent; leaves mostly pinnately 5- or 7-foliolate, uppermost ones simple and 3-cleft; leaflets 12-25 mm. long, mostly divergently 3-cleft or sometimes parted; principal leaflet lobes ovate-oblong to lanceolate, acute to acuminate, entire or incisely 1- to 3-toothed; peduncles sparsely flowered, sometimes simple and with a pair of leafy bracts next to the base, commonly trichotomous and with higher bracts on the lateral pedicels; sepals sericeous on outer surface, about 12 mm. long; the narrow and copious sterile filaments of the fertile flowers as long as sepals; achene tails very slender, becoming 7.5-10 cm. long. In dryish soils, dry washes and rocky canyons, commonly climbing over trees and shrubs, in cen., s. and w. Tex., Apr.-Sept.; from Tex. to Ariz. and n. Mex.

4. *Clematis alpina* Mill. Plant somewhat suffrutescent; stems slender, to 15 dm. long, with prominent joints becoming swollen with age, appressed-pubescent; leaves once- or twice-ternate; leaflets short-petiolulate, ovate to ovate-lanceolate, irregularly serrate to incised or simply 3-foliolate with some or all of the leaflets 2- or 3-parted; sepals 4, bright-blue, upright, appressed-pubescent; stamens numerous, petal-like, devoid of anthers. In mts. of the Trans-Pecos, spring; from w. N.A. to Sib. and cen. Eur.

5. *Clematis texensis* Buckl. SCARLET CLEMATIS. Herbaceous or slightly woody climbers, glabrous or nearly so, the slender stem somewhat glaucous; cauline leaves with 4 or 5 pairs of leaflets; rachis slender, geniculate, terminated by a tendril-like filament; leaflets simple, 2- or 3-lobed or rarely 3-foliolate, subcoriaceous, ovate or orbicular, rounded to cordate at base, obtuse to rounded or occasionally emarginate at apex and usually with a small mucro; basal leaflets 3-9 cm. long, long-petiolulate, glabrous on both surfaces, glaucous below, moderately to strongly reticulated; peduncles axillary, 1- to 7-flowered; lowest pair of floral leaves approximating in size and character the cauline leaflets but with a short petiole; flowers ovoid, 2-3 cm. long, bright-carmine or scarlet; sepals ovate-lanceolate, recurved at the tip, glabrous on outer surface, glaucous, the margins scarcely expanded, white-tomentose; achene bodies orbicular, essentially symmetrical, 6-7 mm. broad, prominently rimmed, closely appressed-pubescent; achene tails plumose, tawny, 6-7 cm. long, loosely intertwined or spreading. *C. coccinea* Engelm., *Viorna cocctnea* (Engelm.) Small. On limestone cliffs, rocky slopes and trailing over shrubs, usually along streams, on the Edwards Plateau, Mar.-July; endemic.

6. *Clematis glaucophylla* Small. Stem rather slender, ribbed, glabrous; cauline leaves with 4 or 5 pairs of leaflets, the rachis somewhat geniculate and terminating in a slender filiform appendage or minute leaflet; leaflets (at least the basal ones) usually deeply 3-lobed or 3-foliolate but also simple, ovate, acute- to obtuse-tipped, cordate or subcordate at base; basal leaflets 3-7 cm. long, thickish, with a few prominent veins but not reticulate, glabrous on both surfaces, glaucous on lower surface; peduncles axillary, 1- to 3-flowered; floral leaves simple, sometimes small, sometimes larger than the cauline leaflets, approximating the latter in shape and character but with a short petiole; flowers ovoid, 2-2.5 cm. long, reddish-purple; sepals ovate-lanceolate, spreading slightly at the tip, glabrous, the margins unexpanded and white-tomentose; achene bodies suborbicular, inequilateral, 2-6 mm. broad, with a moderately wide rim; achene tails 6 cm. long, plumose, tawny, loosely intertwined or spreading. In rich woods or along streams from Va., s. to Fla. and w. to s.e. Okla. and e. Tex.

7. *Clematis versicolor* Britt. A slender vine, simple or little-branched; stems ribbed, glabrous, glaucous; cauline leaves with 4 pairs of leaflets; rachis slender, geniculate, terminating in a tendril-like filament; leaflets simple or rarely 2- or 3-lobed, ovate, obtuse to subcordate at base, acute to rounded and mucronate but not emarginate at apex; basal leaflets 3-7 cm. long, with slender petiolules, glabrous, glaucous above, glaucous below, reticulate; peduncles axillary, 3- to 7-flowered, the lowest pair of floral leaves similar in shape and character to the cauline leaflets but smaller and short-petioled; flowers subglobose, 15-25 mm. long, blue-lavender, fading to whitish or green toward the tips; sepals narrowly ovate to lanceolate, scarcely recurved at the tips, glabrous to puberulent and glaucous, the margins unexpanded, white-tomentose; achene bodies orbicular to ovate and usually somewhat inequilateral, 5-6 mm. broad, moderately rimmed, closely appressed-pubescent; achene tails 3-6 cm. long, plumose, silvery or pale yellow, loosely intertwined or spreading. In barrens and sandy or stony woods and sandhills in e. Tex., May-Sept.; from s. Mo., Ky. and Tenn. s. to Okla. and e. Tex.

8. *Clematis crispa* L. BLUE JASMINE. Plant climbing freely, glabrous or nearly so, often flowering when only 3 dm. high; leaves compounded with 2 to 5 pairs of leaflets; leaflets from ovate to lanceolate or even linear, cuneate to cordate at base, acute to acuminate at apex, entire to rarely 3-foliolate, membranaceous, little-reticulated; peduncle naked, arising between a pair of compound or rarely simple leaves; calyx cylindrical-campanulate or urceolate-campanulate, rose-colored varying to violet; sepals 2.5-5 cm. long, recurved or spreading from near the middle, the spreading portion with broad undulate thinnish margins; achenes 6-9 mm. broad; style canescent to somewhat villous in flower, in fruit 2-3 cm. long and either almost glabrate (and the upper part falling away in age) or finely appressed-pubescent. *C. cylindrica* Sims, *Viorna crispa* (L.)

Small. Frequently in wet soils, climbing on shrubs, along streams in low woodlands or sometimes on coarse dry sandhills with available water in e. Tex., w. to Calhoun and Williamson cos., Mar.-Oct.; from Fla. to Tex., n. to s.e. Va., Ill. and Mo.

The plant which typically flowers when low and has narrowly lanceolate to linear leaflets (6-8 mm. wide) and whose sepals are artificially outspread is referred to var. *Walteri* Gray.

9. *Clematis Viorna* L. LEATHER-FLOWER, VASE-VINE. Herbaceous or slightly woody climbers, glabrous or nearly so; leaves not glaucous nor coriaceous, 3- to 9-foliolate; leaflets ovate to ovate-lanceolate, subcordate at base, often acute at apex, membranaceous, inconspicuously reticulated, those of the peduncle or inflorescence ovate or cordate; calyx thick, barely 25 mm. long, glabrous or minutely furfuraceous-canescens on outer surface, dull-reddish or purplish; sepals oblong-lanceolate, acuminate, the slender tip recurving; achenes 3-6 mm. broad; achene tails densely plumose, light yellow or brownish.

This species is included here based on a report of its occurrence in Texas. It should be in woods of east Texas. Its distribution is given as from Ga. to Tex., n. to Pa., O., Ind., s. Ill. and s.e. Ia.

10. *Clematis reticulata* Walt. Herbaceous or slightly woody climbers, glabrous or nearly so; stem slender, sparsely pubescent at the nodes; cauline leaves long-petioled, with about 4 pairs of leaflets, the rachis terminating in a tendril-like filament or minute leaflet; leaflets long-petioluled, entire or rarely 2- or 3-lobed, usually elliptical with a rounded and mucronate tip but varying to ovate and acute-tipped, 2-6 cm. long or longer, coriaceous, very strongly and closely reticulated on both the upper and lower surfaces; peduncles axillary, 1- to 3-flowered, the floral leaves usually less than 4 cm. long, otherwise simulating the cauline leaflets; flowers nodding, 15-25 mm. long; sepals purplish-red to mauve or pink-lavender, equaling or somewhat exceeding the stamens, densely covered with yellow canescent pubescence on the outer surface, the tips acute and recurved, the margins narrowly expanded and tomentose; achene bodies suborbicular, symmetrical, 4 mm. broad, with a prominent rim, appressed-pubescent; achene tails 4-6 cm. long, plumose, pale yellow-brown, loosely intertwined. *C. subreticulata* Harbison, *Viorna reticulata* (Walt.) Small. In sandy soils in forests of e. Tex., often climbing on shrubs, w. to Van Zandt Co., Apr.-July; from S.C. to Fla., w. to Ark. and Tex.

11. *Clematis Beadlei* (Small) Erickson. Stem slender, 6-angled, reddish-brown, glabrous or slightly pubescent at the nodes; cauline leaves with 3 or 4 pairs of leaflets; rachis slender, finely pubescent, geniculate, terminating in a tendril-like appendage; leaflets ovate, acute or acuminate, simple and entire or the basal ones commonly 2- or 3-lobed, 2.5-8 cm. long, thin and chartaceous, moderately and distantly reticulate; peduncles axillary, 1-flowered; floral leaves 25 mm. long, simple and entire, short-petioled; flowers not seen; fruiting heads 5 cm. in diameter; achene bodies ovate, inequilateral, 4.5-5.5 mm. broad, moderately rimmed, not greatly compressed, long appressed-pubescent; achene tails 5-6 cm. long, plumose, loosely intertwined. Reported from Ga. to Tex., May-July.

Very close to *C. reticulata* if not referable to it; we have seen no material from the state.

12. *Clematis Pitcheri* T. & G. LEATHER FLOWER, BLUEBELL. Freely climbing more or less herbaceous vine; stem simple or somewhat branched, 6-angled or -ribbed, reddish-brown, nearly glabrous or sparsely pubescent; cauline leaves with 3 or 5 leaflets, the slender rachis terminating in a slender tendril-like filament; leaflets simple, slightly or deeply 2- to 5-lobed or 3-foliolate, chartaceous or coriaceous, nearly glabrous or quite pubescent below, obscurely to very strongly reticulate but not so closely as in *C. reticulata*, the lowest leaflets 4-10 cm. long; ultimate leaflets varying greatly in size and shape from narrowly ovate or elliptical to broadly ovate-cordate, blunt to acute-tipped, mucronate; peduncles axillary, as many as 7-flowered; floral leaves similar to but usually smaller than the cauline leaflets; flowers nodding, ovoid or urceolate; sepals slightly exceeding the stamens to twice their length, ribbed, short appressed-pubescent and dull-purple to brick-red without, deeply colored or greenish within, the margins unexpanded or moderately expanded above the middle, white-tomentose, spreading or recurved at the tip; achene bodies orbicular to suborbicular or obscurely quadrangular, more or less inequilateral, 6-8 mm. broad, with a broad thick rim, appressed-pubescent; achene tails about 3 cm. long

but usually broken and hence much shorter, slender and tapering, sparsely appressed-pubescent or nearly glabrous to silky or villous but not plumose. *Clematis Simsii* and *Viorna Simsii* of auth., *Viorna Pitcheri* (T. & G.) Small. Climbing on shrubs in thickets, open woodlands, along streams and in low places, mostly in n.-cen. Tex., the Edwards Plateau and along the coast, Apr.-Sept.; from Ind. to e. Neb., s. to Tex.

13. *Clematis filifera* Benth. Woody vine with branches to 1 m. long or more; leaves much-divided; leaflets ovate, obtuse to acute or acuminate, rather small, very rarely more than 4 cm. long, strongly reticulated, more or less densely pubescent or tomentose beneath; sepals rose-color to dark-lavender or purplish-black, about 25 mm. long, lanceolate, acuminate at the recurved apex, always with expanded margins above the middle; achene 8-10 mm. in diameter, the very slender tails nearly naked. *C. Pitcheri* var. *filifera* (Benth.) Robins. In crevices of canyon walls, climbing on shrubs and over boulders in canyons at base of cliffs in the Trans-Pecos, Apr.-Sept.; also N.M. and adj. Mex.

The cultivated plant, Love-in-a-mist (*Nigella damascena* L.), occasionally occurs as a waif in waste places. It may be distinguished by its solitary flower subtended by an involucre of finely cut leafy bracts and its pinnately compound leaves whose leaflets are cut into threadlike segments.

FAM. 73. BERBERIDACEAE JUSS.

BARBERRY FAMILY

Shrubs or herbs with alternate often stipulate leaves; sepals and petals imbricated in the bud and usually in 2 rows of 3 each; stamens hypogynous, as many as the petals and opposite them or twice as many as the petals (in *Podophyllum*); anthers opening by 2 hinged valves or along the sides; pistil solitary, becoming a 1- to few-seeded berry or pod; seeds anatropous, with albumen.

About 9 genera and more than 600 species, mainly of the North Temperate Zone.

1. Succulent herbs with a rather large solitary white to rose-colored flower between 2 broad lobulate leaves (sometimes at base of one leaf); confined to the eastern fourth of Texas 1. *Podophyllum*, p. 654.
1. Shrubs with small yellow flowers in racemes on the branches among prickly coriaceous leaves; from central Texas westward 2. *Berberis*, p. 654.

1. PODOPHYLLUM L.

MAY-APPLE. MANDRAKE

A genus of 11 species, with all but the following in eastern Asia; often placed in a distinct family, Podophyllaceae.

1. *Podophyllum peltatum* L. Perennial herb forming gregarious colonies, with creeping rhizomes and thick fibrous roots; stem erect, to 5 dm. high, terminated by a solitary leaf or 2 leaves and a single nodding short-pedunculate flower; leaves peltate, large, orbicular, radially 3- to 9-parted, to 3 dm. or more in diameter; flower buds with 3 green bractlets that are early-fugacious; sepals 6, fugacious; petals 6 or 9, obovate, waxy-white to rose-colored, to 4 cm. long; stamens twice as many as the petals; anthers linear-oblong, opening longitudinally; ovary ovoid, with a large sessile ruffled stigma; fruit a large ovoid many-seeded berry to 5 cm. long, yellow to purplish when ripe, sweet and edible; seeds covering the large lateral placenta, in many rows, each seed enclosed in a pulpy aril. In rich woods, thickets, open pastures and on edge of forests in e. Tex., Mar.-Apr.; from w. Que., s. Ont. and Minn., s. to Fla. and Tex.

The rare variant, f. *Deamii* Raymond, with pink to rose-colored or purplish pigment in flowers, ovary, fruit and seeds, has recently been found in northeast Texas (Upshur Co.).

2. BERBERIS L.

BARBERRY

Evergreen shrubs with yellow flowers and wood; leaves trifoliolate to pinnately lobed, rarely simple; flowers in drooping or rigidly projecting racemes; petals 6, obovate, con-

cave, with a pair of glandular spots at the base; stamens 6, sensitive, the anthers opening by valves; stigma circular, depressed; seeds elliptic to obpyriform, with a crustaceous integument.

About 450 species, mostly in Asia, but also in Europe, Africa and America.

1. Leaves palmately trifoliolate; leaflets sessile at apex of petiole 1. *B. trifoliolata*.
1. Leaves pinnately lobed; leaflets 5 or more (2)
- 2(1). Bracts of inflorescence foliaceous; fruits globose, about 12 mm. in diameter, grading in color from white to brilliant-red, shiny; in west-central Texas 2. *B. Swaseyi*.
2. Bracts of inflorescence not foliaceous; fruits ellipsoid to subglobose, less than 10 mm. in diameter, purple to deep-red, with a bloom; in mountains of Trans-Pecos Texas (3)
- 3(2). Lowermost pair of leaflets arising 10 mm. or more above base of petiole; fruiting pedicel about 8 mm. long; plant rather rigidly erect, usually much more than 3 dm. tall; fruits red 3. *B. haematocarpa*.
3. Lowermost pair of leaflets arising within 3 mm. of base of petiole; fruiting pedicel about 5 mm. long; plant prostrate or weakly ascending, mostly less than 3 dm. tall; fruits purple 4. *B. repens*.

1. *Berberis trifoliolata* Moric. AGARITO, ALGERITAS, CURRANT-OF-TEXAS. Shrub to 2 m. tall or more, with rigid ascending or spreading branches; leaflets rigidly coriaceous, commonly grayish-green and sometimes glaucous, elliptic to narrowly lanceolate, to 7 cm. long, 3- to 7-lobed or -toothed, with the teeth and tip spinescent, the apical lobe usually narrowly triangular-elongate; flowers saffron-scented; fruits globose, red, often with a bloom, 8-10 mm. in diameter, acidulous, edible; seeds reddish-brown to brownish-black, vernicose, 3-4 mm. long. *Mahonia trifoliolata* (Moric.) Fedde. On rocky slopes and flats of pastures, thickets and open woods from coastal s. Tex. northw. and westw. into the Trans-Pecos, Feb.-Apr.; also s. Ariz. and n. Mex.

Those plants with glaucous foliage are usually segregated as var. *glauca* (I. M. Johnst.) M. C. Johnst. (*Mahonia trifoliolata* var. *glauca* I. M. Johnst.) An excellent jelly is made from the fruits of this species.

2. *Berberis Swaseyi* Buckl. TEXAS BARBERRY. Small intricate shrub to 1 m. or more tall; leaflets 5 to 9, thinly coriaceous, grayish-green or yellowish-green on upper surface, paler and conspicuously venose on lower surface, elliptic to elliptic-lanceolate or subquadrate, the 7 to 20 spines relatively weak, turning a deep red in fall; bracts of inflorescence resembling the leaves in miniature; fruits about 12 mm. in diameter, juicy, edible; seeds brown, plump, about 3.5 mm. long. In limestone ridges and canyon walls of the Edwards Plateau, reported from Bailey Co. in the Panhandle, Feb.-Apr.; endemic.

3. *Berberis haematocarpa* Woot. RED BARBERRY. Shrub much-branched, to about 2 m. tall; leaflets 5 to 9, stiffly coriaceous, ovate-subquadrate to elliptic-lanceolate, to 55 mm. long, usually much smaller, typically with 5 to 7 spinescent teeth; racemes laxly 5- to 7-flowered; floral bracts ovate, acute, concave, brown-membranous, about 2 mm. long; fruit 8-10 mm. long, ellipsoid, edible; seeds reddish-brown, about 4 mm. long. *Mahonia haematocarpa* (Woot.) Fedde. In grasslands, on rocky slopes and canyons of mts. in the Trans-Pecos, Mar.-June; also N.M., Ariz. and Mex.

The shrub could become a desirable ornamental. Its flowers are fragrant and a delicious jelly can be made from its attractive fruits.

4. *Berberis repens* Lindl. CREEPING BARBERRY. Dwarf depressed or prostrate shrubs, rarely to 3 dm. tall; leaflets 5 or 7, rarely some leaves with 3, broadly ovate to ovate-elliptic, rounded to slightly cordate at base, mostly with obtuse to rounded apex, to 5 cm. long and 3 cm. wide, pale or glaucous, with 11 to 21 rather weak spinulose teeth; racemes densely 15- or more-flowered; floral bracts tan-color, membranous, suborbicular-ovate, apiculate, concave, 2-3 cm. long; fruit 6-8 mm. long, purple. On walls of wooded canyons and in pine forests of the Guadalupe Mts. in the Trans-Pecos, Mar.-Apr.; from w. Tex., N.M. and Ariz., n. to Wyo. and B.C., w. to Calif.

FAM. 74. MENISPERMACEAE JUSS.

MOONSEED FAMILY

Dioecious woody twining and climbing vines with palmately veined exstipulate petiolate leaves and racemes or panicles of small white or greenish unisexual flowers that are mostly trimerous, regular and hypogynous; sepals and petals similar, distinct, in 3 or more rows, imbricated in the bud; stamens 6 to 12; ovary of 3 to 6 separate pistils, apparently only one maturing with a fruit; fruit a 1-seeded drupe.

A primarily tropical family with about 65 genera and 400 species.

1. Petals and sepals both present; stamens 6, the anthers 4-celled; seed incurved or crescent-shaped; leaves not apically lobed 1. *Cocculus*, p. 656.
1. Petals none; stamens 12, the anthers 2-celled; seed saucer-shaped; leaves deeply several-lobed above middle 2. *Calycocarpum*, p. 656.

1. COCCULUS DC.

CORALBEAD

Flowers in axillary racemes or panicles; sepals, petals and stamens each 6, alternating in threes; pistils 3 or 6, with the stigma entire; drupe globular, with a flattened somewhat roughened stone.

About a dozen species worldwide in distribution, mostly tropical and subtropical.

1. Leaves very variable in shape, typically ovate in outline, the lower surface downy ..
..... 1. *C. carolinus*.
1. Leaves typically oblong, rarely suborbicular, the lower surface glabrous
..... 2. *C. diversifolius*.

1. *Cocculus carolinus* (L.) DC. RED-BERRIED MOONSEED, SNAILSEED. Plant climbing to 3 m. or more, minutely pubescent; leaves ovate or cordate, entire or sinuately or hastately lobed, acute or mucronate at apex, rarely as much as 16 cm. long and wide; flowers greenish, 3-4 mm. across, the petals in the staminate flowers auriculate-inflexed below around the filaments; drupe red, about 8 mm. in diameter, said to be edible but we haven't tried it. Rather frequent in rich woods and thickets in the e. half of Tex., rare westw., July-Aug.; from Fla. to Tex., n. to s.e. Va., Ky., s. Ill., Mo. and s.e. Kan.

2. *Cocculus diversifolius* DC. CORREHUELA. Plant climbing to 2 m. or more, essentially glabrous throughout; leaves not so variable as in *C. carolinus*, linear-oblong to oblong or sometimes ovate or suborbicular, mucronate, sometimes deeply retuse with a mucro in the sinus, to 6 cm. long and 4 cm. wide; flowers white or yellowish; fruit dark-purple, frequently with a bloom, about 6 mm. in diameter. In brushlands, palm hammocks and along resacas in s. Tex., June-Aug.; also s. Ariz. and Mex.

2. CALYCOCARPUM T. & G.

CUPSEED

A monotypic genus.

1. *Calycocarpum Lyonii* (Pursh) Gray. High-climbing vine; leaves large, thin, to 2 dm. long and about as wide, deeply 3- to 5-lobed, cordate at base, the lobes acuminate; flowers greenish-white, about 5 mm. across, numerous in long racemose panicles to 2 dm. long; sepals 6, petaloid; petals none; stamens 12; pistils 3, fusiform, tipped by a dilated many-cleft stigma; drupe ellipsoid, about 25 mm. long, black when ripe, the stone deeply excavated on one side with the incurved margin somewhat erose. In rich soils and swampy areas in e. Tex., May-June; from Fla., w. to Tex., n. to Ky., s. Ill., Mo. and e. Kan.

FAM. 75. MAGNOLIACEAE JUSS.

MAGNOLIA FAMILY

Trees, rarely shrubs or vines with bitter aromatic bark and with the leaf buds covered by membranous stipules; leaves alternate, petiolate, entire, pinnately-veined; flowers solitary or several clustered, usually large and fragrant, polypetalous, hypogynous, with many stamens; perianth segments (3 sepals and 6 to 9 petals) similarly colored, decidu-

ous, imbricated in the bud; stamens numerous, linear, caducous; anthers adnate; carpels numerous, crowded together to cover the prolonged receptacle, cohering with each other and in fruit forming a fleshy or rather woody conelike fruit; mature carpels opening on the back from which the 1 or 2 anatropous arillate seeds hang by an extensile thread.

About 230 species in 12 genera, worldwide in distribution.

- 1. Leaves 4-lobed; mature carpels samaralike, indehiscent 1. *Liriodendron*, p. 657.
- 1. Leaves not lobed, sometimes merely auricled at the base; mature carpels dehiscent or berrylike (2)
- 2(1). Twining shrubs with unisexual flowers; stamens 5, connate into a 5-lobed disk; fruit a spike of berries 2. *Schisandra*, p. 657.
- 2. Erect trees with perfect flowers; stamens numerous, distinct; fruit a head of imbricated follicles 3. *Magnolia*, p. 657.

1. LIRIODENDRON L. TULIP-TREE. YELLOW POPLAR

Two closely related species; the other in China.

1. *Liriodendron tulipifera* L. Tree to 60 m. tall or more, with a straight gray-barked trunk to about 3 m. in diameter; leaves alternate, stipular, long-petioled, to 14 cm. long, about as wide, broadly retuse at apex, 4-lobed or occasionally with small additional lobes or even entire; flowers perfect, solitary at the end of branches; sepals 3, pale-green, soon reflexed; petals 6, broadly ovate, adherent to form a cup-shaped corolla, 4-5 cm. long, greenish-yellow with a large orange blotch at the base within; stamens many, the anthers extrorse; pistils many, on an elongate long-persistent receptacle that ripens into a cone-like fruit 3-4 cm. long; each pistil dry, woody, flattened, samaralike, eventually deciduous. Nat. in rich woods from Fla. to La., n. to Vt., Mich. and Mo.; planted and becoming somewhat naturalized in e. Tex.

An ornamental tree valued for its wood.

2. SCHISANDRA MICHX.

About 25 species, all but one of which is in Asia. Some authors segregate this genus as the basis for the family Schisandraceae.

1. *Schisandra coccinea* Michx. WILD SARSAPARILLA, BAY STAR-VINE. Woody vine climbing into small trees; leaves slender-petioled, deciduous, alternate or somewhat clustered at the nodes, rather thick, ovate to elliptic or oval, 5-15 cm. long, obliquely cuneate at base, somewhat abruptly acuminate at apex, the margins entire or with a few remote teeth; flowers few in axillary clusters, slender-stalked, unisexual; sepals and petals 7 to 12, not differentiated; sepals ovate to oval, 3-6 mm. long; petals obovate-cuneate, mostly crimson; stamens 5; fruit spike 4-7 cm. long; berries about 1 cm. long. In rich woodlands probably in e. Tex., Apr.-July; from Fla. to Tex. (reported from but not seen) and Ark., n. to S.C.

3. MAGNOLIA L. MAGNOLIA

Characters of the family. About 80 species, mostly Asiatic.

- 1. Leaves persistent or sometimes deciduous, leathery-coriaceous or thick-membranous, scattered along the branches, typically elliptic and widest about or below the middle, rounded or cuneate at base; leaf buds tomentose or silky-pubescent (2)
- 1. Leaves deciduous, thin-herbaceous, more or less crowded at the summit of the flowering branches, typically elliptic-obovate and widest above the middle, prominently auriculate at base; leaf buds glabrous or tomentose (3)
- 2(1). Fruits tomentose; leaves leathery-coriaceous, persistent, with a rusty tomentum on lower surface 1. *M. grandiflora*.
- 2. Fruits glabrous; leaves thick-membranous, subsistent or deciduous, minutely pubescent and pale or whitish on lower surface 2. *M. virginiana*.

- 3(1). Leaf blades typically rhombic-obovate, abruptly acute; stamens 4-6 mm. long 3. *M. pyramidata*.
 3. Leaf blades elongate-obovate to oblong-spatulate, gradually pointed at the apex; stamens 9-12 mm. long 4. *M. Fraseri*.

1. *Magnolia grandiflora* L. SOUTHERN MAGNOLIA. Evergreen pyramidal or cylindrical tree to 30 m. tall, with a straight trunk occasionally to 2 dm. in diameter, the smoothish bark tight or rarely flaky; branchlets and buds rusty-pubescent; leaves typically elliptic, to 2 dm. long and 9 cm. wide, rounded to shortly obtuse at apex, cuneate at base, bright-green and lustrous on upper surface, ferruginous-pubescent on lower surface, firmly coriaceous; petioles stout, rusty-tomentose, about 2 cm. long; flowers large, cup-shaped, to 2 dm. across, white, fragrant, with a stout tomentose pedicel; sepals 3, petaloid; petals usually 6 or rarely 9 to 12, obovate, thick; filaments purple; fruit ovoid, rusty-tomentose, 7-10 cm. long, 4-6 cm. thick; seeds red, obovoid, somewhat flattened, about 12 mm. long. *M. foetida* Sarg. In low moist woods, especially along streams, in e. and s.e. Tex., July-Aug.; from e. N.C., s. to Fla. and Tex.

A Texas (if not a national) law should exist forbidding the cutting of these noble trees, whose wood has been used primarily for railroad ties and furniture.

2. *Magnolia virginiana* L. SWAMP BAY, SWEET BAY. A slender semievergreen tree to 20 m. tall, with a trunk to 15 cm. in diameter or rarely shrubby and deciduous; branchlets slender, bright-green and hoary-pubescent when they first appear, usually soon glabrous; buds pubescent; leaves elliptic to oblong-lanceolate, 10-15 cm. long, to 6 cm. wide, acute or obtuse at apex, broadly cuneate or sometimes rounded at base, pale or whitish on lower surface and silky-pubescent at first; petioles slender, 1-2 cm. long; silky-pubescent to glabrous; flowers subglobose, 5-7 cm. across, white, fragrant of lemon, on slender peduncles; sepals thinner and shorter than the petals, spreading; petals 9 to 12, obovate, obtuse to acutish, 3-6 cm. long, concave; fruit ellipsoid, 4-5 cm. long, about 12 mm. thick, dark red, glabrous; seeds red, obovoid, flattened, about 7 mm. long. *M. glauca* L. In swamps, low woods, along boggy streams and on seepage slopes in e. Tex., Apr.-June; from Mass., s. to Fla. and Tex.

Those plants in our region that have young branchlets and petioles more or less persistently densely silky pubescent, and tomentose pedicels, are referable to var. *australis* Sarg.

3. *Magnolia pyramidata* Pursh. Tree to 10 m. high; leaf buds and branchlets glabrous; leaves with a petiole 2-4 cm. long, thin, crowded at the end of branchlets, broadly obovate to rhombic-obovate or rhombic-spatulate, abruptly narrowly obtuse to acute at apex, auriculate at base, to 23 cm. long, somewhat glaucescent on lower surface; flowers creamy-white, 8-12 cm. across; sepals oblong-obovate, much shorter than the petals; petals oblong, gradually narrowed to the base, acuminate at apex; fruit oblong, bright-rose-color, 5-7 cm. long; tips of mature carpels incurved. In rich woodlands in s.e. Tex. (Jasper Co.), Apr.-May; from s. Ga. and n.w. Fla., w. to Tex.

This species, *M. Fraseri*, *M. Ashei* Weath. and *M. macrophylla* Michx. form a complex group. *Magnolia Ashei*, which has been reported from Texas and for which no material has been seen from the state, can be distinguished by its typically larger leaves (more than 35 cm. long) with glaucous-white lower surface and pubescent twigs, petioles and buds. Trees of the huge-leaved *M. macrophylla* are known to be under cultivation in east Texas, leading to the possibility that it might eventually become an escape.

4. *Magnolia Fraseri* Walt. MOUNTAIN MAGNOLIA, EAR-LEAVED UMBRELLA-TREE. Deciduous tree to 20 m. tall, essentially glabrous throughout, with a straight trunk to 3 dm. in diameter and spreading slender branches; leaves clustered at summit of flowering branches, with slender petioles that may become as much as 1 dm. long, elliptic-obovate, only slightly constricted below the middle, auriculate at base, obtuse to acute at apex, to 3 dm. long and 18 cm. wide, bright-green on upper surface, slightly paler on lower surface; flowers on a glaucous peduncle that is to 4 cm. long, creamy-white, sweetly scented, 20-25 cm. in diameter; sepals narrowly obovate to oblanceolate, rounded at the apex, 10-12.5 cm. long, deciduous almost immediately after opening of bud, somewhat shorter than the petals; petals 6 or 9, obovate to oblanceolate, thin, rounded to acute at

the apex, conspicuously narrowed below into a claw, 3-6 cm. wide; fruit oblong, glabrous, bright-rose-red when fully ripe, to 12 cm. long and 5 cm. thick, the mature carpels ending in long subulate persistent tips; seeds red, obovoid, compressed, about 15 mm. long. Rich wooded slopes in s.e. Tex. (Jasper Co.), Mar.-Apr.; from uplands of Va., W.Va. and e. Ky., s. to Ga., Ala., La. and Tex.

FAM. 76. ANNONACEAE JUSS. CUSTARD-APPLE FAMILY

Tree or shrubs with naked buds and aromatic wood and leaves; leaves alternate, entire, exstipulate, pinnately-veined; flowers axillary, solitary, perfect, composed of 3 sepals and 6 thickened petals that are arranged in 2 whorls, imbricate or valvate in bud, hypogynous; stamens numerous or rarely few, distinct, spirally arranged, the large connectives usually extending beyond the anthers; filaments thickened, short; anthers adnate, extrorse; pistils several or many, separate or cohering in a mass, the ovules one to many; fruit (in ours) fleshy or pulpy (a berry); seeds anatropous, large, the minute embryo at the base of the ruminated endosperm.

A family of about 900 species in 75 genera, mainly tropical.

1. ASIMINA ADANS. AMERICAN PAWPAW

Shrubs or small trees; leaves deciduous, usually broadest above the middle; flowers solitary from the axils of leaves of preceding year; sepals early-deciduous; petals accrescent after the bud opens, those of the outer whorl larger than those of the inner whorl; stamens numerous, in a globular mass; pistils as many as 15, ripening into 1 to 5 thick-cylindric pulpy-creamy edible fruits; seeds several, horizontally placed, flat or turgid, brown-coated, enclosed in a fleshy aril.

About 8 species, entirely American.

1. Flowers 3-4 cm. in diameter; seeds flattish; leaves typically obovate-elliptic 1. *A. triloba*.
1. Flowers 1-2 cm. in diameter; seeds turgid; leaves typically cuneate-oblongate ... 2. *A. parviflora*.

1. *Asimina triloba* (L.) Dun. PAWPAW. Large shrubs or small trees, 3-12 m. tall; young shoots and expanding leaves at first clothed with a rusty down, soon becoming glabrescent; leaves elliptic-obovate, abruptly short-acuminate, the midnerve on upper surface provided with reddish-brown hairs, when mature 1.5-3 dm. long, 7 cm. or more wide above the middle; petioles 5-10 mm. long; flowers appearing with the leaves, 3-4 cm. in diameter, on villous pedicels to 3 cm. long; petals dull-purple, veiny, orbicular-ovate to ovate, very unequal, the outer ones spreading and three to four times as long as the calyx; style definite; fruits 5-12 cm. long, 3-4 cm. thick, green or dark-brown when fully ripe, the pulp sweet and edible in autumn; seeds somewhat flattened, 1.5-2 cm. long. Rich woods and banks of streams in n.e. Tex., Apr.-May; from Fla. to Tex., n. to N.J., w. N.Y., s. Ont., Mich., Ill., s.e. Ia. and s.e. Neb.

The fruit, which usually drops while still hard, green and acrid, must be slightly frozen or kept until ripe before they are eaten. The ripening treatment is similar to that for the fruits of the persimmon. The creamy pulp is sweet and luscious.

2. *Asimina parviflora* (Michx.) Dun. DWARF PAWPAW. Shrub 5-20 dm. tall; leaves firmer than in *A. triloba*, oblanceolate-cuneate to narrowly oblanceolate-obovate, broadly rounded to very shortly apiculate-acute at apex, rusty-appearing on lower surface, midnerve on upper surface glabrous except at the very base, 5-17 cm. long, usually much less than 6 cm. wide above the middle; flowers appearing with the leaves, 1-2 cm. in diameter, on tomentulose pedicels to 6 mm. long; petals livid-green, ovate to oblong-elliptic, subequal; stigma sessile; fruits 3-6 cm. long, about 2 cm. thick; seeds plump, 1-1.5 cm. long. In dryish pinelands, thickets and oak woods in s.e. Tex., Apr.; from n. Fla. to Tex., n. to s.e. Va.

FAM. 77. LAURACEAE JUSS.

LAUREL FAMILY

Aromatic trees or occasionally shrubs with alternate simple persistent or deciduous leaves, or sometimes twining parasitic vines with greatly reduced scalelike leaves, without stipules; flowers small, clustered, greenish or yellowish, without petals; calyx of 4 to 6 sepals that are imbricate and free from the ovary, mostly fewer than the stamens; stamens basically 12, in 4 series of 3 each, any one or more series reduced to staminodia or altogether lacking; anthers 2- or 4-celled, opening by 2 or 4 uplifted valves; ovary 1-celled, the ovule solitary and pendulous; style simple; fruit a 1-seeded berry or drupe; seeds anatropous, suspended.

A family of more than 2,000 species in about 32 genera, chiefly tropical and subtropical.

1. Flowers in peduncled racemes; anthers 4-celled and 4-valved; leaves entire and persistent or (if deciduous) lobed (2)
1. Flowers sessile or short-stalked in small clusters; anthers 2-celled and 2-valved; leaves entire and deciduous (4)
- 2(1). Leaves frequently lobed; fruiting pedicel strongly clavate 1. *Sassafras*, p. 660.
2. Leaves entire; fruiting pedicel not noticeably swollen (3)
- 3(2). Axils of the principal leaf veins with glandular pits; calyx cup truncate 2. *Cinnamomum*, p. 660.
3. Axils of veins without glandular pits; calyx cup 6-lobed 3. *Persea*, p. 661.
- 4(1). Shrubs or small trees with well-developed leaves .. 4. *Lindera*, p. 661.
4. Parasitic orange to green twining viny herbs with leaves reduced to scales 5. *Cassytha*, p. 661.

1. SASSAFRAS TREW

Several species in America and eastern Asia.

1. *Sassafras albidum* (Nutt.) Nees. SASSAFRAS. Trees dioecious, to 35 m. high, usually much smaller, with spicy aromatic bark and very mucilaginous pale-green twigs and foliage, with a trunk to 6 dm. in diameter, the young twigs glaucous or nearly so; leaves deciduous, ovate to elliptic in outline, tapering to a long petiole (to 4 cm. long), obtuse to acute at apex, entire or with some 2- or 3-lobed or rarely more-lobed, at first silky on lower surface but usually soon glabrescent, to 16 cm. long and 1 dm. wide; flowers greenish-yellow, naked, in clustered and peduncled racemes, appearing with the leaves, involucrate with scaly bracts; calyx 6-parted, spreading; fertile stamens 9, inserted on the base of the calyx in 3 rows, the inner row with a pair of stalked glands at the base of each filament, without staminodia; anthers 4-celled and 4-valved; pistillate flowers with 6 rudimentary stamens and an ovoid ovary; drupe subglobose to ovoid, dark-blue, about 1 cm. long, with a clavate and rather fleshy reddish pedicel. *S. officinale* Nees & Eberm., *S. variifolium* (Salisb.) O. Ktze. In sandy woods, old fields, on road cuts and along fence rows in e. third of Tex., Mar.-Apr.; from Fla. to Tex., n. to N.E., w. to Mich., Ia., Mo., Kan. and Ark.

Most of our plants are referable to var. *molle* (Raf.) Fern., characterized by having a persistent pubescence on the lower surface of the leaves. The bark of the roots is steeped to produce a pleasant drink, known as "sassafras tea."

2. CINNAMOMUM L.

About 250 species, mainly native to Asia.

1. *Cinnamomum camphora* (L.) Nees & Eberm. CAMPHOR-TREE. Small tree to about 15 m. tall, usually much smaller, glabrous throughout, the buds enclosed by large imbricate scales; leaves with slender petioles about 3 cm. long, alternate, persistent, ovate

to elliptic or elliptic-lanceolate, rounded to cuneate at base, abruptly short-acuminate at apex, to 12 cm. long, pale on lower surface, prominently 3-nerved, when bruised having the odor of camphor; flowers perfect, in slender-peduncled panicles; sepals 1-1.5 mm. long, all deciduous to form a truncate cup surrounding the base of the fruit; fertile stamens 9 in 3 rows, the innermost 3 with extrorse anthers and biglandular at base, a fourth inner row reduced to staminodes; anthers 4-celled and 4-valved; style slender, the stigma minute; drupes subglobose, bluish-black, 6-9 mm. in diameter. A nat. of e. Asia, cult. in s. Tex. and becoming naturalized, Apr.-May; also along the Gulf Coast to s. Fla.

3. PERSEA MILL.

About 150 species primarily of tropical America, of which the avocado (*P. americana* Mill.) is best known.

1. *Persea Borbonia* (L.) Spreng. RED BAY. Tree to 20 m. tall or more, with ascending branches and densely rusty-tomentose to thinly puberulent or sometimes glabrous twigs; leaves alternate, entire, coriaceous, lanceolate to elliptic or elliptic-oblong, tapering into the petiole (to 25 mm. long), broadly rounded to abruptly short-acuminate at apex, to 2 dm. long and 6 cm. wide, persistent, thinly tomentose on lower surface but commonly glabrescent with age; flowers perfect, in small panicles, peduncle to 7 cm. long, usually less than 3 cm. long; calyx 6-parted, surrounding base of fruit; inner row of sepals elliptic, at least twice as long as the outer row and with the upper two-thirds early-deciduous; fertile anthers 9 in 3 rows, the innermost 3 with extrorse anthers and biglandular at base, a fourth inner row reduced to staminodes; anthers 4-celled and 4-valved; drupes subglobose, dark-blue or blackish, about 1 cm. long, 1-seeded. *P. pubescens* (Pursh) Sarg., *P. palustris* (Raf.) Sarg. In woods, swamps, along streams and about shores in s.e. Tex., May-June; from Fla. to Tex., n. to Del.

4. LINDERA THUNB.

A large genus of about 100 species, primarily in eastern Asia.

1. *Lindera Benzoin* (L.) Bl. SPICEBUSH. Deciduous polygamo-dioecious shrub or slender tree, much-branched, to 5 m. tall; leaves obovate to obovate-elliptic or elliptic, cuneate at base into the short petiole (to 12 mm. long), acute to abruptly acuminate at apex, to 15 cm. long and 6 cm. wide, pale and usually pubescent on lower surface, deep-green on upper surface; flowers yellow, in almost sessile lateral umbel-like clusters that appear before the leaves, the clusters composed of small groups of umbels each of 2 to 6 flowers that are surrounded by an involucre of 4 deciduous scales, with a 6-parted open calyx; fertile stamens 9 in 3 rows, the 3 innermost each with a pair of stalked glands at base; anthers 2-celled and 2-valved; pistillate flowers with 15 to 18 rudiments of stamens in 2 forms and a globular ovary; drupe bright-red, subglobose-obovoid, about 1 cm. long. *Benzoin aestivale sensu* Nees. On rich wooded slopes and in rocky areas along streams on the Edwards Plateau, Mar.-Apr.; from s.e. Va., s. to Fla. and Tex., w. to O., Mich., Mo. and Ark.

Our plants are referable to var. *pubescens* (Palm. & Steyererm.) Rehd., characterized by having the lower leaf surface and young branches permanently pubescent.

5. CASSYTHA L.

About 15 species, mainly tropical and subtropical.

1. *Cassytha filiformis* L. WOE-VINE, LOVE-VINE. Parasitic vine superficially resembling *Cuscuta*, with yellowish or pale-green wiry entwined stems and branches with a spicy fragrance; leaves wanting or reduced to spirally arranged scale; flowers perfect, subtended by a minute bract and 2 similar bracteoles, 2 to several at irregular intervals in a slender spike; sepals 6, in 2 unequal series, topping the accrescent fruit; the several inner sepals triangular-ovate, about 1.5 mm. long, much larger than the outer bractlike sepals; fertile stamens 9 in 3 rows, the innermost 3 with extrorse anthers and basal glands, a fourth

inner row reduced to 3 cordate staminodia; anthers 2-celled and 2-valved; drupe globose, blackish, to about 7 mm. in diameter. Parasitic on various herbaceous and woody plants mostly along coastal Tex., rare, May-July; from Fla. and Tex.; also Latin Am. and Afr.

FAM. 78. PAPAVERACEAE JUSS. POPPY FAMILY

Plants herbaceous, sometimes rhizomatous, with acrid usually colored sap; leaves rosulate or usually alternate, rarely opposite, exstipulate; inflorescence terminal and cymose, rarely paniculiform; flowers solitary or clustered, subtended by a leaf or bract, perfect, hypogynous or rarely perigynous, essentially regular; perianth cyclic, 2- or 3-merous; sepals large, enclosing the buds until anthesis, then caducous; petals twice as many as sepals and biseriata, occasionally polypetalous or rarely apetalous; stamens many; ovary 1-celled with 2 or more parietal placentae; fruit a 1-celled capsule, dehiscent by 2 or more valves.

About 200 species in 26 genera, mostly of the subtropics and temperate regions of the Northern Hemisphere.

1. Acaulescent herbs; petals 8 or more, not crumpled in the bud; stigmas over the valves of the capsule1. *Sanguinaria*, p. 662.
1. Caulescent herbs or (of subcaulescent) confined to the Trans-Pecos; petals 4 to 6, mostly crumpled in the bud; stigmas over the placentae (2)
- 2(1). Perianth and stamens borne on the rim of the hypanthiumlike expansion of the receptacle; sepals united into a calyptra; fruit conspicuously ribbed 2. *Eschscholzia*, p. 662.
2. Perianth and stamens strictly hypogynous; sepals not united into a calyptra; fruit not ribbed (3)
- 3(2). Herbage not prickly; flowers on long pedicels; capsules dehiscent by means of small openings just beneath the truncate summit ... 3. *Papaver*, p. 663.
3. Herbage prickly; flowers on short pedicels; capsule dehiscent from the apex by 4 to 6 valves 4. *Argemone*, p. 663.

1. SANGUINARIA L.

A monotypic genus.

1. *Sanguinaria canadensis* L. BLOODROOT, RED PUCCOON. Low perennial, with a thick prostrate rhizome containing an abundant red-orange acrid sap, producing in earliest spring a palmate-lobed or undulate leaf and a 1-flowered scape; leaves orbicular in outline, at full-development of flowers usually nearly reaching them, pale-green or sometimes strongly glaucous beneath, membranaceous to subcoriaceous, becoming at maturity to 3 dm. broad, the margins of the broad basal lobes and summits of the upper narrower ones coarsely dentate or crenate; mature petiole to 4 dm. long, distinctly overtopping the mature capsule; flowers handsome, the bud erect; sepals 2, caducous; petals 8 or more, oblong-spatulate, white or rarely pinkish; stamens about 24; capsule ellipsoid, 1-celled, bivalved, 3-5 cm. long; seeds with large crest. In rich woods in e. Tex., uncommon, Feb.-Mar.; from Que. s. to Fla., w. to Tex.

Our plant has been segregated as var. *rotundifolia* (Greene) Fern., dubiously distinct from var. *canadensis*.

2. ESCHSCHOLZIA CHAM. CALIFORNIA POPPY. GOLD POPPY

About a dozen species confined to western North America.

1. *Eschscholzia mexicana* Greene. MEXICAN GOLD POPPY, AMAPOLA DEL CAMPO. Annual herb with yellowish sap, to about 4 dm. high; stem leafy and branching above; leaves ternately dissected, smooth, glaucous; flowers solitary and erect on long pedicels or in small loose clusters at the ends of the branches; petals 4, orange or yellow, 1.5-3 cm. long; outer rim of hypanthium distinct, usually at least 0.5 mm. wide, nearly as wide as

to wider than the scarious inner rim, after anthesis more or less cartilaginous and flaring or revolute; fruit a slender 1-celled 2-valved several-seeded longitudinally ribbed capsule; mature seeds dark-colored, rugose-reticulate. On limestone slopes of the Franklin Mts. near El Paso, Mar.-May; from w. Tex. to s. Ut., s.e. Calif. and n. Mex.

3. PAPAVER L. POPPY

Annual, biennial or perennial herbs, with whitish or colored juice and large showy usually long-peduncled flowers that terminate the stem and branches; flower buds nodding; sepals 2, deciduous; petals usually 4, thinnish, white or colored; stamens numerous, extrorse; ovary of 4 to many carpels, the placentae parietal but deeply intruded toward the center; stigmas as many as the carpels, sessile and radiating upon a disk that rests on the summit of the ovary and capsule; capsule short and turgid, opening by pores under the edge of the stigma.

About 100 species mostly in the North Temperate Zone.

1. Cauline leaves cordate-clasping, glabrous 1. *P. somniferum*.
1. Cauline leaves not clasping, densely hirsute 2. *P. Rhoeas*.

1. *Papaver somniferum* L. OPIUM POPPY, COMMON POPPY. Plant smooth, glaucous; stem rather stout, to 1 m. tall; leaves sessile, cordate-clasping, oblong in general outline, wavy, coarsely toothed or shallowly lobed; flowers purple or red to white; capsule subglobose or broadly ovoid, glabrous; stigmatic rays 8 to 12. Nat. of Euras.; widely cult. as an ornamental from which it tends to escape.

The small seeds are commonly used in baking. Opium is derived from the milky juice of the unripe capsule.

2. *Papaver Rhoeas* L. CORN POPPY, AMAPOLA. Plant bristly, to 1 m. tall; stems sparsely branched; leaves deeply pinnatifid with the divisions somewhat lobed or incised; flowers usually bright-scarlet, varying to purple or whitish; petals broadly flabelliform; capsule subglobose to broadly obovoid, turbinate, glabrous; stigmatic rays 8 to 14, usually 10. A nat. of Euras. and N. Afr. that has been introd. and become naturalized in cen. Tex. and elsewhere, Apr.-June.

4. ARGEMONE L.⁶⁹ PRICKLY POPPY

More or less glaucous annual, biennial or rarely perennial herbs, with prickly bristles and yellow to orange-red sap (latex); leaves sessile or clasping, sinuate-lobed and with prickly teeth, often blotched or lined with white or light-blue; flower buds erect, short-peduncled; flowers large and showy; sepals caducous, usually 2 or 3, often prickly and with a subterminal fistulose horn; petals 4 to normally 6; stamens mostly numerous, with filiform filaments; style almost none; stigmas 3 to 6, radiate; capsule ellipsoid, fluted on the sutures, prickly, opening by 3 to 6 valves at the top; seeds blackish-brown, crested.

About a dozen species confined to the Americas.

1. Petals pale-lemon-yellow to bright-yellow or bronze (2)
1. Petals white or some shade of lavender (3)
- 2(1). Flowers 3-7 cm. broad when fully expanded; stamens 20 to 75
..... 1. *A. mexicana*.
2. Flowers 7-12 cm. broad when fully expanded; stamens 150 to 250
..... 2. *A. aenea*.
- 3(1). Petals of some shade of lavender (4)
3. Petals white (6)
- 4(3). Uppermost leaves clasping; lower leaves lobed to less than two-thirds the distance to the midrib 7. *A. polyanthemos*.
4. Uppermost leaves not clasping; lower leaves lobed to four-fifths of the distance to the midrib or more (5)

⁶⁹ Adapted from G. B. Ownbey in Mem. Torrey Club 21:1-59. 1958.

- 5(4). Stems not closely prickly; capsules narrowly to broadly elliptic; longest dimension of seeds about 1.5 mm.; southern Texas5. *A. sanguinea*.
5. Stems often closely prickly; capsules narrowly elliptic-lanceolate or ovate-elliptic; longest dimension of seeds 1.8-2.2 mm.; western Texas6. *A. chisosensis*.
- 6(3). Leaf surfaces prickly on the primary and secondary veins above and below and also minutely hispid or prickly (often closely so) between the veins; stems usually closely prickly (7)
6. Leaf surfaces prickly almost exclusively on the primary and secondary veins above and below, sometimes essentially smooth; stems usually with more widely spaced prickles or almost smooth (8)
- 7(6). Largest capsular spines 15-35 mm. long; latex reddish-orange when fresh3. *A. aurantiaca*.
7. Largest capsular spines 8-15 mm. long; latex pale-lemon-yellow to yellow when fresh4. *A. squarrosa* subsp. *glabrata*.
- 8(6). Largest capsular spines compound, that is with few to many smaller spines or prickles arising from the basal portion, usually 8-35 mm. long (9)
8. Largest capsular spines simple, 4-12 mm. long (10)
- 9(8). Largest capsular spines 15-35 mm. long, always definitely compound; latex reddish-orange when fresh3. *A. aurantiaca*.
9. Largest capsular spines 8-15 mm. long, sometimes not clearly compound; latex pale-lemon-yellow to yellow when fresh4. *A. squarrosa* subsp. *glabrata*.
- 10(8). Prickles of sepals and those of the sepal horns (when present) perpendicular; lower cauline leaves mostly lobed to four-fifths or more of the distance to the midrib (11)
10. Prickles of sepals and sepal horns (when present) ascending or sepals smooth; lower cauline leaves often lobed to less than one-half the distance to the midrib (12)
- 11(10). Stems not closely prickly; capsules narrowly to broadly elliptic; longest dimension of seeds about 1.5 mm.; southern Texas5. *A. sanguinea*.
11. Stems often closely prickly; capsules narrowly ovate-elliptic to elliptic-lanceolate; longest dimension of seeds 1.8-2.2 mm.; west Texas ..6. *A. chisosensis*.
- 12(10). Sepal horns 7-15 mm. long7. *A. polyanthemus*.
12. Sepal horns 3-6 mm. long8. *A. albiflora* subsp. *texana*.

1. *Argemone mexicana* L. DEVIL'S FIG, YELLOW PRICKLY POPPY, CARDO SANTO, CHICALOTE, MEXICAN POPPY. Annual with bright-yellow latex; stems mostly solitary, to about 8 dm. tall, often branched from near the base, rather sparingly prickly with perpendicular or slightly reflexed prickles; leaves glaucous, the light-blue markings over the veins conspicuous, the lower ones oblanceolate, progressively broadly elliptical to ovate above, the middle and upper ones mostly very evidently clasping the stem, the lower surfaces sparingly prickly on the main veins, the upper surfaces very distinctly prickly on the main veins or totally smooth, lobed to one-half or more of the distance to the midrib in the lower leaves, more shallowly lobed in upper leaves; leaf lobes oblong, the sinuses comparatively narrow, the acute marginal teeth tipped with a slender spine; buds subspherical or barely oblong, to 15 mm. long and 13 mm. wide, very sparingly prickly; flowers to 7 cm. in diameter, closely subtended by 1 or 2 foliar bracts; sepal horns terete, 5-10 mm. long (including the apical spine), smooth; petals bright- or pale-yellow, the outer ones obovate, the inner ones obovate to obcuneate; stamens 30 to 50, the filaments pale-lemon-yellow, the anthers yellow; stigma purple, 1.5-4 mm. wide, 1-2 mm. high, the lobes pressed against each other and appressed to the style at anthesis; style 1-3 (usually 1) mm. long in fruit; capsules 4- to 6-carpellate, oblong to broadly elliptical, the width (excluding the spines, if present) 1.2-2 cm., the length (including the stigma and style) 25-45 mm., the surface spinescent; capsular spines mostly large and rather even-sized, the

longest 6-10 mm., with very few lesser spines or prickles sometimes present, the capsular surface clearly visible through the armature; seeds 1.6-2 mm. long. In waste places, fields and along roadsides in s.-cen. Tex., spring; from N.E., w. to Ill., s. to n. S.A.

2. *Argemone aenea* G. Ownbey. Annual, biennial or short-lived perennial with bright-yellow latex; stems 1 or few, to about 8 dm. tall, moderately branched, sparingly to quite evidently prickly with usually slender perpendicular or visibly reflexed prickles; leaves glaucous, the veins prominently blue-lined, the lower ones pinnatifid, the middle and upper ones sometimes less deeply cut, the lobes oblong with acute prickle-tipped marginal teeth, the broad sinuses rectangular, the surfaces somewhat prickly on the veins below and smooth or very sparingly prickly on the veins above; buds at flowering time elliptic-oblong, to 24 mm. long and 16 mm. broad, moderately prickly; flowers usually about 9 cm. broad, mostly closely subtended by 1 or 2 foliar bracts; sepal horns approximately round in cross section, to 14 mm. long, smooth or with a few prickles on the herbaceous base, spine-tipped; petals yellow to golden or bronze, suborbicular to very broadly obovate-obcuneate, the outer margins erose; stamens about 150, the filaments red or purplish, the anthers purplish-yellow, the stamens and ovary subequal at flowering time; stigma purple, 3-6 mm. wide, 2-3 mm. high, the lobes characteristically sinuate; capsules 4- or 5-carpellate, narrowly elliptic to elliptic-oblong, the length (including the stigma) to 35 mm., the width (exclusive of spines) to 16 mm., coarsely spiny, the larger spines interspersed with smaller ones, the longest spines usually to about 8 mm. long, the capsular surface clearly visible through the armature; seeds 1.5-1.7 mm. long. In dry plains, low hills and drainage areas of s. and w. Tex., Feb.-Apr.; also n.e. Mex.

3. *Argemone aurantiaca* G. Ownbey. Annual or biennial, with reddish-orange latex, at maturity more or less flat-topped; stems usually 1 from the base, to about 8 dm. tall, stout, widely branched upward, the primary branches few in number and surpassing the main axis, moderately to copiously prickly throughout with long slender perpendicular prickles; leaves bluish, the basal and lower cauline leaves oblanceolate and deeply cut to four-fifths the distance to the midrib to form oblong lobes, the leaves progressively elliptic to ovate upward and less deeply lobed, the uppermost leaves only shallowly lobed and often clasping the stem, all the leaves with secondary angular lobes and marginal points with the points terminated by a usually weak spine or prickle, the leaves sparingly to copiously prickly on the veins (especially below) with slender prickles and also sometimes very sparingly prickly on the surfaces between the larger veins (especially below); buds oblong, often very large, to 25 mm. long and 18 mm. broad, sparingly to densely prickly, the larger prickles sometimes compound; flowers closely subtended by 1 or 2 reduced leaves, 8-12 cm. in diameter; sepal horns angular, often dorsiventrally flattened, 8-12 mm. long, prickly to the indurated apical spine; petals white; stamens 150 or more, the filaments pale-yellow, the anthers yellow; stigma purple, 3.5-5 mm. wide, 2.5-3.5 mm. high, 5- or 6-lobed; capsules 5- or 6-carpellate, ovate, 4-5 cm. long (including the stigma), 15-25 mm. broad (exclusive of armature), densely covered with long herbaceous erect or reflexed spines that are to 35 mm. long, often branched, provided with numerous secondary prickles for three-fourths their length and terminated by a slender indurated point; capsule also provided with small simple prickles arising between the large spines, the surface partially but not completely obscured; seeds 2.5-3 mm. long. In fields and pastures, hilly often rocky country and sandy soils in s.-cen. Tex., Mar.-Aug.; endemic.

4. *Argemone squarrosa* Greene subsp. *glabrata* G. Ownbey. Perennial with yellow latex, at maturity more or less flat-topped; stems 1 to several from the base, to 6 dm. tall, widely branched in the upper portion, the branches stout, moderately to copiously prickly with slender rather even-sized perpendicular prickles; leaves distinctly bluish, deeply lobed below with the segments oblong, less deeply to shallowly lobed upward, the uppermost leaves distinctly clasping the stem, the margins with acute points or secondary lobes that are terminated by a rigid prickle, sparingly prickly on the main veins beneath, smooth or very sparingly prickly on the main veins above, the areas between the larger veins essentially smooth both above and below; buds subspherical, 1.6-2 cm. long and broad, sparingly prickly; flowers closely subtended by 1 or 2 reduced leaves, 8-11 cm. in diameter; sepal horns more or less angular in cross section, 8-11 mm. long, very sparsely prickly, terminated by a rigid spine; petals white; stamens 150 or

more, the filaments pale-yellow, the anthers yellow; stigma purple, 3-4 mm. broad, 2-3 mm. high, 4- or 5-lobed; capsules 4- or 5-carpellate, oblong-elliptic to lance-ovate, the width (exclusive of armature) 14-18 mm., the length (including the stigma) 2.5-5 cm., armed with stout scattered basally herbaceous spreading or reflexed spines, the largest spines 8-12 mm. long and provided with a few secondary prickles, the spines terminated by a stout indurated point; capsules provided with few to numerous very uneven-sized small spines and prickles; seeds to 2.5 mm. long. In arid valleys and on slopes in w. Tex., Apr.-Aug.; also s.e. N.M.

5. *Argemone sanguinea* Greene. RED POPPY. Annual, biennial or short-lived perennial with pale- to bright-yellow latex; stems 1 to few, to 12 dm. tall, simple below, widely branched above, sparingly prickly with perpendicular to recurved prickles; leaves glaucous, the veins conspicuously light-blue-lined, the basal and lower cauline leaves deeply lobed to four-fifths the distance to the midrib, the middle and upper cauline often less deeply lobed, the oblong lobes with marginal acute prickle-tipped teeth, the lower surfaces moderately prickly on the main veins, the upper surfaces almost smooth to sparsely prickly on the main veins; buds broadly elliptic-oblong, to 2 cm. long, 15 mm. broad, moderately prickly with spreading prickles; flowers 6-9 cm. in diameter, usually closely subtended by 1 or 2 small foliar bracts; sepal horns basally slightly prickly, often angular in cross section, 5-10 mm. long (including the indurated sometimes slightly flattened apical spine); petals white to lavender, broadly obovate-obcuneate to sub-orbicular, distally erose; stamens 150 or more, about equaling the ovary in length at anthesis, the filaments lemon-yellow to red, the anthers yellow to lavender; stigma purple, not sinuate, 2.5-5 mm. wide and 1.5-3 mm. high; capsules 3- to 5 (-6)-carpellate, narrowly to broadly elliptic, the width (exclusive of spines) to 18 mm., the length (including the stigma) to 5 cm., armed with stout often recurved spines interspersed with smaller spines and prickles, the largest spines commonly 5-7 (-10) mm. long, the capsular surface clearly visible; seeds strongly apiculate at the micropyle, the longest dimension about 1.5 mm. (excluding the micropylar beak). *A. pinatifida* Nort. In disturbed areas as roadways, fields, embankments and vacant lots or on chaparral plains in s. and s.w. Tex., Feb.-Apr.; also n.e. Mex.

6. *Argemone chisosensis* G. Ownbey. Biennial or perennial with yellow latex, the older plants with a stout fleshy caudex; stems 1 to few, to 8 dm. tall, sparingly branched, sparsely to copiously prickly with long slender perpendicular prickles; lower leaves lobed to near the midrib, the middle and upper ones usually less deeply lobed, the lobes distant with the larger ones oblong and the margins with acute teeth, the lower leaf surfaces stoutly armed on the mid-vein and less so on the secondaries, the upper surfaces almost smooth or weakly armed on the main veins; buds broadly elliptic, to 2 cm. long and 15 mm. wide, mostly moderately prickly with strong perpendicular prickles; flowers 7-10 cm. in diameter, usually closely subtended by 1 or 2 foliar bracts; sepal horns terete or angular in cross section, to 12 mm. long, the basal portion usually prickly with perpendicular prickles, the long indurated apical spine sometimes flattened at its juncture with the herbaceous basal portion; petals white to pale-lavender, suborbicular to obcuneate-obovate; stamens about 150 or more, the filaments pale-lemon-yellow or red, the anthers yellow or purplish; stigma purple, 2.5-3.5 mm. wide, 1.5-2.5 mm. high; capsules 3- or 4-carpellate, mostly narrowly elliptic-lanceolate, sometimes elliptic-ovate, the width (excluding the armature) to 13 mm., the length (including the stigma) to 45 mm., armed with scattered stout spreading or slightly recurved spines interspersed with a few smaller spines and prickles, the largest spines to about 1 cm. long, the capsular surface clearly visible through the armature; seeds 1.8-2.2 mm. long. On arid plains and mts., often along drainages in w. Tex., Mar.-June; also n. Mex.

7. *Argemone polyanthemos* (Fedde) G. Ownbey. Annual or biennial with a deep taproot and bright-yellow latex; stems 1 to 5, to 12 dm. tall, cymosely branched, sparingly prickly with stout perpendicular or recurved prickles; leaves glaucous, succulent, the lower ones oblanceolate and lobed to two-thirds the distance to the midrib with the lobes oblong, the middle and upper leaves elliptic-ovate and more shallowly lobed, the uppermost leaves definitely clasping the stem, with scattered perpendicular or recurved prickles on the main veins beneath, totally smooth above; buds elliptic-oblong, to 22 mm. long and 15 mm. broad, rather sparingly to moderately prickly with spreading prickles; flowers

mostly 7-10 cm. in diameter, usually rather closely subtended by 1 or 2 foliar bracts but sometimes the bracts distant; sepal horns essentially terete, to 15 mm. long, usually completely devoid of prickles; petals white, very rarely lavender, the inner ones broadly obovate-obcuneate, the outer ones suborbicular, with the outer margins minutely erose; stamens 150 or more, the filaments lemon-yellow, the anthers bright-yellow, equaling the stigma in length at anthesis; stigma purple, 3-4.5 mm. broad, 2-3 mm. high, 3- or 4-lobed; capsules 3- or 4-carpellate, narrowly to broadly elliptic, the width (exclusive of armature) to 17 mm., the length (including the stigma) to 3 cm., stoutly spinescent with widely spaced spreading or recurved simple spines (8-10 mm. long) that are commonly interspersed with a few smaller spines, the capsular surface clearly visible; seeds about 2 mm. long. *A. intermedia* of auth. In sandy or gravelly soils on prairies, foothills and mesas, and roadsides, fields, pastures and waste grounds in the n. half of Tex., Apr.-June; from S.D. to e. Wyo., N.M. and Tex.

8. *Argemone albiflora* Hornem. subsp. *texana* G. Ownbey. **WHITE PRICKLY POPPY.** Annual or biennial with a deep taproot and yellow latex; stems usually solitary, to 15 dm. tall, sparsely to rather moderately prickly with usually slender perpendicular or recurved prickles; basal and lower cauline leaves often lobed to near the midrib, the middle and upper leaves more shallowly lobed, entirely smooth or with a very few weak prickles mainly on the midrib above; bud broadly elliptic to subspheric, sparingly to rather closely covered with slender spreading simple prickles; flowers usually rather closely subtended by 1 or 2 foliar bracts, the interval between flower and nearest bract sometimes as much as 5 mm. at fruiting time; sepal horns to 1 cm. long, smooth or sparingly prickly at the base; petals white; stamens equal to or shorter than the pistil at anthesis; stigma 2-3.5 mm. broad, 1.5-2 mm. high; style sometimes evident; capsules 3- to 5-carpellate, typically narrowly elliptic, the width (exclusive of spines) to 14 mm., the length (including the stigma) to 4 cm., moderately armed with usually slender spreading basally herbaceous simple spines as well as numerous uneven-sized smaller spines and prickles, the largest spines to 12 mm. long, the capsular surface partially obscured; seeds about 1.7 mm. long. Incl. var. *texana* (G. Ownbey) Shinnars. In sandy or gravelly soils on embankments and in vacant lots, pastures, waste places, hills, and along fence rows, roadsides and railroad right-of-ways throughout most of Tex., Mar.-June; from n. Ark. and s. Mo. to Tex.

FAM. 79. FUMARIACEAE DC.

FUMITORY FAMILY

Plants herbaceous, with watery sap; leaves rosulate or alternate, glabrous, dissected, exstipulate; inflorescence terminal or axillary, bracteate, racemose or cymose; flowers perfect, hypogynous, bilaterally symmetrical or irregular; perianth cyclic, 2-merous; sepals 2, small and bractlike, not enclosing the buds at anthesis; petals 4, in 2 pairs, very rarely sympetalous, 1 or both outer petals more or less saccate or spurred at base, the inner petals apically connate; stamens 6, in 2 sets of 3 each, 1 or both median stamens basally spurred and/or nectariferous; anthers applied to the lobed and flattened stigmatic mechanism; ovary 1-celled with 2 parietal placentae; fruit 2-valved, rarely indehiscent.

About 450 species in 16 genera, native to the North Temperate Zone and southern Africa.

1. Style persistent; fruit an elongated bivalved capsule, several-seeded; annuals or biennials 1. *Corydalis*, p. 667.
1. Style articulated and deciduous; fruit a globose indehiscent 1-seeded hard nut; adventive annuals 2. *Fumaria*, p. 670.

1. CORYDALIS VENT.⁷⁰

SCRAMBLED EGGS

Annual, biennial or rarely perennial pale or glaucous herbs from a taproot, tuberous root or rhizome; stems monopodial or sympodial; leaves basal or cauline, alternate, usually

⁷⁰ Adapted from G. B. Ownbey in Ann. Missouri Bot. Gard. 34:187-258. 1947.

more or less petioled, pinnately dissected, the pinnae deeply once- or twice-divided and incised; inflorescence a panicle or raceme, terminal, bracteate; flowers short-pedicel, bilaterally symmetrical; sepals 2, minute, scarious, appressed, often fugacious; petals 4, elongate, pale- to bright-yellow, free or somewhat coherent at the base, in 2 whorls of 2 petals each; outer petals dissimilar with 1 spurred and the other sometimes gibbous at the base, both are more or less distinctly keeled or hooded at the apex; inner petals similar, connate at the apices, clawed; stamens in 2 groups or phalanges opposite the outer petals, each phalange with 3 anthers, the outer 2 of which are monotheical, the central dithecal, the phalange opposite the spurred petal having a distinct glandular spur that is adherent to the inner surface of the petal spur except at the tip; stigma persistent, flattened, sometimes bilobed, with 4 to 8 papillary stigmatic surfaces; style distinct, slender; fruit a bicarpellate many-seeded capsule with 2 sterile valves and 2 persistent placentae, often torulose, terminated by the style; seeds numerous, black, with a distinct chalazal appendage or caruncle, lustrous, smooth or variously decorated under magnification.

About 320 species of the North Temperate Zone.

1. Fruits densely beset with transparent clavate pustules or vesicles; spurred petal 16-22 mm. long, the hood with a very high crest, the wing margin very broad 1. *C. crystallina*.
1. Ovary and fruit essentially glabrous although sometimes granulose along the sutures; spurred petals 18 mm. or less long, the wing margin moderately broad to narrow (2)
 - 2(1). Plants often bearing cleistogamous flowers; spurred petal of normal flowers 10-15 mm. long, the hood with a low regular undulate or obsolescent crest; seeds about 1.5 mm. in diameter, nearly smooth under magnification (3)
 2. Plants seldom bearing cleistogamous flowers; spurred petal mostly 14-18 mm. long; seeds about 2 mm. in diameter, essentially smooth to variously decorated under magnification (5)
- 3(2). Normal-flowered racemes not greatly exceeding the leaves, often short; spur usually somewhat globose at tip; fruits often stout, commonly 1-1.5 cm. long ... 2. *C. micrantha* var. *micrantha*.
3. Normal-flowered racemes often greatly exceeding the leaves, elongated; spur not globose at the tip; fruits slender, 1.5-3 cm. long (4)
- 4(3). Stems usually weak and not strongly striate when dry; foliage green to glaucous; fruits 1.5-2 cm. long 2. *C. micrantha* var. *australis*.
4. Stems usually stout and strongly striate when dry; foliage glaucous; fruits 2.5-3 cm. long 2. *C. micrantha* var. *texensis*.
- 5(2). Seeds distinctly muricate or muriculate under magnification (6)
5. Seeds never muricate though sometimes muriculate at the margin under magnification (7)
- 6(5). Hood crestless or with a moderately well-developed crest; fruits 26-34 mm. long, usually abruptly acute; seeds distinctly muricate under magnification 3. *C. curvisiliqua* var. *curvisiliqua*.
6. Hood with a well-developed crest; fruits 20-25 mm. long, gradually tapered; seeds muriculate under magnification 3. *C. curvisiliqua* var. *grandibracteata*.
- 7(5). Racemes usually surpassed by the leaves; hood sometimes crested; fruits spreading or pendent, usually 18-24 mm. long; seeds with no ring margin 4. *C. aurea* var. *aurea*.
7. Racemes usually surpassing the leaves; hood usually not crested; fruits erect, often incurved, usually 12-20 mm. long; seeds usually with a ring margin 4. *C. aurea* var. *occidentalis*.

1. *Corydalis crystallina* Engelm. Glaucescent winter annual; stems 1 to several, to 4 dm. tall, erect or ascending; leaf blades pinnate, the segments pinnatifid and once again incised, the ultimate lobes broadly lanceolate to linear-lanceolate and subapiculate; racemes surpassing the leaves, as many as 18-flowered; bracts ovate to ovate-acuminate, to 12 mm. long and 6 mm. wide, usually much-reduced upward; pedicels stout, erect, about 1 mm. long; sepals 2 mm. or less long, broadly ovate to cordate, somewhat attenuate; spurred petal 16-22 mm. long, the hood always crested with the crest very high and undulate or toothed, the broad wing margin reflexed upon the hood, the spur 6-8 mm. long and with the blunt tip distinctly globose; stamen spur 3.5-5 mm. long, clavate, curved or bent near the apex; fruits erect, 14-18 mm. long, stout, straight or moderately incurved toward the floral axis, densely beset with transparent pustules that often break open at maturity; seeds black, about 2 mm. in diameter, distinctly submuricately decorated under magnification, without a ring margin. *Capnoides crystallinum* (Engelm.) O. Ktze. In prairies, fields, open woods and wastelands in e.-cen. Tex., Mar.-May; from Mo. to Tex.

This species is distinguished from all other species of *Corydalis* by the peculiar type of pubescence of the fruit. The pustules sometimes appear ligulate when desiccated or, as is often the case, when they rupture at maturity. The crest and margins of the hood of the outer petals are more highly developed than in any other yellow-flowered species.

2. *Corydalis micrantha* (Engelm.) Gray. Glaucescent or nearly green winter annual; stems 1 to several, to 6 dm. tall, usually less than 3 dm. tall, erect to ascending, sparingly branched, sometimes striate when dry; leaf blade pinnate, the 5 or 7 primary segments pinnatifid and again incised, the ultimate leaf segments ovate to oblong-elliptic or obovate and acute to subapiculate; normal-flowered racemes more or less exceeding the leaves, 6- to 20-flowered, not surpassed by the few-flowered secondary racemes; cleistogamous-flowered racemes (when present) inconspicuous, 1- to 5-flowered; bracts ovate to elliptic, the lowermost 5-8 mm. long and 2-4 mm. broad, the upper much-reduced; pedicels erect or spreading, the lower 3-6 mm. long, gradually decreasing in length upward; flowers pale-yellow, somewhat crowded or distant throughout anthesis; sepals ovate, 1.5 mm. or less long, often undulate or toothed on the margin; spurred petal 11-15 mm. long, sometimes arcuate, the hood with a low crest that is undulate or rarely obsolescent, the wing margin well-developed, the spur 4-7 mm. long and blunt or distinctly globose at the apex; stamen spur 2-4 mm. long, usually about three-fifths the length of the petal spur, straight or curved, sometimes clavate; fruits erect or incurved, slender, to 3 cm. long (including the beak), straight or moderately incurved; seeds about 1.5 mm. in diameter, black, shiny, turgid, concentrically but mostly moderately decorated under magnification, obtuse at the border, with no ring margin.

Var. *micrantha* usually can be distinguished from var. *australis* and var. *texensis* by its less elongated racemes, generally smaller flowers, globose-tipped spur and generally shorter (15 mm. or less long) stouter fruits. Along bluffs, rocky hills, open woods and on river banks in n.e. Tex., Mar.-May; from Minn. to Ill., Kan. and Tex.

Var. *australis* (Chapm.) Shinnery [subsp. *australis* (Chapm.) G. Ownbey, *C. Halei* (Small) Fern. & Schub., *C. campestris* (Britt.) Buchh. & Palm.] is best distinguished by its elongate normal-flowered racemes, its short saccate spur which is never clearly globose at the tip, its slender erect fruits, and its minute nearly smooth seeds. In disturbed often sandy soils in abandoned fields, along roadsides, in open woods and wastelands in e. and s. Tex., Feb.-Apr.; from s. Mo. and e. Kan. to Tex., Fla. and N.C.

Var. *texensis* (G. Ownbey) Shinnery (subsp. *texensis* G. Ownbey) is closely comparable to var. *australis* but it is easily distinguished by its longer fruits (2.5-3 cm. long) and more strongly arcuate spurred petals. In habit and foliage it is very similar to *C. curvisiliqua* var. *curvisiliqua* with which it is often confused. It can be distinguished from the latter by its nonmuricate seeds and shorter spur which is not globose at the tip. In moist often sandy soil, open ground of alluvial plains and uplands in s. coastal Tex., Feb.-Apr.; endemic.

3. *Corydalis curvisiliqua* Engelm. Glaucescent winter annual or (perhaps) biennial; stems 1 to several, erect to ascending, to 4 dm. long, often somewhat branched; leaves pinnate, the pinnae twice-pinnatifid and rarely again incised; ultimate leaf segments oblong to obovate, obtuse to rounded; peduncles usually surpassing the leaves, usually about 12-flowered; bracts ovate to acuminate, sometimes conspicuous, to 15 mm. long and 6 mm. wide, the lowest sometimes foliose, much-reduced upward; pedicels stout,

spreading, 2-3 mm. long; sepals broadly ovate to ovate-attenuate, often more or less toothed or undulate on the margin, about 1 mm. long; flowers bright-yellow, often strongly arcuate, at first crowded on the raceme, becoming more distant during anthesis; spurred petal 15-18 mm. long, with a very broad wing margin, the crest absent to well-developed and undulate or toothed, the spur 7-9 mm. long and often somewhat globose at the blunt tip; stamen spur clavate, bent near the apex, 4-6 mm. long, about two-thirds the length of the spur; fruits slender, erect, moderately to strongly arcuate or incurved toward the floral axis, 2-3.4 cm. long; seeds about 2 mm. in diameter, black, muricate, with little or no ring margin at maturity.

Var. *curvisiliqua* is most easily recognized by its extremely long (26-34 mm. long), erect, incurved fruits, and its seeds that are distinctly muricate under magnification. The latter characteristic is approached nowhere else in the genus. The well-developed wing margins of the outer petals, the much-reduced clawlike basal portion of the unspurred outer petal, and the well-developed spur which is about one-half the total length of the spurred petals are floral characters that aid in the recognition of this plant. In disturbed soil, sandy bottoms, abandoned fields, open woods, hillsides and valleys in cen. and w. Tex., Feb.-May; endemic.

Var. *grandibracteata* Fedde [subsp. *grandibracteata* (Fedde) G. Ownbey] is best distinguished by its slender, lanceolate, erect, incurved fruits (2-2.5 cm. long), its relatively large flowers, the usually highly developed crest and wing margin, and the large ovate floral bracts (1-1.5 cm. long). Usually in sandy soils, open ground, alluvial plains, roadsides, prairies and slopes in n.e. Tex., Apr.-May; from s. Kan. to Tex. and e. Ia.

4. *Corydalis aurea* Willd. Glaucous winter annual or biennial from a more or less branched rootstock; stems erect to prostrate-ascending, to 6 dm. long, usually about 25 cm. long; leaves barely or occasionally reduced in size upward, with 5 or 7 pinnae that are pinnatifid and again incised; ultimate leaf segments oblong to broadly or narrowly elliptic, as much as 5 times as long as broad; peduncles short, terminal; racemes shorter than to barely exceeding the leaves, 4- to 20-flowered; bracts elliptic to linear, to 1 cm. long and 2 mm. broad, rarely larger, often denticulate at the apex, much-reduced upward; pedicels erect when young, often reflexed or recurved in fruit, to 1 cm. long; sepals ovate to ovate-attenuate, irregularly toothed, 1-3 mm. long; flowers pale- to bright-yellow; spurred petal 13-18 mm. long, the hood usually not crested, the crest (when present) low and incised, the wing margin moderately to well-developed; spur blunt, straight or slightly incurved, 4-9 mm. long, the tip somewhat globose; stamen spur 2-6 mm. long; fruits commonly 16-24 (rarely to 30) mm. long, stout or slender, erect to pendent at maturity, straight to moderately arcuate, sometimes moniliform, the valves often torulose when dry; seeds about 2 mm. in diameter, black, shiny, turgid, obscurely decorated to nearly smooth under magnification, broadly acute at the edge, without or with a narrow ring margin. *C. euchlamydeum* Woot. & Standl. In gravelly or sandy soil on hillsides, prairies, plains, gravel pits, creek bottoms, road cuts and burned-over areas in the w. half of Tex., Feb.-Sept.; also n. Mex.

Var. *aurea* is best distinguished on the basis of its generally weak racemes and slender, pendent or spreading fruits. The racemes ordinarily do not exceed the leaves except in early stages of growth.

Var. *occidentalis* Engelm. [subsp. *occidentalis* (Engelm.) G. Ownbey] is best distinguished from var. *aurea* by its more strongly monopodial growth form, its stouter racemes, generally larger flowers and longer spurs (5-9 mm.), and the stouter (16-18 mm. long), more strongly curved, erect or semierect fruits.

2. FUMARIA L. FUMITORY

Annual glaucous glabrous herbs with diffusely branching to erect or scandent stems; leaves decompose, with small narrow segments; racemes terminal or opposite the leaf; flowers zygomorphic; sepals 2, scalelike, closely appressed; petals 4, elongate, erect-connivent, the 2 outer dissimilar with one of them spurred, the inner pair narrow and coherent at apex, carinate or crested on back; stamens 6, diadelphous, opposite the outer petals; style filiform, with a small entire or obscurely 2-lobed stigma; ovary with 1 ovule near the base; fruit subglobose, indehiscent, 1-seeded.

An Old World genus of about 55 species.

- 1. Sepals at least 2 mm. long and 1 mm. wide; fruit truncate to emarginate at apex; bracts shorter than the fruiting pedicels; leaf segments flat 1. *F. officinalis*.
- 1. Sepals at most 1.5 mm. long and 0.8 mm. wide; fruit obtuse to apiculate or beaked at apex; bracts about equal to fruiting pedicels; leaf segments with channeled lobes 2. *F. parviflora*.

1. *Fumaria officinalis* L. COMMON FUMITORY. Plants glabrous and glaucous; stems diffusely branched, spreading or ascending, to 8 dm. long; leaves petioled, finely dissected into narrow linear or cuneate segments; racemes narrow, dense, to about 5 cm. long; bracts small; pedicels 2-4 mm. long; sepals ovate to ovate-lanceolate, acuminate, 2-3.5 mm. long, 1-1.5 mm. wide; corolla reddish-purple, darker at the apex, 7-9 mm. long; nutlet depressed-globose, about 2.5 mm. in diameter. In waste places, mostly in cen. Tex., spring-summer; adv. from Eur. in various areas of s. U.S.

2. *Fumaria parviflora* Lam. Plant suberect to diffuse or sometimes climbing, noticeably glaucous; leaf segments with channeled linear or subulate lobes; inflorescence often about 20-flowered, subsessile, dense in flower, lax in fruit; bracts linear-oblong, cuspidate, about equaling the suberect or ascending fruiting pedicels; sepals broadly ovate, acute, 1-1.5 mm. long, 0.6-0.8 mm. wide, somewhat lacinate-dentate; corolla 5-6 mm. long, white or flushed with pink, with a blotch at the base of the wings and with the tips of the lateral petals blackish-red; upper petal dorsally compressed, truncate; fruit suborbicular to ovate-orbicular, about 2 mm. long, little-compressed but distinctly keeled, obtuse to beaked at apex. In waste or arable lands in cen. Tex., spring-summer; adv. from Eur.; also in Mex. and S.A.

FAM. 80. CRUCIFERAE JUSS.⁷¹ MUSTARD FAMILY

Herbs with watery and mostly pungent sap, infrequently suffrutescent and subshrubby; leaves alternate (rarely opposite), entire to lobed or pinnately divided and without stipules; flowers bisexual, usually tetradynamous, mostly regular and ebracteate in terminal racemes, infrequently solitary and pedunculate; sepals 4, deciduous, usually oblong, erect and appressed to the corolla or spreading at anthesis; petals 4 (rarely absent), hypogynous, entire or emarginate, rarely lobed or fimbriate, yellow, white or lavender; stamens 6 (rarely fewer or more) in two whorls, outer single stamens 2, inner paired stamens 4; ovary with 2 locules (rarely with a single locule); fruit a dry usually dehiscent silique with a wide range of shapes from narrowly linear to depressed-globose; seeds without an endosperm; embryo curved with radicle usually folded retrorsely along cotyledon margins (accumbent), or along the back of one cotyledon (incumbent), or in a somewhat intermediate position; embryo rarely straight as in *Leavenworthia*.

About 375 genera and over 3,000 species. Nearly cosmopolitan, but mostly in the temperate and cold parts of the world. At high elevations elsewhere. Many species have become widespread weeds.

- 1. Siliques linear, at least 3 times longer than broad (2)
- 1. Siliques variously shaped from globose to orbicular or triangular, didymous or flattened, less than 3 times longer than broad (37)
- 2(1). Stamens distinctly exerted, nearly equal and unpaired; siliques distinctly stipitate; stipe 3-20 mm. long (3)
- 2. Stamens included or only slightly protruding, unequal, tetradynamous; siliques sessile or with a short stipe (4)
- 3(2). Petals yellow; stipes 10-20 mm. long 1. *Stanleya*, p. 674.
- 3. Petals white to lavender; stipes less than 4 mm. long .. 2. *Thelypodium*, p. 675.
- 4(2). Siliques dehiscent by longitudinal linear valves (5)
- 4. Siliques with a transverse partition, indehiscent except by breaking into jointed segments (34)

⁷¹ Treatment prepared by Reed C. Rollins, Elizabeth A. Shaw and Ray J. Davis.

- 5(4). Calyx urn-shaped; flowers at least slightly irregular to markedly irregular
 3. *Streptanthus*, p. 676.
5. Calyx with plane sepals, not constricted; flowers regular (6)
- 6(5). Petals definitely lobed in the blade portion 7. *Dryopetalon*, p. 679.
6. Petals entire or at most emarginate (7)
- 7(6). Siliques flattened parallel to the septum (8)
7. Siliques terete or if compressed, then flattened contrary to septum (16)
- 8(7). Stems arising from a basal rosette of leaves or a branched caudex, or with
 rhizome leaves present (9)
8. Stems with lower leaves separated by internodes, no basal rosette or tuft of leaves
 present (14)
- 9(8). Petals white to lavender; inflorescences racemose, none of the flowers peduncu-
 late; styles less than 3 mm. long (10)
9. Petals yellow; at least some flowers pedunculate or styles over 5 mm. long; pedicels
 much-elongated (13)
- 10(9). Valves not extending to silique margin, elastic and rolling up after dehiscence . .
 14. *Cardamine*, p. 685.
10. Valves extending to edge of the replum margin, not elastic and rolling upon de-
 hiscence (11)
- 11(10). Siliques linear-elliptical; seeds wingless, in two distinct rows in each loculus . .
 27. *Draba*, p. 692.
11. Siliques linear; seeds winged, in a single row in the loculus (12)
- 12(11). Leaves entire to dentate; pedicels expanded below receptacle
 5. *Arabis*, p. 677.
12. Leaves pectinate to pinnatifid; pedicels not expanded below receptacle
 8. *Sibara*, p. 679.
- 13(9). Leaves lyrate-lyobed to entire; siliques flattened, not thick and spongy or mar-
 gined; styles less than 2 mm. long 26. *Leavenworthia*, p. 692.
13. Leaves pinnately or bipinnately dissected; siliques thick, spongy and margined or
 styles over 5 mm. long 25. *Selenia*, p. 691.
- 14(8). Sepals and petals lavender to deep-purple; buds acute; petals showy, over twice
 the length of the sepals 3. *Streptanthus*, p. 676.
14. Sepals greenish; petals white to light-lavender; buds obtuse; petals not showy, less
 than twice the length of the sepals (15)
- 15(14). Cauline leaves petiolate or cuneate at base, upper ones entire
 5. *Arabis*, p. 677.
15. Cauline leaves sessile and auriculate, upper ones lobed . 8. *Sibara*, p. 679.
- 16(7). Siliques compressed contrary to septum, densely pubescent with whitish branched
 trichomes; stigma conical or sagittate 12. *Nerisyrenia*, p. 684.
16. Siliques terete, densely pubescent or glabrous; stigmas capitate or bifid but not
 sagittate or conical (17)
- 17(16). Leaves entire or lobed, never divided as far as midrib (18)
17. Leaves (at least some) pinnately lobed to bipinnate, the primary lobes cut to the
 leaf rachis (29)
- 18(17). Flowers white to lavender, never yellow (19)
18. Flowers yellow or yellowish, never white to lavender (25)
- 19(18). Siliques densely pubescent, grayish (20)
19. Siliques glabrous or nearly so, greenish (21)
- 20(19). Stigmas entire, not noticeably bilobed 11. *Halimolobos*, p. 684.
20. Stigmas strongly bilobed or horned 17. *Matthiola*, p. 688.

- 21(19). Flowering stems arising from a flat basal rosette; leaves dimorphic 13. *Arabidopsis*, p. 685.
21. Flowering stems arising from leaves with definite internodes; basal and cauline leaves somewhat similar (22)
- 22(21). Upper cauline leaves auriculate 8. *Sibara*, p. 679.
22. Upper cauline leaves petiolate or cuneate at the base (23)
- 23(22). Trichomes of leaves and stems many-branched; petals barely exceeding sepals 6. *Pennellia*, p. 678.
23. Trichomes of leaves and stems mostly simple or plants glabrous; petals at least half again as long as sepals (24)
- 24(23). Lower cauline leaves auriculate; cotyledons accumbent 4. *Iodanthus*, p. 677.
24. Lower cauline leaves petiolate or cuneate at base; cotyledons incumbent 9. *Sisymbrium*, p. 680.
- 25(18). Trichomes closely appressed, bifurcate or trifurcate 16. *Erysimum*, p. 687.
25. Trichomes spreading or absent, mostly simple if present (26)
- 26(25). Siliques with a definite beak in addition to style .. 21. *Brassica*, p. 689.
26. Siliques blunt at apex or tipped with a style but no beak present (27)
- 27(26). Cauline leaves auriculate-clasping; pedicels unexpanded at summit, nearly same diameter as siliques 18. *Conringia*, p. 689.
27. Cauline leaves cuneate at base or petiolate; pedicels expanded at summit (28)
- 28(27). Pedicels slender, 10-15 mm. long 19. *Diploaxis*, p. 689.
28. Pedicels short, less than 5 mm. long 15. *Rorippa*, p. 686.
- 29(17). Trichomes mostly highly branched; stems and leaves often grayish from a dense pubescence; leaves often bipinnate to tripinnate ... 10. *Descurainia*, p. 682.
29. Trichomes mostly simple or absent; stems and leaves greenish; leaves at most pinnate plus secondary lobing (30)
- 30(29). Petals yellow or yellowish (31)
30. Petals white to light-lavender (33)
- 31(30). Siliques with a definite beak in addition to the style; seeds globose 21. *Brassica*, p. 689.
31. Siliques blunt at apex or tipped with a style but no beak present; seeds elongated, ovoid or compressed (32)
- 32(31). Lower flowers bracteate; bracts usually pinnatifid . 20. *Erucastrum*, p. 689.
32. Lower flowers ebracteate 9. *Sisymbrium*, p. 680.
- 33(30). Plants aquatic or of very wet habitats; valves of siliques nerveless; cauline leaves pinnate to bipinnate 15. *Rorippa*, p. 686.
33. Plants terrestrial and of dryer habitats; valves of siliques nerved; cauline leaves entire or at most lobed 9. *Sisymbrium*, p. 680.
- 34(4). Upper member of silique flattened, smaller and usually shorter than the lower member 22. *Eruca*, p. 690.
34. Upper member of silique larger and longer than the lower member (35)
- 35(34). Upper member of silique globose, roughened, abruptly narrowed to a slender beak 37. *Rapistrum*, p. 705.
35. Upper member of silique elongate, smooth, gradually narrowed toward apex (36)
- 36(35). Plants glabrous, fleshy, of sandy beaches and shores 24. *Cakile*, p. 690.
36. Plants hirsute, not fleshy, weed of cultivated or waste places 23. *Raphanus*, p. 690.

- 37(1). Siliques deeply constricted above and below producing two subglobose or sub-orbicular halves separated by the replum (38)
37. Siliques globose, triangular, flattened or elongated but not fully constricted to form separate halves (39)
- 38(37). Siliques with orbicular flattened nonrugose halves; trichomes highly branched ..
.....40. *Dithyrea*, p. 706.
38. Siliques with subglobose rugose halves; trichomes mostly simple
.....39. *Coronopus*, p. 705.
- 39(37). Siliques strongly flattened at right angles to septum, the replum much narrower than silique width (40)
39. Siliques inflated or compressed parallel to septum, the replum equaling the silique width (45)
- 40(39). Siliques broader above than below, more or less triangular to heart-shaped in outline (41)
40. Siliques orbicular to broadly oblong, not markedly asymmetrical (42)
- 41(40). Siliques densely pubescent with branched trichomes; ovary white from the dense indument 32. *Synthlipsis*, p. 698.
41. Siliques glabrous; ovary greenish 28. *Capsella*, p. 694.
- 42(40). Seeds one in each loculus (43)
42. Seeds two or more in each loculus (44)
- 43(42). Siliques indehiscent; valves obtuse at the margin .. 30. *Cardaria*, p. 697.
43. Siliques dehiscent; valves winged or sharply keeled at the margin
.....29. *Lepidium*, p. 694.
- 44(42). Siliques winged, glabrous; flowers white 31. *Thlaspi*, p. 698.
44. Siliques not winged, pubescent; flowers yellow 34. *Lesquerella*, p. 699.
- 45(39). Siliques compressed to strongly flattened parallel to septum (46)
45. Siliques globose to pyriform, sometimes slightly longer than broad or broader than long but not compressed laterally (49)
- 46(45). Leaves pinnately to bipinnately dissected; petals yellow
.....25. *Selenia*, p. 691.
46. Leaves entire or merely lobed; petals white to lavender (47)
- 47(46). Siliques orbicular; trichomes bifurcate and appressed
.....36. *Lobularia*, p. 705.
47. Siliques elongated; trichomes simple to multiple branched and spreading (48)
- 48(47). Flowering stems arising from a basal rosette; siliques strongly flattened
.....27. *Draba*, p. 692.
48. Flowering stems without a basal rosette; siliques slightly compressed but not flattened parallel to the septum 33. *Mancoa*, p. 699.
- 49(45). Siliques with an evident style but no beak formed by the valves
.....34. *Lesquerella*, p. 699.
49. Siliques with an evident beak in addition to the style (50)
- 50(49). Siliques keeled over replum margin, dehiscent ... 35. *Camelina*, p. 704.
50. Siliques not keeled over margins, indehiscent 38. *Myagrurn*, p. 705.

I. STANLEYA NUTT.

Six species in western North America.

1. *Stanleya pinnata* (Pursh) Britt. var. *integrifolia* (James) Roll. DESERT PRINCE'S PLUME. Subshrubby glabrous perennial; stems several to many from a woody base, usually branched above, glabrous, to 1 m. tall; basal leaves absent; cauline leaves petioled, glabrous and glaucous, thick, ovate to linear-oblongate, usually entire; inflorescence

dense, racemose, 1-2 dm. long, elongating farther in fruit; buds clavate; sepals yellow at anthesis, spreading, linear-oblong; petal blade yellow, the claw brownish, pilose on inner face; stamens nearly equal, exserted; anthers coiled after pollen discharge; pedicels widely spreading, about 1 cm. long; gynophore slender, 1-2 cm. long; siliques linear, nearly terete, 2-4 cm. long; stigma entire, nearly sessile; seeds oblong, wingless; cotyledons incumbent. Clay or silty flats and desert washes, Trans-Pecos, Apr.-May; Kan. to Wyo. and Ut.

2. THELYPODIUM ENDL.

Biennial herbs with mostly erect branching stems; leaves petiolate, entire to pinnately lobed; inflorescences dense, racemose, terminating the branches; flowers white to purplish; sepals nonsaccate, spreading at anthesis, oblong; petals spatulate; stamens exserted, nearly equal, spreading at anthesis; anthers recurved; siliques terete to slightly flattened parallel to septum, stipitate, narrowly linear; stigmas small, entire; seeds oblong, wingless or nearly so; cotyledons accumbent to obliquely incumbent.

About 20 species in western United States and adjacent Mexico.

1. Leaves entire or at most dentate; plants 10-20 dm. high, widely branching toward summit 1. *T. Wrightii*.
1. Leaves pinnately lobed and with the lobes dentate; plants less than 6 dm. high, branching somewhat compact beginning just above base (2)
- 2(1). Pedicels rigidly and widely divaricate, less than 15 mm. long; inflorescence ebracteate 2. *T. texanum*.
2. Pedicels very slender, divaricately ascending, 20-30 mm. long; lower portion of inflorescence bracteate 3. *T. tenue*.

1. *Thelypodium Wrightii* Gray. Paniculately branching biennial to 2 m. tall; branches slender; lower leaves tending to be dentate or lobed but not pinnate, upper leaves lanceolate and usually entire; inflorescences dense, terminating the branches; flower white to purplish-tinged; sepals and petals spreading at anthesis; petals oblanceolate; stamens nearly equal, exserted, spreading at anthesis; anthers recurved, about 2 mm. long; pedicels slender, spreading at right angles to slightly descending; siliques stipitate, narrowly linear, torulose, widely spreading, 5-7 cm. long, less than 1 mm. wide; styles about 1 mm. long; seeds oblong, wingless. *Stanleyella Wrightii* (Gray) Rydb. Cliffs, canyon walls and lower mt. slopes, mainly in the Juniper Belt, w. Tex., Aug.-Oct.; Okla. and Tex. to Nev. and Ariz.

2. *Thelypodium texanum* (Cory) Roll. Annual, usually with a single stem, branched beginning just above the base, stems to 6 dm. tall; leaves pinnate, the lobes dentate, decurrent on the rachis, petiolate, not auriculate; flowers in a dense raceme; sepals, petals and stamens spreading at anthesis; sepals oblong, 2-3 mm. long; petals white, narrowly oblanceolate, 4-6 mm. long; stamens exserted, nearly equal; anthers purplish, recurved; pedicels spreading at right angles to rachis to slightly ascending, to 15 mm. long; infructescence very dense, to 3 dm. long; siliques stipitate, nearly terete, slightly flattened parallel to septum, 3-6 cm. long; stipe less than 1 mm. long; style slender, to 1.5 mm. long; stigma small, entire; seeds broadly oblong, wingless, just over 1 mm. long. *Stanleyella texana* Cory. Barren hillsides and gravelly creek beds, Big Bend area of w. Tex., Feb.-Apr.; endemic.

3. *Thelypodium tenue* Roll. Annual; stems single, branched, glabrous; leaves pinnately lobed, petiolate, basal ones 1-2 dm. long, the lobes irregularly dentate; inflorescence dense, elongated; pedicels very slender, divaricately ascending, glabrous, 2-3 cm. long; sepals, petals and stamens spreading at anthesis; sepals greenish to slightly tinged with purple, nonsaccate, 4-5 mm. long; petals white, narrowly spatulate, 7-8 mm. long; stamens exserted; filaments nearly equal; anthers purplish, recurved; siliques stipitate, terete or nearly so, the stipe less than 1 mm. long; styles slender, narrowing toward apex; stigma circular, entire, small. Known only from bed of Fresno Creek, Presidio Co., Tex., Jan.-Mar.; endemic.

3. STREPTANTHUS NUTT. TWIST-FLOWER

Annual single- or few-stemmed herbs, often somewhat succulent and leafy, glabrous, often glaucous; stems erect, simple or branched, 3-10 dm. high; calyx closed, mostly purplish; petals showy and purplish or narrow, dull and rust-colored; stamens included to exserted; flowers of several species irregular; pedicels mostly short (less than 1 cm.) and stout; siliques erect to divaricately ascending; valves 1-nerved (at least below); seeds winged; cotyledons accumbent.

About 35 species in southwestern United States and adjacent Mexico.

1. Upper cauline leaves petiolate or at least cuneate at base (2)
1. Upper cauline leaves auriculate and clasping the stem (3)
- 2(1). Cauline leaves entire, cuneate at base or short-petioled; petals equally developed 1. *S. hyacinthoides*.
2. Cauline leaves runcinate, long-petioled; petals unequal, the lower petals with blades absent or poorly developed 7. *S. Cutleri*.
- 3(1). Petal blades poorly developed, not showy, about the same width as the claw 6. *S. carinatus*.
3. Petal blades well-developed, showy, at least twice as wide as the claw (4)
- 4(3). Lower cauline leaves auriculate (5)
4. Lower cauline leaves petiolate (6)
- 5(4). Siliques less than 2.5 mm. wide; lower cauline leaves entire or at most shallowly sinuate-dentate 2. *S. maculatus*.
5. Siliques 5-6 mm. wide; lower cauline leaves pinnatifid to somewhat lobed 5. *S. sparsiflorus*.
- 6(4). Infructescences fully bracteate; mature pedicels terete; siliques less than 3 mm. wide 3. *S. bracteatus*.
6. Infructescences ebracteate or lower pedicels infrequently subtended by bracts; mature pedicels angular, striated; siliques 4-6 mm. wide 4. *S. platycarpus*.

1. *Streptanthus hyacinthoides* Hook. Glabrous throughout; stems erect, stiff, virgately branched above or simple, to 1 m. tall; basal leaves absent; cauline leaves linear-lanceolate, short-petiolate to sessile, to 15 cm. long; flowers at right angles to pendent, slightly irregular; buds acuminate; sepals purplish; petals deep-purple to magenta; upper stamen pair exserted with filaments free or fused, lower stamen pair included with filaments fused; siliques divaricately ascending, nearly sessile to short-stipitate, 6-10 cm. long, to 2 mm. wide; styles to 1 mm. long; seeds uniseriate, flattened, winged. *Euklisia hyacinthoides* (Hook.) Small. Sand hills and sandy areas in oak woods, May-June; Tex. and Okla.

2. *Streptanthus maculatus* Nutt. Glabrous annual; stems erect, simple or branched, leafy, to 8 dm. tall; basal leaves absent; cauline leaves ovate to oblong, acute, entire to shallowly dentate, auriculate and clasping; flowers showy, divaricately ascending; sepals purplish; petals purple and magenta-spotted, the blades broad and reflexed; siliques divaricately ascending, sessile, 6-10 cm. long, less than 3 mm. wide, 1-nerved from base to apex, acute; seeds oblong, winged. Moist lands in woods, n.e. Tex., Apr.-May; also e. Okla. and w. Ark.

3. *Streptanthus bracteatus* Gray. BRACTED TWIST-FLOWER. Stems erect, glabrous, simple or branched above, 6-12 dm. tall; lower cauline leaves petiolate, irregularly lobed and irregularly dentate, to 15 cm. long; middle and upper cauline leaves ovate, sagittate, entire to shallowly dentate; lower bracts of inflorescence leaflike, upper bracts reduced; mature pedicels terete, papillose or glabrous, divaricately ascending; siliques subsessile, 8-12 cm. long, to 4 mm. wide; seeds flattened, broadly oblong, winged. Wooded slopes and sandy river margins, s.-cen. Tex., Apr.-May; endemic.

4. *Streptanthus platycarpus* Gray. Stems stiff, usually branched, glabrous or pubescent above, 4-10 dm. tall; lower cauline leaves petiolate, sinuate to deeply lobed, glabrous,

fleshy, to 2 dm. long; upper cauline leaves sessile, auriculate, ovate, sinuate to entire, reduced upward; lower flowers occasionally bracteate; sepals erect, purplish at anthesis; petals with a conspicuous blade, purplish, spreading or reflexed; both sets of paired stamens nearly equal, included; anthers about equaling filaments in length, 4-5 mm. long; fruiting pedicels divaricately ascending, usually pilose, sometimes glabrous; siliques erect to divaricately ascending, subsessile, 6-10 dm. long, 4-6 mm. wide; seed orbicular to slightly oblong, widely winged. Cliff ledges, canyon-walls, talus slopes and rocky inclines, w. Tex., mostly w. of the Pecos, Mar.-Apr.; endemic.

5. *Streptanthus sparsiflorus* Roll. Stems erect, usually branched above, glabrous, 3-6 dm. tall; lower leaves sessile, auriculate, pinnatifid, some nearly runcinate, 8-12 cm. long, 2-4 cm. wide; upper cauline leaves ovate, entire to shallowly dentate, auriculate and clasping the stem; flowers less than ten in a raceme; sepals purplish, erect; petals purplish, the blade well-developed and reflexed; upper stamen pair exerted, lower stamen pair included; pedicels divaricate, glabrous, less than 1 cm. long; siliques divaricately ascending to erect, 4-7 cm. long, 5-7 mm. wide, subsessile; seeds flattened, orbicular, widely winged. Shady places in gravel and among boulders, Guadalupe Mts. in the Trans-Pecos, May-June; endemic.

6. *Streptanthus carinatus* Wright. Glabrous; stems usually branched just above base and upward, 3-6 dm. tall; lower leaves pinnatifid, usually runcinate, petiolate, about 1 dm. long; cauline leaves auriculate, clasping, ovate to narrower, often attenuate, usually entire; calyx urn-shaped, purplish, closed; petals narrow, strap-shaped, twisted, dull-white with purple veins to purplish; upper stamen pair exerted, lower pair shorter with longer anthers; pedicels divaricate, glabrous, 1-2 cm. long, lower sometimes bracteate; siliques subsessile, 3-6 cm. long, 3-5 mm. wide; seeds widely winged, flat, orbicular. Cliff bases, gravelly slopes, canyons and dry creek beds in the Trans-Pecos, Mar.-Apr.; endemic.

7. *Streptanthus Cutleri* Cory. Glabrous throughout; stems branched above base and upward, 5-8 dm. tall; lower leaves petiolate, runcinate, to 2 dm. long, the segments acute; cauline leaves similar to basal leaves, reduced upward; flowers irregular; calyx deep-purple; upper petals with broad erect purplish-lavender blades, lower petals with blades absent; upper paired stamens exerted, lower pair with longer anthers and nearly included; pedicels slender, divaricately ascending, 1.5-3 cm. long; siliques sessile, erect, 3-5 mm. wide; seeds widely winged. Talus slopes, rocky hillsides and gravelly dry streambeds, Big Bend area of w. Tex., Feb.-Apr.; endemic.

4. IODANTHUS STEUD.

Four species from central United States and Mexico.

1. *Iodanthus pinnatifidus* (Michx.) Steud. PURPLE ROCKET. Perennial; stem usually single from base, branched above, leafy, glabrous or rarely sparsely pubescent, with simple trichomes below, 3-8 dm. tall; leaves glabrous, ovate to lanceolate, petiolate or the upper sessile and cuneate, irregularly serrate, lower leaves usually with a winged petiole and auricles clasping the stem; inflorescence narrowly racemose, elongated; sepals oblong, erect, often purplish, 6-8 mm. long; petals white to light-lavender, spatulate to narrowly obovate, 7-14 mm. long; pedicels widely spreading, glabrous, 4-10 mm. long; siliques linear, widely spreading to divaricately ascending, straight, nearly terete, glabrous, 2-4 cm. long, sessile or with a short stipe; seeds oblong, wingless, 1-1.5 mm. long; cotyledons accumbent. Alluvial soil of river bottoms and in rich woods, cen. and e. Tex., Apr.-June; Pa. to Ia., Ala. and Tex.

5. ARABIS L. ROCK-CRESS

Annual, biennial or perennial herbs; stems erect, stiff, simple or branched, glabrous to pubescent; basal leaves petiolate; cauline leaves petiolate or sessile; inflorescence racemose, ebracteate; flowers tetradynamous; sepals erect, oblong; petals spatulate to oblong, white, cream or lavender; siliques sessile, straight to curved, erect to pendulous, flattened parallel to partition; styles evident, entire; seeds orbicular to oblong, winged; cotyledons accumbent.

About 150 species in North America, Asia, Europe and Africa.

1. Upper cauline leaves sessile and auriculate; perennials with a woody base 3. *A. Fendleri*.
1. Upper cauline leaves petiolate or cuneate at base; annuals or biennials without a woody base (2)
- 2(1). Siliques erect; lower leaves deeply lobed; flowers lavender 1. *A. petiolaris*.
2. Siliques pendulous; lower leaves entire or at most dentate; flowers whitish to cream 2. *A. canadensis*.

1. *Arabis petiolaris* Gray. Annual; single stem simple below, branched above, pubescent with simple trichomes below, becoming glabrous upward, 4-10 dm. tall; leaves ranging from pinnately lobed below to entire above, petioled; lower leaves pubescent, the upper usually glabrous; sepals oblong, glabrous; petals lavender, spatulate, 6-8 mm. long; pedicels glabrous, divaricately ascending, straight, 8-12 mm. long; siliques straight, flattened, broad, acuminate, erect to divaricately ascending, 4-8 cm. long, 3-4 mm. wide; styles slender, 1-2 mm. long; seeds orbicular, widely winged, 3-4 mm. across including wings, uniseriate. Open woods, rocky knolls, wooded bluffs and among boulders, cen. Tex., Apr.-May; endemic.

2. *Arabis canadensis* L. SICKLEPOD. Biennial; single stem erect, often branched above, 4-9 dm. tall, sparsely hirsute below, glabrous above; basal leaves short-petiolate, entire to dentate, pubescent with simple and bifurcate trichomes on both surfaces; cauline leaves becoming sessile and cuneate at base on upper part of stems; sepals 2-4 mm. long, pubescent; petals white to cream, narrowly oblanceolate to oblong, 3-5 mm. long; pedicels recurved, 8-12 mm. long; siliques falcate to arcuate, pendulous, 5-9 cm. long, 2-3 mm. wide; seeds uniseriate, narrowly winged. Sandy woods and shaded slopes, n.e. Tex., Apr.-June; Tex. to Minn., Vt. and Ga.

3. *Arabis Fendleri* (Wats.) Greene. Perennial, woody at base; stems one to several from a simple or branching caudex, hirsute near base, glabrous above; basal leaves oblanceolate, short-petiolate, entire to dentate, sparsely to densely hirsute with simple or branched trichomes, ciliate, 3-6 cm. long; cauline leaves sessile, auriculate, lower imbricated on the stem; pedicels slender, ascending at anthesis, arching downward in fruit, 1-2 cm. long; sepals erect, oblong, 3-5 mm. long; petals spatulate, white to light-lavender, 5-8 mm. long; siliques glabrous, pendulous, straight to slightly bent inward, 3-6 cm. long, 1.5-2.5 mm. wide; seeds orbicular to slightly oblong, narrowly winged. Rocky hillsides and rock crevices in full sun, w. Tex., Mar.-Apr.; Tex. and Mex. to Colo. and Nev.

6. PENNELLIA NIEUW.

Biennials or perennials with branched trichomes (at least below); stems slender, erect, simple or branched above; basal leaves ovate to oblanceolate, more or less toothed, often early-deciduous; stem leaves linear to lance-linear, usually entire; calyx with one pair of sepals somewhat broader than the other; petals small, barely exceeding sepals, purple to whitish; anthers at length spirally curved; siliques linear, terete to slightly flattened parallel to septum.

About 6 species in southern North America and temperate South America.

1. Siliques pendent; sepals becoming purple; petals purple to whitish; pedicels arched downward 1. *P. longifolia*.
1. Siliques erect; sepals greenish; petals white, pedicels straight, divaricately ascending to erect 2. *P. micrantha*.

1. *Pennellia longifolia* (Benth.) Roll. Biennial or perennial; stems single from base, 5-12 dm. tall, usually branched above; basal leaves 3-6 cm. long, shallowly toothed, linear-oblanceolate, densely pubescent, early-deciduous; cauline leaves linear, cuneate at base, pubescent, entire to somewhat toothed; flowers remote in elongated narrow racemes, cup-shaped; petals just exceeding sepals; pedicels about 1 cm. long, very slender; siliques 5-8 cm. long, about 1 mm. wide; styles less than 1 mm. long; seeds oblong, wing-

less, plump. *Thelypodium longifolium* (Benth.) Wats. Open oak woodlands in mts. in the Trans-Pecos, July-Aug.; N.M. and Ariz. to Guat.

2. *Pennellia micrantha* (Gray) Nieuw. Biennial or perennial; stems one to few from base, branched above, 5-10 dm. tall; basal leaves 3-5 cm. long, oblanceolate, coarsely dentate to lobed, densely pubescent with dendritic trichomes; cauline leaves often glabrate, oblanceolate to linear, remotely toothed to entire, 3-10 cm. long; flowers remote; racemes elongate, narrow; pedicels 4-6 mm. long, straight, erect to divaricately ascending; siliques erect, straight, 3-5 cm. long; stigmas nearly sessile. *Thelypodium micranthum* (Gray) Wats. Canyons and cliffs, mts. in the Trans-Pecos, July-Sept.; N.M. and Ariz. to s.-cen. Mex.

7. DRYOPETALON GRAY

Four species in southwestern United States and northern Mexico.

1. *Dryopetalon runcinatum* Gray. Biennial or perennial; stems one to several, densely hirsute below with simple spreading trichomes, glabrous or nearly so above, 2-6 dm. tall; basal leaves petiolate, hirsute, pinnately divided to deeply lobed, the lobes dentate, terminal lobe larger than lateral lobes; upper cauline leaves less pubescent than lower leaves; inflorescence crowded, racemose; sepals oblong to obovate, hyaline-margined, usually with a few trichomes present; petals white, obovate to spatulate, 5- to 9-lobed; stamens minutely papillose to sparingly pilose at base; pedicels sparsely hirsute to glabrous, straight, divaricately ascending, 1-2 cm. long; siliques linear, glabrous, divaricately ascending to slightly arcuate, 3-5 cm. long, about 1 mm. wide; seeds oblong, wingless; cotyledons accumbent. Cliffs and shady areas among rocks in the mts. of extreme w. Tex., Mar.-Apr.; Tex. and N.M. to Ariz. and n. Mex.

8. SIBARA GREENE

Annual or biennial herbs; stems single to several from the base, glabrous to sparsely pubescent; leaves pectinate to pinnatifid, sometimes runcinate; upper cauline leaves sometimes entire; inflorescence racemose, lax; flowers small, not at all showy; sepals oblong, nonsaccate or the outer pair slightly saccate; petals white to pale-lilac, spatulate; pedicels divaricately ascending, straight, not expanded at summit; siliques linear, flattened parallel to septum, the valves nerveless to nerved below; seeds oblong to nearly orbicular, winged; cotyledons accumbent.

Eleven species, primarily of southwestern United States and Mexico.

1. Styles obsolete to less than 0.5 mm. long; cauline leaves not auriculate; pedicels glabrous, mostly less than 4 mm. long 1. *S. virginica*.
 1. Styles 2-4 mm. long; cauline leaves auriculate; pedicels sparsely hirsute, 5-10 mm. long 2. *S. runcinata*.

1. *Sibara virginica* (L.) Roll. Annual herb; stems arising from rosette of basal leaves, erect or decumbent, usually hirsute toward base, 1-3 dm. tall; leaves pinnatifid with narrow lateral segments, terminal lobe somewhat broader; cauline leaves petiolate, not auriculate; flowers small and inconspicuous; petals white to faintly pinkish, oblanceolate to narrowly oblong, 1.5-3 mm. long; pedicels divaricately ascending, short, mostly less than 4 mm. long; siliques narrowly oblong to linear, flattened parallel to septum, obtuse above and below, 15-25 mm. long, 1.5-2 mm. wide, glabrous; seeds nearly orbicular, flattened, narrowly winged. Old fields, roadsides and open areas, s., cen. and e. Tex., Mar.-Apr.; s. Calif. and Okla. to O., Va. and Fla.

2. *Sibara runcinata* (Wats.) Roll. Annual herb; stems erect to decumbent, weak, several arising from the base, branched above, hirsute with simple trichomes below, glabrous above, to 6 dm. tall; lower leaves petiolate, lyrate-pinnatifid to runcinate-pinnatifid, hirsute with simple trichomes; cauline leaves sessile, auriculate, reduced upward, upper leaves often entire; sepals glabrous to sparsely pilose, oblong; petals spatulate, white to light-lavender, 4-8 mm. long; pedicels divaricately ascending, usually pilose, 5-10 mm. long; siliques linear, glabrous, subsessile, flattened parallel to septum, 1.5-4 cm. long,

1.5-2 mm. wide; seeds oblong, narrowly winged. Incl. var. *brachycarpa* Roll., *S. Viereckii* (Schulz) Roll. Among boulders and in brushlands of mesas and hills, lower Rio Grande Valley, Feb.-Apr.; also Mex.

9. SISYMBRIUM L.

Annual or biennial herbs, glabrous or with simple trichomes; stems usually branched above base; leaves monomorphic or dimorphic, green or glaucous; sepals nonsaccate; petals yellow, white or lavender; inflorescences dense, elongating in fruit; siliques narrowly cylindrical or long-subulate, erect to divaricately ascending; seeds in a single row, oblong, marginless; cotyledons incumbent.

About 90 species, mainly in Eurasia, the Mediterranean region and temperate Africa, North America and South America.

1. Middle and upper cauline leaves petiolate or cuneate at base, not auriculate or if auriculate then pinnately divided (2)
 1. Middle and upper cauline leaves sessile, auriculate and clasping the stem, entire or dentate (7)
 - 2(1). Inflorescences leafy; flowers borne from near base to apex of plants, usually in fascicles 1. *S. polyceratium*.
 2. Inflorescences without bracts; flowers borne in terminal racemes (3)
 - 3(2). Siliques subulate, 1-2 cm. long, borne on short stout pedicels closely appressed to rachis 2. *S. officinale*.
 3. Siliques linear, terete, 3-10 cm. long; pedicels (and siliques) loosely spreading or ascending (4)
 - 4(3). Leaves entire; cauline leaves linear to lanceolate .. 6. *S. linearifolium*.
 4. Leaves pinnately divided; cauline leaves ample, broadly oblong to broadly oblanceolate in outline (5)
 - 5(4). Segments of upper leaves filiform to very narrowly linear; siliques widely spreading at same angle as pedicels and same diameter as pedicels 3. *S. altissimum*.
 5. Segments of upper leaves lanceolate or oblong, terminal segment triangular or broadly ovate; siliques more erect than the spreading pedicels or much greater in diameter than pedicels (6)
 - 6(5). Flowers yellow; sepals and petals subequal; petals linear and without blade and claw; pedicels much more slender than siliques ... 4. *S. Irio*.
 6. Flowers white; petals showy, distinctly exceeding sepals and differentiated into blade and claw; pedicels nearly same diameter as siliques 5. *S. auriculatum*.
 - 7(1). Lower leaves deeply dentate, petiolate, oblong to oblanceolate in outline 7. *S. Purpusii*.
 7. Lower leaves entire, sessile or at least with a winged petiole, obovate 8. *S. Shinnersi*.

1. *Sisymbrium polyceratium* L. Annual; stems simple or branched near base, glabrous, 2-5 dm. tall; lower leaves petiolate, oblanceolate, dentate to nearly lobed, glabrous or with a few simple tapering trichomes; cauline leaves hastate to oblong, entire to dentate, subtending one or more flowers in each axil; flowers minute, occurring from near base of plant to ends of branches; sepals erect, with one or a few trichomes on exterior at apex; petals white, equal to or barely exceeding the sepals; pedicels stout, closely appressed to the stem, usually less than 2 mm. long; siliques terete, tapering from base to apex, erect to somewhat curved away from stem, 1-2 cm. long, the valves somewhat persistent; seeds wingless. Roadsides and waste places, occurring sparingly as an introd. weed, Mar.-May; nat. to Euras.

2. *Sisymbrium officinale* (L.) Scop. HEDGE-MUSTARD. Annual, widely branching; stems to 1 m. tall, hirsute at least at base; leaves petiolate, irregularly pinnately lobed, the

lobes dentate, reduced upward, sparsely hirsute with simple trichomes; flowers small, in terminal spiciform racemes that greatly elongate in fruit; petals pale-yellow, about 3 mm. long; siliques subulate, closely appressed to rachis, 1-2 cm. long, pubescent with simple trichomes to glabrous; styles 1-2 mm. long; seeds plump, wingless, variable in shape, cotyledons obliquely incumbent. The most widespread form has glabrous fruits and has received the name var. *leiocarpum* DC. Weedy, in fields, thickets and waste places, Apr.-June; nat. of Eur.

3. *Sisymbrium altissimum* L. TUMBLE-MUSTARD. Annual; stems loosely branched above, to 1.5 m. tall, hirsute toward base with large spreading simple trichomes; lower leaves petiolate, hirsute, pinnately lobed, the lobes oblong and dentate, gradually changing upward on the plant to leaves with linear-filiform entire segments; flowers loosely racemose; petals pale-yellow, 6-9 mm. long; pedicels straight, widely spreading, similar in diameter to siliques; siliques terete, straight, long-linear, widely spreading and extending same angle as pedicel, 5-10 cm. long, glabrous; styles 1-2 mm. long; seeds wingless, plump, oblong, about 1 mm. long, cotyledons incumbent. Weedy, fields, roadsides and waste places, May-Aug.; nat. of Eur.

4. *Sisymbrium Irio* L. LONDON ROCKET. Annual; stems branched near base and above, to 6 dm. tall, glabrous or sparingly hirsute above; leaves petiolate, pinnately lobed or the upper nearly entire, glabrous to sparsely hirsute with simple trichomes on petioles and lobe margins, terminal lobe larger than laterals; flowers small; petals pale-yellow, oblanceolate, barely exceeding sepals, to 4 mm. long; pedicels slender, divaricately ascending, glabrous or sparsely hirsute on the adaxial surface; siliques slender, terete, glabrous, straight, divaricately ascending, 3-5 cm. long, about 1 mm. wide; seeds oblong, wingless, less than 1 mm. long; cotyledons incumbent. Fields, roadsides, waste places and open deserts, Dec.-May; introd. weed, nat. of Eur.

5. *Sisymbrium auriculatum* Gray. Annual or biennial, sparsely pilose with long simple trichomes to nearly glabrous; stems erect, branched above, to 1.5 m. tall, mostly less than 1 m.; leaves ample, thin, petiolate; basal leaves irregularly incised or lobed, broadly oblanceolate; cauline leaves lobed with terminal lobe larger than laterals, triangular to ovate, auricles present at base of petiole, often clasping stem; inflorescences dense at apex, greatly elongating in fruit; sepals nonsaccate, pale- to light-lavender, sparsely pilose or glabrous; petals white or light-lavender, strongly differentiated into blade and claw, 7-9 mm. long; pedicels widely spreading nearly at right angles to rachis, 6-12 mm. long, pilose to glabrous; siliques divaricately ascending, terete, sparsely pilose to glabrous, sessile, 2-4 cm. long, less than 1 mm. wide; styles 1-2 mm. long; seeds plump, wingless, small, less than 1 mm. long, enmeshed in tissue of septum. *Thelypodium auriculatum* (Gray) Wats., *Coelophragmus auriculatus* (Gray) Schulz. Shallow washes, open flats and borders of thickets, w. Tex., Mar.-Nov.; also Mex.

6. *Sisymbrium linearifolium* (Gray) Pays. Perennial, glabrous, glaucous, branched above, 5-15 dm. tall; leaves petiolate to cuneate at base; lowest leaves oblanceolate, denticulate to entire, usually missing in older plants; cauline leaves entire, linear-lanceolate to narrowly linear; inflorescences loosely racemose; sepals light-lavender, outer pair saccate, inner pair apiculate; petals showy, lavender, veiny, strongly differentiated into blade and claw, 12-18 mm. long; pedicels divaricately ascending, slender, 1-2 cm. long; siliques erect, terete, sessile or subsessile, 4-8 cm. long, about 1 mm. wide; styles 1-2 mm. long; seeds plump, angular, about 1 mm. long; cotyledons obliquely incumbent. *Hesperidanthus linearifolius* (Gray) Rydb. Ledges, crevices of rocks, steep hillsides and open brushland, mts. and hills, w. Tex., Apr.-Oct.; Tex. and Mex. to Colo., Ut. and Ariz.

7. *Sisymbrium Purpusii* (Brandeg.) Schulz. Annual, glabrous throughout; stems single from the base, branched above, leafy, 3-7 dm. tall; lower leaves sinuate-dentate to somewhat lobed, thin, petiolate, oblanceolate, obtuse, 6-15 cm. long, 1-3 cm. wide, the petiole winged; cauline leaves becoming entire upward, overlapping; middle and upper leaves sessile, auriculate, lanceolate; petals spatulate, with a slender claw, white, 4-5 mm. long; anthers oval, less than 1 mm. long; pedicels slender, divaricately ascending to nearly erect, straight, 1-1.5 cm. long; siliques narrowly linear, terete, ascending, slightly divergent to nearly erect, 4-7 cm. long; styles about 1 mm. long; seeds plump, wingless, less than 1 mm. long; cotyledons incumbent. *Thelypodium Purpusii* Brandeg. Partial to dense shade of trees, boulders or cliffs, Fresno Canyon, Presidio Co., Feb.-Apr.; Tex. and Mex. to Ariz.

8. *Sisymbrium Shinnersii* M. C. Johnst. Annual, glabrous and glaucous; stems simple or usually branched beginning just above base, 3-7 dm. tall; basal leaves with a winged petiole, obovate, denticulate, to 1 dm. long, 3-5 cm. wide; cauline leaves sessile, entire, auriculate and clasping the stem, ovate to somewhat pandurate, obtuse; sepals light-lavender, outer pair slightly saccate; petals white, narrowly spatulate, scarcely differentiated into blade and claw, barely exceeding sepals; pedicels slender, divaricately ascending, 6-10 mm. long; siliques divaricately ascending, nearly straight, terete, 4-6 cm. long, less than 1 mm. wide; styles nearly obsolete; seeds plump, wingless, less than 1 mm. long. *Thelypodium Vaseyi* Coult., not *Sisymbrium Vaseyi* Wats. Edges of thickets and under trees in partial shade, lower Rio Grande Valley, Oct.-Apr.; also Mex.

10. DESCURAINIA WEBB & BERTH. TANSY-MUSTARD

Herbaceous annuals or biennials pubescent (more or less densely) with branched trichomes, these sometimes intermixed with simple trichomes and/or stalked glands, the latter especially frequent on the axes of the racemes; leaves tripinnate to pinnate; flowers small; petals less than 3 mm. long, white to bright-yellow; infructescences usually much-elongated at maturity; siliques narrow, linear or clavate, the valves more or less distinctly 1-nerved; style short or obsolete; seeds uniseriate to biseriate; cotyledons incumbent.

Three species in Texas (one introduced from Europe); about 50 species in temperate and cold parts of North America and South America, Europe and Asia, also in the Canary Islands.

- 1. Siliques subclavate; seeds usually biseriate, rarely nearly uniseriate 3. *D. pinnata*.
- 1. Siliques linear; seeds strictly uniseriate (2)
- 2(1). Leaves 2- or 3-pinnate; siliques 10-30 mm. long; petals shorter than or about as long as the sepals 1. *D. Sophia*.
- 2. Leaves simply pinnate; siliques 8-15 mm. long; petals longer than the sepals (3)
- 3(2). Plants not glandular 2a. *D. Richardsonii* subsp. *incisa*.
- 3. Plants glandular 2b. *D. Richardsonii* subsp. *viscosa*.

1. *Descurainia Sophia* (L.) Webb. Annual or biennial, subglabrous to sparsely pubescent but not glandular; stem usually single from the base but branched above, erect, to 8 dm. high; basal leaves 2- or 3-pinnate, the segments sometimes toothed or incised, usually withered and lost early; cauline leaves 2- or 3-pinnate, the segments usually linear, sometimes elliptic to obovate; infructescences loose and elongated; fruiting pedicels to about 15 mm. long, spreading at about 45°; sepals erect, narrowly elliptic to more or less linear, obtuse; petals about as long as the sepals or slightly shorter, clawed, yellowish-green; siliques 1-3 cm. long, linear and narrow, terete, usually more or less torulose, curved or (less often) straight; style short; seeds 0.8-1.5 mm. long, oblong-ellipsoid, uniseriate. *Sophia sophia* (L.) Britt. On disturbed and/or sandy soil in w. and n.w. Tex., early spring through summer; introd. from Eur. and now occurring throughout the U.S.

2a. *Descurainia Richardsonii* subsp. *incisa* (Engelm.) Detl. Biennial, subglabrous to pubescent with branched trichomes, generally not glandular; stems single from the base but branched above, to 12 dm. high; basal leaves bipinnate to pinnate, the segments broad and obtuse, withering early; cauline leaves pinnate, the segments entire to incised; infructescences elongated and rather loose; pedicels 4-10 mm. long, spreading from the axis at 45°-80°; sepals 1-1.5 mm. long, oblong; petals 1.5-2 mm. long, spatulate, pale-yellow; siliques 8-15 mm. long, linear but tapered at both ends, sometimes torulose, usually arcuate, often nearly parallel with the axis of the raceme; seeds about 0.8 mm. long, oblong to ellipsoid, uniseriate. *Sisymbrium incisum* Engelm. El Paso Co. (*vide* L. E. Detling); in the Rocky Mts. from N.M. to s. Mont., also in s. and cen. Calif. in the Sierra Nevada; Baja Calif. and Chih.

2b. *Descurainia Richardsonii* subsp. *viscosa* (Rydb.) Detl. Differs from subsp. *incisa* in that the upper parts of the stems, the axes of the racemes, pedicels, and sometimes the

foliage bear clavate glands. *Sophia viscosa* Rydb., *Descurainia Rydbergii* Schulz. Trans-Pecos (Mt. Livermore, Davis Mts. and Chisos Mts.), June-Sept.; also N.M., n.e. Ariz., and through the Rocky Mts. to s. Alta.

3. *Descurainia pinnata* (Walt.) Britt. Annual, sparsely pubescent to densely canescent with usually branched trichomes, sometimes glandular on the stems, inflorescences and leaves; stems to 8 dm. high, several from the base and branched or simple but then often branched above; basal leaves to 1 dm. long, usually bipinnate, the segments often deeply incised, the upper leaves gradually reduced in size and usually simply pinnate, the lobes narrow and linear to broadly obovate; infructescences elongated and rather loose; fruiting pedicels to 25 mm. long, ascending to horizontal or slightly reflexed; sepals more or less oblong to ovate, sometimes with rose or magenta pigmentation; petals spatulate to obovate and clawed, whitish to bright-yellow; siliques 4-20 mm. long, clavate (sometimes broadly so), slightly latiseptate, usually straight; style very short or obsolete; seeds to 1 mm. long, more or less ellipsoid but flattened, biseriate or rarely crowded so as to appear uniseriate. In sandy soils and waste places throughout Tex., spring through early summer; throughout the U.S., also in Can. and n. Mex.

In L. E. Detling's treatment of *Descurainia* in North America (Am. Midl. Nat. 22: 481-520. 1939), five of the eleven subspecies of *D. pinnata* there recognized (these five later treated as varieties by L. H. Shinnars in Field & Lab. 17: 145. 1949) are shown as occurring in Texas. These are here treated with the synonyms relevant to the Texas flora and with brief descriptions adapted from Detling's treatment.

Var. *pinnata*. Plants single-stemmed or branched near the base, moderately to densely canescent, the stems and flowering axes glandular; basal leaves bipinnate, the upper ones simply pinnate but the pinnae divided with the segments obovate and obtuse; sepals 1-2 mm. long, the petals slightly longer and whitish; pedicels spreading at 70°-90°; siliques 5-9 mm. long, clavate; seeds always biseriate. *Sisymbrium canescens* Nutt., *Descurainia multifoliata* Cory. According to Detling, in cen., s. and e. Tex.

Var. *ochroleuca* (Woot.) Shinnars. Plants several-stemmed, widely branching from the base, densely canescent but not glandular; lower leaves bi- or tripinnate; upper leaves bipinnate or simply pinnate with the ultimate segments obovate, short and obtuse; sepals 1.5-2 mm. long, often with some rose or magenta pigmentation, the petals about as long and whitish; pedicels spreading at about 40°-80°; siliques 9-13 mm. long, broadly clavate; seeds biseriate. *Sophia ochroleuca* Woot., *Descurainia Menziesii* var. *ochroleuca* (Woot.) Schulz, *D. pinnata* subsp. *ochroleuca* (Woot.) Detl. S.w. Tex., n. to Lubbock.

This is one of the best marked varieties of *D. pinnata* and can be recognized by the much-branched habit, the dense canescence and by the fact that on plants with widely spreading pedicels the siliques are often attached at an angle to the pedicels and thus may be nearly parallel to or at only a slight angle from the axis of the raceme.

Var. *osmiarum* (Cockll.) Shinnars. Plants simple or branched from near the base, the foliage and lower stems more or less canescent; axes of the racemes and the pedicels subglabrous to canescent and usually glandular; lower leaves pinnate to bipinnate, the upper ones usually simply pinnate, the segments usually more or less linear and entire; sepals 1-2 mm. long, often with rose pigmentation, the petals slightly longer and whitish or yellow; pedicels spreading at about 65°-90°; siliques clavate; seeds biseriate. *Sophia andrenarum* var. *osmiarum* Cockll., *Descurainia halictorum* (Cockll.) Schulz, *D. andrenarum* (Cockll.) Cory, *D. pinnata* subsp. *halictorum* (Cockll.) Detl. According to Detling, in the n.w. half of Tex.

This variety is marked by the linear leaf segments, the horizontally spreading pedicels and the branching habit. Detling points out that the name *Sophia andrenarum* Cockll. refers to the nonglandular form of this group.

Var. *glabra* (Woot. & Standl.) Shinnars. Plant usually branching from near the base, the foliage and lower stems more or less canescent, the rest of the plant glabrous and not glandular; leaves bipinnate, the segments ovate to oblong, short; sepals 0.75-1.5 mm. long, the petals slightly longer and yellow; pedicels spreading at 60°-90°; siliques 5-8 mm. long, clavate; seeds biseriate. *Sophia glabra* Woot. & Standl., *D. pinnata* subsp. *glabra* (Woot. & Standl.) Detl. According to Detling, in the Trans-Pecos.

Var. *brachycarpa* (Richards.) Fern. Plants usually simple but sometimes branching, the leaves and stems more or less pubescent and glandular; leaves pinnate to bipinnate (the lower often again pinnatifid), the segments of the upper ones usually linear; sepals

1.5-2.5 mm. long; petals about 0.5 mm. longer and yellow; pedicels usually spreading at about 45°; siliques 5-12 mm. long, more nearly erect than the pedicels; seeds biseriate to sub-biseriate. *Sisymbrium brachycarpum* Richards., *Descurainia pinnata* subsp. *brachycarpa* (Richards.) Detl. Occasional in cen. Tex., according to Detling.

Cory and Parks, Cat. Flora Tex. (1938) include *Descurainia intermedia* (Rydb.) Daniels from the "Timber Belt," "Rio Grande Plains," "Blackland Prairies" and "Plains Country." However, Detling on his distribution map of the northern subspecies of *D. pinnata* shows *D. pinnata* subsp. *intermedia* (Rydb.) Detl. as occurring no further south than southern Colorado. He adds that all the specimens seen from the plains region should be assigned to *D. pinnata* subsp. *brachycarpa*.

11. HALIMOLOBOS TAUSCH

Fourteen species in North America and South America.

1. *Halimolobos diffusa* (Gray) Schulz. Perennial, usually woody at the base; stems with branches widely spreading, leafy, densely pubescent, 3-6 dm. high; leaves densely pubescent with dendritically branched trichomes, oblanceolate to nearly oblong, entire to sinuate, petiolate to cuneate at base; inflorescences numerous, terminating the many branches; sepals erect, densely pubescent; petals white, 2-3 mm. long; anthers small, nearly oval; pedicels slender, densely pubescent, widely spreading, 2-7 mm. long; siliques terete, widely spreading, densely pubescent, about 1 cm. long, 0.5 mm. in diameter; styles slender, 0.5-1 mm. long; seeds plump, wingless, about 1 mm. long; cotyledons incumbent. *Sisymbrium diffusum* Gray. Crevices of rocks, ledges and canyon slopes in the mts. of the Trans-Pecos, July-Sept.; also Mex., N.M. and Ariz.; var. *Jaegeri* (Munz) Roll. in Calif.

12. NERISYRENIA GREENE

Perennial herbs or subshrubs usually with a woody base; stems several to many; leaves petiolate to cuneate at base, entire to dentate, thickish, monomorphic; inflorescences terminating each branch, racemose; flowers showy; sepals spreading to slightly reflexed at anthesis, densely pubescent; petals broadly obovate to broadly spatulate, white to lavender; anthers sagittate, the lobes flaring; pedicels divaricate to ascending; siliques densely pubescent with branched trichomes, linear, nearly terete to somewhat flattened contrary to septum; style evident, glabrous; stigma decurrent on the style, elongated; seeds small, numerous.

Five species in southwestern United States and northeastern Mexico.

1. Leaves broadly spatulate to broadly oblanceolate, dentate, rarely entire, 5-20 mm. wide, flattened; siliques whitish-pubescent 1. *N. camporum*.

1. Leaves narrowly linear, entire, fleshy, nearly terete, less than 3 mm. wide; siliques greenish, pubescence not pannose 2. *N. linearifolia*.

1. *Nerisyrenia camporum* (Gray) Greene. Plants whitish-pubescent; caudex becoming woody and branched in older plants; stems few to several, 2-6 dm. tall; leaves monomorphic, broadly oblanceolate to somewhat narrower, usually dentate or repand, rarely entire, petiolate, 1-6 cm. long, 5-20 mm. wide, densely pubescent with branched trichomes on both surfaces; sepals oblong, nonsaccate, densely pubescent; petals broadly obovate to nearly spatulate, dilated toward base, white to light-lavender, infructescence narrow and elongated; pedicels divaricately ascending, usually straight, occasionally arching downward, densely pubescent, 6-12 mm. long; siliques sessile, straight to slightly curved inward, linear-oblong, obtuse above and below, compressed contrary to septum, whitish-pubescent, 1-3 cm. long, 2-3 mm. wide; styles slender, glabrous, 2-3 mm. long; stigmas cylindrical, prominent; seeds slightly oblong, wingless, small, less than 1 mm. broad. Limestone knolls and hills, gravelly and sandy soils on plains and outwashes, w. Tex., Feb.-Aug.; N.M. and Tex. to n.e. Mex.

2. *Nerisyrenia linearifolia* (Wats.) Greene. Plants greenish, intricately branched from a woody base, 1-3 dm. tall; leaves narrowly linear, thick and fleshy, nearly terete, densely

overlapping on the stems; inflorescences terminating the numerous branches, elongating in fruit; sepals pubescent, oblong, nonsaccate, spreading at anthesis; petals white, obovate; siliques pubescent, slightly compressed contrary to septum to nearly terete, 1-2 cm. long, 1.5-2 mm. wide; styles glabrous, 1.5-2 mm. long; stigmas cylindrical, decurrent on style; seeds oblong, wingless. Gypseous soils, open flats, knolls and bluffs, w. Tex., Apr.-Aug.; s.e. N.M., Tex. and n.e. Mex.

13. ARABIDOPSIS HEYNH.

About 10 species in Eurasia and East Africa; 1 species introduced into North America.

1. *Arabis thaliana* (L.) Heynh. MOUSE-EAR CRESS. Annual or winter annual; stems slender, one to several from the base, branched above, hirsute with simple trichomes toward base, 1-4 dm. tall; leaves in basal rosette, entire to shallowly dentate, oblanceolate, obtuse; petioles shorter than oblong blade, hirsute along margins; flowers minute; sepals sparsely hirsute to glabrous; petals white; pedicels slender, widely divaricate, to 1 cm. long; siliques linear, terete, strongly nerved, 1-1.5 cm. long, less than 1 mm. in diameter; styles less than 1 mm. long; seeds numerous, broadly oval to narrower, 0.3-0.4 mm. long; cotyledons incumbent. Open fields, yards and roadsides, e. Tex., Apr.-June; widely dispersed in U.S.; naturalized from Euras.

14. CARDAMINE L. BITTER-CRESS

Annual, biennial or perennial herbs, glabrous to sparsely hirsute with simple trichomes; leaves entire to pinnately compound, petiolate, alternate; flowers in racemes or panicles; petals white or purple, obovate to spatulate; siliques linear, straight, slightly compressed parallel to septum; valves opening elastically from silique base; replum margin extending partially over valvular area; seeds uniseriate, marginless, plump, longer than broad; cotyledons accumbent.

Between 150 to 175 species, cosmopolitan, mostly temperate. The variable species, *C. pennsylvanica* Muhl., has been reported, but not seen by us, from Texas. It resembles *C. parviflora* but differs from that species in having its stem hispid or hispidulous near the base and its terminal leaflet usually much broader than the lateral leaflets that are noticeably decurrent on the rachis.

- 1. Leaves entire or shallowly dentate; tuberous-based perennial 1. *C. bulbosa*.
- 1. Leaves pinnately lobed to compound; annuals with fibrous roots (2)
- 2(1). Siliques 1.5-2 mm. wide; petals greenish, strap-shaped 3. *C. macrocarpa* var. *texana*.
- 2. Siliques 1 mm. wide or less; petals white, spatulate (3)
- 3(2). Petioles and leaf bases glabrous; leaves mostly cauline; stems one or few from the base 2. *C. parviflora* var. *arenicola*.
- 3. Petioles and leaf bases hirsute; leaves mostly basal; stems several to many from the base 4. *C. hirsuta*.

1. *Cardamine bulbosa* (Schreb.) B.S.P. SPRING-CRESS. Stems erect from a short tuber, 2-6 dm. tall, simple or branched above, with fine pubescence on the lower part; leaves simple; basal leaves long-petioled and obovate to cordate-ovate, lower cauline leaves petioled, the upper sessile, entire to remotely dentate; petals white, 7-15 mm. long; siliques linear-lanceolate to linear, divaricate, 2-3 cm. long, on slender pedicels 2-3 cm. long; styles 2-3 mm. long; seeds variable, suborbicular to elongate-oval. Wet woods, creek bottoms and marshy meadows, e. Tex., Feb.-May; Tex. to Fla., Minn. and Que.

2. *Cardamine parviflora* L. var. *arenicola* (Britt.) Schulz. Glabrous annual; stems usually erect, simple or branched above, 1-3 dm. tall; leaves pinnatifid to pinnately lobed, petiolate; leaf lobes entire to shallowly dentate, cuneate at base or with a short petiolule; flowers small, crowded; petals white, spatulate, 2.5-3.5 mm. long; pedicels slender, ascend-

ing, 5-8 mm. long; siliques erect, 2-3 cm. long; styles less than 1 mm. long; seeds plump, oblong, 0.7-0.9 mm. long; cotyledons accumbent. Moist seeps, wet sandy soils and open wet places in wooded areas, ditches and stream banks, cen. and e. Tex., Feb.-Apr.; Fla. to e. Can., w. to Ore. and Wash.

3. *Cardamine macrocarpa* Brandeg. var. *texana* Roll. Herbaceous annual; stems several from base, 2-4 dm. long, glabrous, semierect to decumbent, highly branched, slightly angled with a narrow wing; leaves pinnatifid to simply pinnate, nonauriculate, the rachis minutely puberulent; leaflets usually petiolulate, dentate to shallowly lobed; infructescences with a gyrate rachis; petals greenish, strap-shaped, less than 1 mm. wide; pedicels straight, divaricate, minutely puberulent to glabrous, 5-8 mm. long; siliques straight, 2.5-4 cm. long, 1.5-2 mm. wide; styles 1-2 mm. long. Damp shady places in the mts., Big Bend region, Apr.-July; Tex. to Coah.

4. *Cardamine hirsuta* L. HAIRY BITTER-CRESS. Annual; stems erect to slightly decumbent, several to numerous from the base, simple or sparsely branched above, 1-2.5 (-3) dm. tall; leaves pinnately lobed, basal and lower cauline with entire to shallowly dentate suborbicular lobes and simple spreading trichomes on the petioles and leaf bases, upper cauline reduced and usually glabrous with oblong lobes; flowers small; petals white, spatulate, to 3 mm. long; siliques erect, straight, 15-25 mm. long, about 1 mm. wide, the valves elastic; styles 0.5 mm. long or less; seeds broadly oblong; cotyledons accumbent. Roadsides, open fields and other weedy situations, usually in damp or wet soil, rare in e. Tex. where recently found in Cass Co., spring; introd. from Eur. and found mostly in the s.e. U. S.

15. RORIPPA SCOP. YELLOW-CRESS

Annual to perennial herbs, mostly glabrous or sparingly pubescent; stems usually branched; leaves simple to pinnate or compound; flowers in terminal or axillary racemes; sepals spreading in anthesis; petals yellow or white, small or absent; siliques terete, narrowly cylindrical to globose, sessile; valves nerveless; seeds usually numerous, plump, small, marginless; cotyledons accumbent.

About 70 species in temperate and subtropical areas of the world.

- 1. Petals conspicuous, white; leaves pinnately compound .1. *R. Nasturtium-aquaticum*.
- 1. Petals yellow if present, minute or absent; leaves entire to pinnatifid but not compound (2)
- 2(1). Petals exceeding sepals, broadly oblong to obovate; plants perennial with underground rhizomes6. *R. sinuata*.
- 2. Petals shorter than sepals or absent, narrowly oblanceolate when present; plants with a taproot (3)
- 3(2). Siliques sessile or pedicels less than 2 mm. long; petals absent2. *R. sessiliflora*.
- 3. Siliques pedicellate; pedicels more than 3 mm. long; petals present (4)
- 4(3). Siliques short and thick, broadly oblong, obtuse; trichomes simple and pointed if present3. *R. islandica*.
- 4. Siliques elongated, terete; vesicular bulbous trichomes present on stems, foliage or siliques (5)
- 5(4). Leaf segments deeply dentate; lower leaves pinnatifid; cauline leaves petiolate4. *R. teres*.
- 5. Leaf segments entire; lower leaves merely lobed; cauline leaves sessile5. *R. ramosa*.

1. *Rorippa Nasturtium-aquaticum* (L.) Hayek. WATER-CRESS. Aquatic to semi-aquatic perennial, glabrous; stems floating, creeping or ascending, rooting at the nodes; leaflets ovate to oval, terminal larger than the lateral, somewhat fleshy; petals 3-4 mm. long; fruiting pedicels divaricate, 8-12 mm. long; fruit 1-2 cm. long, spreading or curved upward; style about 1 mm. long; seeds about 1 mm. long, plump, nearly orbicular.

Running streams and stream margins, cold springs, Mar.-May; widely dispersed as an introd. from Eur.

2. *Rorippa sessiliflora* (Nutt.) Hitchc. Annual or biennial with a taproot; stems erect, branched, 2-5 dm. tall, glabrous; leaves petiolate, oblanceolate, dentate; flowers in terminal and lateral racemes, small; sepals yellowish; petals absent or very rarely a petal may be seen in one or two flowers of a plant; pedicels less than 1 mm. long; siliques sessile or nearly so, terete to slightly compressed parallel to septum, oblong, 6-10 mm. long; styles less than 1 mm. long; seeds numerous, cordiform, plump, 0.4-0.6 mm. long. Wet land, river floodplains and along sluggish stream margins or around ponds, n. and e. Tex., Apr.-July; Tex. and La. to Va., Ind. and Minn.

3. *Rorippa islandica* (Oeder) Borbás. BOG MARSH-CRESS. Stems 3-8 dm. tall, branched above, glabrous to hirsute with simple pointed trichomes; lower leaves lobed only, dentate to almost entire, petiolate; upper leaves somewhat lobed to dentate, almost sessile; petals yellow, about 2 mm. long; pedicels slender, spreading; fruit 5-7 mm. long, linear to linear-oblong; seeds plump, cordiform, 0.5-0.8 mm. long. *R. palustris* and *R. obtusa* of Tex. auth. Along stream banks and margins of lakes or ponds, n.e. Tex., s.e. to Brazoria Co., Mar.-May; Tex. and La. to Greenl. and Eur. Several vars., but southwestern U.S. material appears to be var. *islandica*.

4. *Rorippa teres* (Michx.) Stuckey. Annual or biennial; stems 1-3 dm. long, erect to decumbent, branched; sparsely pubescent with vesicular trichomes, rarely glabrous; leaves oblong to oblanceolate, deeply pinnatifid and with the remote segments obtusely toothed, petiolate; racemes terminal and axillary, densely flowered; petals minute, about 1 mm. long, yellow; pedicels spreading, 2-5 mm. long; siliques linear-oblong, 1-1.5 cm. long, straight or slightly curved; styles evident, about 1 mm. long; seeds numerous, plump, slightly longer than broad, about 0.5 mm. long. *R. Walteri* (Ell.) Mohr. Wet fields, lakes, ponds and stream margins and swamp land, e. and s.w. Tex., Dec.-May; S.C. and Fla. to Okla. and C.A.

5. *Rorippa ramosa* Roll. Perennial; stems numerous, decumbent, highly branched, sparsely pubescent with vesicular trichomes, 3-6 dm. long; leaves numerous, sessile, auriculate, oblong to broadly lanceolate, pinnately lobed, 3-5 cm. long, 5-12 mm. wide; inflorescences short, mostly less than 5 cm. long; petals pale-yellow, 2.5-3 mm. long; pedicels widely spreading to ascending, 3-5 mm. long; siliques divaricately spreading to erect, oblong to lanceolate in outline, plump, 6-10 mm. long; valves densely covered with vesicular trichomes along their margins; styles 1.5-2.5 mm. long; seeds plump, cordiform, about 1.5 mm. in diameter. Flood-plains and intermittent stream beds, Big Bend region near the Rio Grande, Mar.-May; also Coah. to Dgo.

6. *Rorippa sinuata* (Nutt.) Hitchc. Perennial with creeping rhizomes; stems 2-4 dm. tall, glabrous, highly branched, erect to decumbent; leaves oblong to oblanceolate, deeply pinnatifid, the segments entire or nearly so; petals obovate, not differentiated into blade and claw, exceeding sepals; pedicels slender, 6-10 mm. long, spreading; siliques curved upward, 8-14 mm. long, about 2 mm. wide; seeds angular, plump, 0.7-0.8 mm. long. Loose soils, fields, roadsides and waste places as well as natural habitats, n. and w. Tex., Apr.-July; Ill. and cen. Can. to Wash., Nev. and N.M.

16. ERYSIMUM L.

WALL-FLOWER

Plants annual, biennial or perennial, rather coarse, with appressed branched trichomes; leaves simple, narrow, entire to dentate; flowers in racemes, mostly showy in native species; sepals erect, outer pair saccate at base; petals mostly large, clawed, yellow to orange or maroon; fruit linear, more or less 4-angled, elongated, erect to widely spreading; styles short, stigma 2-lobed; seeds numerous, uniseriate, wingless or with an abbreviated wing in distal end.

About 100 species in North America, the Mediterranean region, Europe and Asia.

1. Petals erect, greenish-yellow, 5-8 mm. long; pedicels 2-4 mm. long; persistent stigma smaller than style diameter; annual 1. *E. repandum*.
1. Petals unguiculate, yellow to orange, 15-30 mm. long; pedicels 5-10 mm. long; persistent stigma much larger than style diameter; biennial or perennial (2)

- 2(1). Siliques widely spreading; petals yellow; pedicels equaling diameter of mature siliques; branches widely spreading; plants mostly less than 3 dm. tall 2. *E. asperum*.
- 2. Siliques erect; petals yellow to orange or orange-red; pedicels more slender than mature silique diameter; branches ascending; plants mostly over 3 dm. tall 3. *E. capitatum*.

1. *Erysimum repandum* L. Annual, sparsely to densely pubescent with appressed bifurcate trichomes; single stem widely branched (especially above), 1-4 dm. tall; leaves linear to linear-oblongate, mostly repand-dentate, sometimes entire, lower short-petioled, upper cuneate at base; petals greenish-yellow, erect, 5-8 mm. long; pedicels spreading at right angles to rachis, not expanded below receptacle, 2-4 mm. long, about the same diameter as silique; siliques widely divergent, nearly terete, somewhat moniliform at maturity, 4-7 cm. long, about 1 mm. in diameter; seeds oblong, compressed, 1.1-1.4 mm. long; cotyledons incumbent. Weed of fields, roadsides and waste places, mainly n. and w. Tex., Mar.-May; widely scattered in U.S. and s. Can.; adv. from Euras.

2. *Erysimum asperum* (Nutt.) DC. Biennial or perennial, strigose from the presence of a dense covering of appressed bifurcate trichomes; stems usually single from the base, erect, 15-35 cm. tall, widely branched above; leaves numerous, crowded, linear to lanceolate, cuneate at base, remotely dentate to entire; flowers showy in dense racemes; petals yellow, strongly unguiculate, 15-25 mm. long; pedicels diverging at right angles to rachis, scarcely enlarged toward summit, 7-12 mm. long; siliques widely spreading, tetragonal, 8-12 cm. long, densely pubescent on four sides, keels evident as longitudinal lines with a less dense covering of trichomes; seeds plump, oblong, often angular, with a short distal wing, 1.7-2 mm. long; cotyledons incumbent. Grassland prairies, plains, low hills and bluffs in Panhandle, Apr.-June; grassland prairie region Tex. and Okla. to s. Can.

3. *Erysimum capitatum* (Dougl.) Greene. Coarse biennial or perennial herbs, densely pubescent with appressed bifurcate or trifurcate trichomes; stems erect, usually single from the base, branched above, 4-10 dm. tall; leaves numerous, linear-lanceolate, remotely dentate to entire, lower ones petiolate, gradually becoming cuneate upward on stem; inflorescences dense, elongating in fruit; petals strongly unguiculate, 15-25 mm. long, yellow to orange-red; pedicels widely spreading to divaricately ascending, 6-9 mm. long; siliques erect or less frequently divaricately ascending, 5-8 cm. long; styles 1-2 mm. long; persistent stigma large and deeply 2-lobed; seeds oblong, plump, 1.5-2 mm. long, wingless or with a short distal wing, *E. arkansanum* Nutt. Open rocky outcrops, road-cuts, banks, dry streambeds and open wooded hill or mt. slopes, n. and w. Tex., Apr.-July; O. to Ark., w. to Wash. and southw. in Mex.

17. MATTHIOLA R. BR.

Annual to perennial herbs with a dense grayish indument of branched trichomes; sepals erect, inner pair saccate at base; petals long-clawed, purple, white or yellowish; stigma strongly bilobed; siliques linear, terete to compressed; seeds mostly winged, 1 row in each loculus.

About 55 species in Europe and North Africa, extending eastward to Asia.

- 1. Siliques terminating in 2 distinct horns, terete; stems slender and diffuse 1. *M. bicornis*.
- 1. Siliques not horned at apex, compressed; stems rigid, stout and erect 2. *M. incana*.

1. *Matthiola bicornis* (Sibth. & Sm.) DC. EVENING STOCK. Plants much-branched, annual or biennial; leaves lanceolate or narrower, entire to somewhat dentate, acute, 4-8 cm. long; flowers sessile, clustered near ends of stems and branches, broadly opening at evening and closed by day, lilac or purple, fragrant; petals 1.5-2 cm. long; siliques 7-10 cm. long, spreading, forked at apex into two conspicuous horns. *M. longipetala* subsp. *bicornis* (Sibth. & Sm.) P. W. Ball. Occasionally escaped from cult., spring-summer.

2. *Matthiola incana* R. Br. **STOCK**. Biennial or perennial, 2-6 dm. tall, stiff, somewhat woody at base; leaves narrowly oblong to oblanceolate, 6-14 cm. long, obtuse, entire; flowers in terminal racemes, single or double-flowered; petals 2-3 cm. long, purple, pink or white; siliques 3-7 cm. long, erect, thick, terminated by the 2-lobed stigma, without conspicuous horns. Rarely escaped from cult., spring-summer.

18. CONRINGIA ADANS.

Seven species in the Mediterranean region and Europe to central Asia.

1. *Conringia orientalis* (L.) Dum. **TREACLE MUSTARD, HARE'S EAR**. Glaucous annual; stems erect, simple or branched above, leafy, 2-6 dm. tall; basal rosette of leaves wanting; cauline leaves oval to elliptical, entire or nearly so, cordate-clasping, 3-9 cm. long, 2-3.5 cm. broad; sepals saccate, erect; petals erect, yellowish, narrow, not differentiated into blade and claw; pedicels stout, widely spreading to divaricately ascending, scarcely expanded below receptacle; siliques linear, quadrangular in cross section, erect to slightly divergent, 8-11 cm. long; styles 1-2 mm. long; seeds oblong, wingless, plump, in 1 row in each loculus, 1.8-2.2 mm. long; cotyledons incumbent. Grainfields, cult. land, roadsides and open disturbed areas, Mar.-May; widely distributed as an introd. weed, nat. to cen. and e. Eur.

19. DIPLLOTAXIS DC.

About 25 species in the Mediterranean region and Europe.

1. *Diplotaxis muralis* (L.) DC. **STINKING WALL ROCKET, SAND ROCKET**. Annual or biennial herbs; stems usually several from the base, 2-4 dm. tall, branched, sparsely hispid below to glabrous; leaves mostly basal, sinuate, dentate to pinnatifid or lyrate lobed, rarely spatulate and nearly entire; cauline leaves few or none, cuneate at base when present; flowers few in elongated racemes; petals 5-7 mm. long, sulphur-yellow to lavender; pedicels slender, divaricately ascending, 1.5-2 cm. long; siliques remote, erect to slightly spreading, terete to slightly flattened, with prominent median vein, sessile, 2-3.5 cm. long; styles 1-2 mm. long; seeds oblong, about 1 mm. long, in 2 rows in each loculus; cotyledons conduplicate. Fields, roadsides and abandoned land, June-Aug.; widely scattered weed in U.S. and Can.; naturalized from Eur.

20. ERUCASTRUM PRESL

About 15 to 18 species in the Mediterranean region and central Europe.

1. *Erucastrum gallicum* (Willd.) Schulz. **ROCKET WEED, DOG MUSTARD**. Erect branching annual or biennial herb; stems pubescent with stiff retrorse simple trichomes, 2-8 dm. tall; leaves rough, oblong to obovate in outline, pinnatifid to nearly bipinnatifid, with deep rounded sinuses, reduced in size upwards; flowers in racemes; bracts of lower flowers pinnatifid; petals pale-yellow, 7-8 mm. long; siliques 4-angled, 2-4 cm. long, 1-2 mm. wide, ascending, slender, elongate, tapering to a conic beak, the valves keeled, more or less torulose; style about 4 mm. long; seeds oval-oblong, reddish-orange, about 1 mm. long, in 1 row. Weed of roadsides and open waste places, local in n. and n.e. Tex., Apr.-Sept.; widely distributed in U.S. and s. Can.; introd. from Eur.

21. BRASSICA L. MUSTARD

Coarse annual to perennial herbs; leaves sessile or petioled, the lower mostly lyrate-pinnatifid; sepals ascending or spreading; petals yellow to cream, long-clawed; siliques linear, often torulose, with an indehiscent and one-seeded or seedless beak; seeds globose, dark or yellowish.

About 25 species in Europe and Asia. Cultivars of cabbage, cauliflower, broccoli, brussels sprouts, etc. (*B. oleracea* L.) sometimes escape from cultivation. Other species, namely *B. nigra* (L.) Koch (black mustard), *B. hirta* Moench (white mustard) and *B. Rapa* L. (bird's rape) may occur as ruderals.

1. Upper cauline leaves auriculate, sagittate 1. *B. campestris*.
 1. Upper cauline leaves cuneate at base or petioled (2)
 2(1). Plants glabrous; sepals erect 2. *B. juncea*.
 2. Plant hirsute with spreading trichomes at least below; sepals spreading at anthesis ..
 3. *B. kaber*.

1. *Brassica campestris* L. BIRD RAPE, TURNIP RAPE. Annual or biennial; stems erect, 3-10 dm. tall, glabrous and glaucous or very slightly pubescent below; basal leaves lyrate-pinnatifid; upper leaves lanceolate to oblong, entire to shallowly dentate, auriculate and clasping the stem; petals yellow, 6-10 mm. long; pedicels divaricately ascending, 1-3 cm. long; siliques 4-7 cm. long, about 3 mm. thick, the beak 1-2 cm. long; seeds spheroidal or slightly compressed laterally, reddish-gray, 1.5-2 mm. in diameter; cotyledons conduplicate. Fields, waste land and roadsides, sporadic, Apr.-June; widely scattered in N.A.; introd. from Euras.

2. *Brassica juncea* (L.) Coss. INDIA MUSTARD, LEAF MUSTARD. Annual, 3-12 dm. tall, glabrate and somewhat glaucous, branched above; lower leaves 1-1.5 dm. long, lyrate-pinnatifid, long-petioled, with a large terminal lobe; upper leaves reduced, lanceolate to linear, mostly entire; petals yellow, 8-12 mm. long; siliques erect, 3-6 cm. long, the beak 4-8 mm. long; seeds spheroidal, brownish-red; cotyledons conduplicate. Weed of old fields, roadsides and waste places, Apr.-June; sporadic but common, temp. N.A.; naturalized from Euras.

3. *Brassica kaber* (DC.) Wheeler. CHARLOCK. Annual, 3-8 dm. tall, usually with a fleshy taproot; stems branched above, more or less hirsute; basal leaves lyrate-pinnatifid, with a rounded toothed terminal lobe; middle and upper leaves oblong to lanceolate, entire to dentate, sessile or nearly so; petals yellow, 6-8 mm. long; siliques 3-4 cm. long, cylindrical, the 1- or 2-seeded beak 1-1.5 cm. long; seeds spheroidal, red or black; cotyledons conduplicate. Common weed of cult. and waste land, Mar.-May; widely distributed in N.A.; naturalized from Euras.

22. ERUCA MILL.

Six species in Mediterranean Europe and northeast Africa.

1. *Eruca sativa* Mill. ROCKET SALAD, GARDEN ROCKET. Annual herb, 3-6 dm. high; stems erect, branching, hirsute below with simple spreading or retrorse trichomes, often glabrous above; lower leaves pinnatifid or lobed, the upper merely dentate; flowers in racemes; sepals erect; petals 1.5-2 cm. long, white to yellowish with brown or violet veins; pedicels stout, erect, 3-5 mm. long; siliques 15-25 mm. long, erect and appressed to the stem, thick, linear to linear-oblong, turgid, with a long sword-shaped beak; seeds in 2 rows, nearly globose, wingless. Weed of roadsides and waste places, mostly w. Tex., flowers any month; abundant in Mex., introd. from the Medit. region of Eur.

23. RAPHANUS L.

Eight species from Europe, Mediterranean area and Asia.

1. *Raphanus sativus* L. RADISH, RÁBANO. Erect annual or biennial, much-branched above, 3-6 dm. tall, from a fleshy taproot; leaves pinnatifid, the basal long-petioled, glabrous to hirsute; flowers in racemes; sepals erect, the lateral slightly saccate; petals white to purplish, not with dark veins, 15-20 mm. long, obcordate, long-clawed; body of indehiscent silique 2-4 cm. long, the beak 1-2 cm. long; style long, slender. Old fields, waste places and roadsides, spring-summer; probably both escaped from cult. and introd. from Eur. in weed form.

24. CAKILE MILL. SEA ROCKET

Annual herbs, fleshy, glabrous, caulescent, chiefly maritime; leaves alternate, entire or pinnatifid; flowers racemose, perfect; sepals erect, gibbous at the base; corolla cream to

white or light-lavender; ovary sessile, the style wanting and the stigma entire; fruit indehiscent, 2-jointed, the joints 1-chambered with each usually 1-seeded; seeds wingless; cotyledons accumbent, oblique or incumbent.

About 15 species bordering oceans and large lakes in temperate North America, Eurasia and Australia.

1. Upper joint of pod less than 1 cm. long, delicately 4-ridged; pedicels more slender than rachis; infructescence not geniculate 1. *C. fusiformis*.
1. Upper joint of the pod over 1 cm. long or more, coarsely 8-ridged; pedicels nearly same diameter as rachis; infructescence geniculate . . 2. *C. geniculata*.

1. *Cakile fusiformis* Greene. Stems erect or spreading, 3-7 dm. long, fleshy; leaves 5-15 cm. long, ovate in outline, lacinate-pinnatifid, obtuse, the segments linear; racemes greatly elongating, reaching 2-4 dm. long, rachis not geniculate; pedicels more slender than rachis, 3-5 mm. long; fruit slender, 15-25 mm. long, the lower joint turbinate, nearly terete, usually 1-seeded, the upper joint subulate or lance-linear (longer than the lower). Sandy areas near the ocean, mainland and off-shore islands, flowers any month; Fla. to Tex.

2. *Cakile geniculata* (Robins.) Millsp. Stout glabrous herbs; stem branching and more or less spreading, 1-4 dm. long; leaves 3-7 cm. long, oblanceolate to linear-oblanceolate, entire or with a few coarse rounded teeth; raceme 1-2 dm. long, strongly geniculate at maturity; pedicels very stout, 3-5 mm. long, spreading or ascending; fruit nearly terete, 2-3 cm. long, the lower joint with a prominent border at the summit, the upper joint lanceolate or oblong-lanceolate and usually curved, usually 1-seeded but occasionally 2-seeded (twice as long as the lower joint). Beaches and sandy places near ocean, mainland and offshore islands, flowers any month; n.w. Fla. to Tex.

25. SELENIA NUTT.

Low glabrous annuals with pinnately dissected leaves, caulescent or acaulescent; flowers odoriferous, in loose leafy-bracted racemes or on peduncles arising from the axils of a rosette of leaves; sepals spreading or erect, thickened with a low crest to markedly appendaged on exterior surface just below apex; petals obovate to spatulate, yellow; siliques subsessile to stipitate, flattened parallel to septum to inflated, broadly oblong to depressed globose; seeds biseriate in the silique, flattened, strongly margined or winged; cotyledons accumbent.

Five species, all from southwestern United States and adjacent Mexico.

1. Silique valves with vesicles present; siliques sessile; sepals persistent to fruit maturity 1. *S. grandis*.
1. Silique valves glabrous; siliques with at least a short stipe; sepals shed shortly after anthesis (persisting somewhat in *S. dissecta*) (2)
- 2(1). Leaves pinnate, mostly cauline and reduced; inflorescences terminal on well-developed stems 4. *S. aurea*.
2. Leaves bipinnate, mostly basal and well-developed; at least the earliest flowers borne on peduncles originating among basal leaves (3)
- 3(2). Siliques margined, tapered above and below, flattened parallel to septum; pedicels over 3 cm. long 2. *S. dissecta*.
3. Siliques not margined, rounded above and below, inflated and depressed subglobose; pedicels less than 3 cm. long 3. *S. Jonesii*.

1. *Selenia grandis* Martin. Winter annual, branched near base with the lateral decumbent branches equaling or exceeding the central erect stem; main stem or branches to 6 dm. long; leaves bipinnate, petiolate, glabrous or with vesicular trichomes along midvein or petiolule, to 2 dm. long; inflorescences very leafy with each pedicel subtended by a leaflike bract; sepals with a prominent hornlike appendage, persisting while fruits mature; petals yellowish, broadly obovate, notched at apex, barely exceeding the sepals; pedicels slender to stout, widely spreading, to 2 dm. long; mature siliques thick and fleshy, broadly oblong, sessile, to 15 mm. long and 1 cm. wide, valve exterior covered with, vesicular

trichomes; seed somewhat flattened, margined. Heavy soils and open flood-plain areas, from Dimmit and La Salle cos. southw. in the lower Rio Grande Valley, Feb.-Mar.; endemic.

2. *Selenia dissecta* T. & G. Mostly acaulescent, occasionally developing flowering stems, winter annual, often with a well-developed root; leaves bipinnate with acute lobes, glaucous, petiolate, to 1 dm. long; flowers mostly pedunculate as if on stems, then in an indefinite raceme; sepals widely spreading at anthesis, with a definite hornlike appendage; petals yellow, obovate to spatulate, exceeding the sepals; pedicels erect to spreading, to 8 cm. long; siliques at first inflated, becoming thick and fleshy at maturity, flattened parallel to septum, stipitate, to 3 cm. long, 1 cm. wide; style flaring broadly at base, to 5 mm. long; seeds margined, flattened. Low places and playa lake-margins, Big Bend region e. to Ector Co., Feb.-June; also N.M. and n.e. Mex.

3. *Selenia Jonesii* Cory. Winter annual, branching at crown; branches decumbent, to 3 dm. long; leaves bipinnate with small obtuse ultimate lobes, petiolate, to 1 dm. long; flowers both pedunculate and on stems in leafy-bracted racemes; sepals tawny, oblong, with a short pouchlike appendage to merely a thickened area below sepal apex; petals yellow, spatulate; pedicels widely spreading, to 3 cm. long; siliques inflated, subglobose, short-stipitate, rounded above and below, to 12 mm. in diameter; styles 2-3 mm. long; seeds widely winged; cotyledons accumbent. Moist swales and buffalo wallows on high prairies and plateaus of w.-cen. Tex., Mar.-Apr.; endemic.

4. *Selenia aurea* Nutt. Glabrous annual; stems erect or nearly so, single or several arising from the base, to 2 dm. tall; leaves pinnate, mostly cauline, petiolate, to 6 cm. long, the lobes entire or dentate; inflorescences terminal, congested; sepals without appendages; petals yellow, spatulate; pedicels divaricately ascending, slender, to 25 mm. long; siliques broadly oblong, stipitate, acute above and below, flattened parallel to septum, nonfleshy, to 25 mm. long, 5-10 mm. wide; styles flaring at base, 6-10 mm. long; seeds widely margined. Open glades and barrens, probably n.e. Tex., Apr.-May; Kan. and Mo. to extreme s.e. Okla.

26. LEAVENWORTHIA TORR.

Seven species in central and southern United States.

1. *Leavenworthia aurea* Torr. Winter annual; leaves rosette-forming, the early ones with only an orbicular entire and remote terminal blade portion, later leaves with few to several lateral lobes; early and mid-season flowers on scapes 3-9 cm. long, later flowers usually borne in a raceme on lateral decumbent branches; sepals 4-5 mm. long; petals narrowly lingulate, lemon-yellow to orange-yellow, shallowly emarginate, 7-10 mm. long; siliques strongly flattened parallel to septum, thickish, erect, 1.5-3 cm. long, 4-5.5 mm. wide; styles 2-3.5 mm. long; gynophore nearly 1 mm. long; seeds nearly orbicular, 3.5-4.5 mm. in diameter, strongly flattened, narrowly winged; radicle of embryo straight. Limestone cedar glades and fossil outcrops, local near San Augustine, Mar.-May; also s.e. Okla.

27. DRABA L. WHITLOW-CRASS

Annual, biennial or perennial herbs; stems leafy or scapose, usually pubescent with simple or branched trichomes; leaves entire or dentate; racemes short to elongate; petals white or yellow; silicles elliptic to linear, latiseptate, flat or sometimes twisted; seeds numerous, biseriate to irregularly seriate; cotyledons accumbent.

About 250 species in temperate and cold parts of North America, South America, Europe and Asia.

- 1. Perennial; petals 4-6 mm. long; silicles sometimes twisted 1. *D. Standleyi*.
- 1. Annuals or winter annuals; petals less than 5 mm. long or absent; silicles not twisted (2)

base, to 3 dm. high, usually foliose nearly to the inflorescences; basal leaves rosulate, obovate-cuneate, toothed in the distal half, shortly petiolate or sessile; cauline leaves oblong-ovate, sessile (sometimes nearly amplexicaul); infructescences elongated; sepals about 2 mm. long, elliptic to linear; petals white, 3-3.5 mm. long, shortly clawed and the blade obovate and emarginate or very much reduced or none; pedicels 2-7 mm. long, usually spreading, pubescent with simple trichomes; silicles 4-8 mm. long, obovate to elliptic, rounded at the tip and narrowed toward the base, hirsute with short simple trichomes; seeds 0.7-0.8 mm. long, elliptic to oblong, biseriata to several-rowed. *D. cuneifolia* var. *platycarpa* (T. & G.) Wats. Sandy and gravelly soils in cen. Tex., also Jeff Davis Co., early spring; Ark., Ariz., Ida. and Wash.

5. *Draba cuneifolia* T. & G. var. *cuneifolia*. Annual, hirsute with stipitate branched or a mixture of branched and simple trichomes; stems to 3 dm. tall, erect, usually branched from the base; basal leaves to 5 cm. long, usually obovate-cuneate, entire or more or less dentate (especially in the distal half), tapering into a short petiole or sessile; cauline leaves few, on the lower half of the stems, to about 35 mm. long, sessile (sometimes more or less amplexicaul), more or less obovate, entire or remotely dentate; infructescences rather dense and often congested; sepals 1-2.5 mm. long, oblong-ovate to linear; petals white, usually 3.5-5 mm. long, spatulate and emarginate, less often 1-2 mm. long and linear or absent; pedicels 2-7 mm. long, usually spreading; silicles 5-15 mm. long, elliptic to oblong, hispid with simple trichomes or glabrous; styles nearly obsolete; seeds about 0.7 mm. long, biseriata to several-rowed. Incl. var. *Helleri* (Small) Schulz and var. *leiocarpa* Schulz (applied to the form with glabrous silicles), *D. ammophila* Heller. In sandy and gravelly soils throughout Tex., except in the n. Panhandle and s. Rio Grande Plains, early spring; also in s. and cen. U.S.; n. Mex.

Var. *integrifolia* Wats. Differs from the typical variety in that the pubescence (including that of the silicles, these however, sometimes glabrous) is of branched trichomes only; in addition, the styles are usually developed (to 1 mm. long). Incl. var. *sonorae* (Greene) Parish (applied to those plants having pubescent silicles). In sandy soils and/or moist places in s. Tex. (Webb Co. to Starr Co.), early spring; also in s.w. Ut., w. Ariz., s. Calif. and n. Mex.

28. CAPSELLA MEDIC.

About 5 species native to Eurasia.

1. *Capsella Bursa-Pastoris* (L.) Medic. SHEPHERD'S PURSE, PANIQUESILLO. Stem 1-5 dm. tall, branching, pubescent below, glabrous above; basal leaves in a rosette, usually lyrate-pinnatifid; stem leaves auricled, dentate to entire; flowers in long racemes; petals white, 1.5-2 mm. long; pedicels slender, spreading at right angles or nearly so, 8-15 mm. long; siliques obcordate-triangular, 5-8 mm. long, strongly flattened contrary to the partition; styles less than 0.5 mm. long; seeds numerous, oblong, orange-yellow, wingless, about 1 mm. long; cotyledons incumbent. Waste land and street margins in cities and towns, roadsides and fields, Feb.-May; widespread weed occurring in most parts of the world; introd.

29. LEPIDIUM L. PEPPERWORT. PEPPERGRASS

Herbaceous annuals, biennials or perennials, glabrous to hispid; leaves entire to finely divided, sometimes amplexicaul; flowers small; petals 2-3 mm. long or rudimentary, white, pale-yellow or greenish, or absent; stamens 2, 4 or 6; silicles orbicular, elliptic or obovate, much-compressed and angustiseptate, often winged distally, the wings forming an apical notch; seeds one per loculus; cotyledons usually incumbent, rarely accumbent or oblique.

About 125 species throughout the world in temperate and warm regions.

1. Perennial, woody at the base (2)

1. Annual or biennial, not woody at the base (3)

2(1). Stems glabrous; inflorescences papillose 1. *L. montanum* var.

angustifolium.

2. Stems and inflorescences papillose 1. *L. montanum* var.

alyssoides.

- 3(1). Plants granular-puberulent with pustular or clavate trichomes; pedicels less than 3 mm. long2. *L. sordidum*.
- 3. Plants subglabrous to hispid or hirsute but not granular-puberulent (4)
- 4(3). Plants densely hispid to hirsute (5)
- 4. Plants subglabrous, papillose or pubescent, not hispid or hirsute (8)
- 5(4). Upper cauline leaves laciniate to pinnatifid; sepals usually persistent3. *L. oblongum*.
- 5. Upper cauline leaves only dentate to entire; sepals soon deciduous (6)
- 6(5). Pedicels terete or slightly flattened; silicles 2.5-3.5 mm. long, sparsely pubescent with the trichomes appressed4. *L. austrinum*.
- 6. Pedicels markedly flattened; silicles 3-4.5 mm. long, the trichomes not appressed or subglabrous except for marginal hairs (7)
- 7(6). Fruit densely hispid, usually broadly elliptic or obovate5. *L. lasiocarpum* var. *Wrightii*.
- 7. Fruit nearly glabrous, usually orbicular5. *L. lasiocarpum* var. *rotundum*.
- 8(4). Upper cauline leaves laciniate to pinnatifid; sepals usually persistent3. *L. oblongum*.
- 8. Upper cauline leaves dentate to entire; sepals soon deciduous (9)
- 9(8). Basal leaves usually bipinnatifid; petals none; plants fetid6. *L. ruderale*.
- 9. Basal leaves pinnatifid to serrate; rudimentary petals at least present; plants not fetid (10)
- 10(9). Silicles usually obovate, rarely suborbicular; pedicels shorter or about as long as the fruit; petals usually rudimentary or none7. *L. densiflorum*.
- 10. Silicles usually orbicular or elliptic; pedicels usually slightly longer than the fruit; petals usually at least twice as long as the sepals (11)
- 11(10). Cotyledons accumbent; inflorescences at least sparsely pubescent8. *L. virginicum* var. *virginicum*.
- 11. Cotyledons oblique to incumbent; inflorescences usually glabrous8. *L. virginicum* var. *medium*.

1. *Lepidium montanum* Nutt. var. *angustifolium* C. L. Hitchc. Biennial or perennial, woody at the base, glabrous (except on the flowering axes and pedicels); stems one to several, erect or sometimes decumbent, simple or much-branched, to 7 dm. high; basal leaves petiolate, to 15 cm. long, divided to bipinnatifid; cauline leaves exceptionally to 15 cm. long, usually less than 10 cm., 1-5 mm. wide, sessile, more or less linear and usually entire, rarely pinnately divided; sepals broadly elliptic, the outer ones slightly saccate, glabrous or slightly papillose; petals with blades more or less orbicular to broadly obovate, tapering to a narrow claw, white or cream; infructescences usually rather loose; pedicels to 1 cm. long, horizontally spreading, straight or slightly curved; silicles 2.5-5 mm. long, 2-3 mm. broad, sessile, elliptic to ovate, glabrous, narrowly winged distally, the notch shallow; style to 0.7 mm. long; seeds 1.5-2.5 mm. long, 0.9-1.3 mm. wide, elliptic to narrowly ovate, sometimes winged at the chalazal end; cotyledons incumbent. On sandy, saline or calcareous soils in s.w. Tex., Mar.-Aug.; also in s.e. N.M.

Var. *alyssoides* (Gray) M. E. Jones. Differs from var. *angustifolium* in that the entire plant is papillose. On sandy, saline or calcareous soils in s.w. and extreme n.w. Tex., Mar.-June; also in N.M., Colo. and e. Ariz.

2. *Lepidium sordidum* Gray. Annual or biennial, granular with conspicuous white pustular or shortly clavate trichomes; stems decumbent to erect, sometimes somewhat flattened, branched from near the base, to 2 dm. tall; basal leaves to about 8 cm. long,

petiolate, bipinnatifid to pinnatifid, the segments often toothed; cauline leaves to 3 cm. long, pinnatifid with the segments often toothed, the uppermost linear-lanceolate and entire or remotely toothed; sepals ovate with rather conspicuous white margins; petals rudimentary, linear and much shorter than the sepals; infructescences very dense and elongated; pedicels to 3 mm. long, suberect to spreading, straight or slightly curved, flattened on the adaxial side and sometimes narrowly winged; silicles 1.5-3 mm. long, 1-2.5 mm. wide, elliptic or sometimes ovate, flattened, glabrous, narrowly winged at the apex, the wings forming a shallow notch, the style about as long as the notch; seeds 0.8-1.2 mm. long, ovoid but slightly flattened; cotyledons incumbent. In dry grassy places in Trans-Pecos Tex., May-July; also n. Mex.

3. *Lepidium oblongum* Small. Annual or biennial, pubescent with weak spreading trichomes or hispid; stems prostrate to ascending, usually much-branched from near the base, to about 2 dm. long; basal leaves to 5 cm. long, bipinnatifid to pinnatifid, the segments usually dentate, often pubescent only on the vein; sepals ovate to deltate, often magenta with white margins, often persistent until the fruit is nearly fully developed; petals very much reduced and linear, or absent; stamens 2; infructescences dense and elongated; pedicels to 5 mm. long, ascending to spreading or recurved, straight or slightly curved, terete or slightly flattened and narrowly winged, usually pubescent on the adaxial side; silicles 2.5-3.5 mm. long, 2-3 mm. wide, usually elliptic to obovate or nearly orbicular, compressed, glabrous or minutely ciliate on the margins, narrowly winged at the distal end, the wings forming a small V-shaped notch; style obsolete or nearly so; seeds about 1.5 mm. long, 0.7-0.8 mm. wide, narrowly ovate and compressed; cotyledons incumbent. Roadsides and disturbed soils in n.w., n.-cen. and Trans-Pecos Tex., Feb.-Apr.; also in Ark., Kan., Okla., Ariz., Calif., Mex. and Guat.

4. *Lepidium austrinum* Small. Annual or biennial, the entire plant more or less hispid; stems usually single but branched, erect, often sulcate, to 6 dm. long; basal leaves to 9 cm. long, lyrate-pinnatifid with the segments dentate to serrate, tapering to a slender and often winged petiole; lower and middle cauline leaves to 6 cm. long, more or less lanceolate, rarely entire, usually dentate to serrate or somewhat pinnatisect; upper cauline leaves to about 2 cm. long, linear-lanceolate, remotely dentate to serrate; sepals narrowly elliptic, with white margins; petals narrowly spatulate and about twice as long as the sepals or rudimentary and much shorter than the sepals, white; stamens 2; infructescences densely fruited and elongated; pedicels to 5 mm. long, slender and terete or slightly flattened, often glabrescent on the abaxial side, spreading to slightly recurved; silicles 2.5-3.5 mm. long, 2-2.8 mm. wide, elliptic to ovate, compressed, winged on the distal half, the wings forming a shallow notch, sparsely pubescent with short appressed trichomes, often ciliate on the margins; seeds to about 1.6 mm. long and 1 mm. wide, ovoid but compressed, usually with a narrow wing; cotyledons incumbent. *L. lasiocarpum* var. *tenuipes* auct., non Wats. and var. *orbiculare* (Thell.) C. L. Hitchc. In sandy or loamy soils in n.-cen. to s. Tex., also in the Trans-Pecos, Feb.-May; also n. Mex.

5. *Lepidium lasiocarpum* var. *Wrightii* (Gray) C. L. Hitchc. Annual or biennial, densely hispid or hirsute with short acute trichomes; stems single to several, usually branched from the base, to about 3 dm. long; basal leaves to 5 cm. long, petiolate, pinnately lobed to pinnatifid, rarely only crenate; middle cauline leaves 1.5-3 cm. long, oblanceolate to obovate-oblong, rather coarsely toothed or nearly entire, the uppermost leaves linear-lanceolate and serrate to entire; sepals narrowly ovate, white-margined; petals rudimentary and somewhat linear, or absent; stamens 2; infructescences dense and elongated; pedicels to about 5 mm. long, conspicuously flattened, ascending to spreading, usually pubescent on the adaxial side; silicles 3-4.5 mm. long, 2-2.4 mm. wide, nearly orbicular or broadly elliptic to somewhat obovate, compressed, winged at the apex, the notch rather deep and narrow, hispid with spreading trichomes, the style very short; seeds 1.5-2 mm. long, 1-1.2 mm. wide, ovoid and compressed, narrowly winged; cotyledons incumbent. In sandy and/or disturbed soils in s.w. Tex., especially in the Trans-Pecos, to Rio Grande Plains, Feb.-May; also in s. and cen. N.M., s.e. Ariz. and n. Mex.

Var. *rotundum* C. L. Hitchc. Differs from var. *Wrightii* in that the silicles are usually nearly orbicular and are nearly glabrous except for trichomes on the margins. Sandy soils in the s. Rio Grande Plains, early spring; endemic?

6. *Lepidium ruderae* L. Fetid annual or biennial, glabrous or pubescent with very short simple trichomes; stems usually single, often branched especially near the top, to 3 dm. high; basal leaves petiolate, to 7 cm. long, usually bipinnatifid, rarely only pinnatifid; lower cauline leaves similar but less finely divided; upper cauline leaves to about 2 cm. long and 2 mm. wide, linear to narrowly spatulate, usually entire, rarely lobed or dentate near the base, the margins generally ciliate; sepals narrowly ovate-lanceolate; petals none; stamens 2; infructescences loose and elongated; pedicels to about 1 cm. long, spreading at about 45° to nearly horizontal; silicles 2-3.5 mm. long, 1-2.5 mm. wide, ovate to broadly elliptic, much-flattened, narrowly winged at the apex, the wings forming a broad shallow notch, the style very short and the stigma nearly sessile; seeds 1.2-1.8 mm. long, elliptic to narrowly ovate, compressed; cotyledons incumbent. Waste places and roadsides, disturbed soils in e. and s. Tex., Mar.-July; also in cen. and e. U.S., e. Can.; introd. from Eur.

7. *Lepidium densiflorum* Schrad. Annual or sometimes biennial, usually pubescent with short spreading trichomes, less often merely papillose or nearly glabrous; stem usually single from the base, somewhat erect, terete, usually branched above, to 5 dm. high; basal leaves to about 6 (-10) cm. long, petiolate, oblong to elliptic or lanceolate, deeply serrate-incised, rarely somewhat pinnatifid and then the segments often toothed; middle cauline leaves 2-3 cm. long, shortly petiolate and sometimes nearly amplexicaul, oblong-lanceolate to lanceolate, serrate; upper cauline leaves 1-2 cm. long, sessile, linear-lanceolate, usually remotely toothed, rarely nearly entire; sepals ovate, white-margined; petals rudimentary and more or less filiform, or none; stamens 2, rarely 4; infructescences dense, elongated; pedicels to 5 mm. long, spreading to suberect, terete or slightly flattened; silicles 2.5-3.5 mm. long, 2-3.3 mm. wide, obovate or rarely suborbicular, compressed, glabrous or minutely pubescent, narrowly winged on the distal third, the wings forming a narrow notch; seeds 1-1.3 mm. long, ovoid but compressed; cotyledons incumbent. *L. apetalum* Aschers., non Willd. In sandy and/or disturbed soils in e., cen. and n.w. Tex., Feb.-June; also in the cen. and e. U.S., occasionally in the Rocky Mts., Pac. States and Can.

8. *Lepidium virginicum* L. var. *virginicum*. LENTEJILLA. Annual or biennial, usually pubescent, rarely nearly glabrous; stem usually single from the base but often much-branched, somewhat erect, to 7 dm. high; basal leaves to about 15 cm. long, lyrate-pinnatifid, the segments often toothed; lower cauline leaves much as the basal but less divided; middle cauline leaves to 4 cm. long, shortly petiolate, oblong-lanceolate to lanceolate, usually serrate, rarely more deeply incised; uppermost cauline leaves to 2 cm. long, linear to linear-lanceolate, usually entire or nearly so; sepals white-margined, elliptic, usually caducous; petals usually obovate-spatulate and 2 to 3 times longer than the sepals, rarely somewhat linear and shorter than the sepals; stamens usually 2, rarely 4 or 6; infructescences dense and elongated; pedicels to 1 cm. long, slender and terete, spreading and often nearly horizontal; silicles 2.5-4.2 mm. long, 2.5-3 mm. wide, usually nearly orbicular, less often broadly elliptic or obovate, compressed, narrowly winged on the distal half, the wings forming a broad shallow notch, glabrous, the style very short; seeds to about 2 mm. long and 1 mm. wide, obovoid but much-compressed, narrowly winged; cotyledons accumbent. In sandy and/or disturbed soils in s., s.e. and cen. Tex., Feb.-July; throughout the U.S. except in the far w.

Var. *medium* (Greene) C. L. Hitchc. Differs from var. *virginicum* in that the infructescences are usually glabrous with the pedicels sometimes slightly flattened and the cotyledons are oblique to incumbent. *L. intermedium* Gray, non Rich., *L. medium* Greene. In disturbed soils and waste places throughout Tex., Feb.-July; also in Okla., Ariz., Colo. and the n.w. U.S.

30. CARDARIA DESV.

Two species known, the other, adventitious from Asia, in western and northern United States.

1. *Cardaria Draba* (L.) Desv. WHITE-TOP, HOARY CRESS. Perennial; stems arising from an underground rhizome, usually at least sparsely pubescent, erect, leafy, to about 5 dm. high; basal and lower cauline leaves petiolate, sinuate or lyrate (but usually lost by the

time of flowering); middle and upper cauline leaves sessile, elliptic to lanceolate, usually sinuate-toothed, somewhat amplexicaul and cordate or sagittate at the base; infructescences branched, the racemes corymbose; sepals elliptic; petals about twice as long as the sepals, clawed, white; pedicels to 1 cm. long, spreading; silicles 3.5-4.5 mm. long, the same in width, obcordate to ovate, often unequally inflated by the development of only one seed, indehiscent, often slightly emarginate; style to 1.5 mm. long, slender; seeds ovate to elliptic, much-compressed, not winged. In disturbed and agricultural ground, s.w. and w. Tex., Feb.-Aug.; introd. from Eur. and widely spread as a weed in U.S. and Can.

31. THLASPI L.

Annual or perennial herbs, glabrous and frequently glaucous; stems one to several from base, simple or branched above; leaves dimorphic, the basal petiolate, the cauline sessile and usually auriculate; inflorescence congested, elongating in fruit; siliques orbicular to obovate or broadly oblong, flattened contrary to septum, the valves winged or at least margined; seeds wingless.

About 60 species, mostly in Eurasia. A few species in temperate western North America and in South America.

1. Siliques nearly orbicular, widely winged and deeply notched at apex; styles obsolete; annual 1. *T. arvense*.
1. Siliques obovate, margined but scarcely winged, scarcely notched at apex; styles prominent; perennial 2. *T. Fendleri*.

1. *Thlaspi arvense* L. FANWEED, FRENCHWEED, PENNYCRESS. Annual weed; stems erect, branched above, 3-5 dm. tall; basal leaves petioled, oblanceolate, early-deciduous; cauline leaves sessile, oblong to lanceolate, the upper dentate, auriculate and clasping the stem; petals white, 2-4 mm. long; pedicels slender, divaricately ascending, 1-1.5 cm. long; silique deeply notched at apex, 8-15 mm. across; styles obsolete; seeds ovoid, compressed, 2-2.3 mm. long, with concentric ridges; cotyledons accumbent. Introd. weed, nat. to Euras., Apr.-June; most abundant in n.-cen. and w. U.S. and s.-cen. Can.

2. *Thlaspi Fendleri* Gray. Perennial caespitose herbs, glabrous and glaucous; stems unbranched above the base, 1-3 dm. tall; basal leaves with slender petioles, 2-4 cm. long, the blade 5-15 mm. long; cauline leaves sessile, auriculate and clasping; inflorescence very dense, only slightly elongated in fruit; petals spatulate, white to light-lavender, 5-8 mm. long; pedicels horizontal to slightly descending, 5-8 mm. long; siliques obovate to nearly elliptical, apex obtuse to truncate, 5-7 mm. long; styles 1.5-3 mm. long; seeds wingless, plump, 1 to 3 in each loculus. Mts. of the Trans-Pecos, Apr.-May; N.M. to Wyo., Ariz. and Mex.

32. SYNTHLIPSIS GRAY KEELPOD

Three species in western Texas and northeastern Mexico; a single species reaches Texas.

1. *Synthlipsis Greggii* Gray. Annual or biennial; stems numerous from a slender or thickened caudex, densely pubescent, weak, often decumbent or sprawling, 2-7 dm. long; leaves petiolate, densely pubescent with multiple-branched trichomes, deeply dentate to nearly entire, 2-14 cm. long; sepals narrowly oblong, nonsaccate, densely pubescent, 5-8 mm. long; petals white to lavender, broadly obovate, 9-12 mm. long; infructescence much-elongated, 1-4 dm. long; pedicels widely spreading to slightly descending, 5-15 mm. long, densely pubescent; siliques strongly flattened contrary to septum, margined, elliptical to broadly oblong, densely pubescent, 8-15 mm. long, 5-8 mm. wide; styles slender, glabrous, 2-5 mm. long; seeds slightly longer than broad, plump, 1.5-2 mm. long; cotyledons accumbent. Sandy to gravelly soils or limestone rubble in open areas or among desert shrubs, Rio Grande Plains and Trans-Pecos, Jan.-Nov.; also n.e. Mex.

33. MANCOA WEDD.

Eight species in southern North America and temperate South America.

1. Mancoa pubens (Gray) Roll. Annual or biennial, canescently pubescent throughout with intricately branched trichomes; stems erect, usually branched above, 3-9 dm. tall; basal leaves shortly petioled to sessile, pinnatifid to more deeply lobed, 3-6 cm. long; cauline leaves sessile, overlapping, oblong to oblanceolate, dentate to somewhat lobed, 1-6 cm. long; inflorescence racemose; sepals ovate to broadly oblong, densely pubescent, nonsaccate, erect at anthesis; petals white, narrowly spatulate, 2.5-3.5 mm. long; infructescence greatly elongated, 1-4 dm. long; pedicels spreading at right angles to slightly ascending, rigid, 6-15 mm. long; siliques densely pubescent, oblong to oval, not compressed or only slightly flattened parallel to septum, 5-8 mm. long, 3-4 mm. wide; styles slender, less than 1 mm. long; stigmas minute; seeds oblong, plump, wingless, less than 1 mm. long. Grassy banks and plains, often near springs or creeks, Trans-Pecos, Apr.-June; also n. e. Mex.

34. LESQUERELLA WATS. BLADDER-POD

Herbaceous annuals, biennials or perennials, more or less densely pubescent, the trichomes usually branched or stellate; basal leaves oblanceolate to suborbicular, pinnatifid to entire; cauline leaves more or less oblanceolate and shortly petiolate or sessile, in a few species auriculate; petals yellow or white; infructescences usually elongated but in a few species dense and subumbellate; siliques usually globose to obovoid (in a few species flattened), sessile or stipitate, glabrous or stellate-pubescent; style usually long and slender; seeds biseriata, usually somewhat flattened; cotyledons accumbent.

Eighteen species in Texas; about 75 species, for the most part in North America, several in temperate South America.

- 1. Stem leaves definitely auriculate; fruit glabrous (2)
- 1. Stem leaves not auriculate or only obscurely so (3)
- 2(1). Lower stems pubescent with appressed branched trichomes 1. *L. grandiflora*.
- 2. Lower stems pubescent with spreading simple trichomes 2. *L. auriculata*.
- 3(1). Plants annual (doubtful cases should be keyed under both alternatives) (4)
- 3. Plants biennial or perennial (15)
- 4(3). Siliques pubescent (5)
- 4. Siliques glabrous (6)
- 5(4). Siliques with both large simple and small branched trichomes 3. *L. lasiocarpa* var. *lasiocarpa*.
- 5. Siliques bearing small branched trichomes only 3. *L. lasiocarpa* var. *Berlandieri*.
- 6(4). Pedicels uniformly recurved and siliques therefore pendent (7)
- 6. Pedicels various but not uniformly recurved (8)
- 7(6). Petals yellow; siliques 3-4 mm. in diameter 4. *L. recurvata*.
- 7. Petals white; siliques 5-6 mm. in diameter 5. *L. pallida*.
- 8(6). Siliques sessile (9)
- 8. Siliques at least shortly stipitate (11)
- 9(8). Valves sparsely pubescent within 7. *L. sessilis*.
- 9. Valves glabrous on the inner surface (10)
- 10(9). Cauline leaves lyrate to narrowly obovate; ovules 2 per locule; plants of northeast Texas 6. *L. angustifolia*.
- 10. Cauline leaves elliptic to obovate; ovules 4 to 8 per locule; infructescences dense 11. *L. densiflora*.

- 11(8). Pedicels straight or simply curved (12)
 11. Pedicels sigmoid (14)
 12(11). Infructescences dense; rays of the trichomes arranged asymmetrically
 11. *L. densiflora*.
 12. Infructescences usually loose; rays of the trichomes arranged symmetrically (13)
 13(12). Siliques globose or ellipsoid 8. *L. gracilis* var. *gracilis*.
 13. Siliques obpyriform with a basal shoulder 8. *L. gracilis* var. *repanda*.
 14(11). Cauline leaves lyrate to narrowly elliptic; stipe usually less than 1 mm. long;
 plants of west Texas 9. *L. Gordonii*.
 14. Cauline leaves broadly elliptic to obovate; stipe usually more than 1 mm. long; plants
 of south Texas 10. *L. Lindheimeri*.
 15(3). Siliques pubescent 14. *L. valida*.
 15. Siliques glabrous (16)
 16(15). Infructescences dense and crowded at apex of stems (17)
 16. Infructescences elongated and loose (20)
 17(16). Trichomes with rays fused into peltate scales 15. *L. Mcvaughiana*.
 17. Trichomes with rays free or only partly fused (18)
 18(17). Plant biennial; trichomes nearly all with rays asymmetrically arranged; siliques
 to 5.5 mm. long; chiefly in south-central Texas 11. *L. densiflora*.
 18. Plant perennial from a woody caudex; trichomes often with symmetrical rays; siliques
 5.5 mm. long or more (19)
 19(18). Caudex usually unbranched; basal leaves with blades usually elliptic to obovate;
 stems usually 2-5 dm. high; plants of east-central Texas
 12. *L. Engelmannii*.
 19. Caudex usually branched; basal leaves with blades usually somewhat orbicular to
 rhombic; stems usually 1-2 dm. high; plants of northwest Texas
 13. *L. ovalifolia*.
 20(16). Pedicels usually sigmoid; styles usually fragile and early-deciduous
 18. *L. argyraea*.
 20. Pedicels recurved to ascending, not sigmoid; styles persistent (21)
 21(20). Pedicels ascending; trichome rays fused for half or more their length
 17. *L. Fendleri*.
 21. Pedicels ultimately recurved; rays free or fused only at the base
 16. *L. purpurea*.

1. *Lesquerella grandiflora* (Hook.) Wats. Annual or biennial (?), densely pubescent with branched usually 5-rayed trichomes; stems several to numerous, erect to decumbent, 2-7 dm. long, the rays of the trichomes usually appressed; basal leaves 5-15 cm. long, petiolate, oblanceolate, dentate to bipinnatifid, the rays of the trichomes often erect; cauline leaves 1-4 cm. long, sessile, the upper ones auriculate, those lower usually without auricles, oblong to lanceolate, dentate; sepals oblong, not saccate; petals obovate to orbicular, sometimes slightly emarginate, usually with a short claw, yellow; ovules 4 to 6 per locule; infructescences rather loose; pedicels 1-2 cm. long, ascending or divaricate, sometimes slightly curved; siliques 4-6 mm. long and broad, sessile or on a short gynophore, globose to slightly longer than broad, terete, glabrous; seeds 2.5-3 mm. in diameter, orbicular, flattened and margined. In loose sandy soils in s. and cen. Tex., also Borden Co., Mar.-Apr.; endemic.

2. *Lesquerella auriculata* (Engelm. & Gray) Wats. Annual, densely hirsute with long simple trichomes and an understory of smaller branched ones; stems several to numerous, erect or decumbent, to 2 dm. long; basal leaves 2-5 cm. long, 8-15 mm. wide, shortly petiolate, dentate to lyrate, sometimes nearly entire; cauline leaves 1-4 cm. long, 3-10 mm. broad, sessile and auriculate, oblong to sagittate, entire to dentate; sepals narrowly oblong, the outer pair slightly saccate; petals obovate, entire or slightly emarginate, yellow; ovules 6 to 8 per locule; infructescences often rather dense; pedicels 7-15 mm.

long, ascending to spreading at about 45°, densely hirsute; siliques 4-6 mm. long, 4-6 mm. broad, nearly sessile, globose to slightly longer than broad, terete, glabrous; seeds about 2 mm. in diameter, somewhat orbicular, flattened and margined. Prairies and disturbed soils in e.-cen. Tex., Mar.-May; also in w.-cen. and n.e. Okla.

3. *Lesquerella lasiocarpa* (Gray) Wats. var. *lasiocarpa*. Annual, biennial or perennial, hirsute with a mixture of branched and simple spreading trichomes; stems several, decumbent to procumbent, to 5 dm. long; basal leaves 3-10 cm. long, 1-3 cm. broad, petiolate, oblanceolate, sinuate to incised; cauline leaves 1-4 cm. long, 0.5-2 cm. broad, sessile, obovate to elliptic or oblong, sinuate to incised, nonauriculate to barely so or with definite auricles present; sepals linear-oblong; petals broadly obovate with a somewhat orbicular blade and a short claw, pale-yellow but often purplish when dry; ovules 8 to 14 per locule; infructescences lax; pedicels 15-25 mm. long, recurved; siliques 5-9 mm. long, 4-9 mm. broad, sessile, in outline orbicular to elliptic or cordate, strongly flattened contrary to septum to only slightly compressed; seeds about 1.5 mm. long, nearly orbicular, flattened and margined. In sandy, gravelly and/or disturbed soils in the Rio Grande Plains, Jan.-Apr.; also n.e. Mex.

Var. *Berlandieri* (Gray) Pays. As the typical variety but hirsute with branched trichomes only and more often bearing flattened rather than inflated siliques. In sandy to heavy and/or disturbed soils, s.e. Rio Grande Plains, Mar.-Apr.; also Tam.

4. *Lesquerella recurvata* (Gray) Wats. Annual, rather sparsely pubescent with granular-rough sessile or shortly stipitate stellate trichomes usually having forked rays; stems several, erect to decumbent and usually branched, 2-5 dm. long; basal leaves 3-5 cm. long, usually dentate to pinnatifid, rarely entire and the blade elliptic to rhombic; cauline leaves 1-3 cm. long, sessile or (the lower ones especially) shortly petiolate, obovate to elliptic or lanceolate, entire or finely dentate, often secund; sepals elliptic, not saccate; petals cuneate or somewhat obdeltate, tapering into a short broad claw, often slightly emarginate, yellow; ovules 4 to 8 per locule; infructescences rather loose; pedicels of the lowermost fruit 1-2 cm. long, recurved; siliques 3-4 mm. in diameter, sessile or on a very short gynophore, more or less globose, glabrous, the style as long as or slightly shorter than the fruit; seeds about 1.4-1.5 mm. \times 1.5-1.7 mm., somewhat orbicular to broadly ellipsoid (slightly broader than long), flattened and usually margined. Usually on calcareous soils, cen. Tex., Mar.-May; endemic.

5. *Lesquerella pallida* (T. & G.) Wats. Apparently annual, pubescent with small stellate trichomes, the rays simple or forked; stems slender and decumbent, much-branched, about 3 dm. long; basal leaves not known; cauline leaves to about 3 cm. long, rather coarsely toothed; sepals elliptic-oblong; petals white (*vide* Torrey & Gray); ovules 6 per locule; infructescences loose; pedicels recurved; siliques 5-6 mm. in diameter, on a short gynophore, somewhat globose, the style about as long or slightly shorter. San Augustine (San Augustine Co.), Tex. (only collection known.)

6. *Lesquerella angustifolia* (T. & G.) Wats. Annual, densely to sparsely pubescent with small several-rayed trichomes, the rays usually forked and often fused for part of their length; stems one to several, sometimes branched, to 4 dm. long; basal leaves to 7 cm. long, petiolate, entire or remotely dentate to pinnatifid; cauline leaves to 1 dm. long, sessile or (the lower ones) shortly petiolate, narrowly obovate or lorate, entire to remotely dentate; sepals somewhat ovate to elliptic, the outer ones usually slightly saccate; petals obovate or with an obovate to obdeltate blade tapering to a short broad claw, usually emarginate, yellow; ovules 2 per locule; infructescences rather lax to dense; pedicels 1-2 cm. long, usually spreading, sometimes nearly erect; siliques 4-5.5 mm. long, sessile or on a very short gynophore, somewhat globose, glabrous; style 2.5-3 mm. long; seeds 2.5-3 mm. \times 3-3.5 mm., somewhat orbicular to broadly ellipsoid (broader than long), much-flattened and margined. *L. longifolia* Cory. On limestone soils in extreme n.e. Tex., Apr.; also s.e. Okla.

7. *Lesquerella sessilis* (Wats.) Small. Annual, pubescent with sessile or very shortly stipitate stellate trichomes, the rays unfused but often forked; stems one to several, erect, sometimes branched, to 6 dm. high; basal leaves to 8 cm. long, petiolate but sometimes very shortly so, entire to lyrate, sometimes mucronulate, sparsely to densely pubescent; cauline leaves to 5 cm. long, sessile, linear to narrowly elliptic, acute, entire to repand or remotely dentate; sepals elliptic, the outer ones acute, the inner somewhat thickened

distally and slightly cucullate; petals with blades somewhat orbicular to broadly obovate or slightly broader than long, tapering to a short broad claw; ovules 4 to 6 per locule; infructescences usually loose; pedicels of the lowermost siliques 1-2 cm. long, usually spreading, sometimes horizontal to recurved or loosely sigmoid; siliques 3-5.5 mm. long, sessile, more or less globose or less commonly obovoid, the valves often papillose without but within sparsely pubescent with stipitate irregularly-rayed trichomes; styles 1.8-3.3 mm. long; mature seeds not seen. *L. gracilis* var. *sessilis* Wats. In s.-cen. Tex., Feb.-May; endemic.

8. *Lesquerella gracilis* (Hook.) Wats. var. *gracilis*. Annual, sparsely pubescent with stellate trichomes, the numerous rays free or somewhat fused; stems several, to 5 dm. long, erect or decumbent, usually branched; basal leaves petiolate, to 8 cm. long, the blade narrowly oblanceolate to obovate, entire to lyrate; cauline leaves usually sessile, 1-5 cm. long, somewhat linear to oblanceolate, entire to dentate; sepals somewhat elliptic to oblong, the outer ones saccate; petals spatulate to cuneate or obovate, yellow; ovules 8 to 10 per locule; pedicels 1-2 cm. long, ascending to spreading, straight; siliques 3-5 mm. in diameter, globose to ellipsoid, glabrous within and without, on a slender stipe 1-2 mm. long; styles slender, 2-4 mm. long; seeds flattened, not winged. In sandy and/or disturbed soils and waste places in cen. and s.-cen. Tex., Mar.-May; also Okla., Miss. and Ark.

Var. *repanda* (Nutt.) Pays. Differs from the typical variety in that the siliques are obpyriform, usually with a distinct basal shoulder. *L. repanda* (Nutt.) Wats., *L. Nuttallii* (T. & G.) Wats. In fields and on roadsides in n.e. Tex., Apr.-May; also s.e. Okla., Kan. and Ark.

9. *Lesquerella Gordonii* (Gray) Wats. Annual, densely pubescent with sessile or shortly stipitate stellate trichomes generally with 4 to 6 rays usually forked; stems few to many, to 4 dm. long, prostrate, decumbent or erect, usually branched; basal leaves petiolate, to 4 cm. long, the blade elliptic to obovate, often entire but may be dentate to pinnatisect; cauline leaves petiolate (the lower ones) or sessile, to 5 cm. long, lorate-falcate to narrowly elliptic, entire (usually) to repand or coarsely dentate; sepals somewhat elliptic to oblong, the outer ones slightly saccate, the inner ones more or less cucullate; petals cuneate or with an obdeltate to obovate blade tapering to a broad claw, sometimes expanded at the base, yellow; ovules 5 to 10 per locule; infructescences usually elongated; pedicels 1-1.5 cm. long, normally sigmoid but at times merely recurved or spreading; siliques 4-7 mm. long, or a short stipe (to 1 mm. long), somewhat globose to broadly ellipsoid, glabrous within and without; styles slender, 2-4 mm. long; seeds 1.7-1.8 mm. \times 1.7-1.8 mm., somewhat orbicular, flattened, not winged. In sandy and gravelly soils in w. Tex., Mar.-June; also w. Okla., N.M., Ariz. and n. Mex.

10. *Lesquerella Lindheimeri* (Gray) Wats. Annual, rather sparsely pubescent with sessile or shortly stipitate stellate trichomes, the several rays free (usually) or somewhat fused, usually forked; stems usually several, to 5 dm. long, erect or the laterals decumbent, often rather straggling; basal leaves petiolate, to 8 cm. long, oblanceolate to obovate, usually pinnatifid, sometimes only sinuate; cauline leaves to 4 cm. long, shortly petiolate (the lower ones) or sessile, elliptic or obovate, usually entire but sometimes dentate; sepals somewhat elliptic, the outer ones saccate, the inner cucullate; petals spatulate to cuneate or with a somewhat obovate blade tapering to a short broad claw, yellow; ovules 6 to 9 per locule; infructescences loose; pedicels 8-15 mm. long, spreading at 45°-90°, somewhat sigmoid; siliques 4-5 mm. in diameter, on a slender stipe (about 1 mm. long), somewhat globose, glabrous within and without; styles slender, 2-3 mm. long; mature seeds not seen. *Vesicaria Lindheimeri* Gray. Usually in heavy black soils along the coastal plain of s. Tex., Feb.-May; also in adj. coastal Mex.

11. *Lesquerella densiflora* (Gray) Wats. Annual or biennial, densely pubescent with sessile or shortly stipitate stellate trichomes, the rays unfused and often unforked but asymmetrically arranged forming on one side of the trichome a deep U-shaped notch; stems one to several, erect or decumbent (sometimes prostrate?), to 4 dm. long; basal leaves to 5 cm. long and to 1 cm. broad, petiolate, entire or with remote teeth or pinnatifid; cauline leaves to 6 cm. long and 2 cm. broad, sessile or on short petioles, narrowly obovate to elliptic, repand to remotely dentate; sepals elliptic, usually acute, the outer ones generally saccate; petals with blades obovate or obdeltate, tapering into

a rather short claw, yellow; ovules 4 to 8 per locule; infructescences dense, usually 5-10 cm. long, exceptionally to 20 cm.; pedicels 1-1.5 (-2.5) cm. long, spreading at about 45° to nearly horizontal; siliques 3.5-5.5 mm. long, sessile or on a short stipe (1 mm.), somewhat globose to broadly obovoid, glabrous; styles slender, 2.5-4.5 mm. long; seeds 1-1.6 mm. in diameter, somewhat orbicular, flattened, not margined. In sandy and calcareous soils, cen. Tex., Mar.-May; endemic.

12. *Lesquerella Engelmannii* (Gray) Wats. Perennial, densely pubescent with sessile or shortly stipitate stellate trichomes, often umbonate, granular-rough, the several rays free or fused at the base (usually not forked) and regularly disposed or asymmetrically arranged forming on one side of the trichome a deep notch; stems several, to 5 dm. high, erect and rather stout, arising from a woody caudex, usually not branched; basal leaves to 6 cm. long and 2 cm. broad, petiolate, usually elliptic or obovate, entire to coarsely dentate; cauline leaves usually 2-4 cm. long and 3-5 mm. broad, exceptionally to 10 cm. long and 1 cm. broad, sessile or (the lower ones especially) shortly petiolate; sepals narrowly ovate to elliptic, usually saccate; petals obovate to elliptic, sometimes slightly emarginate, often with a short claw, yellow; ovules 5 to 8 per locule; infructescences dense, sometimes subumbellate; pedicels of lowermost fruit to 25 mm. long, usually spreading at 45° but may be erect or nearly horizontal; siliques 5.5-8 mm. long, on a stipe about 1 mm. long, globose to broadly ellipsoid, glabrous; styles 5-8.5 mm. long, slender; seeds about 2.1-2.5 mm. \times 2.2-2.6 mm., somewhat orbicular to broadly ovate, flattened. Calcareous soils in e.-cen. Tex., Apr.-May; endemic.

13. *Lesquerella ovalifolia* Rydb. Perennial, pubescent with sessile or shortly stipitate stellate trichomes, usually umbonate and granular-rough, the numerous rays often forked and fused (at least at the base), and usually symmetrically disposed but occasionally forming a U-shaped notch on one side of the trichome; stems several, usually 1-2 dm. high, erect and rising from a heavy woody caudex, usually branched; basal leaves to 7 cm. long and 2 cm. broad, petiolate, somewhat orbicular to rhombic or narrowly elliptic, usually entire but sometimes coarsely dentate; cauline leaves usually less than 1 cm. long, to 4 mm. broad, sessile or the lower ones shortly petiolate, oblong to narrowly elliptic or obovate, entire; sepals more or less elliptic, usually saccate; petals with blades somewhat orbicular to obdeltate or obovate, sometimes emarginate, tapering to a rather broad claw, yellow; ovules 5 to 8 per locule; infructescences dense, often subumbellate; pedicels of lowermost fruit to 2 cm. long, usually spreading at about 45° but may be nearly erect to nearly horizontal; siliques 6-9 mm. long, on a stipe 0.5-0.8 mm. long, somewhat globose to broadly ellipsoid and then sometimes slightly angustiseptate, glabrous; styles 4.5-8 mm. long; seeds about 1.7-2 mm. \times 1.7-2.2 mm., somewhat orbicular to very broadly ovate, flattened. On sandy and/or calcareous soils in n.w. Tex., Apr.-May; also w. Kan., Okla., s.e. Colo. and n.e. N.M.

14. *Lesquerella valida* Greene. Biennial or perennial, pubescent with small sessile stellate several-rayed trichomes with the rays simple or forked and free or fused to about half their length; basal leaves to 8 cm. long, petiolate, broadly elliptic to lanceolate, entire or remotely dentate; cauline leaves to 15 mm. long, sessile or shortly petiolate, elliptic to obovate, entire; sepals elliptic or oblong, tapering distally and somewhat thickened and slightly cucullate, the outer ones slightly saccate; petals linear or with a broadly obovate blade tapering to a broad claw, the margins lacerate, yellow; ovules 6 to 9 per locule; infructescences dense; pedicels to 15 mm. long, rather thick, ascending or slightly spreading; siliques 5.5-7 mm. long, sessile, in outline round or broadly ovate, somewhat latiseptate, pubescent; styles 3-4 mm. long; mature seeds not known. *L. lepidota* Cory. In Texas known only by a single collection from Hudspeth Co., May; also N.M.

15. *Lesquerella Mcvaughiana* Roll. Perennial, usually densely silvery-pubescent with sessile usually umbonate stellate trichomes having numerous unforked rays fused for half or more their length; stems few to several, erect or decumbent, to 4 dm. long; basal leaves to 9 cm. long, petiolate, rhombic to obovate or lanceolate, entire, sometimes mucronulate; cauline leaves to 3 cm. long, lower ones shortly petiolate, upper ones sessile, obovate to narrowly elliptic, entire; sepals elliptic, the outer ones saccate; petals with blades broadly obovate to rhombic or obdeltate, sometimes emarginate, tapering to a slender claw about the same length as the blade, white to purplish; ovules 3 to 6 per locule; infructescences dense; pedicels of lowermost fruit 8-20 mm. long, ascending to spreading, the lower ones

sometime horizontal or loosely sigmoid; siliques 4-7 mm. long, sessile or on a very short stipe, usually ovoid and rather acute but sometimes globose, glabrous; styles 1.5-4 mm. long; seeds 1.4-1.6 mm. \times 1.2-1.3 mm., somewhat oblong to broadly ovate, flattened, not winged. Rocky limestone slopes and outcrops in Brewster and Pecos cos., spring-summer; endemic.

16. *Lesquerella purpurea* (Gray) Wats. Perennial, pubescent with sessile or shortly stipitate stellate trichomes with numerous unforked rays that are free or fused for a short distance; stems several, usually erect, but sometimes prostrate or decumbent, to 7 dm. long, arising from a caudex, sometimes branched; basal leaves 4-15 cm. long, petiolate, elliptic to obovate, entire to pinnatifid, sometimes panduriform; cauline leaves to 5 cm. long and 1 cm. broad, sessile or shortly petiolate, usually broadly elliptic to obovate or rhombic; sepals elliptic to ovate, the outer ones very saccate; petals obdeltate to narrowly obovate, unclawed or with blades obdeltate to obovate or somewhat orbicular (often emarginate) and tapering to a broad claw, white or purple; ovules 2 to 6 per locule; infructescences usually loose; pedicels 5-20 mm. long, finally recurved but earlier spreading to horizontal; siliques 4-8.5 mm. long, sessile or on a short stipe, globose to broadly ellipsoid, glabrous; styles 1.5-2.5 mm. long; seeds 2.2-2.6 mm. \times 2.6-2.8 mm., somewhat orbicular to broadly elliptic, flattened. Sandy or rocky (often calcareous) soils in mts. of Trans-Pecos Tex., Feb.-Sept.; also Ariz. and N.M.

17. *Lesquerella Fendleri* (Gray) Wats. Perennial, silvery-gray pubescent with sessile or shortly stipitate stellate trichomes with the rays numerous and unforked but fused for half or more their length; stems several, decumbent or erect, 3-40 cm. long, arising from a caudex, sometimes branched; basal leaves petiolate, more or less elliptic, entire or coarsely dentate; cauline leaves variable, to 8 cm. long and 12 mm. broad, sessile or shortly petiolate, usually somewhat lorate to narrowly elliptic, entire to coarsely dentate; sepals more or less elliptic to oblong and tapering distally, usually not saccate; petals obdeltate to obovate and unclawed or with the blade obdeltate to obovate and tapering to a short claw, yellow; ovules 10 to 16 per locule, infructescences usually loose but sometimes hardly extending beyond the foliage; pedicels 1-2.5 cm. long, usually spreading at 45° or less, sometimes nearly erect; siliques 4.5-8 mm. long, usually sessile but occasionally shortly stipitate, somewhat globose to broadly ellipsoid or ovoid, glabrous; styles 3-5 mm. long; seeds 1.3-1.6 \times 1.3-1.5 mm., more or less orbicular to broadly ovate or oblong, flattened. *L. foliacea* Greene, *L. stenophylla* (Gray) Rydb. In sandy or rocky soils, especially when calcareous, in s.w. and s.-cen. Tex., spring-summer; also N.M., Ariz., Colo., Ut. and n. Mex.

18. *Lesquerella argyrea* (Gray) Wats. Biennial or perennial, rather densely pubescent with sessile or shortly stipitate stellate trichomes with the rays usually unforked and free or fused near the base; stems usually several, the outer ones usually decumbent but sometimes prostrate or erect, to 7 dm. long; basal leaves to 9 cm. long, petiolate, more or less elliptic, entire to pinnatifid; cauline leaves to 4 cm. long, sessile or the lower ones shortly petiolate, elliptic to rhombic or obovate, usually acute, entire or repand to coarsely dentate; sepals somewhat elliptic, the outer ones sometimes slightly saccate; petals with blade obovate to obdeltate, sometimes emarginate, tapering to a short claw, yellow; ovules 8 to 18 per locule; infructescences loose; pedicels usually 1.5-2 (-3) cm. long, usually sigmoid, sometimes merely recurved, rarely spreading or ascending; siliques 4-8 mm. long; sessile or very shortly stipitate, globose to broadly ellipsoid, glabrous; styles 3-5 mm. long, fragile and usually early deciduous; seeds 1.3-1.9 \times 1.4-1.9 mm., more or less orbicular to broadly elliptic (slightly broader than long), flattened with a narrow rim. On sandy and calcareous soils in cen. and s. Tex., Feb.-Apr.; also n.e. Mex.

35. CAMELINA CRANTZ

About 10 species of the Mediterranean area, Europe and Asia.

1. *Camelina microcarpa* Andr. LITTLE POD, FALSE FLAX. Erect annual or biennial; stems simple or branched above, 3-6 dm. high, lower portion pubescent with long simple or forked trichomes and an understory of branched trichomes, glabrous above; basal rosette wanting; leaves sessile, auriculate or the lower nearly cuneate, entire or nearly so, oblong to lanceolate, pubescent; flowers small, in elongate racemes; sepals pubescent,

nonsaccate; petals yellowish-white, erect, not differentiated into blade and claw, 3-4 mm. long; pedicels slender, divaricate; siliques pyriform, indurate, slightly compressed parallel to septum, tapered below and abruptly beaked above, minutely mottled, the keel margined over replum; style about 1 mm. long atop the slender beak; seeds plump, oblong, wingless, several to many in each loculus; cotyledons incumbent. Fields, roadsides and waste places, Apr.-June; widely distributed as a weed in N.A.; nat. of Eur.

36. LOBULARIA DESV.

Five species in the Mediterranean area and southwestern Europe.

1. *Lobularia maritima* (L.) Desv. SWEET ALYSSUM. Short-lived perennial but grown in flower gardens as an annual, 6-20 cm. tall, much-branched, partly decumbent, gray-green from a covering of appressed bifurcate trichomes; leaves linear to narrowly oblanceolate, entire, tapering to the base; flowers small, fragrant, slender-pedicelled, numerous, in lengthening racemes; petals white or occasionally lavender or purple, entire; stamens with short filaments, 2 unequal-lengthed glands at the base; siliques obovate to suborbicular, sparsely pubescent, flattened parallel to septum; seeds 1 in each loculus, oval, compressed, 1-1.5 mm. long; cotyledons accumbent. Escaped from cult., adv. from Eur.

37. RAPISTRUM CRANTZ

Three species in central Europe, the Mediterranean region and western Asia.

1. *Rapistrum rugosum* (L.) All. Annual; stems 3-8 dm. tall, branched, usually glabrous above and sparsely hispid below; lower leaves 1-3 dm. long, petioled, lyrate-pinnatifid, the terminal lobe the largest; upper leaves subentire, slender-petioled; flowers small; petals yellow, with darker veins, short-clawed, 6-10 mm. long; pedicels short, thickened; upper segment of silique nearly globose, abruptly conspicuously beaked, 3 or 4 times the size of the lower cylindrical joint; seeds oblong, 1.5-1.8 mm. long; cotyledons conduplicate. Weed of fields, roadsides and waste places, cen. and e. Tex., Apr.-June; sporadic in N.A.; introd. from Euras.

38. MYAGRUM L.

One species in the Mediterranean region and Eurasia.

1. *Myagrum perfoliatum* L. Glaucous glabrous annual, 2-10 dm. tall; stems erect, branching above; basal leaves petiolate, oblanceolate, sinuate-dentate to pinnatifid; cauline leaves oblong to broadly lanceolate, entire to sparsely dentate, sessile, auriculate and clasping the stem; sepals erect, outer saccate, inner less so; petals yellow, 3-5 mm. long; siliques indehiscent, broadly clavate, somewhat compressed, abruptly contracted to a beak; seeds about 3 mm. in diameter. Fields and roadsides, n.-cen. Tex., Apr.-May; local at several locations in U.S.; adv. from Euras.

39. CORONOPUS ZINN

Ten species, cosmopolitan or nearly so.

1. *Coronopus didymus* (L.) Sm. SWINE WART CRESS. Sparingly pubescent annual or biennial herb with prostrate outer branches, 1-4 dm. long; trichomes simple; basal leaves oblong in outline, 3-10 cm. long, with margined petioles, deeply pinnatifid, the lobes dentate; stem leaves similar but shorter and sessile or on much shorter petioles; racemes axillary in leafy bracts; sepals spreading; petals white, about 1 mm. long; stamens 2; siliques didymous, 2-2.5 mm. broad, finely wrinkled, the valves indehiscent; styles wanting; seeds cochleate, 1-1.4 mm. long; cotyledons incumbent and transversely folded. Weed of old fields, roadsides and waste places in cities and towns, e. and s. Tex., Mar.-May; widespread weed of cen. and e. N.A. and in w. Coastal States.

40. DITHYREA HARV. SPECTACLE-POD

Densely pubescent biennials or perennials with numerous cauline leaves; petals white or purple; infructescences loose; pedicels horizontal or slightly recurved; siliques markedly angustiseptate, broader than long, somewhat oblong ("spectacle-shaped"), narrowly winged; styles short and stout; stigmas capitate to tectiform; seeds large, one per locule; cotyledons accumbent.

Five species in southwestern United States and northern Mexico.

1. Cauline leaves usually cuneate at the base, often dentate; stems not branched near the top 1. *D. Wislizenii*.
1. Cauline leaves usually truncate at the base, usually sinuate; stems often branched near the top 1. *D. Wislizenii* var. *Palmeri*.

1. *Dithyrea Wislizenii* Engelm. Biennial or perennial, hirsute with trichomes usually dichotomously or irregularly branched (sometimes stellate or rarely simple); stems one to several, erect, sometimes branched near the base, to 6 dm. tall, densely pubescent; basal leaves to 14 cm. long, 4 cm. wide, sessile on a cuneate base or shortly petiolate, oblong to elliptic, rounded to truncate, repand-sinuate, coarsely dentate or pinnatifid, densely pubescent; cauline leaves 2-12 cm. long, 8-30 mm. wide, sessile on a cuneate base or shortly petiolate, usually lanceolate, entire to repand or coarsely dentate, densely pubescent, often numerous and overlapping on the stem; sepals oblong to narrowly ovate, the outer usually slightly saccate, the inner slightly cucullate, densely pubescent; petals with blades obovate, the claw expanded at the base and occasionally toothed, white or purple; infructescences loose; pedicels 1-2 cm. long, usually horizontally spreading, sometimes recurved, straight or curving-ascending, densely pubescent; siliques 7-10 mm. long, 10-16 mm. wide, oblong and very much angustiseptate, the septum about 1 mm. wide, distally truncate, densely pubescent; styles very short, the stigma tectiform; ovules 1 per locule; seeds 2.5-3.5 mm. long, 2-3 mm. wide, broadly oblong to nearly orbicular, much-flattened with a narrow wing, cotyledons accumbent. Incl. var. *Griffithsii* (Woot. & Standl.) Pays., *D. Griffithsii* Woot. & Standl. In sandy soils of w. and s.w. Tex., Feb.-May, rarely to Aug.; also in N.M., Nev. and Ut.

Var. *Palmeri* Pays. Differs from the typical variety by having the stems often branched near the top, the cauline leaves usually truncate at the base and rarely toothed and often more or less appressed to the stem. In sandy soils, n.w. Tex., Apr.-June, rarely to Aug.; also in Okla.

FAM. 81. CAPPARIDACEAE JUSS.⁷² CAPER FAMILY

Herbs (ours), shrubs or trees often with rank odor; leaves alternate, palmately (1-) 3- to 11-foliolate; stipules minute or lacking; flowers single and axillary or in terminal bracteate or ebracteate many-flowered racemes, somewhat zygomorphic, perfect, 4-merous, polypetalous; sepals 4, free or partially fused; petals 4, free; stamens 6 to 27 or more, as long as or longer than petals; nectariferous disk or gland between corolla and stamens frequent; ovary 1, superior; fruit a 2-valved unilocular capsule, usually borne on a slender gynophore (stipe above receptacle) or sessile, with many free-falling seeds or a 2-valved schizocarp with 1- or 2-seeded closed achenelike mericarps (in *Wislizenia*); seed reniform, the seed coat deeply invaginated. Also spelled Capparaceae.

About 500 species in about 40 genera, mostly tropical America and Africa, often xerophytic, all Texas species of Subfamily Cleomoideae.

1. Stamens (6 to) 8 to 27; capsules erect, sessile or short-stipitate, apically dehiscent, the hirsute-glandular valves persistent; corolla open in bud, the stamens not enclosed; petals white or pink, notched to irregularly torn at apex; nectary gland prominent, strictly adaxial 1. *Polanisia*, p. 707.
1. Stamens 6; capsules or schizocarps divergent to deflexed on a short to long stalk (gynophore), the glabrous valves freely deciduous; corolla closed in bud, the stamens covered by the petals (except in *Cleome gynandra*) (2)

⁷² Contributed by Hugh H. Iltis.

- 2(1). Fruits 2-parted schizocarps, with each of the 2 valves (1-2 mm. long) closely and permanently enclosing its single seed and falling with it; racemes ebracteate (bracts minute), very dense; southwest Texas 4. *Wislizenia*, p. 711.
2. Fruits unilocular capsules with free-falling seeds; racemes bracteate or flowers singly in the axils of cauline leaves (3)
- 3(2). Capsules elongate, many-seeded, 1-8 cm. long; petals white, yellow, pink or purple 2. *Cleome*, p. 709.
3. Capsules rhomboidal, few-seeded, 4-8 mm. long, as wide as or wider than long, the valves laterally expanded cones; petals yellow 3. *Cleomella*, p. 711.

1. POLANISIA RAF. CLAMMY-WEED

Herbaceous viscid-pubescent annuals with strong rank odor; leaves petiolate, palmately 3-foliolate; flowers in bracteate racemes; sepals free nearly to base; corolla open in bud, zygomorphic; petals spatulate with long claw (ours) or obovate, emarginate to lacinate, white, yellowish, pink or purplish, the adaxial pair markedly longer; gland prominent between corolla and stamens, strictly adaxial, solid or tubular, yellow or orange; stamens 8 to 27, of unequal length (staggered maturation); anthers short; capsule elongate, erect, sessile or short-stipitate, glandular, the persistent valves dehiscing apically; seeds many, the deep invagination very narrow but not fused by a membrane at the mouth.

A genus of 5 species (8 taxa) endemic to North America, related to xerophytic African *Cleome* groups.

1. Leaflets lanceolate-elliptic to obovate, 10-30 mm. wide; petals 5-27 mm. long, entire to shallowly notched; nectary solid, concave, 2-3 mm. long and wide; style slender, 6-42 mm. long, withering in fruit; fruits 5-10 mm. wide; seed 2-3 mm. in diameter (Subg. *Polanisia*) (2)
1. Leaflets linear to filiform, 1-5 mm. wide; petals 4-11 mm. long, deeply lacinate; nectary a long hollow tube or (in *P. erosa* subsp. *breviglandulosa*) a shallow cup; style setaceous, short, persistent; fruits 2-4 mm. wide; seed 1-2 mm. in diameter (Subg. *Cristatella*) (4)
- 2(1). Petals 14-27 mm. long, white, often drying yellow; stamens about 20 to 30, 20-50 mm. long; seed coat very smooth, often with a coppery-iridescent sheen; Rio Grande and southwest Texas (Mexico) 1. *P. uniglandulosa*.
2. Petals 5-16 mm. long; stamens about 10 to 20, the longest 8-30 mm. long; seeds dull, more or less rough (3)
- 3(2). Petals white, (5-) 10-18 mm. long, the stamens long-exserted; capsules 5-10 mm. wide, inflated, glandular; seeds more or less roughened to smooth, dull; throughout Texas 2. *P. dodecandra* subsp. *trachysperma*.
3. Petals rose-color to purple, (6-) 10-12 (-17) mm. long, the stamens slightly longer; capsules slender, 4-7 cm. long, 4-6 mm. wide, subglabrous; seeds very prominently roughened; lower Rio Grande Valley 2. *P. dodecandra* subsp. *riograndensis*.
- 4(1). Flowers and gynophore 4-5 mm. long; fruiting style 1-2 mm. long; plants densely glandular-viscid; northwest half of Texas 3. *P. Jamesii*.
4. Flowers 6-11 mm. long; fruiting style 3-6 mm. long; plants slightly glandular to subglabrous; southeastern half of Texas, mainly on Coastal Plain (5)
- 5(4). Nectary 2.5-5.5 mm. long, hollow and tubular, prominent in fruit; gynophore 7-14 mm. long; larger petals 7-11 mm. long; widespread, east Texas 4. *P. erosa* subsp. *erosa*.
5. Nectary 1-2 mm. long, cup-shaped, inconspicuous; gynophore 3-6 mm. long; larger petals 6-9 mm. long; southernmost tip of Texas 4. *P. erosa* subsp. *breviglandulosa*.

1. *Polanisia uniglandulosa* (Cav.) DC. MEXICAN CLAMMY-WEED, HIERBA DEL COYOTE. Branched or unbranched annual (rarely perennial in Mexico), 4-8 dm. tall, glandular-viscid; leaflets 3, broadly elliptic to oblanceolate, 2-4 cm. long, 1-2 cm. wide, acute to

obtuse; racemes dense, many-flowered; bracts of raceme reduced, sessile, ovate, acute, about 1 cm. long; petals white (rarely reported as sulfur-yellow, probably due to drying?), narrowly spatulate, gradually attenuate to a slender claw, the longest 15-30 mm. long; stamens about 20 to 27, purple to pink, mostly 2-5 cm. long; style herbaceous, 2-4 cm. long, slender, equaling stamens; capsules erect, somewhat bladderly, 6-10 cm. long, 7-10 mm. wide, opening at top; seeds many, very smooth, frequently (under 10 \times) with a bronze somewhat iridescent sheen. Sandy washes, river-sides, arroyos, open pinyon-juniper-oak forest, rocky hillsides, roadsides and pastures in Trans-Pecos Tex., May-Oct.; Tex. and N.M. to Chis.

Very similar to *P. dodecandra* but with larger flowers, shinier and slightly smaller seeds.

2. *Polanisia dodecandra* (L.) DC. CLAMMY-WEED. Very similar to *P. uniglandulosa*; sparsely branched or unbranched annual (rarely perennial), 2-6 dm. tall, glandular-viscid; leaflets 3, oblanceolate, 2-4 cm. long, 5-20 mm. wide; petals 5-16 mm. long, white; stamens 6 to 20, 9-30 mm. long, pink to purple, not much longer to much-exceeding petals; seeds many, red- or dark-brown, wrinkled or tubercled, dull.

Extremely variable in flower- and fruit-size; divisible into three intergrading more or less geographic subspecies:

Subsp. *trachysperma* (T. & G.) Iltis. Petals white, (5-) 10-16 mm. long; longest stamens 12-30 mm. long, exerted; bracts lanceolate to ovate; capsules 2-7 cm. long, 5-10 mm. wide, generally wider and more pubescent than the following; seeds dull, more or less roughened on back but not as much as in the following. *Polanisia trachysperma* T. & G. In sandy, rocky or gravelly soil of plains and hills, river bottoms, sandbars and washes, volcanic ash slopes, oak thickets, pinyon-juniper forests, prairies, fields, roadsides and along railroad tracks, common throughout Tex., flowering intermittently from May to Oct.; from Mex. to s.w. Can., Minn., Mo. and Ark.

Subsp. *riograndensis* Iltis. Very similar to the above but leaves more often rounded; petals pink to rose or purple, smaller, mostly (6-) 8-14 (-17) mm. long; longest stamens 12-17 mm. long; style 3-5 (-8) mm. long; bracts ovate to often nearly orbicular; raceme often dense and flat-topped; capsules often narrower, (3-) 4-7.5 cm. long, (3-) 4-5 (-7) mm. wide, sparsely glandular; seeds prominently roughly tuberculate-rugose. In sandy, gravelly (sometimes limestone) or alluvial silty soil, near riverbanks, coastal dunes, open areas in coastal live oak forest, bottoms of washouts, in semidesert *Opuntia*-mesquite scrub and shrub thickets, often weedy on roadsides in chaparral pastures, fallow fields or other disturbed areas, both sides of lower Rio Grande Valley and adj. desert areas, Mar.-Nov.; endemic.

Appears to intergrade with subsp. *trachysperma* (Aransas, Llano and Hays cos. and vic.), but typical, pink-flowered, dense-racemed, rough-seeded plants are distinct enough and more southern.

Subsp. *dodecandra*. Petals white, very small, 5-7 mm. long; stamens (6 or) 7 to 10, short. From Mo. to Wisc., Que. and Me., with occasional Tex. plants (especially from near Dallas, introd.?) and cen. Tex. (San Saba, Hays and Llano cos.) that approach it closely but are not referred here.

3. *Polanisia Jamesii* (T. & G.) Iltis. Branched strict densely viscid-glandular annual 1-3 (-4) dm. tall; leaves short-petioled; leaflets 3, linear, 1-4 cm. long, to 5 mm. wide, often folded; racemes open, 3-15 cm. long, few-flowered, each with 5 to 9 open flowers and buds; bracts 3-foliolate; petals spatulate, slender-clawed, white to yellowish, strongly dimorphic, the larger pair 4-5 mm. long and emarginate to shallowly laciniate with 3 to 6 lobes, the smaller 2-3 mm. long, and deeply laciniate; stamens 6 to 9, pink, 3-5 mm. long; nectary yellow, tubular, 2-3.5 mm. long, yellow, drying pink-purple; capsules linear-fusiform, 1-3 cm. long, 3-4 mm. wide, dehiscing nearly to base; style 1-2 mm., persistent; gynophore 2-4.5 mm. long; pedicels 8-9 mm. long; seeds 4 to 18, bright-reddish-brown. *Cristatella Jamesii* T. & G. Loose sands, sand hill prairies, sand blow-outs, sand bars etc., n.w. and w. Tex., late May-Oct.; Wisc. and Ill., on the Great Plains to Colo., s. to Kan.

4. *Polanisia erosa* (Nutt.) Iltis. Branched annual 2-6 dm. tall, the divergent slender branches sparsely glandular to subglabrous; petioles to 2 cm. long; leaflets 3, linear to oblanceolate, 1-4 cm. long, 1-5 mm. wide, often folded; racemes to 25 cm. long, very open, each with 10 to 17 open flowers and buds; bracts 3-foliolate; petals broadly spatulate, white to pale-yellow, sometimes pink-tinged, with purplish-pink claw, very strongly

dimorphic, the larger pair 6-11 mm. long and to 7 mm. wide with 5 to 9 palmately lacinate lobes, the smaller 4-6 mm. long and much deeper cut into filiform segments; stamens 6 to 15, pink, 6-12 mm. long; nectary yellow, tubular or cup-shaped (s.e. Tex.); capsules erect, narrowly linear-fusiform, 2-6 cm. long, 1.5-3.5 (-5) mm. wide, dehiscent nearly to base; style 3-6 mm. long, persistent; gynophore 3-14 mm. long; pedicel 12-22 mm. long; seeds 6 to 36 per capsule, dark-reddish-brown.

Divisible into 2 geographic subspecies:

Subsp. *erosa*. Nectary gland tubular, prominent, (2.5-) 3-5.5 mm. long; larger petals 7-11 mm. long; gynophores (in fruit) 7-14 mm. long, the capsule stipitate. *Cristatella erosa* Nutt. Dry loose deep sandy soils, sandhills, sandy prairies, woods and fields, common in Tex. in the w. Gulf Coastal Plain from s. Tex. to the Red River, Okla. and into La. (rare), early Apr.-Oct.; essentially a Tex. endemic.

Subsp. *breviglandulosa* Iltis. Like subsp. *erosa* but plants bushier; leaves denser, the leaflets more oblong and shorter; nectary gland cup-shaped, small, 1-2 mm. long; larger petals 6-9 mm. long; gynophores (in fruit) 3-6 mm. long; capsule nearly sessile. Sand plains of Tex. from the Rio Grande to Aransas, Jim Hogg and Zapata cos., Apr.-Oct.; endemic.

2. CLEOME L. SPIDER FLOWER. CLEOME

Erect slender to robust annual (ours) or perennial herbs, shrubs or small "trees," glabrous or glandular-pubescent, often spiny; leaves palmately 1- to 11-foliolate; leaflets entire or serrulate, flat or conduplicate; stipules none or minute; racemes terminal, greatly elongating in fruit, bracteate or flowers singly in axils of cauline leaves; corolla open or closed in bud; sepals 4, free or fused at base; petals 4, subequal, free, white, yellow, pink or purple, spatulate, entire, acute to rounded; disk conic, the nectary inconspicuous, sometimes adaxially expanded; stamens 6; anthers elongate, longitudinally dehiscent; capsules elongate, pendent, deflexed or erect, sessile or borne on a stipe (gynophore); seeds many, the invagination open (if very narrow) or fused by a membrane.

About 150 species, mostly of tropical America and Africa, often of arid habitats.

1. Aestivation open, the petals not covering the stamens in bud; stamens on the gynophore 6-22 mm. above petals, the stamen scars visible on gynophore in fruit; petals white; leaves 5- to 7-foliolate; sporadic weed, east Texas (Sect. *Gymnogonia*) . . .
 1. *C. gynandra*.
1. Aestivation closed, the stamens covered by petals until anthesis; stamens inserted next to petals; petals white, pink or purple (2)
- 2(1). Plants armed with pairs of "stipular" thorns at base of petioles; disk conic-circular, not adaxially expanded (Sect. *Tarenaya*) (3)
2. Plant unarmed, glabrous; disk pronouncedly adaxially expanded; petals pinkish or purple; anthers coiled when dry; native species (Sect. *Peritoma*) (4)
- 3(2). Low diffusely branched slender 3-foliolate herb; petals white, 5-10 mm. long; siliques sessile or short-stiped, erect or ascending; rare, south Texas (Cameron Co.)
 2. *C. aculeata*.
3. Tall robust 5- to 9-foliolate herb; petals pink to purple (rarely white), 20-40 mm. long; siliques on gynophore 5-8 cm. long, deflexed; cultivated and escaped, scattered in east Texas 3. *C. Hassleriana*.
- 4(2). Leaflets narrowly elliptic, 5-15 mm. wide; plants tall, branched; flowers 8-13 mm. long, racemose in the axils of small 1-foliolate bracts; siliques 3-9 mm. wide; northeast corner of Texas Panhandle 4. *C. serrulata*.
4. Leaflets linear, 2 mm. wide or less; plants slender, simple or few-branched; flowers 4-7 mm. long, singly in axils of 3-foliolate cauline leaves; siliques 2-4 mm. wide; rare in Presidio Co., Texas 5. *C. multicaulis*.

1. *Cleome gynandra* L. SPIDER WISP. Erect annual herb, 5-15 dm. tall, more or less glandular-pubescent, unarmed; stems simple or sparsely branched; petioles 3-9 cm. long; leaflets 3 to 7, oblanceolate to rhomboidal, acute to acuminate or rounded-apiculate, to

7 cm. long and 4 cm. wide, glabrate, serrulate-denticulate to ciliate; racemes to 4 dm. long, few- to many-flowered; bracts small, 3-foliolate, sessile; sepals free, to 6 mm. long; petals 4, not covering the stamens in bud, white, 1-2 cm. long, spatulate with a long claw; stamens 6, inserted 6-22 mm. up on the slender gynophore, the filaments 8-22 mm. long; capsule linear-cylindric, to 10 cm. long, 5 mm. thick; gynophore 2-4 cm. long, with stamen scars visible even in fruit; seeds many, sharply tuberculate. *Gynandropsis gynandra* (L.) Merr. A pantropic weed of Afr. origin, sporadic in much of the warmer e. U.S. from N.C. to e. Tex.; May-Oct. (-Dec.).

2. *Cleome aculeata* L. Spreading open-branched or erect annual, 3-8 dm. tall, sparsely glandular-pubescent to subglabrous; stems slender, flexuous, armed with pairs of (often very) small recurved "stipular" prickles 1-3 mm. long; leaflets 3, thin, lance-elliptic to ovate, broadly acute, 2-6 cm. long, 1-3 cm. wide, entire; racemes open, with bracts 1-2 cm. long; sepals 2-6 mm. long, divergent to reflexed, deciduous; petals white, 5-10 mm. long; stamens 6, 1-2 cm. long; capsule erect or ascending, 2-6 cm. long, 3-5 mm. wide, more or less constricted, on a stipe 1-8 mm. long; seeds several, 2.4-2.8 mm. in diameter, transverse-rugose, with white aril attached to cleft. Weedy open places in Rio Grande Valley (Cameron Co.), June-Oct.; s. Tex. to n. Arg. and W.I.; sporadically introd. in the Old World.

3. *Cleome Hassleriana* Chod. SPIDER PLANT, SPIDER FLOWER, PINK QUEEN. Robust shrubby glandular-pubescent annual herb, 1-2 m. tall, prominently armed with pairs of stout "stipular" prickles 2-6 mm. long at base of petioles that are 4-13 cm. long; leaflets 5 or 7, oblanceolate-elliptic to narrowly elliptic, long-pointed at both ends, to 12 cm. long and 3 cm. wide, serrulate-denticulate, glandular; racemes dense, to 1 m. long; bract 1-foliolate, to 3 cm. long; petals large, showy, pink to purple (rarely white), 2-4 cm. long, long-clawed, in one row; stamens 6, 4-7 cm. long in "male" flowers that alternate cyclicly with essentially "female" ones; anthers 1 cm. long; capsules linear-cylindric, 4-10 cm. long, to 4 mm. thick, glabrous, more or less constricted; gynophore 5-8 cm. long; pedicel 2-4 cm. long, the fruit divergent to deflexed; seeds many, 1.8-2.3 mm. in diameter, with a shiny membrane covering the cleft. *C. spinosa* L. and of auth., not Jacq., *C. pungens* of auth., not Willd.? Often cult. and occasionally escaped in e. Tex., Apr.-Oct.; introd. from Latin Am.

4. *Cleome serrulata* Pursh. ROCKY MOUNTAIN BEE PLANT. Erect somewhat shrubby branched annual, 2-15 dm. tall, glabrous, glaucous, unarmed; leaflets 3, narrowly elliptic, 2-6 cm. long, 5-15 mm. wide, pointed at both ends; flowers in dense elongated many-flowered racemes; bracts narrow, simple; sepals united for one half to two thirds their length, persistent in fruit; petals bright-pink to purplish, rarely white (f. *albiflora* Cockll.), 8-12 mm. long; disk with nectariferous adaxial scale to 4 mm. long; stamens 13-20 mm. long; capsules variable, linear-cylindric to fusiform, pointed sharply at both ends, 2-8 cm. long, 3-9 mm. wide, deflexed; gynophore 11-23 mm. long; pedicel 14-20 mm. long; seeds several to many, ovoid, sharply pointed, 3-4 mm. long, black-brownish-mottled, blistered, the cleft fused. *Peritoma serrulatum* (Pursh) DC., *P. integrifolia* Nutt. Open woods and along railroads, restricted to n.e. corner of Tex. Panhandle, one station (introd.?) on Mustang Island, Corpus Christi Bay, May-Sept.; widespread throughout the Rocky Mts., Great Basin and Great Plains, from n.w. Calif. to s.w. Can., Ariz., n. Tex., Neb. and Minn.; adv. eastw.

5. *Cleome multicaulis* DC. Slender erect unbranched or sparingly branched glabrous annual, 2-7 dm. tall; leaflets 3, linear, strongly folded, 1-3 cm. long, 1-3 mm. wide; flowers in axils of cauline leaves, in very open elongate racemes; petals pinkish-purple, 4-7 mm. long; disk small, bulbous; capsule obovoid to linear, 9-18 mm. long, 2-4 mm. thick, deflexed; gynophore 3-10 mm. long, the pedicel 15-22 mm. long, both delicate; seeds subglobose, light-brown, 1.8-2.5 mm. long, smooth. *C. sonorae* Gray, *Peritoma sonorae* (Gray) Rydb. Presidio Co. (edge of cienega, volcanic ash soil, in thick growth of sacaton above Capote Falls, Sierra Vieja, 2000'); in alkaline sinks and old saline lake beds in *Larrea* belt in N.M., from s. Colo. to s.e. Ariz., s.w. N.M. to s.-cen. Mex. (D.F.), very sporadic and rare; June-Aug.

3. CLEOMELLA DC.

Erect slender to robust glabrous (rarely pubescent) annuals (ours) or perennial herbs; leaves alternate, palmately 3-foliolate; leaflets entire, mucronate, less than 4 cm. long; stipules minute, filiform; racemes terminal, bracteate; sepals minute, barely fused at base, tardily deciduous; corolla yellow, closed in bud, the petals subsessile; stamens 6, equal; anthers tightly coiled when dry; capsule an obdeltoid or rhomboidal silicle, often wider than long, the 2 valves deciduous, expanded contrary to the placenta into 2 obtuse to sharply pointed cones; gynophore elongate; style slender, persistent, indurate; seeds 3 to 20.

A small endemic North American genus of 10 xerophytic species, differing from *Cleome* (Sect. *Peritoma*) and *Wislizenia* in fruit characters.

1. Seeds 3 to 6 per capsule; fruiting gynophore 6-17 mm. long; style 0.5 mm. long; petals 4-6 mm. long; flowering portion of raceme short, flat or rounded, 1-2 cm. long; leaflets acute; eastern half of Texas 1. *C. angustifolia*.

1. Seeds 6 to 16 per capsule; fruiting gynophore 4-7 mm. long; style 1.5-2 mm. long; petals 6-9 mm. long; flowering portion of raceme oblongoid-elongate, 2-5 cm. long; leaflets often rounded to emarginate; Trans-Pecos Texas
..... 2. *C. longipes*.

1. *Cleomella angustifolia* Torr. Glabrous erect often very bushy annual, 6-26 dm. tall; leaflets 3, linear-elliptic, acute, 25-60 mm. long, 2-8 mm. wide; racemes to 4 dm. long, the flowering portion flat to rounded and 1-2 cm. long, bracteate (the lower 3-foliolate, the upper 1-foliolate); petals yellow, 4-6 mm. long; mature capsules oblongoid to rhomboidal or obdeltoid (cones acute to rounded), 5-10 mm. long, 5-9 mm. wide; style 0.5 mm. long or less; gynophore 4-7 mm. long, the androgynophore prominent and 1-1.5 mm. long; pedicel 7-12 (-17) mm. long; seeds 3 to 6 per capsule, dark-brown-mottled. Deep sands, gravels in river-bottoms, edge of ponds, roadsides, sandy prairies and bare sandstone shale in e. half of Texas (also Dawson Co.), June-Oct.; Tex. to e. Kan., w. Neb. and n.e. Colo.

2. *Cleomella longipes* Hook. Glabrous erect branched annual (or rarely perennial?) 3-8 dm. tall; leaflets 3, oblanceolate to oblong-oblanceolate, acute to rounded or emarginate, 15-30 mm. long, 4-10 mm. wide; racemes 1-5 dm. long, the flowering portion oblong-cylindric and 2-6 cm. long; bracts 1-foliolate or upper flowers ebracteate; petals yellow, 6-9 mm. long; mature capsule (silicle) obdeltoid or rhomboidal (the cones often sharply acuminate), 4-8 mm. long, 6-10 mm. wide; style 1-2 mm. long; gynophore 6-17 mm. long; pedicel 5-18 mm. long; seeds 6 to 16 per capsule, obovoid, when mature dark-brown. In saline or alkaline soils or sands of semideserts in the Trans-Pecos, May-Sept.; s.e. Ariz., s.w. N.M. and w. Tex. to cen. Mex.

4. WISLIZENIA ENGELM.

JACKASS CLOVER

About 3 species (or monotypic, with one highly polymorphic species?) in southwestern United States and northwest Mexico; very similar to *Cleomella*.

1. *Wislizenia refracta* Engelm. Robust glabrous annual, 4-7 dm. high (easily confused with *Cleomella* spp.), sparsely to densely branched; leaflets 3, oblanceolate to elliptic or ovate-oblong, 1-2 (-3) cm. long, 3-8 (-11) mm. wide, rounded at apex, attenuate at base into slender petiolules to 4 mm. long; stipules minute tufts of filiform hairs; racemes short, 1-8 cm. long, very dense, ebracteate; sepals minute, tardily deciduous; corolla closed in bud; petals yellow, subsessile, 2-4 mm. long; stamens 6, 6-7 mm. long, the anthers tightly coiled when dry; pistil long-exserted; style 4-6 mm. long in fruit, very slender; gynophore slender, 3-7 mm. long, strongly refracted against the slender pedicel (4-10 mm. long); fruit a 2-celled twin pod that separates into 2 divaricate or deflexed obovoid nutlets, each with 1 or 2 seeds permanently enclosed by the capsule-valve; nutlets 1.5-2.5 mm. long, smooth to veined, minutely to markedly tuberculate at distal end; seed smooth, yellow. In alkaline sandy or loamy soils of semideserts, on edges of playas, grasslands (*Hilaria* assoc.), riversides and roadsides, at 3,000 ft. elev. in the Trans-Pecos, mid-July-Sept.; Tex. and n. Mex. to Nev. and Baja Calif.

FAM. 82. RESEDACEAE S. F. GRAY

MIGNONETTE FAMILY

Annual (in ours) or perennial herbs with alternate leaves and glandlike stipules; racemes or spikes terminal, composed of small perfect bracteate flowers that are irregular and unsymmetrical; calyx 4- to 7-parted, persistent; petals small, clawed, as many as 7, sometimes laciniate; stamens as many as 40, not covered in bud; fruit a 1-celled capsule, 3- to 6-beaked; seeds many, subreniform.

About 6 genera comprising about 70 species that are mostly in the Mediterranean region.

1. OLIGOMERIS CAMB.

Characters of the family. About 9 species in both hemispheres.

1. *Oligomeris linifolia* (Vahl) Macbr. Rather succulent erect annual, glabrous, to 35 cm. tall, branching from base; leaves numerous, linear, often fascicled, to 25 mm. long; spike densely but often loosely flowered, to 15 cm. long; flowers sessile, about 2 mm. long; sepals 4, ovate-lanceolate, white-marginate; petals 2, white, cuneate-obovate, acuminate, with irregular apical margins; stamens 3, the slender filaments about 1 mm. long; capsule depressed-globose, to about 2.5 mm. long and 3-4 mm. thick, 4-beaked, opening at the summit, each lobe dorsally sulcate; seeds black, vernicose, about 0.5 mm. long. *O. subulata* Webb. On salt and clay flats, about boulders and on gravel bars along streams in the Rio Grande Valley and Trans-Pecos, Feb.-Aug.; from Tex. to Calif. and n. Mex.

FAM. 83. SARRACENIACEAE DUM.

PITCHER-PLANT FAMILY

Perennial rhizomatous and insectivorous plants with clustered tubiform leaves and solitary nodding flowers borne on a long naked erect scape; leaves rigidly erect, trumpet-shaped and partially filled with liquid, with a ridge on the adaxial side and terminated by an expanded hood; flowers regular, bisexual; sepals 5, with 3 appressed persistent bracts; petals 5, pendent, deciduous; stamens numerous; anthers 2-celled, dehiscing longitudinally; style simple below, expanded above into a large persistent 5-lobed umbrellalike structure, with a small stigma under each of the notched lobes; ovary 5-celled; fruit 5-valved; seeds keeled or winged on one side.

A small family of three genera comprising about 15 species.

1. SARRACENIA L.

PITCHER-PLANT. TRUMPET

Characters of the family. A genus of eight species, all of which are confined to the United States with the exception of *S. purpurea* L. which extends into Canada.

1. *Sarracenia alata* Wood. YELLOW TRUMPETS. Leaves yellow-green, trumpet-shaped, dilated upward, to 7 dm. long; hood ovate to suborbicular, with inconspicuous reddish veins, to 8 cm. long; scape about as long as the leaves; sepals broadly ovate to rhombic-ovate, bluntly obtuse at apex, curved, 4-5 cm. long, to 4 cm. wide; petals greenish-yellow, drooping, panduriform, 5-6 cm. long, to 4 cm. wide near the broadly rounded apex; style to 8 cm. wide, convex; capsule muricate; seeds tuberculate. *S. Sledgei* Macfarl. In wet acid bogs on slopes and flats in pinelands in e. and s.e. Tex., Mar.-Apr.; on the Gulf Coastal Plain from s. Ala. to e. Tex.

FAM. 84. DROSERACEAE SALISB.⁷³

SUNDEW FAMILY

Perennial or biennial (rarely annual) insectivorous herbs growing in wet or damp soil; leaves circinate in bud, expanding into a rosette or tuft at base of scape or rarely scattered

⁷³ Ref.: Frances E. Wynne in Bull. Torrey Club 71:166-174. 1944; Lloyd H. Shinnars in Sida 1:53-59. 1962; C. E. Wood, Jr. in Jour. Arnold Arb. 47:89-99. 1966.

in submersed plants, with or without prominent stipules, red or green, adorned with gland-tipped hairs that exude drops of a clear glittering glutinous fluid; scape with a simple or branched few-flowered secund inflorescence that nods at the undeveloped apex; flowers regular, shortly pedicellate, opening only in sunlight, hypogynous, usually 5-merous, soon withering but persistent; calyx imbricated; petals convolute; stamens 5, opposite the sepals, the anthers fixed by the middle; styles 3 or 5, bipartite to base; capsule 3- to 5-valved, with as many parietal placentas as valves; seeds numerous.

About 4 genera of more than 100 species of worldwide distribution.

1. DROSERA L. SUNDEW

Characters same as those of the family. More than 100 species primarily in the Southern Hemisphere.

- 1. Scape with gland-tipped hairs except toward base; stipules absent or vestigial; seeds crateriform, 0.3-0.4 mm. long 1. *D. annua*.
- 1. Scape glabrous or with inconspicuous sessile glands; stipules prominent, free (2)
- 2(1). Petioles with few to many long lax hairs lacking gland-tip; flowers pink, about 10 mm. in diameter; seeds 0.4-0.5 mm. long, papillose-corrugated with 14 to 16 ridges 2. *D. capillaris*.
- 2. Petioles glabrous or with inconspicuous sessile glands; flowers white, 7-8 mm. in diameter; seeds 0.7-1 mm. long, irregularly and densely covered with long papillae 3. *D. intermedia*.

1. *Drosera annua* E. L. Reed. Leaf blades suborbicular to cuneate-flabellate, to 8 mm. long and wide, about one-third as long as the glandular petiolar base; stipules lacking or rudimentary; scape erect, to 12 cm. tall, provided with gland-tipped hairs, supporting as many as 6 flowers; sepals ovate, subacute, to 4 mm. long, united at base; petals pink or roseate, obovate, to 9 mm. long; capsule obovoid, 3.5-4 mm. long; seeds black, obovoid, the pits in 10 to 12 rows. In damp sand in pinelands or mixed forests and in open bogs in e. and s.e. Tex., Feb.-June; Tenn., s. to Ala., Okla., La. and Tex.

Referred by some authors to *D. brevifolia* Pursh.

2. *Drosera capillaris* Poir. Leaf blades broadly spatulate to obovate, to 1 cm. long and 9 mm. wide, exceeded in length by the more or less pubescent petioles that are to 4 cm. long; stipules divided into numerous setaceous segments to 5 mm. long; scape erect, to 25 cm. tall, glabrous or inconspicuously glandular, supporting as many as 20 glabrous flowers in a strictly erect inflorescence; sepals oblong-elliptic, obtuse, to 4 mm. long and 2 mm. wide, united at base; petals pink, to 7 mm. long and 3 mm. wide; capsule ellipsoid-obovoid, to 5 mm. long; seeds ovate-oblong to elliptic, asymmetric, brown, coarsely papillose-corrugated. In wet sands and on seepage slopes and in bogs in e. Tex., Feb.-June; Va., Tenn. and Ark., s. to Fla. and Tex.; also W.I., Mex., C.A. and n. S.A.

3. *Drosera intermedia* Hayne. Leaves usually basal but sometimes extending up the stem when the plants grow in water or very wet places; leaf blades spatulate to oblong-obovate, to 2 cm. long and 5 mm. wide, with slender glabrous or inconspicuously glandular petioles to 5 cm. long; stipules divided into several setaceous segments to 5 mm. long; scape erect, to 2 dm. tall, glabrous or inconspicuously glandular, supporting as many as 20 flowers in an inflorescence that at first curves outward and often downward at the base before becoming erect; sepals oblong, to 4 mm. long and 1.5 mm. wide, united at base; petals white or sometimes pinkish, to 5 mm. long and wide; capsule ellipsoid, to 5 mm. long; seeds oblong, reddish-brown, blunt at the ends, densely and irregularly covered with long papillae. In wet sands and peaty areas in s.e. Tex., June-Aug.; Nfld. to Ont., w. to O., Ill. and Minn., s. to Fla. and Tex.

**FAM. 85. PODOSTEMACEAE AGARDH
RIVER-WEED FAMILY**

Aquatic herbs, attached to rocks in swift-flowing water by dislike processes, in habit resembling some species of algae and mosses; leaves alternate, 2-ranked, simple to lobed or decomposed; flowers naked, solitary, perfect, arising from a spathe-like involucre;

perianth wanting or composed of 3 to 5 scalelike or membranous sepals; stamens 1 to many; fruit a 2- or 3-celled many-seeded ribbed capsule.

About 130 species in more than 40 genera, mostly tropical.

1. PODOSTEMON MICHX. RIVER-WEED

Characters of the family. More than a dozen species of wide distribution.

1. *Podostemon Ceratophyllum* Michx. **THREAD-FOOT.** Plant olive-green, firm, glabrous; leaves long-petiolate, rigid, divided into linear or filamentous segments or sometimes simple, with dilated base sheathing the stem; stems abbreviated to very elongate, sometimes as much as 6 dm. long or more; flowers green, arising along the stems or in clusters at apex of stems, with slender pedicels; perianth obsolete; stamens 2, the more or less united filaments exceeding the ovary; ovary 2-celled; stigmas 2, subulate; capsule unequally 2-valved, with one 5-ribbed valve persistent, broadly ellipsoid, 2-3 mm. long. Attached to rocks in streams in (?) e. Tex., May-July; from Ga., along the Gulf Coast to Okla., n. to Ont. and N.B.

Although no specimens have been seen from Texas the species is included here because of the strong possibility of its occurrence in the state. It is extremely abundant in some sections of the Mountain Fork River in McCurtain Co., Oklahoma, less than 30 miles north of Bowie and Red River counties, Texas.

FAM. 86. CRASSULACEAE DC.⁷⁴ ORPINE FAMILY

Annual or perennial succulent exstipular herbs with perfect symmetrical flowers usually in a cyme; leaves simple or sometimes dentate; petals (free or somewhat united) and pistils the same number as the calyx segments and the stamens the same or double their number; fruit a 1-celled follicle that opens down the ventral suture, 1- to many-seeded.

About 1,500 species in 35 genera that are worldwide in distribution.

1. Plants minute, spreading or decumbent, annual; leaves opposite and connate at base, 7 mm. long or less; flowers solitary or in glomerules usually in axil of leaves, to 2 mm. long; stamens as many as calyx segments 1. *Tillaea*, p. 714.
1. Plants erect to suberect-ascending or sometimes procumbent, perennial or sometimes annual; leaves not opposite or (if so) not connate at base, sometimes in irregular whorls, longer than above; flowers in cymes, racemes or panicles, usually much more than 2 mm. long; stamens twice as many as the calyx segments (2)
- 2(1). Corolla with the parts free or essentially so; perennials or annuals 2. *Sedum*, p. 715.
2. Corolla united (at least at base) to form a tube; all perennials (3)
- 3(2). Leaves broad and flat, borne in a basal rosette, those of the scape reduced and often bractlike 3. *Echeveria*, p. 716.
3. Leaves terete to subcylindric and turgid, linear, borne on stem (4)
- 4(3). Plants small, in anthesis to 15 cm. tall; leaves less than 2 cm. long; flowers less than 5 mm. long 4. *Villadia*, p. 716.
4. Plants large, in anthesis well above 30 cm. tall; leaves much more than 2 cm. long; flowers about 25 mm. long 5. *Kalanchoë*, p. 717.

1. TILLAEA L. PIGMY-WEED

About 20 species of worldwide distribution.

1. *Tillaea aquatica* L. **WATER PIGMY-WEED.** Tufted or matted more or less aquatic annual, glabrous throughout; stems filiform, much-branched from base, spreading or

⁷⁴ Adapted partly from N. L. Britton and J. N. Rose in *N. Am. Fl.* (22)(1):7-74. 1905.

decumbent, to 10 cm. long; leaves opposite, connate-perfoliate, linear to linear-oblong, entire, to 7 mm. long; flowers minute, solitary, axillary, 4-merous, essentially sessile or with pedicels longer than the leaves; calyx 1 mm. long, about half as long as the greenish-white petals; follicles ovoid, 1.5-2 mm. long, 1- to several-seeded. *Crassula aquatica* (L.) Schoenl., *Tillaeastrum aquaticum* (L.) Britt. On dry mud flats about pools and along shores in e. and s.e. Tex., May-Aug.; from Nfld., w. to Wash., Ut., Wyo. and Tex., s. to Md. and La.; also Mex.

Plants with some of the pedicels exceeding the leaves have been segregated as var. *Drummondii* (T. & G.) Jeps. [*Tillaea Drummondii* T. & G., *Crassula Drummondii* (T. & G.) Fedde, *Tillaeastrum Drummondii* (T. & G.) Britt.].

2. SEDUM L. STONECROP. ORPINE

Smooth and fleshy-leaved perennials or occasionally annuals with mostly alternate (sometimes opposite or whorled) or imbricated simple leaves and flowers in broad to one-sided terminal or axillary cymes; sepals and petals 4 or 5, the usually narrow petals free or scarcely united at base; stamens 8 to 10, mostly perigynous; follicles several- to many-seeded, each subtended by a basal scale.

About 600 species, mainly in temperate and boreal regions of the Northern Hemisphere.

1. Leaves (at least the upper ones) densely imbricated, rarely to 5 mm. long (2)
1. Leaves not imbricated (excepting those of rosettes), alternate or rarely opposite or whorled, more than 5 mm. long (3)
 - 2(1). Stems covered with tubercles; follicles widespreading .1. *S. Havardii*.
 2. Stems not tuberculate; follicles erect2. *S. moranense*.
- 3(1). Annual or biennial species (4)
3. Perennial species (5)
 - 4(3). Follicles ascending; petals white or pinkish3. *S. pulchellum*.
 4. Follicles widely divergent; petals bright-yellow4. *S. Nuttallianum*.
- 5(3). Plants found in coastal area of south Texas; leaves opposite, 2-2.5 cm. long5. *S. texanum*.
5. Plants confined to mountains of Trans-Pecos Texas; leaves not opposite, to 1 cm. long (6)
 - 6(5). Petals narrowly lanceolate, about 4 mm. long; lower leaves ovate6. *S. Robertsianum*.
6. Petals spatulate to spatulate-obovate or elliptic, 6-8 mm. long; lower leaves obovate to elliptic-obovate7. *S. Wrightii*.

1. *Sedum Havardii* Rose. Low procumbent perennial, much-branched at base; stems reddish and covered with tubercles, to about 15 cm. long; leaves flattened but somewhat turgid, 2.5-5 mm. long, elliptic, obtuse, the upper ones distinctly imbricated; flowers few clustered at and near the apex of the branches, sessile or nearly so; calyx small, about 1 mm. long; petals creamy-white tipped with dark-red or reddish, narrowly lanceolate, acuminate, 4-5 mm. long; follicles widespreading. *S. Liebmannianum* of Coult. (Bot. W. Tex. 110. 1891), not Hemsl. At foot of cliffs and in crevices of rock ledges in Davis and Chisos Mts. in the Trans-Pecos; endemic.

2. *Sedum moranense* H.B.K. Perennial, procumbent, much-branched, rooting at the nodes; leaves glabrous, ovate, minute, scarious at base, 1-3 mm. long, thick, turgid, obtuse, densely appressed, imbricated; flowers in short secund racemes or only one or two at the tips of the branches; pedicels very short; sepals linear-oblong, somewhat unequal, fleshy, produced backward at base; petals reddish, 5 mm. long, lanceolate; follicles erect, at least at first. *S. Liebmannianum* Hemsl.

Reported from Trans-Pecos Texas but it is very dubious that this Mexican species occurs there.

3. *Sedum pulchellum* Michx. Glabrous annual (or biennial ?), ascending or trailing, branched, 1-3 dm. long; leaves crowded, terete, linear, sessile, obtuse, slightly auriculate at the base, 6-25 mm. long, about 2 mm. wide; cyme 4- to 7-forked, its branches

spreading or recurved in flower; flowers sessile, close together, 8-12 mm. broad; petals linear-lanceolate, acute, about twice the length of the lanceolate obtusish sepals; follicles 4-6 mm. long, tipped with slender styles. In seepage on and about calcareous rocks in e. Tex., Mar.-May; from w. Va., w. to s. Ill., Mo. and Kan., s. to Ga., Ala., Ark. and Tex.

4. *Sedum Nuttallianum* Raf. YELLOW STONECROP. Annual, pale-green, low, tufted, glabrous, 5-8 cm. tall; leaves alternate, linear-oblong, teretish, obtuse, sessile, entire, 4-15 mm. long; cyme 2- to 5-forked, its branches 1-5 cm. long; flowers sessile or very short-pedicelled, about 7 mm. broad; petals yellow, lanceolate, acute; follicles divergent, tipped with short subulate styles. *S. Torreyi* G. Don. On shallow soil, especially on and about sandstone and granite, also in pasturelands and clayey soils, mainly on the Edwards Plateau but n.e. to Hopkins Co., Apr.-July; in s.w. Mo., Ark., Okla. and Tex.

5. *Sedum texanum* J. G. Sm. Glabrous ascending herbaceous perennial, 1-2 dm. tall, cespitose, sparingly branching near base; leaves opposite, thick, fleshy, obovate to ovate-lanceolate, obtuse to acute, to 25 mm. long; inflorescence a spicate equilateral raceme or somewhat paniculate; flowers subsessile; sepals oblong to lanceolate, acute, 2-3 mm. long; petals free, rosy-yellow, 4-5 mm. long, oblong to oblanceolate, acute to subacuminate; follicles erect, long-acuminate. *Villadia texana* (J. G. Sm.) Rose, *Lenophyllum texanum* (J. G. Sm.) Rose. In chaparral and brushland along the coast in s. Tex., Oct.-Dec.; endemic.

6. *Sedum Robertsianum* Alex. Erect-sprawling succulent perennial; stems strongly red-streaked and -spotted, 8-12 cm. long; leaves ovate, turgid, elliptic in cross section, glabrous, yellow-green, heavily spotted with red, 5-8 mm. long, 3-4 mm. in diameter, obtusely apiculate at apex; inflorescence 2-branched or sometimes simple; flowers 6 to 12 on each branch of inflorescence, about 1 cm. across, equilaterally arranged, sessile or short-pedicelled; sepals lanceolate, the outer ones largest; petals narrowly lanceolate, about 4 mm. long, twice the length of the largest sepals, greenish at base, bright-yellow above, the channel on the upper surface deepening into a pit below the middle of petal. In shallow calcareous soils on mt. summits in the Trans-Pecos, spring-summer; endemic.

7. *Sedum Wrightii* Gray. Perennial, glabrous; stems weak, decumbent, 2-5 dm. long or less, often with long branches; basal and lower leaves obovate to elliptic-obovate, obtuse, 6-10 mm. long, those of the inflorescence oblong to spatulate-oblong, much smaller; cymes compact; flowers very short-pedicelled; calyx segments oblong, obtuse, half the length of the petals; petals spatulate to spatulate-obovate or sometimes elliptic, obtuse or obtusish, apiculate, white tinged with rose, 6-8 mm. long, their tips spreading; follicles erect, a little shorter than the petals, tipped with subulate styles. In crevices of ledges and on boulders, both igneous and limestone, in w. Edwards Plateau and the Trans-Pecos, July-Oct.; Tex., N.M. and n. Mex.

3. ECHEVERIA DC.

About 200 species mainly in the drier regions of the Western Hemisphere.

1. *Echeveria strictiflora* Gray. Scapose perennial plant with a rosette of broad flat succulent leaves; leaves oblanceolate to broadly spatulate, acuminate, glabrous, pale-green and slightly glaucous, to about 1 dm. long and 4 cm. wide, the upper surface with bright-red margins; flowering scape 2-4 dm. tall, simple or sometimes forked, provided with greatly reduced lanceolate leaves; racemes secund, to 15 cm. long; flowers shortly pedicelled, about 15 mm. long; sepals 5, oblong; corolla 5-angled and -lobed, twice the length of sepals, scarlet; stamens 10, the anthers oblong; scales large, thick, truncate; follicles free, oblong, erect, tapering into a slender style. *Cotyledon strictiflora* (Gray) Baker. On ledges and rocky slopes in mts. of the Trans-Pecos, June-Aug.; also n. Mex.

4. VILLADIA ROSE

Between 25 and 30 species, mostly Mexican and Andean.

1. *Villadia squamulosa* H.B.K. Perennial herb with fleshy or somewhat tuberous roots and terete turgid leaves, glabrous throughout; stems slender, branching at base, erect or ascending, 1-1.5 dm. long; leaves linear, 1-2 cm. long; flowers sessile or short-pedicelled,

either single and axillary or in small clusters; sepals 5, nearly equal; corolla segments rose-colored, ovate, acute, thin, 2-3 mm. long, about twice as long as the sepals, united into a short but distinct tube; appendages very large, yellow, 1 mm. long or more, thickened above; stamens 10; follicles erect. In the mts. of Trans-Pecos Tex. and Chih.; spring-summer.

5. KALANCHOË ADANS.

About 125 species mainly in Africa and Madagascar; containing many species grown for their ornamental value, including the following.

1. *Kalanchoë verticillata* Elliot. Glabrous perennial with simple erect stems to about 1 m. tall; leaves sessile, opposite or whorled, linear-subcylindric, mottled with violet-brown, 2.5-15 cm. long, producing plantlets at the tips; flowers in panicles, tubular, scarlet to salmon-color, pendulous, about 25 mm. long. *Bryophyllum tubiflorum* Harv. A nat. of S. Afr., cult. in s. Tex. where it has become naturalized, especially abundant in cactus-mesquite thickets at Loyola Beach, Kleberg County, as well as elsewhere in the Rio Grande Valley.

Quite a few species of succulents are cultivated in the Rio Grande Valley. Since some of these tend to persist around abandoned homesites and some even tend to migrate into the surrounding brush and chaparral growth, these will undoubtedly, in time, have to be treated as a part of our introduced and established flora.

FAM. 87. SAXIFRAGACEAE JUSS.

SAXIFRAGE FAMILY

Perennial herbs, woody vines, shrubs or rarely small trees with opposite or alternate usually exstipulate leaves; inflorescence variable; stamens mostly definite; carpels commonly fewer than the sepals, either separate or partly so or all combined into one compound pistil; floral cup either free or adherent to ovary, usually persistent or withering away; stamens and petals almost always inserted on rim of floral cup; ovary usually at least partly inferior; fruit a capsule or berry; ovules anatropous; seeds with copious endosperm.

Closely allied to Rosaceae and with some genera without clear relationships; sometimes split into several families. Estimated to be more than 1,000 species in nearly 100 genera in both hemispheres.

1. Plants herbaceous (2)

1. Plants woody (6)

2(1). Plants diminutive, forming prostrate patches less than 5 cm. across 1. *Lepuropetalon*, p. 718.

2. Plants with prominent erect stems (3)

3(2). Leaves scattered along the flowering stem; ovary 5- to 7-celled; follicles circumscissally dehiscent; ovary mostly superior 2. *Penthorum*, p. 718.

3. Leaves mostly basal and rosulate; ovary 1- or 2-celled; fruits not dehiscent as above; ovary about half-inferior (4)

4(3). Fertile stamens 10; ovary 3- or 4-celled; mature leaves usually less than 3 cm. long 3. *Saxifraga*, p. 718.

4. Fertile stamens 5; ovary 1-celled; mature leaves usually more than 3 cm. long (5)

5(4). Leaves lobulate or toothed; flowers in panicles, without staminodia 4. *Heuchera*, p. 719.

5. Leaves entire; flowers solitary on a scapose stem, with staminodia 5. *Parnassia*, p. 719.

6(1). Leaves alternate (7)

6. Leaves opposite (8)

- 7(6). Leaves pinnately veined, unlobed, at most with serrulate margins; ovary superior, free from the calyx; fruit a capsule 6. *Itea*, p. 720.
7. Leaves noticeably palmately veined and lobed; ovary inferior; fruit a berry
..... 7. *Ribes*, p. 720.
- 8(6). Stamens usually many more than 15; leaves characteristically ovate or elliptic (9)
8. Stamens 12 or less; leaves characteristically linear or linear-elliptic (10)
- 9(8). Erect or spreading shrubs; flowers 4- or 5-merous; calyx lobes well-developed ..
..... 8. *Philadelphus*, p. 722.
9. High-climbing vines; flowers 7- to 10-merous, calyx lobes toothlike
..... 9. *Decumaria*, p. 725.
- 10(8). Petals long-clawed; filaments terminated by 2 narrowly triangular appendages; capsules ovoid or conic, more than 8 mm. long 10. *Fendlera*, p. 725.
10. Petals without a claw; filaments without appendages; capsules ellipsoid, less than 6 mm. long 11. *Fendlerella*, p. 726.

1. LEPUROPETALON ELL.

A monotypic genus. Segregated by some authors as a monotypic family, Lepuropetalaceae.

1. *Lepuropetalon spathulatum* (Muhl.) Ell. Annual diminutive herbs, growing in small tufts, glabrous, mostly in hemispheric patches 1-1.5 cm. across; stems abbreviated, usually branched from the base, the branches angled; leaves alternate, simple, sessile, spatulate, 2-6 mm. long, obtuse, usually adorned with lines of reddish glands; entire; flowers inconspicuous but large for the plant, solitary near or at the ends of the stems and branches; hypanthium flattish, at maturity longer than the calyx; calyx 1.5-2 mm. wide; sepals 5, ovate, spreading, 1-2 mm. long at maturity; corolla white, minute, regular; petals 5, broad, scalelike, shorter than the sepals, reniform to ovate-reniform; stamens 5; filaments subulate, very short; ovary partly inferior, the 3 or 4 short carpels united; fruit about 2 mm. long, the folliclelike carpel apices erect, slightly spreading; fruit a capsule loculicidal at apex; seeds pitted. Sandy soil about sinks and on wet soil in the e. half of Tex., Feb.-Mar.; from S.C. and Ga. to Tex and Mex.; also Chile.

2. PENTHORUM L. DITCH-STONECROP

About 3 species, with 2 in Asia. Segregated by some authors as a monogeneric family, Penthoraceae.

1. *Penthorum sedoides* L. Upright or somewhat bushy-sprawling weedlike perennial herb, stoloniferous; stem decumbent at base, simple to widely branched, to about 8 dm. tall; leaves alternate, scattered, elliptic to broadly lanceolate, serrate, acute to acuminate at apex, narrowly cuneate at base, to 15 cm. long and 4 cm. wide; flowers yellowish-green, loosely spiked along the upper side of the naked scorpioid branches of the cyme; calyx lobes 5 or 7; petals usually absent; stamens 10; pistils 5 or 7, united below and slightly sunken in the receptacle, forming a 5-angled 5-horned and 5-celled capsule that opens by dehiscence of the caplike beaks, with numerous ellipsoid echinate seeds. Wet ground, usually along and on edge of water in streams in e. and s.e. Tex., June-July; from Fla. to Tex., n. to s. N.B., N.E., s.w. Que., s. Ont., Mich., Wisc., Minn. and Neb.

3. SAXIFRAGA L. SAXIFRAGE

About 370 species, mostly in the North Temperate Zone.

1. *Saxifraga texana* Buckl. Perennial herb from a bulbous base, to 15 cm. tall; leaves simple, in a basal rosette, spreading, broadly ovate to ovate-oblong, obtuse at apex, abruptly narrowed into a petiolate base, to 4 cm. long, usually much smaller, with undulate margins, essentially glabrous; scapes erect, usually solitary, green or rose-colored, coarsely white-pubescent (especially below the middle); cymules aggregated into tight

heads; sepals ovate to oblong, obtuse, 1.5-2 mm. long, commonly rose-colored; petals white, broadly elliptic to obovate, 2.5-3 mm. long, narrowed at base; stamens 10; follicle-like carpel tips 3 or 4, about 3 mm. long, the stout tips ascending or somewhat spreading. *S. Reevesii* Cory, *Micranthes texana* (Buckl.) Small. In seepage on rock outcrops in fields and on edge of woods in e. Tex., uncommon, Feb.-Mar.; in Mo., Kan., Ark., Okla. and Tex.

4. HEUCHERA L.⁷⁵ ALUMROOT

Perennial herbs with scapose stems from a stout caudex and long-petioled mostly basal simple leaves; petioles glabrous to densely pubescent, with dilated margins or adherent stipules at their base; leaf blades orbicular to broadly ovate or somewhat pentagonal or reniform, cordate to subtruncate at base, often somewhat lobulate and toothed; flowers in small clusters borne in a narrow often lax panicle, slightly irregular, greenish or purplish; calyx 5-cleft; petals 5, narrow; styles 2, slender; ovary half-inferior; capsule 1-celled, ovoid, with 2 parietal many-seeded placentae, 2-beaked, opening between the beaks; seeds oval, with a rough close seed coat.

About 50 species in North America.

1. Petals shorter than to only slightly exceeding the sepals; plants confined to northeast Texas1. *H. americana*.
1. Petals about twice as long as the sepals; plants confined to mountains of Trans-Pecos Texas (2)
- 2(1). Inferior part of ovary turbinate to broadly obconic at anthesis, about as broad as or broader than long2. *H. rubescens*.
2. Inferior part of ovary narrowly obconical, distinctly longer than broad3. *H. leptomeria*.

1. *Heuchera americana* L. Leaves to 15 cm. long, with 5 to 9 rounded lobules and numerous blunt teeth, glabrous to finely strigose on upper surface, more or less hirsute or strigose on veins of lower surface; flowering stems glabrous to short-hirsute, becoming glandular in the inflorescence, to 1 m. tall; flowers 3-5 mm. long; calyx nearly regular, the tube flaring from summit of the broadly campanulate hypanthium, about 1 mm. long; petals obovate to spatulate or oblanceolate, often purplish; stamens and style conspicuously exerted; capsule ovoid, 5-7 mm. long, with persistent styles nearly as long. Upland woods in n.e. Tex., Apr.-June; from Conn. to Ont. and Mich., s. to Ga., Ala., Tex. and Okla.

Our plants appear to be referable to var. *brevipetala* Rosend., Butt. & Lak., with the petals shorter than the sepals or linear-oblanceolate and slightly exceeding the sepals.

2. *Heuchera rubescens* Torr. Leaves to about 5 cm. long, glabrous to sparingly hirsute on upper surface (especially on the veins), often more or less hirsute on the veins of lower surface, rounded-lobulate and with rounded-ovate, ciliate and bristle-pointed teeth; flowering stems glabrous to more or less hirsute below, shining, becoming glandular in the inflorescence, to 4 dm. tall; hypanthium narrowly campanulate, pinkish, glandular-puberulent and (with the sepals) more or less white-hairy; sepals oblong, obtuse, green-tipped, 3-6 mm. long; petals linear-oblanceolate, about twice the length of the sepals; stamens as long as or slightly longer than the petals. Rocky places in the mts. of the Trans-Pecos, up to 8,000 ft. alt., July-Sept.; from Ut. to Calif. and s.e. Ore., e. to w. Tex.

3. *Heuchera leptomeria* Greene. The basis for separating *H. leptomeria* from *H. rubescens* is extremely tenuous. It is quite possible that they should be combined. *H. versicolor* Greene var. *leptomeria* (Greene) Kearn. & Peeb. On moist shaded rocks in conifer forests in mts. of the Trans-Pecos, July-Oct.; from w. Tex. and s. Ut. to Ariz., Calif. and n. Mex.

5. PARNASSIA L. GRASS-OF-PARNASSUS

Perennial glabrous herbs with short rootstocks and with a scapelike stem; leaves simple, entire, mostly basal and petioled, the single cauline leaf sessile; scape typically 1-flowered;

⁷⁵ Ref.: C. O. Rosendahl, F. K. Butters and Olga Lakela in Minn. Stud. Pl. Sci. 2:1-180. 1936.

hypanthium short and usually poorly developed; sepals 5, imbricated in bud; petals 5, imbricated in bud, white, conspicuously greenish- or yellowish-veined, deciduous; stamens 5, persistent and alternate with the petals and with 5 clusters of more or less united staminodia that are gland-bearing at the ends; ovary 1-celled, superior to half-inferior; style short or none; stigmas 4, sessile; capsule 1-celled, 4-valved.

About 50 species in the Northern Hemisphere. Segregated by some authors as a monogeneric family, Parnassiaceae.

1. Leaves reniform; petals with claw; staminodes 5-9 mm. long, equaling or shorter than the stamens1. *P. asarifolia*.

1. Leaves suborbicular-ovate; petals sessile; staminodes 12-15 mm. long, conspicuously longer than the stamens2. *P. grandifolia*.

1. *Parnassia asarifolia* Vent. Flowering stem 2-5 dm. high; basal leaves with petioles to 15 cm. long, broadly reniform, 3-4 cm. long, wider than long; cauline leaf about or below middle of stem, similar to but smaller than the basal leaves; petals oblong-elliptic, contracted at base into a claw, 12-18 mm. long, with 11 to 15 radiating veins; staminodia 3-pronged, usually slightly shorter than the stamens, 5-9 mm. long, united for one fifth to two fifths their length. In sphagnum moss of evergreen shrub bogs in e. Tex., rare, Sept.-Nov.; from Va. and W.Va., s. to Ga. and Tex.

2. *Parnassia grandifolia* DC. Flowering stems to 4 dm. tall; basal leaves with petioles to 15 cm. long, thick and firm, ovate to suborbicular, usually subcordate at base, to 1 dm. long and 8 cm. wide; cauline leaf ovate to suborbicular-ovate, usually borne below the middle of the scape; sepals elliptic, 4-5 mm. long, 3- to 7-veined; petals elliptic, 15-20 mm. long, with about 7 strong veins; filaments 7-8 mm. long, subulate; anthers ovate, acute, about 3 mm. long; staminodia nearly filiform, 12-15 mm. long, 3 to 5 in each set, united only at the base; capsule ovoid, about 15 mm. long. In moist meadows and wet marly situations in e. Tex., rare, Aug.; from Fla. to Tex., n. to Va., W.Va., Tenn. and Mo.

6. ITEA L. SWEET-SPIRE

About 15 species, mostly in southeast Asia. This genus, along with *Choristylis* Harv., is treated as a segregate family, Iteaceae, by some authors.

1. *Itea virginica* L. TASSEL-WHITE. Shrubs to 25 dm. tall; leaves simple, alternate, petioled, deciduous, broadly elliptic to oblong or obovate, acute to abruptly acuminate at apex, minutely serrate, at time of flowering to 8 cm. or more long; racemes simple, terminating the branchlets, to 2 dm. long and 2 cm. in diameter, loose and open, the rachis and pedicels evident; calyx 5-cleft, free from the ovary or nearly so; petals 5, white, lanceolate, much longer than the calyx and longer than the 5 stamens; capsule oblong, 2-grooved, 2-celled, tipped by the 2 united styles, 2-parted when mature, several-seeded. Swamps, about lakes and along wooded streams in e. Tex., Apr.-May; from Fla. to Tex., n. to N.J., e. Pa., Ky., s. Ill., Mo. and Okla.

7. RIBES L. CURRANT. GOOSEBERRY

Shrubs with arching or straggly branches, unarmed or sometimes spiny; leaves alternate or appearing to be fascicled, broadly rounded, mostly palmately lobed, with the lobes toothed or crenate; flowers solitary or in fascicles or abbreviated racemes; calyx 5-lobed, often colored, the tube adherent to the ovary; petals 5, small, inserted in the calyx tube; stamens 5, inserted on calyx tube alternately with the petals; ovary 1-celled; berry crowned by the shriveled remains of the flower.

About 150 species in cold or temperate regions in both hemispheres. A number of species are of economic importance because they are alternate hosts for the white pine blister rust, the fruits are eaten by birds, animals and man, and many are favorite browse plants of both domestic animals and deer. This genus, along with *Grossularia* Mill., is treated by some authors as a segregate family, Grossulariaceae.

1. Branchlets prickly with short nodal spines; pedicels not jointed (2)

1. Branchlets without spines; pedicels jointed (3)

- 2(1). Branches with 2 to 4 spines at a node; petioles sparsely pilose and typically with scattered long pectinate hairs below the middle; found only in east Texas 1. *R. curvatum*.
2. Branches with a solitary spine at a node; petioles uniformly densely pubescent; found only in mountains of west Texas 2. *R. leptanthum*.
- 3(1). Hypanthium and sepals densely pubescent; anthers with a conspicuous cup-shaped apical gland; fruit glandular-stipitate; inflorescences and petioles pubescent and with noticeably stipitate glands 3. *R. mescalegium*.
3. Hypanthium and sepals glabrous or essentially so; anthers at most with a callus at the apex; inflorescence and petioles without long-stipitate glands (4)
- 4(3). Hypanthium 12-15 mm. long; sepals at most about half as long as the tube, revolute or spreading in the faded flower; young branchlets reddish-brown 4. *R. odoratum*.
4. Hypanthium 6-10 mm. long; sepals more than half as long as the tube, upright and closed in the faded flower; young branchlets tan-color 5. *R. aureum*.

1. *Ribes curvatum* Small. GRANITE GOOSEBERRY. Shrub diffusely branched, to 1 m. tall; branchlets slender, reddish-brown, with reddish slender nodal spines 4-6 mm. long; leaves suborbicular, cuneate to subcordate at base, 1-3 cm. wide, 3- to 5-lobed, the lobes with few obtuse-rounded teeth, sparingly pubescent; petioles slender, as long as or shorter than blade; flowers 1 to 5 on slender peduncles, white; bracts often 3-lobed, ciliate; ovary glandular or pubescent; hypanthium broad-campanulate, glandular; sepals linear to linear-spatulate, 6-10 mm. long, revolute; petals prominently toothed near apex, 1.5-2 mm. long; stamens as long as sepals; filaments villous; fruit greenish, glabrous, globose, 6-8 mm. in diameter. *Grossularia texensis* Cov. & Berger. Rocky woods and slopes in e. Tex., Mar.-May; from Ga. to La. and Tex.

2. *Ribes leptanthum* Gray. Shrub slender, to 2 m. tall; branchlets arching, smooth or bristly, with stout nodal spines from a broad swollen base and to 12 mm. long; leaves suborbicular-reniform, truncate to open-cordate at base, 5-20 mm. wide, 3- to 5-cleft with dentate lobes, glabrous to pubescent and somewhat glandular; petioles as long as or shorter than blade; flowers greenish-white, 1 or 2 on a slender peduncle; pedicels short or wanting; ovary glabrous or sometimes glandular-pubescent; sepals oblong, greenish-white, about as long as the nearly cylindrical greenish hypanthium; petals white or pinkish, obovate, obtuse, about half as long as the sepals and as long as the stamens; style glabrous, exerted, bifid at apex; fruits black, lustrous, smooth or glandular-hispid. On talus slopes and about boulders and cliffs in mts. of the Trans-Pecos, up to 8,000 ft. alt., Mar.-May; from w. Tex. and Colo. to Ut. and Ariz.

3. *Ribes mescalegium* Cov. Shrub, much-branched and upright; leaves reniform to orbicular, cordate to broadly cuneate at base, 1-4 cm. wide, 3- to 5-lobed, with obtuse crenulate lobes, commonly pubescent; flowers greenish-white; bracts obovate, dentate at the obtuse apex; hypanthium about 7 mm. long, pubescent; sepals oblong-ovate, about half as long as the hypanthium; anthers with a conspicuous cup-shaped apical gland; style glabrous; fruit sparingly glandular-pubescent, black. Near summit of mts. in the Trans-Pecos, up to 8,000 ft. alt., July-Sept.; in w. Tex. and N.M.

This species is closely allied to the more western *R. inebrians* Lindl. and *R. cereum* Dougl.

4. *Ribes odoratum* Wendl. BUFFALO CURRANT. Shrub erect, to 2 m. tall, the young branchlets reddish-brown, pubescent; leaves ovate to orbicular-reniform, cuneate to truncate at base, 3-8 cm. wide, deeply 3- to 5-lobed, with coarsely dentate lobes, glabrate to puberulous on lower surface; flowers yellow, fragrant, 5 to 10 in a usually nodding raceme; bracts ovate to oval, foliaceous; rachis pubescent; hypanthium 12-15 mm. long and 2-2.5 mm. wide; sepals elliptic-obovate, scarcely half as long as tube, 5-6.5 mm. long, revolute or recurved, not upright and closed in the faded flower; petals 2.5-3.5 mm. long, erose at apex, reddish; fruit globose to ellipsoid, black or yellowish, 8-10 mm. long. On cliffs, rocky slopes and sandy bluffs in w. half of Tex., Feb.-May; from Minn. to Ark., Tex., Col. and S.D.

5. *Ribes aureum* Pursh. GOLDEN CURRANT. Shrub to 2 m. tall; young branchlets light-tan-color, glabrous or puberulous; leaves orbicular-reniform to obovate, cuneate to sub-

cordate at base, to 5 cm. wide, 3-lobed, the coarsely crenate-dentate lobes often with only 2 or 3 teeth, glabrous or sometimes puberulous on lower surface; petioles about as long as blade; flowers yellow, fragrant or slightly so, 5 to 15 in a raceme; bracts oblong to obovate; hypanthium slender, 6-10 mm. long, 1.5 mm. wide; sepals more than half as long as the tube, spreading, upright and closed in the faded flowers; petals changing to red; fruit globose, black or purplish-brown, 6-8 mm. in diameter. At lower elev. in the s. part of the Trans-Pecos, up to 6,000 ft. alt., Mar.-June; from S.D. to Assiniboia and Wash., s. to w. Tex., N.M., Ariz. and Calif.

8. PHILADELPHUS L.⁷⁶

MOCK-ORANGE

Shrubs with much-branched stems and exfoliating bark; leaves opposite, deciduous, exstipulate, entire or occasionally dentate, usually more or less pubescent and frequently white-sericeous on lower surface; axillary buds exposed or enclosed; flowers solitary or sometimes several in a cluster, mostly showy and fragrant; calyx turbinate or subcampanulate, adnate to ovary to form an hypanthium, glabrous to pubescent, the lobes 4 or 5; petals white to occasionally cream-color; stamens numerous, with subulate filaments and oblong anthers; ovary partly inferior; capsules ellipsoid to turbinate or subglobose.

About 75 species, mostly in temperate regions of both hemispheres, especially eastern Asia. Many species are grown as ornamentals.

1. Leaves broadly ovate to ovate-elliptic, 5-8 cm. long, 2.5-5 cm. wide; confined to river bluffs in northeast Texas 1. *P. pubescens*.
1. Leaves mostly elliptic, rarely more than 3 cm. long and 1.5 cm. wide; distribution on Edwards Plateau and the Trans-Pecos (2)
- 2(1). Axillary buds enclosed in nodal pouches at the ends of the petioles; branches determinate; inflorescence one- to few-flowered; stamens 25 to 75; stigmas linear; fruit ellipsoid, with subapical or circumferential persistent sepals; seeds more or less caudate, with rounded lobes on the crown (3)
2. Axillary buds exposed in axils of leaves; branches indeterminate; flowers solitary; stamens 13 to 35; stigmas columnar or subcapitate, 4-grooved; fruit turbinate or subglobose, with apical persistent sepals; seeds noncaudate (8)
- 3(2). Hypanthium and sepals glabrous or only sparsely pilose at the base 2. *P. microphyllus*.
3. Hypanthium and sepals uniformly pubescent (4)
- 4(3). Leaves glabrescent or sparsely villose on upper surface; hypanthium lanate 3. *P. argyrocalyx*.
4. Leaves definitely and permanently strigose, hispid or villose on upper surface; hypanthium incanous or slightly pilose (5)
- 5(4). Leaves pilose or villose on upper surface, the hairs appressed; densely long-villose on lower surface, the hairs erect; hypanthium incanous, the hairs long-villose, straight or slightly curly 7. *P. crinitus*.
5. Leaves strigose or hispid on upper surface; hypanthium incanous or slightly pilose, the hairs straight and appressed (6)
- 6(5). Hypanthium slightly pilose, the epidermal tissue visible 4. *P. occidentalis*.
6. Hypanthium thickly covered, the hairs incanous, the epidermal tissue obscured, the indumentum consisting of straight strigose hairs mixed with some weak crisp ones (7)
- 7(6). Leaves ovate-oblong; corolla disciform 4. *P. argenteus*.
7. Leaves ovate-lanceolate to lanceolate; corolla subcampanulate 6. *P. Palmeri*.

⁷⁶ Adapted from S. Y. Hu in Jour. Arnold Arb. 35:175-233; 36:52-109, 326-368; 37:15-90. 1954-1956.

- 8(2). Leaves strigose or strigose-villose, the hairs all straight; style 1 mm. long (9)
 8. Lower surface of leaves lanate and hirsute, the hairs dimorphous; style 1-2 mm. long
 (11)
- 9(8). Hypanthium glabrous; leaves strigose on both surfaces, the hairs appressed
 10. *P. Hitchcockianus*.
9. Hypanthium pubescent; upper surface of leaves pilose, the hairs appressed (10)
- 10(9). Corolla stellate, the petals oblong-lanceolate, 2-3 mm. wide; leaves oblong-lanceolate, 2-5 mm. wide 8. *P. Mearnsii*.
10. Corolla disciform, the petals suborbicular, 6-7 mm. wide; leaves ovate, 8-13 mm. wide 9. *P. Ernestii*.
- 11(8). Hypanthium villose and lanate; upper surface of leaves strigose with long appressed hairs and usually hirsute with scabridous erect ones; the persistent calyx apical on fruit 11. *P. serpyllifolius*.
11. Hypanthium glabrous or rarely sparsely pilose at the base; upper surface of leaves sparsely pilose, the hairs all appressed; the persistent calyx usually circumferential 12. *P. texensis*.

1. *Philadelphus pubescens* Lois. Shrub to about 3 m. tall; bark of young twigs gray, not exfoliating; leaves ovate to ovate-elliptic, 5-8 cm. long, 2.5-5 cm. wide, mostly rounded at base, acuminate at apex, sharply dentate to nearly entire, glabrous above, pubescent beneath; flowers with pubescent pedicels, in racemes of 5 or 7, about 25 mm. wide; sepals triangular-ovate, pubescent, about 5 mm. long; hypanthium pubescent. Rare on wooded bluffs in n.e. Tex. (Red River Co.), Apr.-June; from Tex. n. to Mo. and Ark., e. to Tenn. and Ala.

2. *Philadelphus microphyllus* Gray. Shrub erect, to about 2 m. tall; leaves with a petiole about 2 mm. long, ovate-elliptic to elliptic or sometimes elliptic-lanceolate, obtuse to acute at apex, 1-1.5 cm. long, 5-7 mm. wide, dark-green and villose-strigose to glabrous on upper surface, paler and more densely villose-strigose on lower surface, the hairs mostly appressed; flowers 1 or 2; sepals ovate-lanceolate, about 5 mm. long and 3 mm. wide at base; corolla cruciform; petals obovate-oblong, rounded and erose at apex, about 15 mm. long and 8 mm. wide above middle; stamens about 32, the filaments distinct; style 1 mm. long; capsules globose, 7 mm. in diameter. Incl. subsp. *typicus* C. L. Hitchc. In canyons at high elev. in the Chisos Mts., Brewster Co., June-Oct.; from Colo., Ut. and Nev. to w. Tex., N.M. and Ariz.

3. *Philadelphus argyrocalyx* Woot. Shrub erect, 1-2 m. tall; leaves with a petiole 1.5-2.5 mm. long, ovate to ovate-lanceolate or elliptic, obtuse to acute at apex, 1-3.5 cm. long, 4-15 mm. wide, sparsely strigose-villose on lower surface, the hairs more or less erect; flowers solitary; sepals ovate-lanceolate, 7-8 mm. long, 3.5-4.5 mm. wide at base; corolla cruciform; petals ovate-oblong, rounded and emarginate at apex, 15-17 mm. long, 10-14 mm. wide; stamens about 55, the filaments united into bundles; style 3 mm. long; capsules ellipsoid-subglobose, 10-12 mm. long, 7-9 mm. in diameter.

Although this species is considered to be endemic to mountains in south-central Mexico, it has been reported from Trans-Pecos Texas; June-Aug. No specimen, however, has been seen.

4. *Philadelphus occidentalis* A. Nels. Shrub low, the branches ochraceous; leaves ovate to ovate-elliptic, obtuse to acute at apex, 10-25 mm. long, 5-11 mm. wide, uniformly sparsely strigose-pilose on both surfaces, the hairs appressed; flowers solitary or ternate; sepals ovate, acuminate, 4-6 mm. long; corolla disciform; petals obovate, rounded at apex, 5-10 mm. long, 4-8 mm. wide; stamens about 35; style 1 mm. long; capsules subglobose-ellipsoid, 5 mm. long, 4.5 mm. in diameter. In canyons of mts. in the Trans-Pecos, June-Aug.; from Wyo. to Calif. and w. Tex., s. to n. Mex.

5. *Philadelphus argenteus* Rydb. Shrub to 2 m. tall; leaves with petioles 1-1.5 mm. long, ovate to oblong-elliptic, obtuse to acute at apex, 8-16 mm. long, 4-10 mm. wide, weak-strigose on upper surface, incanous on lower surface, the hairs largely strigose but mixed with some crisp weakly villose ones, all appressed; flowers solitary; sepals deltoid, acuminate, 5 mm. long, 4 mm. wide at base; corolla disciform; petals broadly ovate, 6-10 mm. long, 5-10 mm. wide; stamens about 46, the filaments separated; style 1 mm. long; capsules ellipsoid, 6 mm. long, 5 mm. in diameter. In canyons and on steep limestone

slopes in the Trans-Pecos, July-Aug.; from Calif., Nev., Ut. and Colo., s. to w. Tex. and n. Mex.

6. *Philadelphus Palmeri* Rydb. Small shrub with fibrous gray branchlets; leaves lanceolate, acute to acuminate at apex, 1-3 cm. long, 3-10 mm. wide, appressed sparse-pilose on upper surface, densely strigose-pilose on lower surface with the hairs largely straight and mixed with some weak and crisp ones, all appressed; flowers solitary; sepals ovate, acute, 5 mm. long, 3.5 mm. wide; corolla subcampanulate; petals oblong-obovate, 1 cm. long, 5-8 mm. wide; stamens about 23, the filaments united in 5 or more bundles; style 1.25 mm. long; capsules turbinate, 4-7 mm. long, 5-7 mm. in diameter. In high mts. of the Trans-Pecos, July; Ariz., w. Tex. and n. Mex.

7. *Philadelphus crinitus* (C. L. Hitchc.) Hu. Shrubs small, to 2 m. tall, with brownish-gray branchlets; leaves ovate to ovate-elliptic, acute at apex, 1-2 cm. long, 5-10 mm. wide, weakly villose on upper surface, moderately to densely villose or strigose-villose on lower surface, the hairs appressed; flowers solitary or rarely ternate, very fragrant; sepals ovate, acuminate, 6-8 mm. long, 3-4 mm. wide at base; corolla campanulate-disciform; petals suborbicular, 6 mm. in diameter; stamens 48 to 74, the filaments free; style 1-1.5 mm. long; capsules subglobose-ellipsoid, 7-9 mm. long, 6-7 mm. in diameter. *P. microphyllus* subsp. *crinitus* C. L. Hitchc. On talus slopes in the Davis Mts. of the Trans-Pecos, July-Aug.; also Ariz.

8. *Philadelphus Mearnsii* Evans. A spinescent low shrub with gray branches; leaves with a petiole 2 mm. long, oblong-lanceolate, obtuse to acute at apex, 5-15 mm. long, 2-5 mm. wide, strigose-pilose with appressed hairs on both surfaces; flowers solitary; sepals ovate-lanceolate, caudate at apex, 3 mm. long, 2 mm. wide; corolla stellate; petals oblong-lanceolate, acute or rarely notched at apex, 8 mm. long, 2.5 mm. wide; stamens 13 to 16; style 1 mm. long; capsule hemispherical, with a flat top, about 2 mm. in diameter. Rare in the mts. of the Trans-Pecos, June-July; N.M., w. Tex. and n. Mex.

9. *Philadelphus Ernestii* Hu. Small shrub with grayish branches; leaves ovate, obtuse at apex, 14-28 mm. long, 8-13 mm. wide, sparsely pilose on upper surface, villose on lower surface, the hairs more or less crisped at base; flowers solitary; sepals ovate, acuminate, 4 mm. long, 2 mm. wide; corolla disciform; petals suborbicular, 6-7 mm. in diameter; stamens about 20; style 1.5 mm. long; capsules subglobose, 4-5 mm. in diameter. Rare and apparently endemic on the Edwards Plateau.

10. *Philadelphus Hitchcockianus* Hu. A small subspinescent shrub; leaves ovate, obtuse at apex, 1-2.5 cm. long, 6-12 mm. wide, uniformly short-strigose on both surfaces, the hairs appressed; flowers solitary; sepals broadly ovate, acuminate, 3 mm. long, 2.5 mm. wide at base; corolla cruciform; petals oblong, rounded-emarginate at apex, 8 mm. long, 4.5 mm. wide; stamens about 23; style 1 mm. long; capsules turbinate, 4 mm. long, 5 mm. in diameter. About boulders and on walls of cliffs in canyons of the Guadalupe Mts. in the Trans-Pecos, May-June; Tex., N.M. and n. Mex.

11. *Philadelphus serpyllifolius* Gray. Subspinescent shrub, to 15 dm. tall, the branches cinereous; leaves ovate to ovate-oblong or ovate-lanceolate, obtuse to rarely rounded or acute at apex, 5-20 mm. long, 2-8 mm. wide, sparsely strigose and densely hirsute on upper surface, white with rather dense straight appressed hairs mixed with a close covering of very fine tangled tomentum; flowers solitary; sepals ovate, acuminate, 4 mm. long, 2.5 mm. wide, twice as long as the small hypanthium; corolla cruciform; petals oblong, 4-6 mm. long, 3-4 mm. wide; stamens about 20, the filaments distinct; style 1.5 mm. long; stigma columnar, 4-ridged, 1-1.5 mm. long; capsules subglobose, 4 mm. in diameter. On lower slopes of mts. in the Trans-Pecos, Apr.-May; Ariz., N.M., w. Tex. and n. Mex.

12. *Philadelphus texensis* Hu var. *texensis*. Small much-branched shrub; leaves ovate or rarely elliptic, acute at apex, prominently 3-nerved, 6-30 mm. long, 3-20 mm. wide, sparsely appressed-pilose on upper surface, white-villose and lanate on lower surface; flowers solitary; sepals deltoid, acuminate; corolla cruciform; petals oblong, 7-8 mm. long, 3 mm. wide; stamens about 16, the filaments dilated at base; style 1 mm. long; capsules subglobose, 4 mm. in diameter. On limestone bluffs and among boulders on the Edwards Plateau, Apr.-May; endemic.

Var. *Coryanus* Hu resembles *P. serpyllifolius* in that it has a pilose hypanthium and calyx, the latter being apical on the fruit. Bandera Co., Tex.

9. DECUMARIA L. CLIMBING HYDRANGEA

Two species, ours and one in China; sometimes placed in the segregate family, Hydrangeaceae.

1. *Decumaria barbara* L. WOOD-VAMP. Vines with aerial rootlets; leaves opposite, petiolate, ovate to ovate-elliptic, acute to subacuminate at apex, to 1 dm. long, dark-green and shining above, paler and sparingly pubescent on lower surface; flowers numerous, fragrant, white, mistlike, in compound terminal cymes, regular, all fertile; calyx tube turbinate, 7- to 10-toothed; sepals deltoid, less than 1 mm. long; petals linear-oblong to oblong, 3-4 mm. long; stamens 20 to 30; styles united into one, persistent; ovary inferior; stigma thick, 7- to 10-rayed; capsules numerous, 4-5 mm. long, with the persistent style and stigma urceolate, pendulous, 10- to 15-ribbed, 7- to 10-celled, many-seeded, bursting at the sides, the thin partitions at length separating into numerous chaffy scales. In rich woods and swamps of e. Tex., May-June; from Fla. to La. and (?) Tex., n. to s.e. Va. and Tenn.

No specimen has been seen from Texas, but it is included here on the distinct possibility that it occurs in the state.

10. FENDLERIA ENGELM. & GRAY

Deciduous to somewhat evergreen intricate shrubs with striate arching slender branches; leaves opposite or somewhat clustered on branchlets, 1- or 3-nerved, entire, sessile or nearly so; flowers solitary or 2 or 3 together, white, sometimes marked or tinged with red, pedicelled; hypanthium turbinate to broadly campanulate, 8-ribbed; sepals 4, valvate, deltoid to narrowly triangular-lanceolate, exceeding the hypanthium in length; petals 4, clawed, the blade rhombic-ovate to ovate-deltoid, erose to subentire; stamens 8; filaments flattened, with 2 narrowly triangular appendages at the top parallel with and often exceeding the apically elongated anthers; ovary partly inferior, about as wide as long during anthesis, 4-celled; styles 4, distinct, usually noticeably pubescent; capsule broad at the base, ovoid or conic, crustaceous, 4-valved, septicidal, less than half-inferior.

Four species from Colorado to Mexico. Favorite browse of deer, goats and sheep; also ornamental.

1. Leaves linear, often recurved, the margins revolute to the broad midrib, 1.5 mm. or less wide 1. *F. linearis*.

1. Leaves narrowly lanceolate to ovate-oblong, the margins (at most) only slightly revolute, usually 2 mm. wide or more (2)

2(1.) Leaves green and more or less coarsely strigose on both surfaces, the margins not noticeably revolute 2. *F. rupicola*.

2. Leaves grayish to whitish and tomentulose-strigose on lower surface, the margins distinctly revolute 3. *F. Wrightii*.

1. *Fendleria linearis* Rehd. Stiff erect shrubs to about 1 m. tall, the branches more or less strict; leaves linear, bluntly apiculate, coriaceous, about 15 mm. long and 1.5 mm. wide, sparsely strigillose, the margin strongly revolute to the broad midrib and enfolding a white tomentum, commonly recurved; flowers 3 to 5 clustered at end of branchlets; pedicels 2-5 mm. long; sepals triangular, about 4 mm. long; petals obovate, 7-8 mm. long and 5 mm. wide; anthers 2 mm. long, with a subulate appendage; capsule ovoid, about 8 mm. long. On rocky open slopes of mts. in the Big Bend National Park in w. Tex., rare, Apr.-May; also n. Mex.

2. *Fendleria rupicola* Gray. Shrubs much-branched, to 2 m. tall; leaves linear-elliptic to oblong-elliptic or sometimes elliptic-lanceolate, obtuse to acute, 1-4 cm. long, chartaceous to leathery; sepals 4-7 mm. long, more or less strigose on outer surface, softly lanate on inner surface; petals spreading, 1.5-2 cm. long, to 13 mm. wide; stamens erect, about half as long as the petals; capsules brown, to 15 mm. long. On ledges, slopes and among boulders in canyons of mts. in the Trans-Pecos, both igneous and limestone soils, Mar.-May, rarely as late as July; from Colo. through w. Tex., N. M. and Ariz. to n. Mex.

Plants with flowers often 4 cm. in diameter, and leaves 2-4 cm. long that are narrowly

elliptic to linear-lanceolate, usually subglabrous and often falcate, have been segregated as var. *falcata* (Thornb.) Rehd.

3. *Fendlera Wrightii* (Gray) Heller. Similar to *F. rupicola* except for the typically smaller leaves with their tomentulose lower surface and revolute margins, and the usually smaller flowers. *F. rupicola* var. *Wrightii* Gray, *F. tomentella* Thornb. Uncommon in the Trans-Pecos and on the w. edge of the Edwards Plateau, Mar.-May; from Colo. s. to n. Mex.

A specimen of this plant from Val Verde County (possibly deserving of varietal segregation) has more or less falcate leaves to 25 mm. long and large flowers that are 4 cm. in diameter. If it were not for the tomentulose, instead of solely strigose, lower surface of the leaves this plant, on the above characteristics, could be referred to *F. rupicola* var. *falcata*.

11. FENDLERELLA HELLER

Several species in western United States and Mexico.

1. *Fendlerella utahensis* (Wats.) Heller. YERBA DESIERTO. Shrubs upright, from a thick tough rootstock, much-branched, to about 1 m. tall, more or less strigose throughout; leaves thickish, opposite, shortly petioled, to 25 mm. long and 4 mm. wide, elliptic to linear-oblong or oblanceolate, entire, obtuse to acute; flowers inconspicuous, in few-flowered cymose clusters on a naked peduncle; petals and sepals 5 each; calyx tube adnate to the lower half of capsule, the linear lobes about 1 mm. long; petals white to cream-color, oblanceolate, about 4 mm. long; stamens 4 to 12; styles 3; capsules 2-4 mm. long, 3-celled. *Whipplea utahensis* Wats. On dry limestone ridges and in crevices of ledges and boulders in mts. of cen. and n. Trans-Pecos, June-Aug.; from s. Ut., n. Ariz. and s. Calif., w. to Tex. and n. Mex.

FAM. 88. HAMAMELIDACEAE R. BR.

WITCH-HAZEL FAMILY

Shrubs or trees with alternate simple leaves and deciduous stipules; flowers in heads or clusters, often polygamous or monoecious; calyx (when present) adherent to the base of the ovary; petals (when present) inserted on the calyx, narrow, valvate or imbricate in the bud; stamens numerous or twice as many as the petals and with half of them (those opposite the petals) sterile and changed into scales; ovary of 2 pistils united below and forming a 2-beaked 2-celled woody capsule that opens at the summit, usually with 1 or 2 anatropous seeds in each cell.

About 80 species in 22 genera in both hemispheres, chiefly tropical.

1. Shrubs with wavy-toothed pinnately-veined leaves; flowers with a definite calyx, perfect or polygamous, borne 2 or several on a short peduncle; capsule distinct, each cell with a single wingless bony seed; buds naked, stalked 1. *Hamamelis*, p. 726.
1. Trees monoecious, with palmately-veined and -lobed leaves; flowers with rudimentary calyx and no petals, in globular heads; capsules fused at base into a globular echinate head, each capsule with 1 or 2 winged seeds; buds scaly 2. *Liquidambar*, p. 727.

1. HAMAMELIS L.

WITCH-HAZEL

Tall shrubs or small trees with straight-veined deciduous short-petioled leaves and usually perfect flowers in small axillary pedunculate clusters or heads, the pubescence (when present) stellate; flowers usually surrounded by a scalelike 3-parted involucre; calyx 4-parted and with 2 or 3 bractlets at its base, the ovate obtuse lobes spreading and tomentose on outer surface; petals 4, liguliform, linear, spirally involute in the bud; stamens 4, very short, opposite the sepals, alternating with 4 scalelike staminodes; styles 2, short; capsule bivalvate, opening loculicidally from the top, elastically dehiscent; seed 1 in each cell, black, lustrous.

About 6 species in North America and Asia.

1. Flowering in autumn (Sept.-Dec.); calyx lobes yellowish to greenish on the smooth inner surface; petals mostly more than 15 mm. long 1. *H. virginiana*.
1. Flowering from midwinter to spring (Jan.-Apr.); calyx lobes reddish or orange-color on inner surface; petals mostly less than 12 mm. long 2. *H. vernalis*.

1. *Hamamelis virginiana* L. Coarse sparsely branched shrub or small tree to 5 m. tall, only occasionally sprouting from base; branchlets glabrous or sparsely pubescent and glabrate; leaves obovate to oval or suborbicular, rounded to cuneate or rarely subcordate at the oblique base, rounded to abruptly acute at apex, the margin undulate to crenate-dentate, prominently several-nerved, when mature to 15 cm. long and 75 mm. wide, glabrous to pubescent beneath or only sparsely pilose on the nerves; petals yellow; capsules obovoid, 1-1.5 cm. long, densely pubescent. *H. macrophylla* Pursh. Dry or moist woods in e. and cen. Tex., w. to Bandera Co. on the Edwards Plateau, Sept.-Dec.; from s. Que. to Minn., s. to Ga., Tex. and Mo.

2. *Hamamelis vernalis* Sarg. Similar in habit and appearance to *H. virginiana*. It differs from that species in its flowering season, the freely sprouting base of plants, more pubescent branchlets, the pale or glaucous lower surface of the essentially glabrous leaves, and the vividly colored inner surface of the calyx lobes. The yellow petals are also often reddish at base or sometimes throughout. Along streams in open woods in e. Tex., Jan.-Apr.; from s. Mo. and Okla. to Tex., La. and Ala.

2. LIQUIDAMBAR L.

Considered to be 3 species, one in America and 2 in Asia. Segregated by some authors into a separate family, Altingiaceae. The foliage is highly ornamental in the fall.

1. *Liquidambar styraciflua* L. SWEET-GUM, Tree to 40 m. tall or more, with grayish-brown furrowed bark and commonly with corky ridges on the branchlets, often exuding a gum said to be pleasant to chew; leaves deciduous, with slender petioles to 12 cm. long, rounded in outline, to 18 cm. long and 12 cm. wide, deeply 5- to 7-lobed to resemble a star, smooth and shining, fragrant when bruised, turning crimson in autumn, truncate to somewhat cordate at base, the triangular lobes acuminate and glandular-serrate; flowers unisexual, apetalous; *staminate flowers* intermixed with small scales in globose heads that are disposed in terminal racemes; *pistillate flowers* in slender-peduncled globose heads, consisting of more or less coherent 2-celled 2-beaked ovaries subtended by minute scales; styles 2, stigmatic along the inner surface; fruit globose, woody, to 3 cm. in diameter, on peduncles to 5 cm. long, the individual capsules opening between the persistent subulate rigid styles and producing 1 or 2 winged seeds, the capsules filled mostly with abortive seeds that resemble sawdust. In wet situations and in swampy woods in e. and s.-cen. (w. to Lee Co.) Tex., Mar.-May; from Fla. to Tex., Mex. and C. A., n. to s. Conn., s.e. N. Y., W. Va., s. O., s. Ind., s. Ill. and s.e. Mo.

FAM. 89. PLATANACEAE DUM.

PLANE-TREE FAMILY

Trees usually large, monoecious, with wide-spreading branches and mostly exfoliating bark; leaves deciduous, alternate, palmately lobed; petiole dilated and hollow at the base to envelope the axillary bud; stipules membranous, caducous, encircling the twig; flowers densely arranged in long-stemmed unisexual globose heads; calyx and corolla insignificant or sometimes wanting; *staminate flowers* with numerous sessile linear 2-celled anthers that are subtended by minute scales, the connective peltate at apex; *pistillate flowers* with numerous sessile carpels intermixed with scattered linear bracts; ovary tapered above, 1-celled, with a unilateral stigma extending for most of the length of the inner face of the linear-subulate style; fruit indehiscent, surrounded at the base by a tuft of long bristly tawny hairs that are directed upward parallel with and almost encompassing the fruit; seed orthotropous, one in each carpel, linear-fusiform.

Only one genus of uncertain relationship.

1. PLATANUS L.

SYCAMORE. PLANE-TREE. BUTTONWOOD

Characters of the family. About 10 species in the North Temperate Zone.

1. *Platanus occidentalis* L. Large tree to 50 m. tall and with a trunk to 4 m. in diameter; bark mottled brown and white or buff due to exfoliation; leaves broadly ovate to sub-orbicular or broadly reniform in outline, to about 2 dm. in diameter, truncate to cordate at base, essentially glabrous or with stellate pubescence on lower surface, 3- to 5-lobed, usually with broadly rounded shallow sinuses; leaf lobes mostly broadly triangular and acuminate, entire or with few long remote pointed teeth; fruiting heads 25 mm. or more in diameter, usually persistent on the tree during at least part of winter; fruit narrowly clavate, about 8 mm. long; seed brownish, about 6 mm. long. Incl. var. *glabrata* (Fern.) Sarg. and f. *attenuata* Sarg. Mostly along streams and in bottomlands throughout most of Tex. e. of Val Verde Co., Mar.-May; from Me., w. to Ont. and Neb., s. to n. Fla. and Tex.

FAM. 90. ROSACEAE JUSS.

ROSE FAMILY

Trees, shrubs or herbs; leaves alternate, simple or compound; stipules present, sometimes caducous to obsolete or wanting; flowers mostly perfect, regular or nearly so, having a floral cup ("hypanthium") formed by the fusion of the bases of sepals, petals and stamens (this appearing in some taxa with inferior ovaries to be merely the outer layer of the ovary wall); sepals usually 5, sometimes 3 to 8, rarely united at base, often appearing double by a row of outer bractlets; petals as many as the sepals, rarely wanting or numerous by "doubling," mostly imbricated in the bud and usually inserted with the stamens on the edge of the floral cup; stamens usually numerous, inserted near the edge of the floral cup; pistils one to many, distinct or united and sometimes adnate to the floral cup or hypanthium; ovules 1 to several in each carpel; endosperm scanty or absent; fruit a follicle, achene, pome or more or less aggregate drupelets or an achenelet.

This diverse family of plants perhaps comprise more than 2,000 species in about 100 genera. They are represented in most areas of the world but are most abundant in eastern Asia, North America and Europe. Its production of miscellaneous fruits edible to man is not surpassed by any other family of plants; among these are the apple, peach, pear, cherry, apricot, plum, almond, strawberry, raspberry and blackberry. Its contribution to ornamentals, epitomized by the rose, is of the highest importance. Many species provide food and forage for domestic and wild life.

1. Plants annual or perennial herbs above ground, unarmed, the caudex often somewhat woody (2)
1. Plants hardy or perennial shrubs or trees, if somewhat herbaceous then provided with prickles (9)
- 2(1). Fruit a dehiscent follicle, the superior ovary not enclosed in the calyx tube nor adherent to it 5. *Gillenia*, p. 731.
2. Fruit or carpels indehiscent (3)
- 3(2). Ovaries several to many, borne on a broad to elongate receptacle, not enclosed by the calyx (4)
3. Ovaries one to many, becoming achenes that are covered by the calyx (7)
- 4(3). Styles persistent and elongating after anthesis, plumose or jointed 12. *Geum*, p. 745.
4. Styles not elongate after anthesis, mostly deciduous (5)
- 5(4). Receptacle dry, not greatly enlarged in fruit 11. *Potentilla*, p. 744.
5. Receptacle pulpy and greatly enlarged in fruit (6)
- 6(5). Bractlets of calyx similar to the narrow calyx lobes; petals white or pinkish; receptacle becoming very juicy and edible 9. *Fragaria*, p. 743.
6. Bractlets much broader and longer than the calyx lobes; petals yellow; receptacle spongy, insipid and dryish 10. *Duchesnea*, p. 744.

- 7(3). Leaves palmate or palmately lobed; calyx with bractlets alternating with the 4 lobes; petals none14. *Alchemilla*, p. 750.
7. Leaves pinnate; calyx without bractlets; inflorescence spicate or spicate-racemose (8)
- 8(7). Calyx beset with hooked bristles, the 5-cleft limb closed after flowering and persistent; petals yellow18. *Agrimonia*, p. 751.
8. Calyx not bristly, the 4 petaloid lobes white or purple, deciduous in fruit; petals none19. *Sanguisorba*, p. 752.
- 9(1). Carpel solitary; fruit a dry or fleshy usually 1-seeded drupe (plumlike); leaves simple; flowers white or greenish, in racemes or corymbs, sometimes solitary in the leaf axils21. *Prunus*, p. 756.
9. Carpels more than one or (if solitary) the fruit an achene (10)
- 10(9). Ovary inferior, enclosed by and adnate to the calyx tube (hypanthium) which becomes more or less fleshy; fruit a pome (applelike or berrylike); calyx lobes more or less persistent at apex of fruit; petals white (11)
10. Ovary superior; calyx tube not fleshy and enclosing the pistils or (if so) not adnate to them (13)
- 11(10). Plants typically armed with strong woody spines; mature carpels hard and bony, 1 to 5, free or coherent in the pulpy fruit 8. *Crataegus*, p. 734.
11. Plant unarmed; mature carpels papery or soft-cartilaginous (12)
- 12(11). Carpels of the compound ovary as many as the styles, without false or partial partitions; fruit a pome or berrylike 6. *Pyrus*, p. 731.
12. Carpels of the compound ovary subdivided by partial (false) partitions projecting inward from the back; fruit berrylike 7. *Amelanchier*, p. 732.
- 13(10). Calyx tube enclosing the numerous carpels, becoming fleshy; fruit (hips) simulating a pome, crowned by the persistent calyx lobes20. *Rosa*, p. 752.
13. Calyx tube not enclosing the carpels or not becoming fleshy (14)
- 14(13). Fruits becoming juicy and more or less edible; stems usually armed with prickles13. *Rubus*, p. 746.
14. Fruits not becoming juicy; stems without prickles (15)
- 15(14). Carpels becoming dehiscent capsules or follicles that contain usually more than one seed (16)
15. Carpels becoming indehiscent 1-seeded achenes or sometimes tardily dehiscent in *Holodiscus* (18)
- 16(15). Seeds with a thin elongate terminal wing; leaves evergreen, simple 3. *Vauquelinia*, p. 730.
16. Seeds not winged; leaves deciduous (17)
- 17(16). Plants tall shrubs more than 100 cm. high, solitary or forming thickets; leaves large, rounded-cordate, usually shallowly 3-lobed; flowers in corymbs; fruits much-inflated 1. *Physocarpus*, p. 730.
17. Plants undershrubs less than 15 cm. high, forming mats over boulders and ledges; leaves small, spatulate, entire; flowers in dense spikelike inflorescences; fruits not inflated 2. *Petrophytum*, p. 730.
- 18(15). Flowers in panicles, very numerous and small; leaves simple, deeply cleft or coarsely toothed 4. *Holodiscus*, p. 731.
18. Flowers solitary or in few-flowered cymes or fascicles (19)
- 19(18). Petals normally none; leaves entire or merely dentate; pistil solitary 17. *Cercocarpus*, p. 751.
19. Petals present; leaves usually deeply cleft or pinnatifid (20)
- 20(19). Bark exfoliating; bractlets present, alternating with the sepals; achenes with purplish or lavender tails15. *Fallugia*, p. 750.
20. Bark not exfoliating or tardily so; bractlets none; achenes with white tails 16. *Cowania*, p. 750.

1. PHYSOCARPUS MAXIM.

About a dozen species; one in Manchuria, the others in North America.

1. *Physocarpus monogynus* (Torr.) Coult. MOUNTAIN NINEBARK. Shrub usually less than 1 m. high, with usually decumbent stems and exfoliating bark; branches brownish, glabrous to sparingly stellate-pubescent; leaves alternate, with petioles 15 mm. long or less, suborbicular-ovate to reniform, usually deeply palmately 3- or 5-lobed, incised, 1-4 cm. long, glabrous or nearly so and green on both sides; terminal corymbs few- to many-flowered; bracts lanceolate, caducous; pedicels 1-1.5 cm. long, usually sparingly stellate-pubescent; hypanthium hemispheric, about 3 mm. wide, stellate-pubescent; sepals 5, persistent, ovate-lanceolate to elliptic, usually obtuse, densely stellate-pubescent on both sides; petals 5, white, orbicular, spreading, about 3 mm. long; stamens 20 to 40, on a disk clothing the mouth of the hypanthium; filaments long, slender, filiform; anthers didymous; pistils 2 or 3, more or less united at the base; styles filiform, terminal; stigmas capitate; follicles 2 or 3, united to above the middle, densely stellate-pubescent, 3-5 mm. long, with ascending-spreading beaks, opening along both sutures; seeds over 1.5 mm. long, usually 2, obliquely pyriform, shining, with a bony coat. Rare on seepage ledges in canyons of the Guadalupe Mts. in the Trans-Pecos, Apr.-June; from Tex. to S. D., Wyo. and N. M.

2. PETROPHYTUM RYDB.

ROCK-SPIRAEA

About 4 species native to western North America.

1. *Petrophytum caespitosum* (Nutt.) Rydb. A densely caespitose undershrub with short stout branches, forming large flat mats that are appressed to the rock face; season's shoots very short; leaves persistent, crowded on the short branches, spatulate to narrowly oblanceolate, usually 5-12 mm. long and 2-4 mm. wide, sometimes to 4 cm. long, densely silky, 1-ribbed or very rarely 3-ribbed, somewhat coriaceous, obtuse or mucronate; peduncles 3-10 cm. high, silky, with subulate bractlike leaves; racemes short, 1-5 cm. long, dense, usually simple; pedicels 1-2 mm. long; flowers perfect; hypanthium 1 mm. deep, hemispheric, densely silky; sepals 5, valvate, triangular-ovate, acute, about 1.5 mm. long; petals 5, imbricate, white, linear to spatulate, obtuse, 2-2.5 mm. long; stamens about 20; filaments filiform, distinct, about twice as long as the sepals; disk evident, entire-margined; pistils 3 to 5; ovary and lower part of the style densely pubescent; style filiform, terminal; stigma minute, entire; ovules 2 to 4, pendulous; follicles 3 to 5, about 2 mm. long, dehiscent along both sutures; seeds linear. *Eriogynia caespitosa* (Nutt.) Wats., *Spiraea caespitosa* Nutt. On faces of boulders, cliffs, and ledges on the Edwards Plateau and in the mts. of the Trans-Pecos, July-Sept.; from Tex., n. to S. D. and Mont., w. to Calif.

3. VAUQUELINIA H. & B.

About 9 species in southwestern United States and Mexico.

1. *Vauquelinia angustifolia* Rydb. GUAUYUL, PALO PRIETO. Shrub 3-5 m. high, with a trunk 5-10 cm. in diameter; bark of the young ascending twigs glabrous and light greenish-brown, that of the old branches chestnut-brown and more or less fissured and cracked; stipules small, deciduous; petioles 1-2 cm. long, glabrous; leaf blades linear, 5-10 cm. long, 1 cm. wide or less, coriaceous, shining dark-green above, yellowish-green beneath, acute at each end, sharply dentate, strongly reticulate; corymbs rather small, glabrous; bracts subulate, 5-8 mm. long; flowers perfect, fragrant; hypanthium short-turbinate, glabrous without, villous at the base within; sepals 5, ovate, nearly 2 mm. long, glabrous without, villous on the margins within, persistent, coriaceous, valvate; petals 5, imbricate, deciduous, orbicular to broadly elliptic, 4-5 mm. long, usually notched at apex; stamens 15 to 25, slightly shorter than the petals, inserted on the margin of the disk, subequal; filaments subulate; anthers didymous, versatile; carpels 5, opposite the sepals, connate into a 5-celled ovoid densely tomentose capsule; styles 5, short, parallel, at last deciduous; stigmas capitate; fruit ovoid, woody, about 6 mm. long, densely pubescent.

On rocky slopes in chaparral and in canyons of Chisos Mts. in the Trans-Pecos, June-Aug.; also n. Mex.

4. HOLODISCUS MAXIM.

About 8 species that are native to the Western Hemisphere.

1. *Holodiscus discolor* (Pursh) Maxim. RUSH ROCK-SPIRES, BUSH ROCK-SPIRES. Shrubs to 4 m. high, usually much smaller, more or less branched from the base, with exfoliating bark, the young twigs villous; leaves alternate, 1-10 cm. long, broadly ovate to broadly oval or suborbicular, mostly broadly or narrowly cuneate but sometimes almost truncate at base and mostly somewhat decurrent on the petiole, rounded at apex, simply or somewhat doubly toothed on the margins above, bright-green and sparingly pubescent to glabrate on upper surface, sparsely long-pubescent to tomentose on lower surface; inflorescence racemose to paniculate, to 2 dm. long; hypanthium somewhat saucer-shaped; sepals ovate-lanceolate to oblong-lanceolate, about 1.5 mm. long; petals 5, broadly ovate to elliptic, 1.5-2 mm. long; disk more or less developed, bearing about 20 stamens; anthers didymous; pistils 5, alternate with the 5 sepals, pubescent; styles terminal; fruit indehiscent, one-seeded, stipitate, laterally flattened. *H. dumosus* (Nutt.) Heller and var. *australis* (Heller) Ley. Base of cliffs, rocky-bouldery open-forested slopes and high canyons in mts. of the Trans-Pecos, June-Sept.; from w. Tex. to Ore. and Calif.; n. Mex.

Some plants found on the summit of the Davis and Guadalupe mts. are referable to var. *discolor* while all others in Texas are referable to var. *dumosus* (Nutt.) Maxim. The Guadalupe Mt. plants have large leaves to 10 cm. long with the blade very little decurrent on the prominent petiole and its lower surface merely long-pubescent instead of being densely villous-tomentose.

5. GILLENIA MOENCH INDIAN-PHYSIC

Only two species, another in northeastern United States and Canada.

1. *Gillenia stipulata* (Muhl.) Baill. AMERICAN-IPECAC. Perennial herb with horizontal rootstock and almost sessile 3-foliolate leaves; stems to 1 m. long, more or less pubescent; stipules ovate to orbicular, double-toothed to lacinate, 1-3 cm. long; lower leaves incised or lacinate with acuminate teeth, the upper leaves deeply and sharply double-serrate; leaflets lanceolate, 5-8 cm. long, acuminate, thin, more or less pubescent on both sides; paniculate corymb lax, leafy; hypanthium 4-5 mm. long, 3-3.5 mm. thick; calyx slender, somewhat constricted at the throat; sepals 5, lance-ovate, acute or somewhat acuminate; petals 5, oblanceolate, clawed, white or pinkish, 12-15 mm. long; stamens 20, included, the outer 10 much longer; follicles 5, included, 6-8 mm. long, puberulent; seeds 2 to 4, oval, 3 mm. long, longitudinally rugulose. *Porteranthus stipulatus* (Muhl.) Britt. Woods, thickets and rocky slopes in n.e. Tex., Apr.-June; from Ga. and Ala. to Tex., n. to N.Y., O., Ind., Ill., Mo. and Kan.

6. PYRUS L. PEAR

Trees or shrubs with alternate simple often toothed or lobed leaves; flowers showy, in corymbed or umbel-like cymes; calyxlike receptacle (hypanthium) globose to obconic, urceolate, bearing 5 lobes; petals 5, orbicular to obovate; stamens numerous; styles 2 to 5; fruit a large fleshy pome or smaller and berrylike, the 2 to 5 cells imbedded in the flesh, papery or cartilaginous, mostly 2-seeded.

About 50 species mainly in the North Temperate Zone.

1. Shrubs with slender ascending to spreading branches; leaves glandular along the midrib on upper side; inflorescence simple to more or less compound; petals mostly less than 1 cm. long and 7 mm. wide; fruit small and berrylike, rarely as much as 10 mm. in diameter 1. *P. arbutifolia*.
1. Trees or coarse shrubs often with spinescent branchlets; leaves not glandular along midrib; cyme simple and umbelliform or simply racemose; petals large (1-2 cm. long, 8-15 mm. wide); fruit rarely less than 15 mm. in diameter (2)

- 2(1). Leaves involute in bud and before expanding, never lobed; petals white; anthers reddish; orifice of concave receptacle partly or nearly closed by a disklike cushion; styles free to base; flesh of fruit with grit-cells; introduced and commonly cultivated 2. *P. communis*.
2. Leaves convolute or folded lengthwise in bud and before expanding, often lobed; petals roseate to white; anthers yellow or red; orifice of receptacle open; styles united at very base; fruit (in ours) subglobose and without grit-cells; native species (3)
- 3(2). Calyx glabrous or sparsely pilose and glabrescent on outside; leaves glabrous at maturity 3. *P. angustifolia*.
3. Calyx densely and permanently pannose-tomentose on the outside; leaves permanently pubescent on lower surface 4. *P. ioensis*.

1. *Pyrus arbutifolia* (L.) L.f. **RED CHOKEBERRY**. Colonial shrub or small slender tree (spreading by subterranean offsets) to 7 m. high, usually much smaller; branches slender, loosely ascending, the new branchlets gray- or white-tomentose; leaves broadly oblanceolate to narrowly obovate or elliptic, to 9 cm. long, tapering to the base, acute to short-acuminate or apiculate, dark-green and glabrous (except for glandular midrib) above, densely pannose-tomentose and pale beneath to rarely glabrous, crenate-serrate, in maturity to 9 cm. long and 4 cm. wide; flower clusters terminal on the stem and short axillary branches, 1.5-6 cm. broad, as many as 25-flowered, the rachis and pedicels tomentulose; flowers about 1 cm. broad; hypanthium tomentose; sepals bearing stipitate glands; petals white or pink-tinged; fruit obovoid to subglobose, bright- or dull-red, 5-7 mm. in diameter. *Aronia arbutifolia* (L.) Ell. and f. *macrophylla* (Hook.) Rehd. Low woods, thickets, swamps, wet pine barrens and bogs in e. Tex., Mar.-May; from Fla. to Tex., n. to N. S., N. Y., Ont., Mich. and Mo.

2. *Pyrus communis* L. **COMMON PEAR, PEAR**. Small tree of pyramidal habit, to about 15 m. high, sometimes spiny; branchlets glabrous or glabrate; leaves involute in the bud and (on expanding) orbicular-ovate to elliptic, acuminate at apex, to 8 cm. long, glabrous or promptly glabrate, with crenate margins; petioles 2-5 cm. long; flowers in umbelliform raceme, 2.5-3 cm. across; pedicels 1.5-3 cm. long; petals white, broadly oblong; hypanthium nearly closed by a ring of tissue at the summit, surrounding the free style; fruit pyriform to obovoid, large, the flesh with abundant grit-cells. A nat. of Euras. that has escaped from cult. in e. Tex. to thickets, edge of woods and clearings, Apr.-May.

3. *Pyrus angustifolia* Ait. **WILD CRAB APPLE**. Trees to 8 m. high or colonial shrubs; slender flowering branchlets and leaves glabrous or promptly glabrate; leaves of fertile often spinescent branchlets oblong or narrowly elliptic, round-tipped, blunt or merely short-mucronate, tapering to the base, entire to crenate-dentate or serrate, firm, often evergreen, in maturity to 75 mm. long and 3 cm. broad; sprout leaves much larger, coarsely toothed or lobate, to 9 cm. long and 7 cm. broad; pedicels and hypanthium sparsely villous or glabrous; flowers about 25 mm. across; calyx glabrous outside, tomentose within; petals roseate, fading to white; fruit 2-3 cm. in diameter, yellowish-green, the sepals often deciduous. *Malus angustifolia* (Ait.) Michx. In woods, bottoms and thickets in s.e. Tex., spring-summer; from Fla. to Tex., n. to Md., Va., Ky. and Mo.

4. *Pyrus ioensis* (Wood) Bailey. **WILD CRAB**. Tall shrub or small tree of irregular habit, to 10 m. high; branchlets tomentose; leaves firm, ovate-oblong to broadly elliptic, to 1 dm. long, obtuse to short-acuminate, coarsely serrate and rarely also shallowly lobed, persistently pubescent on lower surface; pedicels stout, 2-3.5 cm. long, tomentose; flowers 3.5-4 cm. across; anthers pink or salmon-color; fruit subglobose, green, waxy, about 25 mm. in diameter. Incl. var. *texana* (Rehd.) Bailey, *Malus ioensis* (Wood) Britt. and var. *texana* Rehd., (?) *M. Soulardii* (Bailey) Britt. On limestone slopes, along creeks and at head of draws on the Edwards Plateau, spring-summer; from Wisc., Minn. and Neb., s. to Ark., Okla. and Tex.

7. AMELANCHIER MEDIC. JUNE-BERRY. SUGAR-PLUM.
SHAD-BUSH. SERVICE-BERRY. SARVICE-BERRY

Shrubs or small trees with simple deciduous leaves and unarmed branches; flowers racemose or rarely solitary; hypanthium campanulate, more or less adnate to the ovary;

sepals 5, narrow, persistent and usually reflexed; petals 5, white, ascending; stamens numerous; filaments subulate; styles 2 to 5, connate, pubescent at the base; ovary wholly or partly inferior, the cells becoming twice as many as the styles by false partitions intruding from the back; fruit a berrylike pome, 4- to 10-celled.

About 25 species that are natives of the North Temperate Zone. Some species are cultivated for their ornamental value or for their edible fruits.

1. Trees with thin-herbaceous leaves 40 mm. long or more that are finely serrulate to near the base; pedicels slender, with 2 or 3 bracteoles scattered about the middle; petals about 15 mm. long; in northeast Texas1. *A. arborea*.
1. Shrubs or small trees with subcoriaceous to coriaceous leaves mostly 35 mm. long or less that are coarsely toothed above the middle; pedicels stout, with a pair of bracteoles on or just beneath the hypanthium; petals 10 mm. long or less; in the mountains of Trans-Pecos Texas (2)
- 2(1). Leaves mostly about 30 mm. long, glabrous or essentially so, the margins with rounded apiculate teeth; petals oblanceolate, 8-10 mm. long; sepals narrowly triangular-lanceolate, 3-4 mm. long2. *A. utahensis*.
2. Leaves mostly 15 mm. long or less, permanently pubescent on the lower surface with contorted whitish hairs, the margins with sharp spreading teeth; petals suborbicular, about 4 mm. long; sepals suborbicular-ovate, 1.5-2 mm. long3. *A. denticulata*.

1. *Amelanchier arborea* (Michx. f.) Fern. Fastigate shrub or slender tree to 20 m. high and a trunk to 4 dm. in diameter; overwintering buds 6-13 mm. long; expanding leaves green above, densely white-tomentose on lower surface, small and folded at flowering time; mature leaf blades ovate to oblong-oval or slightly obovate, acuminate at apex, cordate or rounded at base, to 1 dm. long and 5 cm. wide, retaining some pilosity on lower surface and on the petioles, sharply and often doubly serrate, the long teeth usually 6 to 10 per cm.; racemes rather close, nodding, 3-5 cm. long; lower pedicels to 17 mm. long; hypanthium 2.5-3.5 mm. in diameter; sepals broadly oblong-triangular, obtuse or abruptly pointed, soon strongly reflexed from base; petals white, linear to narrowly oblong, 1-1.4 cm. long, sometimes roseate; fruit reddish-purple, dry, insipid. In rich woodlands along streams, in thickets and on open wooded slopes in n.e. Tex., Mar.-May; from Fla. to Tex. and Okla., n. to N. B., Que., Ont., Mich. and Minn.

2. *Amelanchier utahensis* Koehne. UTAH SERVICE-BERRY. Shrub or small trees to 5 m. high, with gray or brownish branches; leaves suborbicular to oval or sometimes obovate, rounded to somewhat acute at apex, rounded to subcordate at base, 1-4 cm. long, as wide as long, coarsely crenate-serrate to near the base, pale-green, finely tomentose and somewhat canescent; racemes 2-3 cm. long; flowers slightly ill-scented; sepals narrowly lanceolate, short-villous; petals white, elliptic, about 7 mm. long; fruit 7-8 mm. in diameter, yellow, reddish to purplish-black, insipid, puberulent. *A. alnifolia* of auth. In limestone soil on steep canyon slopes among boulders in the Guadalupe Mts. of the Trans-Pecos, fruiting Aug.-Sept.; from Tex. and N.M., w. to Wash., Ore. and Calif.

3. *Amelanchier denticulata* (H.B.K.) Koch. Shrubs 1-3 m. high; branchlets gray or brown when dry, grayish-tomentose when young, becoming glabrous; winter buds small, tomentose; leaves persistent, coriaceous, elliptic to obovate or orbicular, 5-15 mm. long, 3-10 mm. wide, truncate to rounded or acute and mucronulate at apex, shortly cuneate to rounded or truncate at base, the margins denticulate with 4 to 8 spreading acute teeth, glabrous and glossy above, closely grayish-tomentose beneath with the midvein prominent; petioles 2-4 mm. long, more or less tomentose; flowers somewhat fetid, about 1 cm. across, in short compact few-flowered corymbs; rachis and pedicels glabrous or pubescent, 3-6 mm. long; bracts persistent, carinate, lanceolate, green, ciliate, otherwise glabrous, about 2 mm. long; sepals suborbicular, about 2 mm. long and 2.5 mm. wide, rounded at the apex, ciliate, otherwise glabrous, green, soon reflexed; petals white, suborbicular to reniform, veiny, about 4 mm. long and 5 mm. wide, glabrous; stamens 20; filaments glabrous, minutely papillose; anthers 1-1.5 mm. long; hypanthium glabrous outside, campanulate, 3-4 mm. long and in diameter; styles 3, glabrous, free to the base, 2.5-3 mm. long; fruits in clusters of as many as 4, ellipsoid to subglobose, glabrous, purplish-black, 6-8 mm. thick. *Malacomeles denticulata* (H.B.K.) C. N. Jones. On talus slopes, about rimrock and in canyons in mts. of the s. Trans-Pecos, fruiting Aug.-Oct.; Tex., s. to Guat.

The Pacific service-berry, *A. florida* Lindl., has been reported from Texas, doubtlessly based upon a misdetermination of this species.

8. CRATAEGUS L.⁷⁷

HAWTHORN. RED HAW. THORN

Small trees or shrubs with usually crooked thorny branches and simple serrate or variously lobed deciduous leaves; leaves at the ends of vegetative shoots differently shaped, large and usually more deeply cut than those on the flowering branchlets; flowers solitary or commonly in corymbs; calyx tube campanulate or obconic, its limb 5-parted; petals normally 5, deciduous; stamens usually 5 to 20, in 1 to 3 series; filaments filiform; anthers oblong, white, yellow or some shade of red; styles 1 to 5, distinct; fruit a pome with 1 to 5 bony usually 1-seeded nutlets.

There are close to 1,000 specific proposals that have been made in this primarily North American genus. There is no way to estimate the number of valid species that might occur. Species comprising some Series, such as *Molles* and *Virides*, seem to intergrade imperceptibly into each other. Although we are inclined to combine even more of these than have been combined thus far, the conclusions of E. J. Palmer have been followed as closely as possible since our treatment is derived and adapted from his various published contributions regarding this genus. Palmer considered the primary taxonomic characters, in descending order of importance, to be color of anthers, number of stamens, the pubescent or non-pubescent condition of the corymb at time of flowering, and, lastly, general shape of the leaves. He was of the opinion that if these characteristics were used in combination species determinations could be made.

In regard to the three Series, *Crus-galli*, *Molles* and *Virides*, some authors, with apparent good reason, tend to unite most of the proposed segregates in each Series into one collective species or, at most, several entities. Hybrid incidence is high in this genus. Because of this an unusual degree of instability exists, and an entity that is described as a species may, in fact, be a hybrid.

The fruit of many species are edible and make fine jellies and preserves, and most have ornamental qualities.

1. Primary veins of the larger leaves running to the sinuses as well as to the points of the lobes (2)
1. Primary veins of the leaves running only to the points of the lobes, very rarely with some running to sinuses (3)
- 2(1). Leaves mostly broadly ovate in outline, often as broad as long, deeply incised and sharply serrate-laciniate, rounded to cordate at base; calyx densely woolly-pubescent outside; anthers red; fruit oblong 1. *C. Marshallii*.
2. Leaves mostly narrowly obovate to spatulate, unlobed or nearly so except at the ends of the branchlets, cuneate or attenuate at base; calyx glabrous or sparsely pubescent outside; anthers pale-yellow; fruit subglobose 2. *C. spathulata*.
- 3(1). Thorns short and stout, rarely slender or more than 2 cm. long; fruits blue or black at maturity (4)
3. Thorns usually long and slender, typically more than 4 cm. long, rarely absent; fruits red, yellow or remaining green at maturity (5)
- 4(3). Leaves mostly abruptly pointed or rounded at the apex, lustrous above; fruit blue and glaucous at maturity; in eastern Texas 3. *C. brachyacantha*.
4. Leaves mostly acute to acuminate at the apex, dull-green above; fruit grading from purple to black, lustrous but not glaucous; in northwestern Texas 4. *C. rivularis*.
- 5(3). Flowers single or 2 to 5 in simple clusters; stamens 20 to 25 (6)
5. Flowers usually more numerous, as many as 20 in simple or compound cymes or corymbs; stamens 5 to 20 (7)

⁷⁷ Adapted from various publications by E. J. Palmer, mainly in Robert A. Vines, *Trees, Shrubs, and Woody Vines of the Southwest*, pp. 329-387. 1960.

- 6(5). Leaves 35 mm. or more long, typically oblong-elliptic, the margins subentire and with minute glands; flowers usually 2 or several together 5. *C. opaca*.
6. Leaves mostly 30 mm. long or less, typically obovate-cuneate, the margins regularly crenate-serrate above the middle; flowers typically solitary 6. *C. uniflora*.
- 7(5). Flowers opening in April or May; nutlets pitted on ventral surface 7. *C. Calpodendron*.
7. Flowers opening in late March and April; nutlets plane on ventral surface (8)
- 8(7). Foliage and inflorescence glandular, usually conspicuously so 8. *C. Pearsonii*.
8. Foliage and inflorescence eglandular or (if slightly glandular) the glands small and soon deciduous (9)
- 9(8). Leaves mostly ovate or deltoid in outline, broadest below the middle, often obtusely rounded to truncate or subcordate at base (Ser. *Molles*: *C. mollis* and its variant entities) (10)
9. Leaves mostly narrowly obovate to cuneate or oblong-obovate, usually narrowed or somewhat attenuate to the base, unlobed or very obscurely lobed except those at the ends of branchlets (these are sometimes broadly obovate to oval or suborbicular) (17)
- 10(9). Leaves of flowering spurs mostly oval or ovate, rounded at base; leaves of terminal shoots broadly ovate, often truncate or subcordate at base (11)
10. Leaves of flowering spurs mostly elliptic or ovate-oblong, noticeably longer than broad, gradually or abruptly narrowed at base; leaves of terminal shoots broader, usually rounded or rarely truncate at base; sepals glandular-serrate; fruit red at maturity (15)
- 11(10). Fruit bright-yellow at maturity 9. *C. viburnifolia*.
11. Fruit bright-red at maturity (12)
- 12(11). Leaves often as broad as long, relatively small; leaves of terminal shoots sometimes broader than long 10. *C. brachyphylla*.
12. Leaves longer than broad (except rarely at the ends of shoots) (13)
- 13(12). Mature leaves thick or subcoriaceous; flowers 5 to 12 in a corymb 11. *C. Greggiana*.
13. Mature leaves firm but comparatively thin; flowers numerous, as many as 20 in a corymb (14)
- 14(13). Fruit ripening in August and September, the flesh succulent and edible; nutlets usually 5, occasionally 4 12. *C. mollis*.
14. Fruit ripening in October, the flesh dry and mealy; nutlets 3 to 5 13. *C. limaria*.
- 15(10). Mature leaves thick; sepals foliaceous, deeply glandular-serrate; anthers large, dark-red; fruit with thick mellow flesh, edible 14. *C. texana*.
15. Mature leaves relatively thin; sepals not foliaceous, more or less glandular-serrate; fruit with thin dry or mealy flesh, scarcely edible (16)
- 16(15). Anthers white or pale-yellow; sepals laciniately glandular-serrate; nutlets 3 to 5 15. *C. invisia*.
16. Anthers pink or rose-color; nutlets 5, occasionally 4 ... 16. *C. brazoria*.
- 17(9). Leaves of flowering branchlets mostly obovate or oblong-obovate, seldom over 2-3 cm. wide, mostly thick or firm, glossy above in most species; fruit remaining hard and often green at maturity; nutlets commonly 1 to 3, rarely as many as 5 (Ser. *Crus-galli*: *C. crus-galli* and its variant entities) (18)
17. Leaves of flowering branchlets usually rhombic to somewhat obovate or sometimes ovate, typically narrowed at base, relatively thin, dull-green above; fruit becoming soft or mellow with age; nutlets 3 to 5 (Ser. *Virides*: *C. viridis* and its variant entities) (28)

- 18(17). Foliage and inflorescence glabrous or essentially so (19)
18. Foliage and inflorescence pubescent while young and usually throughout the season. (26)
- 19(18). Mature leaves comparatively thin, not subcoriaceous, yellowish-green, slightly lustrous but not glossy above17. *C. sabineana*.
19. Mature leaves thick or subcoriaceous and glossy above (except in some shade forms) (20)
- 20(19). Leaves mostly obovate or spatulate, distinctly longer than broad, broadest above the middle (except sometimes at the ends of branchlets) (21)
20. Leaves broader, mostly broadly obovate to oblong-obovate or oval, only slightly longer than broad or often as broad as long at the ends of shoots. (23)
- 21(20). Serration of the leaves shallow or crenate; fruit 6-10 mm. thick; nutlets usually 218. *C. pyracanthoides*
21. Serration of the leaves sharp with acute teeth; fruit 8-12 mm. thick; nutlets 1 to 3, usually 1 or 2 (22)
- 22(21). Leaves of terminal shoot unlobed or rarely very obscurely lobed; flowers 1-1.5 cm. across; stamens about 1019. *C. crus-galli*.
22. Leaves of terminal shoot often slightly lobed; flowers about 2 cm. across; stamens about 2020. *C. Bushii*.
- 23(20). Young leaves quite glabrous; leaves of terminal shoot usually broadly ovate to suborbicular (24)
23. Young leaves sometimes slightly villous but soon glabrous (25)
- 24(23). Flowers 16-20 mm. across; fruit 11-13 mm. thick, subglobose; terminal leaves broadly oval to suborbicular, often with several small shallow lobes21. *C. Reverchonii*.
24. Flowers about 13 mm. across; fruit about 6 mm. thick, ellipsoidal; leaves oblong-obovate22. *C. cherokeeensis*.
- 25(23). Leaves of terminal shoot broadly obovate to elliptic, glabrous at maturity, unlobed but deeply and irregularly serrate; flowers mostly 5 or 6 in compact corymbs; stamens 20, the anthers pink23. *C. sublobulata*.
25. Leaves of terminal shoot ovate to oval or obovate, pale-villous below at maturity24. *C. Warneri*.
- 26(18). Leaves mostly broadly oval to suborbicular or rhombic, usually broadest about the middle25. *C. Tracyi*.
26. Leaves mostly obovate to oblong-obovate, typically broadest above the middle (27)
- 27(26). Flowers mostly 4 or 5 in compact corymbs; stamens about 20, the anthers pale-yellow or (in variants) rose-color26. *C. berberifolia*.
27. Flowers mostly 8 to 12 in loose corymbs; stamens about 10, the anthers usually pink or rarely white27. *C. Engelmannii*.
- 28(17). Mature leaves and inflorescences glabrous or essentially so (29)
28. Foliage and inflorescence conspicuously pubescent while young, the leaves more or less pubescent throughout the season (31)
- 29(28). Leaves thick or subcoriaceous at maturity, glossy above; nutlets 3 to 528. *C. glabriuscula*.
29. Leaves firm but comparatively thin at maturity, dull-green above; nutlets normally 5 (30)
- 30(29). Leaves variable in shape, mostly ovate-oblong or oblong-elliptic, glabrous; anthers pale-yellow or rarely pink29. *C. viridis*.
30. Leaves more uniform in shape, mostly ovate or ovate-oblong, pubescent above as they unfold, soon glabrous; anthers pink30. *C. sutherlandensis*.
- 31(28). Mature leaves comparatively thin; flowers mostly 8 to 15 in a corymb; fruit subglobose31. *C. anamesa*.
31. Mature leaves thick or coriaceous, pubescent while young, with age becoming glabrous and glossy above and slightly hairy along the veins beneath (32)

- 32(31). Flowers 2 cm. wide or more, mostly 10 to 20 in a corymb; sepals narrowly lanceolate, long-acuminate 32. *C. stenosepala*.
 32. Flowers less than 2 cm. wide, mostly 5 to 15 in a corymb; sepals lanceolate to deltoid-lanceolate, with a broad base 33. *C. poliophylla*.

1. *Crataegus Marshallii* Eggl. PARSLEY HAWTHORN. Shrub or small tree to 8 m. high, with slender thorny or sometimes thornless branchlets pubescent while young and thin scaly bark; leaves broadly ovate to deltoid-ovate, sharply serrate and deeply incised with 2 or 3 pairs of lateral lobes often coarsely toothed or again cleft at the ends, pubescent while young, thin, glabrous above, often slightly pubescent along the veins beneath; petioles slender, half to as long as or longer than the blades; flowers 1-1.5 cm. across, numerous in pubescent corymbs; stamens about 10; anthers red; calyx lobes lanceolate, entire or nearly so; fruit oblong to obovoid, 5-9 mm. long, 4-8 mm. thick, bright-red, with thin succulent flesh and 1 to 3 (usually 2) nutlets. *C. apiifolia* Michx. Sandy woods, hillsides, fencerows and pastures in e. Tex., fruiting Sept.-Oct.; from Va. to Fla., w. along the Coastal Plain to Tex., n. in the Miss. Valley to s.e. Mo.

2. *Crataegus spathulata* Michx. PASTURE HAW. Shrub or tree 5-7 m. high, with stoutish usually thorny horizontal branchlets and thin scaly or smooth gray bark; leaves of flowering branchlets narrowly obovate, mostly 1-2 cm. long and to 1 cm. wide, with several coarse rounded teeth or small lobes above the middle or near the apex, gradually narrowed to the entire base, firm, glabrous at maturity, glossy above, with strongly ascending or nearly parallel obscure veins; petioles one fourth to half as long as the blades; flowers 6-8 mm. across, numerous in compact glabrous corymbs; stamens about 20; anthers pale-yellow; calyx lobes deltoid, entire, persistent on fruit; fruit subglobose, 4-7 mm. thick, red, with thin mellow flesh and 3 or 4 nutlets. *C. microcarpa* Lindl. Sandy or sandy clay woods, fencerows and pastures in e. Tex., fruiting Oct.-Nov.; from Fla. to Tex., n. to Va. and s. Mo.

3. *Crataegus brachyacantha* Sarg. & Engelm. BLUEBERRY HAWTHORN. Tree to 15 m. high; branchlets light-green and slightly pubescent early in the season, soon becoming glabrous and ultimately ashy-gray in color, armed with numerous short stout somewhat curved spines that are rarely to 2 cm. long; leaves oblong-obovate to somewhat rhombic, abruptly pointed or rounded at the apex, gradually narrowed to the cuneate base, crenulate-serrate above with minute incurved glandular teeth, somewhat pubescent at first; mature leaves subcoriaceous, glabrous, lustrous, dark-green, to 5 cm. long and 25 mm. wide; flowers numerous in crowded glabrous corymbs, on slender pedicels, about 8 mm. wide; sepals short, triangular, narrowed to a gland-tipped apex; stamens 15 to 20; anthers yellow; fruit subglobose to obovoid, on erect pedicels, 8-13 mm. thick, bright-blue, covered with a glaucous bloom; nutlets 3 to 5. Borders of streams in rich soil in e. Tex., fruiting Aug.-Sept.; in Ark., La. and Tex.

4. *Crataegus rivularis* Nutt. Tree occasionally to 6 m. high; branchlets slender, reddish-brown, lustrous, unarmed or armed with straight slender spines usually about 25 mm. long; leaves lanceolate to oblong-obovate or elliptic, acute to acuminate at apex, gradually narrowed to a concave-cuneate base, very finely crenately serrate above with glandular teeth, about 5 cm. long and 18 mm. wide; petioles slender, slightly winged at apex, about 12 mm. long; flowers about 12 mm. wide, on long slender pedicels, in rather compact glabrous corymbs; sepals linear, entire or glandular, glabrous on outer surface, sparingly villous on inner surface; stamens 10 to 20; anthers pale rose-color; fruit short-oblong, full and rounded at the ends, dark-crimson becoming black and lustrous at maturity, 8-13 mm. long; flesh thin, yellow, dry and mealy; nutlets 3 to 5. On banks of streams in extreme n.w. Tex., fruiting Sept.-Oct.; from s.e. Ida. to s.w. Colo., n. N. M. and Tex.

5. *Crataegus opaca* H. & A. WESTERN MAYHAW, APPLE HAW. Tree to 9 m. high; branchlets slender, villous-pubescent when they appear but soon glabrous, armless or armed with straight chestnut-brown spines; leaves elliptic to oblong-elliptic or oblong-cuneiform, acutish at apex, cuneate at base, the margins essentially entire or with minute glandular teeth, densely pubescent when young, at maturity dull-green above and pubescent with rusty-brown hairs beneath, to 65 mm. long and 25 mm. wide; petioles slender, villous-pubescent, about 7 mm. long; flowers 2 to 5 in glabrous corymbs, about 25 mm. wide; sepals triangular and acute at gland-tipped apex, essentially entire; stamens 20; anthers large, deep rose-color; fruit depressed-globose, scarlet, lustrous, 12-15 mm. in diameter; nutlets 3 to 5. Commonly in depressions that are filled with water part of the

year, along streams and on border of swamps in e. Tex., fruiting May-July; from Ala. to Tex.

6. *Crataegus uniflora* Moench. Slender shrub to 15 dm. high, with slender often flexuous thorny branchlets, villous while young; leaves obovate-cuneate to oblong or elliptic, sharply or crenately serrate and sometimes obscurely lobed above the middle, usually about 3 cm. long and 15 mm. wide, pubescent while young, thick, the veins impressed above at maturity; petioles short, stout, wing-margined above; flowers 1-1.5 cm. wide, solitary or rarely 2 to 5, on short tomentose pedicels; stamens 20 or more; anthers small, white or pale-yellow; calyx lobes lanceolate, foliaceous, pectinate or deeply glandular-serrate, persistent on the fruit; fruit 1-1.3 cm. thick, subglobose or slightly pyriform, greenish-yellow or dull-red, with dry or mealy flesh and 3 to 5 (usually 5) nutlets. In flat woods and open sandy soils in e. Tex., fruiting Sept.-Nov.; from N. Y. and Pa. to Fla., w. to the Ozark region and Tex.

7. *Crataegus Calpodendron* (Ehrh.) Medic. Shrub or small tree to 6 m. high, with spreading branches, unarmed or with short slender spines; young branchlets pubescent; leaves elliptic to oblong-obovate, acute at apex, cuneate at base, 5-12 cm. long, serrate and often slightly lobed, dull-green and finally glabrous above, pubescent or sometimes glabrous on lower surface; flowers about 12 mm. across, in many-flowered pubescent corymbs 6-12 cm. across; sepals serrate; stamens 15 to 20; anthers pink; fruit ellipsoid to pyriform or somewhat globose, about 1 cm. long, dull-yellow or yellowish-red, pulpy; nutlets 2 or 3. Dryish open woods in e. Tex., fruiting Oct.-Nov.; from Tex. and Ark., northw. and eastw.

Var. *globosa* (Sarg.) E. J. Palm. is a plant with fruit more globose than in var. *Calpodendron*. Var. *hispidula* (Sarg.) E. J. Palm. has leaves more sharply serrate, with narrower acuminate teeth, spreading lateral lobes, and hispidulous beneath at maturity.

8. *Crataegus Pearsonii* Ashe. Small spreading tree to about 5 m. high and a trunk to about 1 dm. in diameter, with rough bark and crooked recurved branches; branchlets slender, light- to dark-gray or -brown, mostly glabrous; armed with slender chestnut-brown spines to 75 mm. long; leaves both spatulate to obovate or cuneate or ovate-flabellate to suborbicular, narrowly cuneate to truncate at base, obtuse to broadly rounded-subtruncate at apex, the margins singly or doubly serrate with the teeth commonly glandular, the glands extending down onto the petiole, frequently crenately lobed above the middle, the blade to 6 cm. long and about as wide or wider; flowers 15-25 mm. across, borne in simple or compound 3- to 6-flowered corymbs, with white-hairy to glabrous pedicels that are sometimes adorned with very glandular bracts; sepals oblong-linear, acuminate, serrulate and conspicuously glandular; petals white, oval to obovate, narrowed into a short claw; stamens 20; anthers yellow; fruit subglobose, bright-red, to 15 mm. in diameter, the flesh soft and juicy, acid. In mixed pine-hardwood forests in s.e. Tex., fruiting Oct.-Nov.; from Miss. to Tex.

9. *Crataegus viburnifolia* Sarg. Tree to 11 m. high, with a trunk to about 3 dm. in diameter, the gray bark scaly; branchlets unarmed, at first tomentose, eventually nearly glabrous and brownish; leaves ovate to elliptic or slightly obovate, 65-85 mm. long, 5-6.5 cm. wide, concave-cuneate to broadly rounded or even truncate at the entire base, coarsely often doubly serrate above with straight glandular teeth, sometimes shallowly lobed above, deep-green and lustrous on the scabrate upper surface, with pale hairs beneath; petiole glabrate, to 35 mm. long; flowers about 2 cm. across, prominently bracted, in wide lax 5- to 12-flowered corymbs; pedicels slender, tomentose; calyx tube and lobes villous; stamens about 20; anthers white; fruits subglobose, bright-canary-yellow, 1.5-2 cm. in diameter. Borders of woods and low ground in s.-cen. Tex., fruiting in Oct.; endemic.

10. *Crataegus brachyphylla* Sarg. Tree to 7 m. high, with a trunk to about 18 cm. in diameter; branchlets bright-red-brown, lustrous, armed or unarmed; leaves broadly ovate, rounded to acute at the apex, rounded to truncate at base, 5-7 cm. long, 5-6 cm. wide, coarsely often doubly serrate with straight acuminate teeth, thin, yellow-green and glabrous above, with long matted hairs beneath; petioles slender, pubescent but eventually glabrate, 2-3 cm. long; flowers about 15 mm. across, in small compact 5- to 8-flowered white-hairy corymbs; pedicels slender, they and the calyx tube with long white hairs; calyx lobes narrow, long-acuminate, laciniately glandular-serrate, thickly covered with white hairs; stamens 20; anthers deep-rose-color; fruit subglobose, dull-dark-red, 1-1.2

cm. thick. On dry gravelly ridges and in open woods in n.e. Tex., fruiting Sept.-Oct.; also Ark.

11. *Crataegus Greggiana* Eggl. Small tree to 6 m. high, with rough bark; branchlets tomentose, becoming glabrous; thorns numerous, straight, slender, chestnut-brown, 3-6 cm. long; leaves to 75 mm. long and 6 cm. wide, broadly ovate to ovate-elliptic, obtuse to acute at apex, broadly cuneate at base, subcoriaceous, dull, tomentose, becoming scabrous above, finely and doubly serrate, sometimes lobed towards the apex; petioles about 5 mm. long, tomentose; corymbs 5- to 12-flowered, along with the calyx densely white-tomentose; calyx-lobes lanceolate, acuminate, remotely and irregularly serrate, about 6 mm. long; stamens 10; anthers yellow; styles 3 to 5; fruit brick-red, 1-1.2 cm. thick, globose, tomentose, with the calyx lobes appressed and persistent against fruit. In rocky areas on the Edwards Plateau, s. into Mex., fruiting Oct.-Nov.

12. *Crataegus mollis* Scheele. DOWNY HAWTHORN, RED HAW. A tree 10-12 m. high, with stout sparingly thorny or nearly thornless branchlets villous while young and thick deeply fissured brownish-gray bark on the trunk; leaves relatively large, variable in shape, mostly ovate or deltoid, sharply or coarsely serrate, 7.5-10 cm. long and wide, usually with 4 or 5 pairs of lateral lobes or on vegetative shoots sometimes deeply lacinate, thickly coated with short appressed hairs on the upper surface and densely white-tomentose (especially along the veins beneath) while young, firm, yellow-green, glabrous above and often slightly pubescent beneath at maturity; flowers 2-2.3 cm. wide, many in tomentose corymbs; stamens about 20; anthers small, yellowish or rarely pink; calyx tube densely tomentose, the lobes glandular-serrate; fruit subglobose or rarely oblong or obovoid, 13-18 mm. thick, scarlet or bright-crimson, pubescent at least toward the ends, with a broad shallow calyx, thick mellow flesh and normally 5 nutlets. *C. Berlandieri* Sarg., *C. columbiana* Sarg., *C. quercina* Ashe, *C. indurata* Sarg. In stream bottoms, hillside woods and thickets in n.-cen. and s.-cen. Tex., fruiting Aug.-Oct.; from s. Ont. and Mich. to Ala., w. to Minn., Okla., Ark., Tex. and Miss.

13. *Crataegus limaria* Sarg. Tree to 9 m. high, with a trunk to 3 dm. in diameter, the dark bark scaly; branchlets with long white hairs at first, eventually lustrous and somewhat pubescent and spiny; leaves ovate, acute, concave-cuneate or rounded at base, 65-75 mm. long, 3.5-5 cm. wide, coarsely (often doubly) serrate with broad straight glandular teeth, sometimes shallowly and acutely lobed above, thin, light-green and scabrate above, pale and tomentose beneath; petioles slender, villous, about 3 cm. long; flowers to 25 mm. across, in compact 15- to 20-flowered villous corymbs, with slender pedicels covered with matted white hairs; calyx tube and lobes pubescent; stamens 15 to 18; anthers white; fruit ellipsoid to ovoid, crimson, lustrous, marked by large pale dots, 1-1.5 cm. in diameter, the flesh dry and mealy. *C. Mackensenii* Sarg. In dense woods of rich bottomlands in n.-cen. and s.-cen. Tex., fruiting Sept.-Oct.; also Ark.

14. *Crataegus texana* Buckl. Tree to 9 m. high, with a trunk to 3 dm. in diameter; branchlets armed or unarmed, at first reddish-brown, eventually grayish; leaves broadly ovate, acute to occasionally rounded at apex, broadly concave-cuneate at base, thickish, coarsely doubly glandular-serrate above, often with several broad acute lobes above, dark-green and lustrous above, pale and pubescent or tomentose beneath, 7.5-10 cm. long, 65-75 mm. wide; petioles stout, deeply grooved, to 2 cm. long, glabrous eventually; flowers about 2 cm. across, in broad open many-flowered tomentose corymbs, with slender densely villous pedicels; stamens 20; anthers red; calyx tube and lobes tomentose to villous, the sepals foliaceous and deeply glandular-serrate; fruits obovoid, 13-25 mm. thick, bright-scarlet, sweet and edible. Rich bottomlands of coastal Tex., fruiting in Oct.; endemic.

15. *Crataegus invisus* Sarg. Tree to 9 m. high, bark dark-brown and in platelike scales; branchlets stout, slightly zigzag, armed or unarmed; leaves ovate to oval, acute to acuminate at apex, cuneate or rounded at base, coarsely (often doubly) serrate with broad straight glandular teeth, occasionally with several short acuminate lobes above, 65-75 mm. long, 5-6.5 cm. wide, thin, dark-yellow-green and roughened on the upper surface by short hairs, coated beneath with long matted white hairs; petioles slender, glabrate, 3.5-5 cm. long; flowers about 2 cm. across, in broad mostly 7- to 12-flowered corymbs, with slender pedicels thickly coated with matted hairs; calyx tube and the laciniately glandular-serrate lobes more or less villous; stamens 20; anthers white or pale-yellow; fruit oblong, orange-red, marked by large pale dots, about 15 mm. in diameter, slightly

hairy at the ends. In dense woods of rich bottomlands mostly in e. Tex., fruiting Oct.-Nov.; also Ark. and Okla.

16. *Crataegus brazoria* Sarg. Tree to 75 dm. high, with a trunk to about 15 cm. in diameter, the bark pale; branches slender, somewhat zigzag, eventually lustrous and unarmed or armed with slender gray spines; leaves oval to oblong or obovate, rounded to acuminate at apex, rounded to concave-cuneate at the entire base, coarsely doubly serrate above with straight glandular teeth, usually slightly lobed above the middle, thin, dark-yellowish-green, glabrous and lustrous above, pale and pubescent beneath, 45-65 mm. long, 3-4 cm. wide; petioles slender, about 15 mm. long; flowers about 15 mm. across, in few- to many-flowered more or less villous corymbs, with slender hairy pedicels; stamens 20; anthers pink or rose-color; calyx tube and lobes with matted pale hairs; fruit subglobose, dull, dark-red, 8-15 mm. in diameter, sweet and edible. *C. dallasiana* Sarg. Stream bottoms or wooded hillsides and thickets in e. Tex. and the Blackland Prairies, Oct.-Nov.; endemic.

17. *Crataegus sabineana* Ashe. Tree to 9 m. high; branchlets stout, glabrous, tan to reddish; leaves broadly obovate to rhombic, acute at apex, cuneate at base, coarsely and sharply serrate, 25-35 mm. long; petioles about 4 mm. long; flowers in few-flowered corymbs; stamens 10 to 20; fruits oblong, 13-16 mm. long, greenish-yellow with a red cheek. In e. Tex. and w. La.

Closely allied to, if not conspecific with, *C. pyracanthoides*.

18. *Crataegus pyracanthoides* Beadle. Tree 8-10 m. high, with slender thorny or sometimes unarmed branchlets and dark-gray scaly bark; leaves obovate to oblanceolate, pointed or rarely rounded at the apex, shallowly serrate except near the base, glabrous, firm, dark-green and lustrous above; flowers 1-1.3 cm. wide, mostly 5 to 8 in lax glabrous corymbs; stamens 10 or 20; anthers white to pale-yellow or purplish; fruit subglobose or short-oblong, 6-10 mm. thick, red, with thin mellow flesh and 2 or 3 nutlets. Incl. var. *uniqua* (Sarg.) E. J. Palm. and var. *arborea* (Beadle) E. J. Palm., *C. uniqua* Sarg., *C. arborea* Beadle. In low rich woods and moist ground along streams in e. Tex., fruiting Oct.; from Ind. to Mo., s. to Fla. and Tex.

19. *Crataegus crus-galli* L. COCKSPUR HAWTHORN. Shrub or tree 6-8 m. high, with widespreading branches and dark slightly scaly bark; branchlets thorny, flexuous; leaves of flowering branchlets mostly obovate, sharply serrate except towards the cuneate base, at maturity thick, shining above; shoot leaves often oblong-elliptic, sometimes twice as large and coarsely serrate or dentate; flowers 1-1.5 cm. wide, numerous in glabrous corymbs; stamens about 10; anthers pink or pale-yellow; calyx lobes linear-lanceolate, entire or nearly so; fruit short-oblong to slightly obovoid or rarely subglobose, 8-10 mm. thick, often slightly 5-angled, greenish or dull-red, with thin dry flesh and 1 to 3 (usually 1 or 2) nutlets. Incl. var. *bellica* (Sarg.) E. J. Palm. On limestone bluffs and hilltops, woods, thickets and fence-rows in e. and n.-cen. Tex., fruiting Oct.-Nov.; from s.e. Can. to S. C., w. to Minn., Kan. and Tex.

20. *Crataegus Bushii* Sarg. Tree to 6 m. high, with a trunk to 25 cm. in diameter with dark scaly bark; branchlets sparingly armed or unarmed; leaves elliptic to obovate, broadly rounded to acute at apex, gradually narrowed from near the middle to the cuneate base, coarsely serrate above, coriaceous, 3-4 cm. long, 13-25 mm. wide, lustrous, glabrous; petioles villous, soon glabrous, about 15 mm. long; flowers 2-2.5 cm. across, in broad many-flowered glabrous corymbs; calyx tube and the linear-lanceolate lobes glabrous; stamens 20; anthers large and pink; fruit short-oblong, green tinged with dull-red, about 1 cm. long. In rich upland woods in n.e. Tex., fruiting Oct.-Nov., also Ark. and La.

21. *Crataegus Reverchonii* Sarg. Shrub or small bushy tree to about 6 m. high; leaves oval to obovate, to 35 mm. long and 25 mm. wide, leathery, glabrous, dark-green and lustrous above, pale beneath; petioles stout, about 8 mm. long; flowers 1-1.5 cm. across, with slender pedicels, in few-flowered compact glabrous corymbs; calyx tube and slender acuminate lobes glabrous; stamens 10 to 15; anthers (?) pinkish-red; fruit subglobose, light-scarlet, about 12 mm. thick. In thickets and open woods in n.-cen. Tex., fruiting Sept.-Oct.; also n. to Ark., Mo. and Kan.

22. *Crataegus cherokeensis* Sarg. Small tree with dark slightly scaly bark; branchlets slender, glabrous, zigzag, red-brown to orange-brown, armed with numerous straight slender spines; leaves oblong-obovate, rounded to acute at apex, cuneate at base, finely

(often doubly) serrate above the middle with acute teeth thickened at apex, thin, glabrous to thinly pubescent, dark-green and lustrous above, paler beneath, 3.5-4 cm. long, 1.5-2 cm. wide, often acutely lobed above the middle; petioles slender, glabrous, to 12 mm. long; flowers about 13 mm. across, with slender pedicels, in 5- to 7-flowered globose glabrous corymbs; calyx tube glabrous; calyx lobes slender, long-acuminate, entire to slightly and irregularly toothed above middle, glabrous; stamens 10, the anthers red; fruit ellipsoidal, dull-orange-red, about 1 cm. long and 6 mm. thick. Upland thickets and lowland woods in e. Tex., fruiting Sept.-Oct.; endemic.

Closely allied to *C. Engelmannii*, if not conspecific with it.

23. *Crataegus sublobulata* Sarg. Tree to 10 m. high, with a short trunk covered with soft corky slightly ridged gray-brown bark; branchlets zigzag, light reddish-brown, glabrous, armed with numerous slender straight chestnut-brown lustrous spines; leaves broadly obovate to elliptic, rounded or acute at apex, cuneate at base, coarsely and deeply irregularly serrate with acuminate teeth, often sublobulate with acuminate lobules, thick, glabrous, dark-green and lustrous above, paler beneath, 3.5-4 cm. long, 2.5-3 cm. wide; petioles stout, about 1 cm. long, villous-pubescent on upper side; flowers about 15 mm. across, with slender pedicels, in 5- or 6-flowered compact glabrous corymbs; calyx tube glabrous; calyx lobes slender, acuminate, entire or with a few teeth above the middle, glabrous on outer surface, sparingly villous-pubescent on inner surface; stamens 20; anthers pink; fruit short-oblong to subglobose or rarely obovoid, orange-red, 8-10 mm. long, 6-7 mm. thick. Edge of upland woods in e. Tex., fruiting Aug.-Sept.; endemic.

This is closely allied to, if not conspecific with, *C. Engelmannii*.

24. *Crataegus Warneri* Sarg. Tree to 8 m. high, with a slender trunk covered by dark scaly bark near the base; branchlets slender, red-brown, with pale hairs but eventually glabrate; leaves ovate to oval or obovate, rounded to acute and short-pointed at the apex, cuneate at base, 3.5-5 cm. long, 25-35 mm. wide, coarsely serrate above the middle with straight gland-tipped teeth, thin, dark-green and glabrous or occasionally villous on the midrib above, pale and villous along the midrib and primary veins beneath; petioles stout, densely villous, 5-7 mm. long; flowers 1-1.2 cm. across, with stout villous pedicels, in compact many-flowered villous corymbs; calyx tube thickly covered with matted pale hairs; calyx lobes slender, acuminate, glandular-serrate, slightly villous on the outer surface, puberulous on the inner surface; stamens 10; anthers red-purple; fruit ellipsoid to subglobose, orange-red, 6-9 mm. long. In sandy woods and on dry banks in e. Tex., fruiting Sept.-Oct.; endemic.

25. *Crataegus Tracyi* Ashe. MOUNTAIN HAWTHORN. Bushy tree to 45 dm. high, with a trunk about 3 dm. in diameter; branchlets slender, straight, dull-reddish-brown and glabrous; leaves obovate to oval or rhombic to suborbicular, rounded to acuminate at apex, often abruptly pointed, concave-cuneate at base, sharply coarsely serrate usually to below the middle with straight acuminate glandular teeth, dark-green, lustrous and scabrate above, pale-yellow-green below, 25-35 mm. long, 2-2.5 cm. wide; petiole about 8 mm. long; flowers about 13 mm. across, in compact mostly 7- to 10-flowered villous corymbs, with villous pedicels 8-13 mm. long; calyx tube glabrous or with occasional hairs at base; calyx lobes glandular-serrate, glabrous on outer surface, villous on inner surface; stamens 10 to 15; anthers pinks; fruit ellipsoid, about 1 cm. long, orange-red. *C. montivaga* Sarg. Rocky banks of streams on the Edwards Plateau and in the Trans-Pecos, fruiting Sept.-Oct.; endemic.

26. *Crataegus berberifolia* T. & G. BIGTREE HAWTHORN. Tree to 12 m. high, with a trunk about 3 dm. in diameter and branchless for about 6 m. above ground, the dark bark scaly and fissured; branchlets slender, dull-red-brown and slightly villous, armed with stout straight spines; leaves oblong-obovate to oval, acute to acuminate at the gradually narrowed apex, cuneate at base, coarsely and often doubly serrate above with glandular teeth, coriaceous-lustrous and slightly roughened on the upper surface, pale-green and scabrate on the lower surface, 3.5-5 cm. long, to 25 mm wide; flowers 1-2 cm. across, in slightly villous 4- or 5-flowered slender-branched compact narrow corymbs; calyx tube glabrous or slightly villous below; calyx lobes linear-lanceolate, entire, obscurely glandular-serrate, reflexed after anthesis; stamens about 20; anthers yellow to rose-color; fruit short-oblong, slightly pruinose, dull-green tinged with red, 8-15 mm. long. In low wet woods and on dryish hills in e. Tex., fruiting Sept.-Oct.; endemic.

Our plant has been referred to var. *edita* (Sarg.) E. J. Palm. (*C. edita* Sarg.) whose anthers are rose-color instead of being yellow as in var. *berberifolia*.

27. *Crataegus Engelmannii* Sarg. A stout shrub or small tree to 7 m. high, with a broad flat-topped crown of stiff spreading branches and gray-brown scaly or fissured bark; branchlets slender, flexuous, thorny, villous while young; leaves mostly obovate to oblong-obovate or sometimes elliptic on vegetative shoots usually slightly pilose above or on the veins beneath while young, subcoriaceous, reticulately veined at maturity; petioles stout, 3-8 mm. long, villous, wing-margined nearly to the base; flowers 12-15 mm. wide, 8 to 12 in slightly villous loose corymbs; stamens about 10; anthers pink or rarely white; fruit subglobose or short-oblong, 6-8 mm. thick, dull-crimson, with thin dry flesh and 1 to 3 nutlets. Sandy upland or lowland woods, thickets and open dry soils in e. and n.-cen. Tex., fruiting Oct.-Nov.; from Ill. to Okla. and Tex.

28. *Crataegus glabriuscula* Sarg. Tree to 75 dm. high, with a trunk about 3 dm. in diameter, with thin dark-brown scaly bark; branchlets slender, unarmed or armed; leaves ovate-oblong to suborbicular, acute to short-pointed or rounded at apex, gradually narrowed from below the middle to the slender entire base, coarsely and often doubly serrate usually only above the middle with broad straight gland-tipped teeth, sometimes divided toward apex into several short acute lobes, subcoriaceous, 3.5-5 cm. long, 2-2.5 cm. wide, glabrous, dark-green and lustrous on the upper surface, pale on the lower surface; petioles slender, about 1 cm. long; flowers about 13 mm. across, in few-flowered rather compact glabrous corymbs; pedicels slender, long; stamens 20; anthers pale-yellow; fruit oblong to obovoid or nearly globose, dull-orange-color, marked by minute dark dots, about 8 mm. long. Incl. f. *desertorum* Sarg. In dry creek beds and bottomlands along rivers in n.-cen. and s. Tex., fruiting Sept.; endemic.

29. *Crataegus viridis* L. GREEN HAWTHORN. Tree sometimes to 12 m. high, with slender unarmed or sometimes thorny branchlets and thin scaly pale-gray bark over orange-brown inner bark; leaves variable and often asymmetrical, thin, glabrous at maturity except for tufts of tomentum in the axils of the veins beneath, on flowering branchlets mostly rhombic or oblong-elliptic, 2.5-5 cm. long, 13-25 mm. wide, finely serrate above the middle or nearly to the base, on vegetative shoots often ovate and sharply serrate and sharply lobed or deeply cut toward the base; petioles slender, 1.2-5 cm. long; flowers 12-15 mm. wide, numerous in glabrous or rarely pubescent corymbs; stamens about 20; anthers small, pale-yellow or rarely red; fruit subglobose, 5-8 mm. thick, red or orange-red, with thin juicy flesh and usually 5 nutlets. *C. Davisii* Sarg. In low wet or alluvial woods, and fields in sandy soils and clays in e. and s.-cen. Tex., fruiting Sept.-Nov.; from Va. and Fla., w. to Ill., Mo. and Tex.

Those plants with somewhat villous-pubescent corymbs and branchlets are segregated as var. *velutina* (Sarg.) E. J. Palm. (*C. velutina* Sarg.). Those plants with leaves shorter than typical have been segregated as f. *abbreviata* (Sarg.) E. J. Palm. (*C. abbreviata* Sarg.), a possible hybrid of this species with *C. mollis*.

30. *Crataegus sutherlandensis* Sarg. Shrub or slender tree to 5 m. high, often forming thickets, the bark dark-gray; branchlets red-brown and glabrous, noticeably armed or unarmed; leaves ovate, acute at apex, concave-cuneate at base, 3-4 cm. long, 2-2.5 cm. wide, thin, dull yellow-green, slightly scabrate on the upper surface; petioles slender, 8-15 mm. long, sparingly villous at first but soon glabrous; flowers about 2 cm. across, with long slender glabrous pedicels, in lax usually 7- to 10-flowered corymbs; calyx tube glabrous; calyx lobes often laciniately divided near the base into glandular teeth, villous-pubescent on inner surface; stamens 20; anthers faintly tinged with pink; fruit subglobose, orange-red, 7-8 mm. thick. Incl. var. *spinescens* Sarg. In low or rich woods in s. Tex., fruiting Sept.-Oct.; endemic.

31. *Crataegus anamesa* Sarg. Shrub or small tree to 5 m. high, with a slender trunk covered by close or scaly gray bark; branchlets glabrous and dull reddish-brown, usually armed; leaves suborbicular-ovate to elliptic or somewhat obovate, acute at apex, cuneate at base, 3-5 cm. long and about as wide, finely serrate with short broad teeth and sometimes with rounded lobes above the middle, subcoriaceous, nearly glabrous, dark-green and lustrous above, pale beneath; petioles slender, 1.5-2 cm. long, densely villous at first but soon glabrous; flowers 2-2.5 cm. across, in compact 8- to 15-flowered densely villous corymbs crowded on the branches; calyx tube glabrous except for occasional short white hairs; calyx lobes rarely minutely dentate, glabrous on outer surface; stamens 20; anthers pale-yellow; fruit subglobose to slightly obovoid, dark-red, 9-10 mm. thick. *C. antiplasta* Sarg. Prairies in s.-cen. Tex., fruiting in Oct.; endemic.

32. *Crataegus stenosepala* Sarg. Shrub or small tree to 45 dm. high, with dark slightly scaly bark; branchlets slender, slightly fractiflex, glabrous, reddish-brown but eventually grayish, armed with numerous straight spines; leaves elliptic to oblong-elliptic or obovate, acute to acuminate at apex, cuneate at base, sharply and coarsely serrate above the middle with straight teeth, with short lobes near apex, glabrous, yellowish-green and lustrous above, paler beneath, 3.5-6 cm. long, to 35 mm. wide; petioles about 1 cm. long; flowers about 2 cm. across, in rather open 10- to 20-flowered slightly villous corymbs; calyx tube with few long white hairs; calyx lobes slender, long-acuminate, glabrous outside; stamens 20; anthers pale-yellow; fruit ellipsoid to somewhat obovoid, orange-red, about 8 mm. long. *C. antimima* Sarg. In s.-cen. Tex., fruiting Oct.-Nov.; endemic.

33. *Crataegus poliophylla* Sarg. Tree to 5 m. high, with a trunk to 25 cm. in diameter, with dark rough bark; leaves oblong-obovate to elliptic, acute to acuminate at apex, cuneate at base, 3-4 cm. long, 2.5-3 cm. wide, rarely larger, finely doubly serrate above the middle with straight teeth and usually irregularly divided toward the apex into short acute lobes, subcoriaceous, at first villous, soon glabrous, yellow-green and lustrous above, pale beneath; petioles slender, 1.5-2 cm. long, at first pubescent, becoming glabrous; flowers about 15 mm. across, in wide lax 5- to 15-flowered densely villous corymbs; calyx tube villous like the slender pedicels; calyx lobes short, lanceolate to deltoid-lanceolate, glandular-serrate or nearly entire, glabrous on outer surface; stamens 20; anthers yellow; fruit globose to ovoid, orange-red, 6-7 mm. thick. In thickets in well-drained soil in s.-cen. Tex., fruiting Sept.-Oct.; endemic.

9. FRAGARIA L.

STRAWBERRY

Rosulate perennials, usually with stolons and forming colonies; flowers white to pink, in cymes on scapes; leaves radical; leaflets 3, obovate-cuneate, coarsely serrate; stipules cohering with the base of the petioles which (with the scapes) are usually hairy; flowers similar to those in *Potentilla* but in varying degrees polygamo-dioecious; styles deeply lateral; receptacle in fruit much-enlarged and conical, becoming pulpy and usually scarlet, bearing the minute dry achenes scattered over or slightly imbedded in its surface.

About 15 species of the North Temperate Zone and the Andean region of South America.

1. Leaflets usually petiolulate; achenes set in usually deep pits; distribution in east Texas1. *F. virginiana*.
1. Leaflets sessile or subsessile; achenes superficial; distribution in mountains of Trans-Pecos Texas2. *F. bracteata*.

1. *Fragaria virginiana* Duchn. VIRGINIA STRAWBERRY, WILD STRAWBERRY. Leaves, scapes and runners from a subsimple caudex at the end of a simple thickish rhizome; old leaves firm or coriaceous, the new ones thinner, plane or hardly rugose; leaflets short-petiolulate, the terminal one cuneate-obovate, the lateral with rounded outer margins, sharply toothed; flowers unisexual or polygamous, the strictly pistillate flowers much smaller than the staminate, to 25 mm. broad, 2 to many in umbelliform cymes; calyx lobes to 1 cm. long; fruits 5-20 mm. in diameter, red, subglobose to ovoid; achenes 1.3-1.6 mm. long, in deep pits; pulp juicy. Fields, prairies, open slopes and borders of woods in the e. fourth of Tex., Mar.-Apr.; from Nfld. to Alta., s. to Ga., Tenn. and Tex.

Besides var. *virginiana*, the var. *illinoensis* (Prince) Gray is found in our region. It is a coarser plant throughout with denser pubescence on scape and petiole.

2. *Fragaria bracteata* Heller. Rootstock very short and rather thick; leaves very thin, somewhat glaucous, silky when young, glabrate in age (especially on the upper surface); petioles slender, 3-10 cm. long, silky with long white spreading or reflexed hairs; leaflets broadly rhombic-obovate, acute, coarsely toothed, 2-5 cm. long, the lateral ones very oblique; runners very slender, rather few; scape often over 1 dm. high, often exceeding the leaves, silky with long spreading or reflexed hairs, often with a unifoliate leafy bract, 2- to 8-flowered; flowers 1.5-2 cm. across; sepals and bracts lanceolate, acute; petals rounded-obovate, often nearly twice the length of the sepals; fruit somewhat elongate, ovoid to semi-ellipsoid, red, about 1 cm. long and 7.5 mm. in diameter; achenes superficial. *F. vesca* L. subsp. *bracteata* (Heller) Staudt. In Guadalupe Mts. in the Trans-Pecos, from Tex. to Mont., B. C. and Calif.

10. DUCHESNEA SM. INDIAN STRAWBERRY

About 6 species native to Asia.

1. *Duchesnea indica* (Andrz.) Focke. Perennial herb from a short rhizome, with leafy stolons and 3-foliolate leaves similar to those of the true strawberries; leaflets ovate to elliptic, 2-4 cm. long, crenately toothed, sparsely strigose on lower surface; peduncles 3-10 cm. long; flowers solitary, 15-18 mm. wide; calyx 5-parted, the lobes alternating with much larger foliaceous spreading 3-toothed appendages; petals 5, yellow; receptacle in fruit spongy but not very juicy; fruit bright-red, resembling a strawberry, insipid, about 1 cm. in diameter. Edge of low woods and thickets, seepage areas and marshes, along roadsides and in old fields in e. Tex., Mar.-Aug.; nat. of Asia that is established in many parts of the world.

11. POTENTILLA L.⁷⁸ CINQUEFOIL. FIVE-FINGER

Herbs or rarely shrubs with compound leaves and solitary or cymose flowers whose parts are rarely in fours; calyx flat, deeply 5-cleft, with as many bractlets at the sinuses so as to appear 10-cleft; petals 5, usually roundish; stamens few to many; achenes numerous, collected in a head on the dry mostly pubescent or hairy receptacle, often partly enclosed by the persistent accrescent calyx; styles slender, lateral or terminal, deciduous.

About 500 species chiefly throughout the North Temperate Zone.

- 1. Pedicel 5 to 12 times longer than the calyx; flowers axillary, solitary 1. *P. simplex*.
- 1. Pedicel shorter than or equaling the calyx in flower, to 3 times as long in fruit; flowers mostly in terminal corymbs (2)
- 2(1). Stem leaves pinnate (3)
- 2. Stem leaves palmate (4)
- 3(2). Principal leaves below inflorescence typically 3-foliolate; achenes smooth and without ventral protuberance 2. *P. rivalis*.
- 3. Principal leaves below inflorescence with 5 to several leaflets; achenes longitudinally ribbed and with a corky protuberance on ventral suture 3. *P. paradoxa*.
- 4(2). Leaflets 3, elliptic to oblong-lanceolate 4. *P. norvegica*.
- 4. Leaflets 5 or 7, oblanceolate 5. *P. recta*.

1. *Potentilla simplex* Michx. OLD-FIELD CINQUEFOIL. Stems and basal leaves from an irregularly enlarged rhizome that is often nodose or moniliform-thickened and to 8 cm. long and 2 cm. thick; stem hirsute to villous-hirsute with spreading hairs, at first erect or ascending, to 5 dm. high but soon greatly prolonging and arching, forking and rooting at tip (producing tubers that become young rhizomes of following years); cauline leaves (during anthesis) mostly to 1 dm. long; leaflets green and more or less strigose-pubescent or barely whitened beneath, narrowly obovate to narrowly elliptic or oblanceolate; middle leaflets of larger leaves to 75 mm. long, 9- to 27-toothed for three fourths their length; stipules of basal leaves with linear-lanceolate usually inrolling auricles, those of mature primary cauline leaves to 3 cm. long; first flower usually from node above second well-developed internode. *P. canadensis* of auth. In woodlands mainly in n.e. Tex., Mar.-June; from N. S. and N. B. to s. Ont. and Minn., s. to N. C., Tenn., Mo., Okla. and Tex.

2. *Potentilla rivalis* Nutt. BROOK CINQUEFOIL. Annual or biennial, rather slender, freely branched, ascending to erect, to 5 dm. high, softly villous, with paniculate-cymose very leafy flowering summit and branches; lower leaves pinnate, with 2 or 3 closely approximate pairs of leaflets or a single pair with the terminal leaflet 3-parted; cauline leaves with 3 or 5 leaflets; leaflets cuneate-obovate to -oblong, 2-5 cm. long, usually blunt, strongly toothed; flowers 4-8 mm. broad; mature calyx 5-8 mm. high, pilose; petals tiny, cuneate; stamens 5 to 20; achenes smooth. In wet situations about lakes and along streams

⁷⁸ Ref.: Lloyd H. Shinnars in *Field & Lab.* 23:19-21. 1955.

and ditches in the Panhandle, May-July; from Man. to B. C., s. to Mo., Kan., Tex., Mex. and Calif.

3. *Potentilla paradoxa* Nutt. Annual, biennial or short-lived perennial, superficially resembling *P. rivalis*, somewhat villous, to about 4 dm. high; stems diffusely branched, decumbent or ascending, slender or stout, leafy; leaves all pinnate, oblong to oblong-obovate; leaflets in 2 to 5 distant pairs, oblong to cuneate-obovate, sparsely crenate-dentate, to about 3 cm. long, usually much smaller; cyme open-paniculate, leafy; flowers yellow, on erect stalks, 5-7 mm. wide, the segments and bractlets subequal; stamens about 20; achenes longitudinally ribbed, with a prominent corky protuberance along the ventral suture. Moist or wet soil on river banks and lake margins in the Panhandle, May-July; from Ont. to B. C., s. to La., Tex. and N. M.

4. *Potentilla norvegica* L. Stout leafy annual or short-lived perennial, to 9 dm. high; stem erect or ascending, much-branched, hirsute with stiff mostly spreading hairs, often with shorter pubescence intermixed; lower leaves long-petioled, 3-foliolate; leaflets obovate to oblanceolate, to 8 cm. long, coarsely serrate, usually more or less hirsute, otherwise green; upper leaves sessile, often with narrow leaflets; inflorescence a leafy cyme; calyx in fruit enlarging to 17 mm. high, its bracteoles acutish; petals yellow, obovate, mostly shorter than calyx lobes; stamens 15 to 20; style slenderly conical at base, subterminal, about equaling the mature carpel; achenes longitudinally ribbed, to 1.3 mm. long. Incl. var. *hirsuta* (Michx.) Lehm., *P. monspeliensis* L. In damp or disturbed soils, thickets, clearings, roadsides and waste places in the Trans-Pecos, June-July; from Greenl. and Lab. to Alas., s. to Tex.

5. *Potentilla recta* L. SULPHUR CINQUEFOIL. Stem erect, very leafy, to 7 dm. high, from a perennial base, loosely hirsute; basal leaves with long hirsute petioles, digitately 5- or 7-foliolate; leaflets oblanceolate, to 14 cm. long, with few to many prolonged narrowly deltoid teeth, more or less hirsute on both surfaces, paler beneath; cyme stiffly erect, standing above the principal foliage; flowers on erect stalks, 15-25 mm. across; calyx hirsute, becoming 15 mm. high; petals obcordate, deeply emarginate, usually pale-yellow, equaling or exceeding the calyx lobes; stamens 25 to 30; style shorter than the mature carpel. In Tarrant and Cass cos., May-June; Eur. weed that has become naturalized in fields and along roadsides throughout much of n.e. U. S.

12. GEUM L. AVENS

Perennial rhizomatous herbs with pinnate or lyrate leaves; flowers few, solitary (in ours); calyx campanulate or deeply 5-cleft, usually with 5 small bractlets at the sinuses; petals 5; stamens numerous; achenes numerous, crowded on a conical or cylindrical dry receptacle, the long-persistent styles forming hairy or naked and straight or jointed tails; seed erect.

About 40 species, mostly in the North Temperate Zone.

1. Heads of achenes conspicuously stipitate above the calyx; achenes minutely appressed-puberulent; bractlets none; corolla yellow .. 1. *G. vernum*.
1. Heads of achenes sessile; achenes hirsute toward the summit or completely glabrous; bractlets commonly present; corolla white 2. *G. canadense*.

1. *Geum vernum* (Raf.) T. & G. Perennial, with a very short rootstock; stem 3-6 dm. high, erect or ascending, slightly pubescent; basal leaves long-petioled, pinnately 3- to 9-foliolate (on the new shoots simple and reniform); divisions with oval to obovate lobes that are 1-3 cm. long and 3-6 cm. wide, crenate or serrate, pilose; lower stem leaves pinnate with doubly serrate divisions, the upper leaves ternate; inflorescence open; bractlets none or rudimentary; sepals triangular, 1.5-2 mm. long, glabrous without, puberulent within, reflexed; petals oblong, yellow or ochroleucous, about equaling the sepals; receptacle stalked, glabrous; fruiting head about 1 cm. in diameter, on a stipe 1-2 mm. long; body of achenes 2-2.5 mm. long, minutely appressed-puberulent; lower segment of the style 2-2.5 mm. long, glabrous, the upper segment less than 1 mm. long and glabrous. In rich woods in n.e. Tex., Mar.-May; from Ont. to Ia. and Kan., s. to Tenn., Ark. and Tex.

2. *Geum canadense* Jacq. WHITE AVENS. Stem rather slender, to 12 dm. high, glabrous to sparingly hirsute, often minutely pubescent or glandular-puberulent at summit; leaves of basal tufts long-petioled, the petioles smooth or sparsely hairy, simple and undivided or with 3 to 5 (rarely 7) rhombic serrate leaflets; lower stem leaves similar to the basal leaves but short-petioled to sessile, mostly with 3 leaflets; upper stem leaves ternately cleft or simple, sharply serrate and acute; stipules ovate-oblong, 1-2 cm. long, subentire or cleft; peduncles filiform, minutely pilose to glandular-puberulent; pedicels velvety-puberulent; calyx lobes lanceolate to ovate-lanceolate, acuminate, 4-10 mm. long; petals white, oblong to obovate, 5-9 mm. long, 2-4.5 mm. broad, about equaling to longer than calyx lobes; fruiting head spherical, with numerous achenes, 1.2-2 cm. in diameter; the upper segment of the style ascending or spreading, only tardily reflexed; denuded receptacle densely white-villous. In rich woods in the e. third of Tex., w. to Real Co., Apr.-June; from N. S. to S. D., s. to Ga. and Tex.

We have two variants of this species in the state that may be segregated as follows:

1. Terminal segment of median cauline leaves usually acute; carpels 3-4 mm. long, broadly ovate (*G. camporum* Rydb.) var. *camporum* (Rydb.) Fern.
1. Terminal segment of median cauline leaves usually obtuse; carpels 2-3 mm. long, narrowly obovate to cuneate. var. *texanum* Fern.

13. RUBUS L.⁷⁹

BRAMBLE. DEWBERRY. BLACKBERRY

Perennial shrubs or less often herbs, very often prickly, with simple or more commonly compound serrate or lobed leaves and small to large perfect or unisexual white to pink or reddish flowers; hypanthium small, flat to hemispheric; sepals usually 5, valvate, spreading to reflexed, commonly ending in a short caudate appendage; bractlets none; petals as many as the sepals, erect or spreading, spatulate to obovate or elliptic; stamens numerous; pistils numerous, inserted on a convex receptacle that often elongates in fruit; style filiform or clavate; fruit a cluster of drupelets that fall together or sometimes separately, the receptacle falling with the drupelets or remaining attached to the pedicel.

In the shrubby species, the plant sends up from a perennial base a series of biennial stems, during their first year these are termed "primocanes" that normally do not branch nor flower, during their second year they are known as "floricanes" at which time they emit a number of short lateral branches with a few leaves and usually with a terminal flower or inflorescence; leaves of the primocanes compound; leaves of the floricanes often partly simple, regularly smaller and often of a different shape than those of primocanes.

The taxonomy of *Rubus* is complicated by hybridization, polyploidy and apomixis. More than 1,000 entities have been proposed in this genus. At present, there exists no infallible method for properly categorizing these proposals. The Gleason (1952) and Gleason and Cronquist (1963) collective species system is perhaps the best method yet devised to handle this task. We have adapted their lead in our treatment.

1. Leaflets whitened beneath with dense closely matted pubescence; flowers in open panicles; pedicels armed with small stout thorns 1. *R. bifrons*.
1. Leaflets green to gray beneath, glabrous or rather densely spreading-pubescent; flowers solitary, corymbose, racemose or in compact panicles; pedicels unarmed or with small prickles (2)
- 2(1). Plant upright and highbush, its canes not truly trailing but sometimes over-arching and the tips sometimes reaching the ground but not rooting; flowers nearly always in cymes or racemes (3)
2. Plant with its canes habitually trailing or lying on the ground surface by growing from the end in that position and taking root at tips of primocanes or branches; flowering shoots arising more or less perpendicular from the grounded canes; pedicels mostly of the ascendent type, the clusters mostly not distinctly of the racemiform type; frequently the primocanes are at first erect, sometimes the plants make distinct mounds but trailing canes issue from them (6)

⁷⁹ Ref.: Various papers by L. H. Bailey in *Gent. Herb.*, vol. 5. 1941-1945; L. H. Shinnars in *Field & Lab.* 22:27-30. 1954.

- 3(2). Main leaflets of mature primocane leaves long and narrow, attenuate at apex, the length usually twice or more the width, narrowed to the tip mostly in concave or sunken curves; floricanes leaflets usually also narrow (4)
3. Main leaflets of mature primocane leaves typically ovate to elliptic, the width distinctly more than one half the length, the sides often convex toward the apex (5)
- 4(3). Lower surface of leaves (especially those of primocanes) decidedly soft-pubescent to the touch 2. *R. louisianus*.
4. Lower surface of leaves (especially those of primocanes) not velvety or soft-pubescent to the touch 3. *R. persistens*.
- 5(3). Clusters of flowers manifestly exceeding the associated leaves and not buried in them, broadly corymbiform; southeast Texas 4. *R. saepescandens*.
5. Clusters of flowers and fruits prevailingly about equaled or often exceeded by the accompanying floral foliage, mostly few-flowered; north-central Texas 5. *R. oklahomus*.
- 6(2). Plants with glandular bristles occurring with the prickles (7)
6. Plants without glandular bristles (8)
- 7(6). Leaflets glabrous beneath or pubescent only on main veins, the margins without glands 6. *R. trivialis*.
7. Leaflets soft-pubescent over the lower surface, the margins with scattered reddish stipitate glands 7. *R. duplaris*.
- 8(6). Lower surface of primocane leaves usually decidedly soft-pubescent or even velutinous to the touch (9)
8. Lower surface of leaves on primocanes not soft-pubescent or velutinous to the touch (10)
- 9(8). Flowers 1 to 3 or occasionally 5, borne from terminal and sometimes middle portion of flowering branchlets on erect to ascending pedicels 8. *R. aboriginum*.
9. Flowers 4 to 9 (5 or more on most branches), borne from terminal middle and usually lower portion of flowering branchlet on ascending to widely spreading pedicels 9. *R. apogaeus*.
- 10(8). Primocane leaflets or the odd or terminal one sharply turned or abrupt toward its apex, or somewhat shouldered 10. *R. flagellaris*.
10. Primocane leaflets or at least the odd or central one gradually tapered to the summit 11. *R. Nessianus*.

1. *Rubus bifrons* Vest. Strong low-arching glandless bramble making canes 2-3 m. long or more with their apices lying or creeping on the ground and sometimes tip-rooting, the clump or colony to 15 dm. high; canes somewhat angled to almost terete, striate, scantily pilose to pubescent; prickles irregularly scattered and of differing lengths, 4-7 mm. long, moderately broad-based, flattened, straight to somewhat hooked; *primocane* leaflets 5, persistent, ovate-elliptic to oblong-elliptic or somewhat rhombic, 8-9 cm. long, 5-6 cm. wide, glabrous above, grayish to brownish-canescenscent or tomentose beneath, gradually or abruptly narrowed at apex, cuneate to subcordate at base, the margins finely and somewhat irregularly serrate; petiole and petiolules armed with short strong hooks; *floricane* leaves mostly 3-foliolate, the leaflets similar to those of the primocanes; inflorescence narrow and long with a few branches in the lower axils; peduncles and pedicels grayish-tomentose and bearing straight conspicuous prickles; flowers 2-2.5 cm. across; calyx lobes long-pointed, becoming reflexed; petals white or rose-color, narrow; fruit not large, about 15 mm. thick, black, the drupelets not numerous and loosely placed. A nat. Eur. plant that has become naturalized along sandy roadsides, in waste places and about old homesites in e. Tex., May-June; from Fla. to Tex., n. to R. I., Tenn. and Mo.

2. *Rubus louisianus* Berger. Erect high-arching and stiffish glandless bramble to 5 m. high; canes sharply angled and deeply furrowed, downy when young, eventually glabrous, green or greenish-brown, adorned along the angles with scattered straight or curved prickles; stipules subulate, ciliate; *primocane* leaflets 5, narrowly lanceolate to oblanceolate, rather long-pointed at apex and somewhat narrowed toward the base, bright dull-green above, paler and sparsely soft-pubescent beneath, rather regularly and sharply simply or doubly serrate; petiole rather stout, like the petiolules pubescent or villous

and with scattered curved prickles that extend to the midveins; *floricane* leaves in threes or with the upper one simple and ovate-deltoid, similar to but smaller than those of the primocanes, the terminal leaflet 2 to 3 times as long as wide; fruiting racemes pubescent, with 4 to 15 erect pedicels that are pubescent and provided with a few curved prickles; flowers rather large; calyx pubescent, the ovate-deltoid lobes tomentose inside; petals white, oblong-elliptic to obtusely oblanceolate or obovate, 6-15 mm. long, 3.5-10 mm. wide; fruit oblong-oval, with numerous small drupelets, whitish, sweet. *R. texanus* Bailey, *R. ramifer* Bailey, *R. arvensis* Bailey, *R. abundiflorus* Bailey, *R. argutus* of auth. In damp and sandy thickets, pastures and lowland areas, and along fencerows in e. Tex., Apr.; from Tex. to S. C., n. to Md. and Va.

3. *Rubus persistens* Rydb. Upright much-branched and intertangled glandless bramble to 2 m. high, not trailing nor root-tipping, sometimes forming close clumps; stems angled but the branches essentially terete; prickles rather abundant, prominent, becoming curved, broad-based and about 3 mm. long on floricanes; *primocane* leaflets 3 or 5, ovate-lanceolate to broadly lanceolate, at first somewhat pilose above but soon glabrous, the mature terminal leaflet 7-9 cm. long and 3-4 cm. wide, with some leaflets persistent over winter; *floricane* leaflets 3 or with some simple, mostly smaller and obtusish; flowers as many as 8 in short racemiform clusters that scarcely if at all exceeds the foliage, with short naked or few-prickly pedicels; flowers 2.5-3 cm. across; calyx lobes oblong, not attenuate but with a brief point; petals obovate, obtuse, soon more or less reflexed; fruit oblong. In sandy soils in open areas in s.e. Tex.; from Fla. to Tex.

4. *Rubus saepescandens* Bailey. A rampant long-branching bramble that produces canes sometimes to 16 m. long which run over shrubs and ascend to and recline against branches of trees; *primocanes* very thin for the great length, usually less than 1 cm. thick, commonly with one or two strong ridges, conspicuously glabrous, bearing a few nearly straight flat-based prickles 2-3 cm. or more apart and 2-3 mm. long; *primocane* leaves mostly 5-foliolate; leaflets oblong-lanceolate to elliptic, acuminate, the central leaflet broad at base, 7-9 cm. long, 4-5 cm. wide, nearly or quite glabrous above, soft-pubescent beneath, the margins finely irregularly serrate; petiole armed; *floricane* leaves 3-foliolate or the upper floral ones simple, the blades oblong to ovate-oblong or obovate and short-pointed, 4-7 cm. long, 1-4 cm. wide; flowers 6 to 10 in a broad corymbiform cluster that usually exceeds the accompanying foliage, borne on short lateral spurs; pedicels slender, ascending or divaricate, about 2 cm. long in anthesis, pilose, weakly armed, glandless, sometimes forked; corolla about 2 cm. across; petals narrow, obtuse. In sandy open areas in e. Tex.; also s. La.

5. *Rubus oklahomus* Bailey. Upright but arching very prickly glandless bramble to 2 m. high, with long weak horizontal or depressed branches some of which tip-root; canes terete but sometimes angular; prickles straight or curved, 3-6 mm. long, broad-based; *primocane* leaflets 3 or 5, broadly oval or the lower lateral pair rhombic, essentially obtuse at apex, rounded or expanded at base, about 7 cm. long and 4 cm. wide or more, thinly pubescent above, somewhat grayish and densely to sparsely soft-pubescent beneath, the margins dentate with obtuse-apiculate teeth; *floricane* leaflets much smaller but otherwise similar to those of the primocanes, the upper ones in the flower cluster sometimes simple; flowers 3 to 5, large, showy, projecting on short laterals that are leafy at base, the ascending pedicels pubescent and armed; calyx lobes very broad, apiculate or sometimes with foliaceous tips, becoming reflexed; corolla about 3 cm. across, the petals very broad and rounded. *R. largus* Bailey, *R. putus* Bailey, *R. valentulus* Bailey. In thickets, edge of woods, on slopes, in stream bottoms and along fencerows in n.-cen. Tex., Apr.; also Okla. and Ark.

6. *Rubus trivialis* Michx. SOUTHERN DEWBERRY, ZARZAMORA. Trailing or low-arching and soon depressed, with slender tough terete canes, tip-rooting; primocanes and usually the floricanes bearing glandular bristles among the hard curved prickles; *primocane* leaves somewhat coriaceous and semievergreen; leaflets usually 5, glabrous, oblong to lanceolate, coarsely toothed, to 1 dm. long and 3 cm. wide; *floricane* leaflets smaller; flowers 1 to few; pedicels erect, filiform, bristly or glandular; calyx glabrous or glabrescent on the back or glandular; petals obovate, 7-10 mm. wide; fruit subglobose to elongate, black, 1-3 cm. long. *R. riograndis* Bailey, *R. seorsus* Bailey, *R. Mcvaughii* Bailey. Rather ubiquitous, commonly a weedy plant along roadsides, fencerows and in thickets in various soils in e. Tex., w. to Grand Prairie, Mar.-Apr.; from Fla. to Tex., n. to Md., Mo. and Okla.

7. *Rubus duplaris* Shinn. Similar to but usually smaller than *R. trivialis*; primocanes low-spreading; floricanes trailing; both old and new canes adorned with a mixture of red gland-tipped bristles and soft pubescence among the prickles; leaves soft-pubescent on the lower surface, commonly provided with reddish stipitate glands along the main veins beneath and on the marginal teeth; flowers solitary. In open sandy oak woods in e.-cen. Tex., Apr.-May; endemic.

8. *Rubus aboriginum* Rydb. Canes running and tip-rooting, glandless, often nearly erect on hard soil, nearly or quite terete, lightly pilose when young but becoming glabrous the second year, bearing few scattered short hooked broad-based prickles that are 2-3 mm. long; primocane leaves 5-foliolate but on younger parts 3-foliolate; leaflets ovate to elliptic or oval, briefly pointed, softly but thinly pubescent on both surfaces and on the lower surface even until winter, sharply double-serrate, the lateral leaflets tapered to base, the terminal or central one 7-9 cm. long and three fourths as broad, mostly rather broad and subcordate at base; petiole and strong terminal petiolule stoutly armed and sparsely soft-pubescent; flowers 2-2.5 cm. across, 1 to 4 on short floral shoots that are provided with small 3-foliolate or sometimes simple cuneate leaves that are sharply serrate and mostly narrowed to base; pedicels slender, short-pilose, scantily if at all armed; calyx small, the pubescent lobes soon reflexed; petals obtuse and contiguous; fruit oblong, seedy, 15 mm. long or more. *R. austrinus* Bailey, *R. velox* Bailey, *R. Bollianus* Bailey, *R. almus* Bailey, *R. neonefrens* Bailey, (?) *R. nefrens* Bailey. In sandy open woods, along roadsides and in fencerows in e. Tex., w. to West Cross Timbers, April.; ? endemic.

9. *Rubus apogaeus* Bailey. Low tangled glandless bramble with downward-bending primocanes and long running tip-rooting floricanes, forming loose mounds to about 6 dm. thick, with few erect shoots but the general direction of all the growth is bending toward the ground, the branches 2-3 m. long and lying flat and tip-rooting; primocanes glabrous except at tip where they are somewhat pubescent, provided with weak essentially straight flat-based prickles 3-5 mm. long and spaced 5-10 mm. apart; primocane leaves 5-foliolate, the petioles long and armed; leaflets narrow, various, those near the top of cane oblong-lanceolate and long-acuminate (about 6 cm. long 3 cm. wide), the main ones broader and short-pointed and at least the central or odd one broad or subcordate at base, practically glabrous and somewhat lucid above, soft-pubescent to the touch or glabrous except on the veins beneath, not persistent, the margins sharply and unequally serrate; floricanes retaining the straight armature that becomes stouter with age; floricane leaflets 3, small, elliptic or narrower, acute to obtuse at apex, soft-pubescent beneath, 2 cm. long or less, obtusely serrate; flowers 7 or fewer on short floral shoots, often 25 mm. across at expansion but sometimes only one half that size; pedicels not elongated (2 cm. or less), pubescent, nude or provided with a few small hooks; petals rounded or obtuse and more or less contiguous; fruit small, oblong, seedy, about 1 cm. long. *R. uncius* Bailey, *R. lassus* Bailey, *R. Lundelliorum* Bailey. In damp thickets, on road shoulders and edge of forests in e. Tex., Apr.; ? endemic.

10. *Rubus flagellaris* Willd. NORTHERN DEWBERRY. Long-creeping and prostrate, the canes eventually flat-trailing and usually tip-rooting; primocanes to 6 mm. thick at base, at first ascending, later depressed, becoming to 5 m. long, glabrous, the angles with firm subulate but thick-based scattered and slightly recurved prickles to 4 mm. long; leaves on slender subglabrous or merely puberulent or appressed-pilose prickleless or sparsely prickly petioles; leaflets 3 or 5, serrate or dentate, glabrous or with the veins beneath appressed-pilose; terminal leaflet with elongate petiolules, ovate to subelliptic, rounded at base, rather abruptly contracted to an acuminate tip to 2 cm. long; lateral leaflets sessile and often asymmetrical; floricanes trailing, woody and tough, often reddish or purplish; flowering branchlets erect, those near the base producing corymbs of up to 9 or sometimes more flowers on nearly erect filiform glabrous to merely puberulent or appressed-pilose (rarely remotely villous) prickleless or sparsely setose-prickly pedicels about 1 cm. long; bracteal leaves 3-foliolate or simple, with glabrescent petioles, glabrous or nearly so beneath, the terminal leaflet or the simple blade ovate to obovate or lanceolate and longer than broad; calyx pubescent; petals white, oblong to elliptic-oval or obovate, 1-1.5 cm. long, 5-10 mm. wide; fruit relatively large, globose to slightly elongate, mostly 1-1.5 cm. in diameter, usually of rich flavor. *R. occidualis* (Bailey) Bailey. In dry fields, opening and borders of thickets in the e. third of Tex., May-June; from Me. and Que. to Ont. and Minn., s. to Tex.

11. *Rubus* *Nessianus* Bailey. Stout much-branched clambering glandless bramble, probably at length tip-rooting, the diffuse more or less prostrate canes sometimes to 6 m. long and 4-5 mm. thick, nearly or quite terete, glabrous, closely provided with stout hard curved broad-based prickles 3-4 mm. long; *primocane* leaves 3-foliolate or probably sometimes 5-foliolate, coriaceous and sometimes persistent, the margins unevenly sharply serrate, essentially glabrous on both surfaces; petiole abundantly hooked and more or less thinly pilose-pubescent; leaflets elliptic, shortly or abruptly acuminate at apex, the odd one 7-8 cm. long and 3-4 cm. wide or more, narrowed to the base; *floricane* leaflets elliptic or the upper ones simple and ovate, 4-6 cm. long, short-acute to almost obtuse or the odd leaflet to 8 cm. long, glabrous above, more or less thinly pubescent on the veins beneath; flowers 2 to 5, about 4 cm. across, showy, with long ascending very prickly pubescent separate pedicels; calyx pubescent, the broad lobes short-acuminate; petals very broad and rounded. In red sands in pinelands and bottomlands in s.-cen. and s.e. Tex., spring; ? endemic.

14. *ALCHEMILLA* L. LADY'S-MANTLE

About 250 species mainly in the mountains of Latin America with several in the Old World.

1. *Alchemilla microcarpa* Boiss. & Reut. PARSLEY PIERT. Annual to 1 dm. high; stem simple or diffusely branched from base, appressed-pubescent; stipules foliaceous, 3-4 mm. long, 3- or 5-lobed to about their middle; leaves shortly petiolate, flabelliform, deeply 3-cleft, pilose, 2-6 cm. wide; flowers small, greenish, several in fascicles opposite the leaves and partly enclosed by the stipule; calyx tube inversely conical, contracted at the throat; calyx limb 4-parted, with as many alternate accessory lobes or bractlets; petals none; stamens 1 to 4, alternate with the sepals; pistils 1 to 4, the slender style arising from near the base; hypanthium ellipsoid, minutely pubescent, to 1 mm. long in fruit, with connivent pubescent calyx lobes. In sandy open places, old fields and along roads in e. Tex., Apr.-June; a nat. of Eur. that has become naturalized from Del. and D. C., s. to Ga., Ala. and Tex.

15. *FALLUGIA* ENDL.

A monotypic genus.

1. *Fallugia paradoxa* (D. Don) Endl. APACHE-PLUME. Slender upright deciduous or semievergreen much-branched shrub, to 2 m. high; branchlets slender, grayish-white-tomentulose; stipulate; leaves alternate, cuneate, with 3 to 7 narrowly oblong lobes that are decurrent into the linear petiole, 8-15 mm. long, revolute, white-tomentulose on the lower surface, partly fascicled; flowers terminal, 1 to 3, perfect or polygamous, conspicuous, 25-35 mm. across; calyx tube cupular; sepals 5, ovate, imbricate, with 5 alternate narrow bracts at base; petals 5, white, suborbicular, spreading; stamens numerous; pistils many on a conical torus, pubescent; style slender; achenes with purplish feathery tails 2-5 cm. long, the heads of achenes attractive. In dry, sunny, well-drained situations in gravelly or rocky-bouldery soils in the w. Edwards Plateau and Trans-Pecos, May-Dec.; from Tex. to Calif. and n. Mex.

16. *COWANIA* D. DON

About 5 species in southwestern United States and Mexico.

1. *Cowania ericaefolia* Torr. HEATH CLIFFROSE. A straggling intricate bush 3-10 dm. high; bark dark-brown and fissured; young twigs very short, more or less tomentose when young; leaves alternate, linear-subulate, entire, coriaceous, glandular-dotted, 4-6 mm. long, with strongly revolute margins and spinulose tips, more or less fascicled at the ends of the branches; flowers solitary, terminal on short branches; pedicels about 5 mm. long, sparingly glandular; hypanthium campanulate-funnelform, persistent, 3 mm. long; sepals 5, elliptic, 4 mm. long, obtuse, imbricate, persistent, slightly tomentose and with stalked glands; petals 5, white or yellowish, obovate, spreading, 6-8 mm. long; stamens numerous in two series, inserted in the throat of the hypanthium; pistils about 8, sessile,

distinct; styles terminal, plumose, in fruit 15-25 mm. long, the naked tips 1 mm. long; achenes oblong or lanceolate, striate, villous-hirsute; seeds linear. On limestone boulders and crevices of cliffs in mts. of the Trans-Pecos, July-Oct.; also Coah.

17. CERCOCARPUS H.B.K.⁸⁰ Mountain Mahogany

Shrubs and small trees with dark-colored hard wood and smooth bark; leaves simple, alternate, fascicled, thick-herbaceous to coriaceous, evergreen, entire or dentate, linear to suborbicular-obovate, stipulate, often conspicuously veined on lower surface; flowers solitary or in small fascicles, with 5 small inconspicuous yellowish sepals and no petals; stamens numerous, inserted in 2 or 3 rows on the limb of the hypanthium; pistil 1, the ovary superior; hypanthium sheathlike in fruit, enclosing the slender villous achene; style long, persistent, plumose, twisted, much-exserted.

About 20 species confined to western United States and Mexico. Several species are considered to be good browse.

1. Leaves mostly 2 cm. long or less, entire or with only a few short teeth at the apex 1. *C. montanus* var. *paucidentatus*.
1. Leaves mostly more than 2 cm. long, usually coarsely toothed on the upper half (2)
- 2(1). Leaves (at maturity) densely pubescent (woolly); mostly in the Panhandle and northern Trans-Pecos 1. *C. montanus* var. *argenteus*.
2. Leaves (at maturity) glabrous or with only a few appressed silky hairs (not woolly); mostly on the Edwards Plateau and in the southern Trans-Pecos 1. *C. montanus* var. *glaber*.

1. *Cercocarpus montanus* Raf. Shrubs or small trees 1-6 m. high, rarely higher, strict or spreading; bark gray to brown, smooth on the branches, checkered and fissured on the older trunks; leaves thin to somewhat thick and firm in texture, rarely subcoriaceous and never resinous, green or gray-green above, lighter below, lanceolate to oblanceolate or elliptic, sometimes subrotund to ovate or obovate, acute or round at apex, usually cuneate at base, entire to serrate or dentate, 7-60 mm. long, to 35 mm. wide, rarely larger; lateral veins 3 to 10, parallel and straight or somewhat deflected toward the apex near the outer ends, evident to prominent beneath, slightly depressed above; petiole to 8 mm. long; stipules lanceolate to ovate, to 8 mm. long; flowers solitary or in fascicles of 2 or 3, the fascicles sometimes crowded on the short spur-branchlets into groups of 5 to 15 flowers; floral tube 3-9 mm. long, in fruit 7-16 mm. long, appressed-silky-strigose to spreading-villous or tomentose, sometimes glabrate; stamens 22 to 44, the anthers hairy; achene about one-third exserted from floral tube at maturity, the tail 2-8 cm. long, densely silky-plumose. In chaparral, canyons, on rimrock, breaks, rocky slopes and in open woodlands on the Edwards Plateau and in the Panhandle and Trans-Pecos, Mar.-June; throughout most of w. U. S. and n. Mex.

We have several variants distinguished in the key in this highly variable species.

Var. *argenteus* (Rydb.) F. L. Martin. Leaves densely pubescent.

Var. *glaber* (Wats.) F. L. Martin (*C. betuloides* Nutt.). Leaves essentially glabrous.

Var. *paucidentatus* (Wats.) F. L. Martin (*C. breviflorus* Gray). Some plants in Brewster and El Paso counties have their leaves and young branches densely covered with short spreading-erect hairs instead of having only the typically appressed hairs.

18. AGRIMONIA L. AGRIMONY. COCKLEBUR. HARVEST-LICE

Perennial herbs from stout rhizomes; leaves pinnate with crenate-serrate leaflets, interspersed with smaller leaflets; stipules foliaceous; flowers yellow, small, spicate-racemose; floral bracts 3-cleft; calyx tube (hypanthium) turbinate or hemispherical, the throat beset with hooked bristles, indurated in fruit and enclosing 2 achenes, the 5-cleft limb closed after flowering; petals 5; stamens 5 to 15; styles terminal; fruit an achene.

About 15 species mostly in the North Temperate Zone.

⁸⁰ Adapted from Floyd L. Martin in *Brittonia* 7:91-111. 1950.

1. Axis of the inflorescence and lower leaflet surfaces without glands, finely to densely pubescent with short crooked or ascending hairs . . . 1. *A. microcarpa*.
1. Axis of the inflorescence and lower leaflet surfaces conspicuously glandular; hypanthium without minute strigose hairs in the furrows (2)
- 2(1). Leaves glabrous on lower surface or with scattered long hairs on the veins; axis without short crooked or incurved hairs; leaflets less than 10, elliptic to obovate . . . 2. *A. rostellata*.
2. Leaves finely to softly pubescent on the lower surface; axis finely and densely pubescent; leaflets 10 or more, of a lanceolate type . . . 3. *A. parviflora*.

1. *Agrimonia microcarpa* Wallr. Plant slender, with fusiform roots, to 12 dm. high; stem divergently long-villous below; leaves mostly clustered near base, the petioles and rachises of principal leaves horizontally long-villous; larger leaflets 3 to 7, narrowly obovate to elliptic, rounded at summit, coarsely dentate, thin, sparsely strigose above and pilose beneath; rachises of inflorescences filiform, to 4 dm. long, minutely pilose, without glands, remotely flowered; hypanthium of mature fruit obconic to short-campanulate, about as broad as long, 1.5-3 mm. long, the bristles ascending or the outer slightly spreading. *A. pumila* Muhl. In low rich woods in e. Tex., July-Oct.; from Fla. to Tex., n. to N. J., Pa., W Va. and Ky.

2. *Agrimonia rostellata* Wallr. Plant slender, with fibrous or sometimes fusiform roots; stem nearly glabrous or with scattered hairs, to 1 m. high, with ascending slender branches; leaflets of principal leaves 5 to 9, broadly elliptic to obovate, with coarse blunt teeth, thin, glabrous or with scattered short hairs on veins of resin-dotted lower surface; intermediate small leaflets 1 to 3; axis of inflorescence with glands; fruits 3.5-4.5 mm. long, the bristles ascending or the outer spreading, the longer bristles overtopped by the domelike beak of calyx lobes; hypanthium round-based, hemispherical, grooveless or only shallowly grooved, smooth or glandular-granulose. In moist rich open woods in n.e. Tex., July-Sept.; from Ga. to Tex. and Okla., n. to Mass., Conn., N.Y., O., Ind., Ill., Mo. and e. Kan.

3. *Agrimonia parviflora* Ait. Plant stout and tall, to 2 m. high, from long fibrous roots; stem densely and divergently long-hirsute or villous; larger leaflets of middle and upper leaves 11 to 15, lanceolate-acuminate, sharply serrate, firm, veiny, copiously glandular-dotted beneath; smaller interspersed leaflets very unequal, often 3 to 5 pairs on the intervals of the hirsute rachis; axis of inflorescence glandular and finely pubescent; fruits 4-5 mm. long, the hooked bristles borne on a horizontal flange and spreading to ascending, the outer bristles strongly spreading; hypanthium turbinate, with deep rounded grooves. In damp thickets and meadows and in marshy areas in the n. Panhandle and in n. e. Tex., July-Oct.; from Fla. to Tex., n. to Conn., N. Y., Ont., O., Ind., Ill. and Neb.

19. SANGUISORBA L.

Several species in the Northern Hemisphere.

1. *Sanguisorba annua* Nutt. PRAIRIE BURNET. Glabrous annual from a slender taproot; stems freely branched, to 4 dm. high; leaves pinnately compound; leaflets 7 to 15, obovate in outline, 7-15 mm. long, pectinately divided almost to the midrib into narrow blunt lobes; stipules similar to leaflets, adherent to the petiole; flower heads dense, subglobose to cylindrical, to 3 cm. long, on a naked peduncle; flowers 4-merous, small, often polygamous or unisexual, each bracteate and 2-bracteolate; calyx with a turbinate tube, constricted at the throat, persistent, the 4 broad greenish petaloid spreading lobes with scarious margins and imbricated in the bud, deciduous; petals none; stamens 4 to 12 or more, with flaccid filaments and short anthers; pistils 1 to 3, the slender terminal style tipped by a tufted or brushlike stigma; achene usually solitary, enclosed in the 4-angled dry and thickish calyx tube. *Poteridium annuum* (Nutt.) Spach. In sandy or gravelly soils in prairies, pastures, open oak woods and along roadsides mainly in n.-cen. Tex., Mar.-June; from Tex. to Ark. and Kan., sometimes adv. elsewhere.

20. ROSA L. Rose

Woody perennials, upright or trailing, usually with prickly stems; leaves alternate, compound or rarely simple, typically with adnate stipules or these rarely absent; leaflets

3 to 15, serrate or biserrate, often pubescent and glandular; flowers perfect, solitary, corymbose or paniculate; sepals 5, rarely 4; petals 5, rarely 4 or (by transformation of the stamens) numerous, obovate to obcordate; stamens numerous, inserted on a disk at the margin of the hypanthium; ovaries numerous within the hypanthium; styles connate or free, included or exserted; stigmas thickened; hypanthium urceolate or globose, contracted at the mouth, becoming fleshy at maturity (the hip); fruit an achene.

Probably a little more than 200 valid cosmopolitan species that are native mainly in the Northern Hemisphere. Contrary to popular belief, there is no yellow rose of Texas except in a song that extols the charms of a sepia-complexioned lady.

1. Receptacle prickly-armed, cup-shaped; achenes only at bottom on a conical torus; leaflets not exceeding 25 mm. in length 1. *R. stellata*.
1. Receptacle smooth or only bristly, urn-shaped; achenes on wall and/or bottom (2)
- 2(1). Stipules free or nearly so, caducous (3)
2. Stipules adnate about one half or more, persistent (4)
- 3(2). Branchlets glabrous; leaflets 3 or 5; stipules denticulate 2. *R. laevigata*.
3. Branchlets tomentose or pubescent; leaflets 7 or 9; stipules pectinate 3. *R. bracteata*.
- 4(2). Styles exserted or at least not forming a head (5)
4. Styles little or not exserted, forming a head closing the mouth of the receptacle (6)
- 5(4). Stipules pectinate; prickles usually infrastipular; style glabrous; leaves usually 5 4. *R. multiflora*.
5. Stipules entire or denticulate; prickles scattered; leaves usually 3 5. *R. setigera*.
- 6(4). Leafles resin-dotted or glandular-pubescent beneath (with or without glandless pubescence in addition); stems with usually stout hooked prickles, sometimes mixed with glandular bristles; outer sepals usually pinnate (7)
6. Leaflets glabrous beneath or pubescent with glandless hairs; stems (at least at base) with usually straight prickles and bristles; sepals usually entire (9)
- 7(6). Prickles slender, straight or slightly curved; leaflets tomentose 6. *R. tomentosa*.
7. Prickles hooked; leaflets glabrous or pubescent beneath (8)
- 8(7). Leaflets suborbicular or broadly oval, usually obtuse, glandular on both surfaces; style pubescent; sepals spreading or erect, long-persistent 7. *R. Eglanteria*.
8. Leaflets ovate to oval, acute or short-acuminate, without glands above; style glabrous or nearly so; sepals reflexed, soon deciduous 8. *R. micrantha*.
- 9(6). Sepals (after flowering) spreading, deciduous; achenes inserted only at the bottom of the receptacle (10)
9. Sepals (after flowering) upright, usually persistent; achenes inserted on wall and bottom (12)
- 10(9). Leaflets typically 9 or 11, rather narrow 9. *R. foliolosa*.
10. Leaflets 7 or fewer, obovate to oblong-lanceolate (11)
- 11(10). Terminal leaflet more than 2.5 times as long as wide; in Johnson County 10. *R. ignota*.
11. Terminal leaflet less than 2.5 times as long as wide; east Texas 11. *R. carolina*.
- 12(9). Infrastipular prickles present; in Trans-Pecos Texas 12. *R. Woodsii*.
12. Infrastipular prickles not present; east of Trans-Pecos Texas (13)
- 13(12). Leaflets glabrous, acute 13. *R. arkansana*.
13. Leaflets pubescent (at least beneath), usually obtuse .. 14. *R. suffulta*.

1. *Rosa stellata* Woot. var. *stellata*. DESERT ROSE. Shrub to 6 dm. high; branches with numerous slender yellowish white prickles and closely stellate-pubescent when young;

leaflets 3, sometimes 5, broadly cuneate-obovate, 5-10 mm. long, incisely dentate, pubescent on both sides; flowers solitary, deep-rose-purple, 3.5-6 cm. across; fruit broadly turbinate, 1-1.5 cm. thick, dull-reddish. In mt. canyons in the Trans-Pecos, summer; from Tex. to Ariz.

Subsp. *mirifica* (Greene) W. H. Lewis (*R. mirifica* Greene) is usually a more vigorous plant with branches without the conspicuous stellate pubescence of var. *stellata*.

Var. *Erlansoniae* W. H. Lewis differs from the typical variety by having floral branches angled at the nodes, pale-green, devoid of internodal bristles and prickles or sometimes sparsely bristly and prickly, or glabrous. In canyons of the Guadalupe Mts.

2. *Rosa laevigata* Michx. CHEROKEE ROSE. Plant to 5 m. high; leaflets 3, rarely 5, elliptic-ovate to ovate-lanceolate, 3-6 cm. long, acute or acuminate, sharply and finely serrate, glabrous and lustrous, reticulate beneath; flowers white, rarely rose-colored, 6-8 cm. across, fragrant; fruit pyriform, bristly, 3.5-4 cm. long. A nat. of China that occasionally escapes from cult.

3. *Rosa bracteata* Wendl. MACARTNEY ROSE. Depressed evergreen with very broad-based paired infrastipular prickles; branchlets densely tomentose and slenderly prickly and stipitate-glandular; stipules about 5 mm. long, cleft essentially to base into slender segments; leaflets 5 to 9, hard and coriaceous, lustrous above, narrowly obovate, obtuse or acutish at apex, finely crenate-dentate, glabrous or pubescent on midrib beneath, 13-35 mm. long; flowers 1 to few, short-stalked, closely subtended by large dissected pubescent bracts, 5-7 cm. across, white; receptacle tomentose; fruit globose, 3-3.5 cm. across, orange-red, woolly. A nat. of China that is often planted as a living fence and which readily escapes from cult., especially in the e. third of Tex., summer-fall; from Fla. to Tex., n. to Va.

4. *Rosa multiflora* Thunb. JAPANESE ROSE. Plant noticeably trailing or arching in habit; leaflets obovate to oblong, mostly 7 or 9, 2-4 cm. long, serrate, pubescent, obtuse to acute; stipules fimbriate-pectinate; flowers abundant in pyramidal inflorescences, 2-4 cm. broad, mostly white; sepals ovate, abruptly acuminate, 5-8 mm. long; style glabrous; fruit small, globular. An Asian species that occasionally escapes from cult. in clearings, along roadsides and borders of woods in e. Tex., May-June.

5. *Rosa setigera* Michx. PRAIRIE ROSE, CLIMBING ROSE. Shrub climbing, leaning or trailing, the canes prolonging to at least 5 m. and bearing remote broad-based prickles; leaflets of flowering branchlets 3 or 5, ovate to ovate-oblong, acuminate, sharply serrate, to 1 dm. long, usually much less, lustrous above, glabrous or merely pilose on nerves beneath; stipules with entire or merely ciliate margins; flowers several in a corymb, roseate, fading to whitish, 4-8 cm. across; pedicels and receptacle glandular-hispid; sepals reflexed in anthesis, lance-attenuate, 12-16 mm. long, deciduous; styles glabrous, united into a column about equaling the stamens; fruit red, subglobose, 8-12 mm. long. Open woods, thickets, clearings and banks in e. Tex., Apr.-July; from Fla. to Tex., n. to N. Y., W. Va., O., Ind., Ill., Mo. and Kan.

Var. *tomentosa* T. & G. has leaves tomentose on the lower surface, dull above, and smaller, more numerous flowers than in var. *setigera*.

6. *Rosa tomentosa* Sm. Shrub to 2 m. high; branchlets often zigzag; young branchlets often bloomy; prickles stout, curved or straight; leaflets 5 or 7, elliptic to ovate, acute to short-acuminate, 2-4 cm. long, doubly serrate, finely pubescent above, tomentose and glandular beneath; stipules with short triangular spreading auricles; flowers pale-pink or nearly white, about 4 cm. across; pedicels often glandular-hispid; sepals lobed, usually deciduous before maturity; fruit subglobose, 1-2 cm. thick, stipitate-glandular. A Eur. species that occasionally escapes from cult., summer-fall.

7. *Rosa Eglanteria* L. SWEET-BRIER. Much-branched shrub to 2 m. high; prickles strong, hooked, sometimes mixed with bristles; leaflets 5 or 7, orbicular to oval, 1-3 cm. long, obtuse or acutish, dark-green and glabrous above, pubescent beneath, glandular on both sides, fragrant; flowers 1 to 3, bright-pink, 3-5 cm. across, with short glandular-hispid pedicels; receptacle glandular-hispid; fruit subglobose to ovoid, orange to scarlet, with more or less spreading tardily deciduous sepals. A Eur. species that occasionally escapes from cult., summer-fall.

8. *Rosa micrantha* Sm. Much-branched shrub to 2 m. high, with arching branches, armed with uniform curved prickles, without bristles; leaflets 5 or 7, broadly ovate, 1.5-3 cm. long, short-acuminate, doubly glandular-serrate, glabrous or pubescent above,

pubescent and glandular beneath; flowers 1 to 4, pink to white, about 3 cm. across; styles glabrous, somewhat exserted; pedicels glandular-hispid; fruit ovoid to subglobose, with spreading or reflexed deciduous sepals. A Eur.-Medit. species that occasionally escapes from cult., summer-fall.

9. *Rosa foliolosa* Nutt. LEAFY ROSE, WHITE PRAIRIE ROSE. Low shrub to 5 dm. high; stem with short straight slightly reflexed prickles or nearly unarmed, rarely bristly; leaflets 7 or 9, rarely 11, narrowly- to linear-oblong, 1-3 cm. long, acute, finely serrate, glabrous and lustrous above, glabrous or pubescent on the veins beneath; stipules usually narrow; flowers solitary or few, white to rose-color, about 4 cm. across; calyx glandular-hispid; pedicels and receptacle sparingly glandular-hispid or the latter sometimes smooth; fruit subglobose, somewhat hispid, about 8 mm. across. Prairies, sandy oak woods, thickets and along fences, roadsides and railroad tracks in n.-cen. and cen. Tex., s.w. to Kerr Co., Apr.-June; also Okla. and Ark.

10. *Rosa ignota* Shinn. Plant woody, otherwise not well-known; leaflets 3 or 5, rarely reduced to one, oblong-lanceolate to narrowly elliptic, serrulate, glabrous; stipules adnate to petioles, glandular-denticulate and puberulent, a little shorter than the petioles; flowers 1 or 2, shortly pedicellate; calyx glabrous towards base, glandular-hispid on outside toward the apex of the tube, the lobes narrowly ovate-attenuate and deflexed; petals pink, obovate, 1-1.2 cm long, smaller than or subequal to the calyx lobes. A poorly known plant from thickets on limestone in Johnson Co.

This plant is considered to be referable to *R. foliolosa* by some recent authors.

11. *Rosa carolina* L. CAROLINA ROSE. Low and slender shrub to 1 m. high; canes usually borne singly from stolons, 2-6 mm. thick at base, these often bearing short acicular scattered prickles; middle and upper internodes with few or no prickles; infrastipular prickles acicular, firm, straight or nearly so, horizontally divergent or slightly reflexed, 4-9 mm. long, rarely wanting; stipules narrow, the halves of the adnate pair spreading, to 15 mm. long and 2 mm. broad; leaflets 5 to 9, elliptic to narrowly ovate-lanceolate or narrowly obovate, acute to obtuse, 1.5-4 cm. long, submembranaceous to firm, dull or barely sublustrous above, coarsely serrate on margins above the middle; rachis glabrous or [in f. *glandulosa* (Crép.) Fern.] stipitate-glandular and the leaflets more or less glandular-toothed; flowers mostly solitary, 35-55 mm. across; calyx stipitate-glandular or smooth; fruit red, subglobose; achenes castaneous, obovoid or semiobovoid (straight on one side), 4-5 mm. long. *R. serrulata* Raf., *R. subserrulata* Rydb., *R. texarkana* Rydb., *R. Treleasei* Rydb. In dry sandy, rocky or open habitats or thin woods in e. Tex., May-July; from Fla. to Tex., n. to N. S., N. E., Ont., Mich., Wisc., Minn., and Neb.

12. *Rosa Woodsii* Lindl. Small shrub to 1 m. high or more, with reddish-brown or later grayish bark; infrastipular prickles acicular or subulate, straight or arching from base; stipules glandular and pubescent on back, often glandular-serrulate, the pair 4-7 mm. broad; leaflets 5 to 9, elliptic-obovate, coarsely serrate, thin, pubescent beneath, 1-3 cm. long; flowers pink, solitary or several-corymbed, about 3 cm. across; sepals 1-1.5 cm. long, often glandular, erect or spreading in fruit; receptacle smooth; fruit subglobose, red, about 8 mm. in diameter. Incl. var. *Fendleri* (Crép.) Rydb., *R. Demareei* E. J. Palm. On plateaus and dry slopes in the Trans-Pecos, May-July; from Ont. and Minn. to B.C., s. to Mo., Neb., Tex. and n. Mex.

13. *Rosa arkansana* Porter. PRAIRIE ROSE. Shrub to 5 dm. high; stems very prickly and bristly; leaflets 9 or 11, elliptic, 2-6 cm. long, obtuse to acute, coarsely and sharply serrate, glabrous and lustrous above, glabrous or sparingly pilose on the veins beneath; stipules dilated, glandular-dentate; flowers few to many in corymbs, pink, about 4 cm. across; pedicels glabrous; fruit subglobose, 1-1.5 cm. thick, beaked by sepals 1-1.5 cm. long; achenes plump-ellipsoid, about 5 mm. long. On rocky slopes, in thickets and dry prairies in e. Panhandle, May-Aug.; from Wisc. and Minn., s. to Kan., Colo. and Tex.

14. *Rosa suffulta* Greene. SUNSHINE ROSE. Low shrub to 5 dm. high; stems densely prickly and bristly, usually green; leaflets 7 to 11, broadly elliptic to obovate-oblong, 1.5-4 cm. long, usually obtuse, cuneate, simply serrate, finely pubescent on both sides or finally glabrous above; stipules dilated, glandular-dentate; petiole and rachis finely pubescent; flowers corymbose, pink, about 3 cm. across; pedicels and receptacles glabrous; sepals sometimes lobed; fruit globose, about 1 cm. thick. *R. arkansana* var. *suffulta* (Greene) Cockl. In dry thickets, on rocky slopes and sands in n.-cen. Tex., May-Aug.; from Alta. and Man., s. to Ill. and Tex.

21. PRUNUS L. PLUM. CHERRY. PEACH

Deciduous or evergreen trees or shrubs; winter-buds with many imbricate scales; leaves alternate, serrate to serrulate or dentate, rarely entire, stipulate; flowers perfect, solitary or in fascicles or racemes; calyx 5-cleft; calyx tube campanulate, urceolate or tubular-obconical, deciduous after flowering; petals 5, spreading, white, pink or red; stamens numerous, perigynous; pistil 1, with elongated style, 2-ovuled; fruit a drupe, usually 1-seeded.

More than 400 species mainly in the temperate zones of the world. Many species are cultivated for their edible fruits or seeds or for their ornamental value.

1. Flowers in racemes (2)
1. Flowers solitary or in corymbs or umbels (4)
- 2(1). Flowers in axillary racemes about 3 cm. long; drupe with a dry exocarp; leaves persistent, evergreen 1. *P. caroliniana*.
2. Flowers in racemes more than 3 cm. long that terminate branches of the year; leaves deciduous (3)
- 3(2). Sepals deciduous; leaf blades mostly serrulate with very slender teeth 2. *P. virginiana*.
3. Sepals persistent; leaf blades mostly serrate with relatively coarse teeth 3. *P. serotina*.
- 4(1). Flowers sessile or rarely with pedicels to 7 mm. long (in *P. texana*); leaves usually small, mostly less than 3 cm. long (except in *P. persica*); fruits pubescent to puberulent or rarely glabrate (5)
4. Flowers distinctly pedicellate; leaves usually more than 3 cm. long; fruits glabrous (8)
- 5(4). Petioles 10-15 mm. long; leaves more than 5 cm. long; flowers 25 mm. or more across; fruit fleshy, not splitting 4. *P. persica*.
5. Petioles less than 5 mm. long; leaves much less than 5 cm. long; flowers less than 20 mm. across; fruits dry, commonly splitting (6)
- 6(5). Leaves cuneate to orbicular-obovate, coarsely toothed with glandless teeth on the rounded apical margin, invested with short silvery hairs; in mountains of Trans-Pecos Texas 5. *P. Havardii*.
6. Leaves elliptic to oblanceolate; on the Edwards Plateau and Rio Grande Plains (7)
- 7(6). Leaves glabrous, green on both surfaces, with entire margins or with several remote glandless teeth 6. *P. minutiflora*.
7. Leaves pubescent, the lower surface cottony-white, the upper surface deep-green, the margins with numerous glandular teeth. 7. *P. texana*.
- 8(4). Plant with mature leaves, with or without flowers or fruits (9)
8. Plant without mature leaves but with flowers (15)
- 9(8). Leaves with acute or acuminate teeth (the leaf tissue, not glands, usually forming the main tip), dull above, usually more or less pubescent; fruits dark purple to red or yellow (10)
9. Leaves with obtuse or rounded-obtusish teeth, the teeth often gland-tipped; calyx lobes usually glandular; fruit red or yellow (11)
- 10(9). Leaves rarely more than 7 cm. long, acute or gradually acuminate, usually sparsely short-pubescent on the lower surface; calyx lobes without glands; fruit subglobose, 1-2 cm. in diameter 8. *P. umbellata*.
10. Leaves usually more than 7 cm. long, abruptly acuminate, densely pubescent on the lower surface; calyx lobes slightly glandular; fruit ellipsoid to globose, 2-3 cm. long 9. *P. mexicana*.
- 11(9). In mountains of Trans-Pecos Texas; pedicels and young branchlets densely short-pubescent 10. *P. Murrayana*.
11. East of the Trans-Pecos region; pedicels and young branchlets glabrous or very rarely with one or both pubescent (12)

- 12(11). Leaves mostly more than 7 cm. long, pubescent along the midrib beneath; fruit 2-3 cm. in diameter11. *P. Munsoniana*.
12. Leaves rarely more than 7 cm. long; fruit smaller than above (13)
- 13(12). Leaves ovate to oval, obtuse to acutish at apex, pubescent on lower surface, plane; young branchlets pubescent; pedicels short-pubescent12. *P. gracilis*.
13. Leaves ovate-lanceolate to elliptic-lanceolate or lanceolate, acute to acuminate at apex, glabrous or sparsely pubescent on lower surface, usually somewhat conduplicate; young branchlets glabrous or rarely somewhat pubescent; pedicels glabrous or essentially so (14)
- 14(13). Calyx lobes glandular, usually pubescent within; leaves usually ovate-lanceolate and acuminate, the teeth without or with a minute often caducous gland13. *P. rivularis*.
14. Calyx lobes without glands, glabrous within except at the base or sparsely pubescent; leaves usually elliptic-lanceolate and acute, the teeth capped with a large permanent gland14. *P. angustifolia*.
- 15(8). In mountains of Trans-Pecos Texas; pedicels and calyx noticeably short-pubescent10. *P. Murrayana*.
15. East of the Trans-Pecos region; pedicels and calyx glabrous to densely pubescent (16)
- 16(15). Petals 3-7 mm. long; calyx lobes usually subglabrous to pubescent below middle on inner surface; leaves with gland-tipped obtusish teeth; rhizomatous shrubs or trees (17)
16. Petals 7.5-11 mm. long; calyx lobes densely pubescent on inner surface; leaves with sharp glandless teeth; nonrhizomatous trees (20)
- 17(16). Calyx lobes entire; pedicels 2-6 mm. long14. *P. angustifolia*.
17. Calyx lobes glandular-toothed; pedicels 5-15 mm. long (18)
- 18(17). Calyx tube and pedicel densely short-pubescent ..12. *P. gracilis*.
18. Calyx tube glabrous or pubescent only at summit; pedicels glabrous (19)
- 19(18). Shrub mostly less than 3 m. high; calyx lobes oblong-lanceolate to ovate-lanceolate13. *P. rivularis*.
19. Tree to 10 m. high; calyx lobes ovate to ovate-oblong11. *P. Munsoniana*.
- 20(16). Pedicels of fully expanded flowers 6-10 mm. long; calyx tube sparsely to densely pubescent; calyx lobes usually sparsely pubescent on outer surface9. *P. mexicana*.
20. Pedicels of fully expanded flowers 9-15 mm. long; calyx tube glabrous to sparsely pubescent; calyx lobes usually densely pubescent on both surfaces8. *P. umbellata*.

1. *Prunus caroliniana* (Mill.) Ait. LAUREL CHERRY. Tree to 12 m. high with a trunk to 25 cm. in diameter; branchlets slender, glabrous; leaves evergreen, oblong-elliptic to elliptic-lanceolate, acute to acuminate at apex, mucronate, coriaceous, glabrous, 5-12 cm. long, to 35 mm. wide, the margins entire or very rarely remotely spinulose-serrate, dark-green and lustrous on upper surface, paler or lower surface; petioles stout, broad, glabrous; flowers in dense racemes that are much shorter than the leaves, 3-5 mm. across; pedicels 3-4 mm. long; calyx tube obconic, the small thin lobes rounded; petals minute, cymbiform, cream-colored; stamens exerted, orange-colored; fruit ovoid to subglobose, short-pointed, black, lustrous, 1-1.3 cm. long, with a thick skin, ripening in the fall but remaining on the branches until after the flowering period of the following year. *Lauro-cerasus caroliniana* (Mill.) Roem. In and on the edge of forests, lowland areas, fields and thickets in e. Tex., flowering in Feb.-Apr., fruiting Apr.-Oct.; from Fla. to Tex., n. to N. C.

A popular ornamental in the eastern third of Texas.

2. *Prunus virginiana* L. COMMON CHOKECHERRY. Shrub or tree to 10 m. high; bark non-aromatic; branchlets glabrous; leaves ovate to broadly elliptic or obovate, 4-12 cm. long,

abruptly acuminate, broadly cuneate to rounded at base, thin, closely and sharply serrulate, dark-green and somewhat lustrous above, glaucescent or grayish-green beneath and glabrous except for axillary tufts of hairs; petioles 1-2 cm. long, glandular; flowers white, 8-10 mm. across, in dense glabrous racemes 7-15 cm. long; calyx limb deciduous in fruit; fruits globose, about 8 mm. in diameter, acid and astringent, dark-purple; stone smooth. Open woods, rocky slopes, bluffs, rimrock, breaks and seepage areas in e. Tex., the Panhandle and Trans-Pecos, fruiting June-Aug.; from Nfld. to Sask., s. to N. C., Tenn., Mo., Kan. and Tex.

3. *Prunus serotina* Ehrh.⁶⁴ BLACK CHERRY, WILD BLACK CHERRY. Tree to 30 m. high, rarely shrubby, with dark bark, the branches reddish-brown, the inner bark aromatic; leaves short-petiolate, oblong-lanceolate to ovate-oblong, acuminate to taper-pointed or acute at apex, firm to coriaceous, crenate-serrate with blunt incurved callous teeth, 3.5-15 cm. long, dark-green and lustrous above, pale-green beneath, the broad midrib prominent beneath and often villous; petioles 6-25 mm. long, usually glandular; racemes slender and elongate, 6-15 cm. long, the divergent pedicels 3-10 mm. long; flowers 7-10 mm. broad; calyx with narrow acute often toothed lobes, persistent in fruit; fruit globose, 7-10 mm. in diameter, dark-red, becoming purple-black, sweetish or bitter. *Padus serotina* (Ehrh.) Agardh. Throughout most of e. and s. U. S., Can. and Latin Am.

A tree valued for its timber and ornamental foliage. The several variants of this species in Texas are segregated as follows:

1. Plants from the region of the Edwards Plateau in south-central Texas; branchlets and often foliage entirely glabrous; leaves coarsely toothed (2nd floral leaf with about 5 teeth per cm. of margin), long-petiolate (petiole of 2nd floral leaf about 15 mm. long); in woodlands, floodplains, canyons, draws and on mountain slopes (*P. eximia* Small) subsp. *eximia* (Small) McVaugh.
1. Plants mostly in east and extreme west Texas; branchlets glabrous to hirsutulous; leaves usually rufous-tufted beneath near base of midrib; floral leaves often with about 7 teeth per cm. of margin and petioles 10 mm. long or less (2)
- 2(1). Plants with small leaves and scant growth, of a xerophytic type; foliage leaves mostly 5-7 (-9) cm. long; fertile branches averaging 10 cm. in length; in canyons and breaks of mountains of Trans-Pecos Texas with an isolated locality (designated as *P. Parksii* Cory) near the Bexar-Wilson counties line [*P. virens* (Woot. & Standl.) Shreve] subsp. *virens* (Woot. & Standl.) McVaugh.
2. Plants with relatively large leaves and luxuriant growth, of a mesophytic type; foliage leaves mostly 6-9 (-15) cm. long; petioles often about 15 cm. long in foliage leaves, 1 cm. long in second floral leaf; fertile branches averaging 12 cm. long; branchlets usually glabrous; in eastern Texas in woodlands, thickets, fence-rows and along roadsides subsp. *serotina*.

4. *Prunus persica* (L.) Batsch. PEACH, DURAZNO. Tree to 8 m. high; branchlets glabrous; buds pubescent; leaves elliptic-lanceolate to oblong-lanceolate, 8-15 cm. long, broadest about or slightly above the middle, long-acuminate and attenuate at apex, broadly cuneate at base, serrate or serrulate, glabrous; petioles 1-1.5 cm. long, glandular; flowers usually solitary, appearing before leaves, pink, 25-35 mm. across, very short-stalked; sepals pubescent on outer surface; fruit subglobose, 5-7 cm. in diameter, fleshy; stone deeply pitted and furrowed, very hard. A nat. of China, widely cult. for its luscious fruit, that occurs as waifs or escapes in waste places, dumps, thickets, along roadsides and edge of woods, mostly in e. Tex.

5. *Prunus Havardii* (W. Wight) W. Wight. HAVARD PLUM. A shrub with rather rigid branches, stout spinescent branchlets and light-gray bark; leaves obovate to oblong-obovate or sometimes flabelliform on young growth, 7-20 mm. long, 3-10 mm. wide, glabrous or sometimes finely pubescent on both surfaces, usually somewhat pale beneath and rather prominently reticulate-veined, the margin conspicuously dentate toward the apex, very rarely toothed below the middle, the teeth usually acute and glandless; flowers appearing with the leaves, sessile; calyx petaloid, slightly pubescent, the tube 2-2.5 mm.

⁶⁴ Adapted from Rogers McVaugh in *Brittonia* 7:279-315. 1951.

long, the entire and obtuse to acute lobes scarcely more than 1 mm. long; petals not evident; fruit sessile, nearly globular, the pubescent exocarp dehiscent along one edge, when dry about 1 cm. long and 7.5 mm. broad and thick; stone about 8 mm. long, rounded at the base and slightly pointed toward the apex, the surface smooth except for indistinct grooves near the ventral edge. *Amygdalus Havardii* W. Wight. On rocky slopes and canyons in the Trans-Pecos, fruiting in July; endemic.

6. *Prunus minutiflora* Engelm. TEXAS ALMOND. A low shrub with irregular often zigzag scarcely spinescent branches and grayish bark, often forming dense masses; leaves oblong-elliptic, narrowed at base, rounded at apex, 7-20 mm. long, 5-8 mm. wide, pale below and glabrous on both surfaces, often glaucous or bluish-gray, the margins sometimes slightly revolute, entire or occasionally irregularly toothed, glandless; petioles 2-3 mm. long; flowers appearing with the leaves on short lateral spurs, sessile or very nearly so, 1 to 4 on each spur; calyx tube campanulate with broadly ovate lobes about 1 mm. long; petals white, obovate, about 3.5 mm. long; fruit globose, about 12 mm. long and 1 cm. broad and thick when dry, the exocarp thin and dehiscent along the ventral edge; stone turgid and with a smooth surface, grooved along the dorsal edge, the ventral edge rather thick with an inconspicuous groove a short distance from the margin. *Amygdalus minutiflora* (Engelm.) W. Wight. Apparently rare on limestone slopes, sandy brushy plains, ledges and in canyon on the Edwards Plateau and Rio Grande Plains, fruiting in June; endemic.

7. *Prunus texana* Dietr. PEACH BUSH. A dwarf bushy shrub with very irregular branches and grayish bark; young branchlets light-gray and strongly pubescent; leaves oval to oblong-elliptic, 1.5-3 cm. long and 6-15 mm. wide on young succulent shoots, slightly narrowed toward the base, mostly obtuse at apex, green and pubescent above, grayish to tomentose below, the margins conspicuously glandular-serrulate; petioles 1-4 mm. long, pubescent; stipules linear, glandular; flowers appearing with or slightly before the leaves, solitary or in twos, 1-1.2 cm. broad; pedicels 3-4 mm. long, grayish-pubescent; calyx pubescent, the tube about 2 mm. long, the ovate-oblong lobes as long as tube and glandular-serrulate; petals white, oblong, 4.5-6 mm. long, obtuse at apex and abruptly narrowed to a very short claw; fruit rather densely velvety-hairy; stone ovoid, 13-15 mm. long, about 1 cm. broad and 9 mm. thick, usually rounded at the base, pointed at the apex and slightly flattened toward the ventral edge but rounded on the dorsal side, the surface smooth. *P. glandulosa* (Hook.) T. & G., *Amygdalus texana* (Dietr.) W. Wight. In the Edwards Plateau and Rio Grande Plains, fruiting in June; endemic.

8. *Prunus umbellata* Ell. FLATWOOD PLUM. Small tree to 6 m. high, with compact head and slender branches; bark light reddish-brown; branchlets glabrous or slightly pubescent at first; leaves elliptic-oblong to sometimes obovate, acute to short-acuminate, finely pubescent or glabrous above, 4-7 cm. long, rounded at base or broadly cuneate, finely serrate with acute teeth, usually pubescent beneath along the midrib, rather thin but firm at maturity; petioles 5-8 mm. long, tomentose; flowers 2 to 4, white, 1-1.8 cm. across, the slender pedicels glabrous; sepals ovate to ovate-oblong, obtuse, shorter than tube, sometimes slightly hairy without, densely pubescent within; fruit subglobose, 1-2 cm. across, red to yellow or dark-purple and with a bloom; stone oval to subglobose, obtuse, smooth or reticulate. Incl. var. *tarda* (Sarg.) W. Wight, *P. tarda* Sarg. In and on edge of forests, on slopes and along creeks, in pastures and fencerows, mostly in e. Tex., w. to Coleman Co., fruiting July-Aug.; from Miss. to Tex. and s. Ark.

9. *Prunus mexicana* Wats. BIG-TREE PLUM, MEXICAN PLUM. Tree to 12 m. high, not sprouting from the root; branchlets pubescent or glabrous; leaves obovate to oblong-obovate, 6-12 cm. long, abruptly acuminate, usually somewhat subcordate, sharply and often doubly serrate, short-pubescent above (at least when young) and rugose, pubescent and somewhat reticulate beneath, thickish at maturity; petioles glandular; flowers 2 to 4, white, 1.5-2 cm. across, the pedicels usually glabrous; calyx lobes dentate at apex or sometimes entire, slightly glandular, pubescent within; fruit globose, sometimes ellipsoid, 2-3 cm. long, purplish-red, bloomy; stone obovoid to subglobose, turgid. *P. arkansana* Sarg., *P. Palmeri* Sarg., *P. reticulata* Sarg., *P. tenuifolia* Sarg., *P. americana* var. *lanta* and *P. lanata* of auth. River bottoms, lake shores, hardwood slopes and prairies mostly n. e. and n.-cen. Tex. and the e. Edwards Plateau, fruiting July-Sept.; also n. Mex.

10. *Prunus Murrayana* E. J. Palm. MURRAY PLUM. Shrub 1-2 m. tall, probably becoming larger in protected situations, intricately branched or sometimes growing with erect stems

and few ascending branches; branchlets slender, rarely spiny, greenish-brown and densely pubescent the first season, becoming gray and glabrous or retaining some of the pubescence the second season; stipules linear, 6-10 mm. long, glandular-serrate; leaves ovate to ovate-lanceolate, 3-5 cm. long, 15-25 mm. wide, rounded at the base, acute or acuminate at apex, finely and evenly serrate with shallow obtuse teeth (12 to 14 per cm.), thin but firm at maturity, scabrate above and pilose-pubescent beneath with short stiff hairs; petioles 5-10 mm. long, densely pubescent, glandless; flowers in simple 1- to 5-flowered umbels, 8-12 mm. in diameter when fully expanded; pedicels slender, 8-12 mm. long, densely pubescent; calyx pubescent, the oblong-lanceolate lobes obtuse, glabrous within and densely hispid-pubescent on the outer surface; petals obovate, short-clawed, 4-5 mm. long, exceeding the short stamens; mature fruit unknown. On steep rocky slopes of canyons in the Davis Mts. of the Trans-Pecos; endemic.

11. *Prunus Munsoniana* Wight & Hedr. WILD-GOOSE PLUM. Shrubs or trees to 8 m. high; branchlets glabrous, soon chestnut-brown; leaves oblong-lanceolate to lanceolate, rarely obovate-oblong, 6-10 cm. long, acute or acuminate, rounded at base, finely glandular-serrate, bright-green and lustrous above, paler beneath and rather sparingly pubescent along the midrib and veins, sometimes pubescent all over when young, rarely quite glabrous, commonly conduplicate, rather thin at maturity; petioles 1.5-2 cm. long, usually biglandular, pubescent above; flowers 2 to 4, borne chiefly on short lateral spurs, 12-15 mm. across; pedicels slender, glabrous; calyx lobes ovate-oblong, as long as the glabrous tube, glandular-ciliate, glabrous or slightly pubescent outside, pubescent inside near base; petals obovate to oblong-obovate; fruit globose to short-ellipsoid, 15-25 mm. long, red or rarely yellow, slightly bloomy; stone oval, usually obliquely truncate at base. On limestone ledges and slopes and grassy thickets centered on the Edwards Plateau but s. to Calhoun Co. and n. to Rockwall Co., fruiting in summer; from Ky. and Tenn., s. to Kan. and Tex.

12. *Prunus gracilis* Engelm. & Gray. OKLAHOMA PLUM. Straggling shrub to 15 dm. high, forming thickets; young branchlets pubescent, later reddish-brown; leaves elliptic to ovate, 2.5-5 cm. long, obtuse to acute or short-acuminate, rounded at base, finely serrate with obtuse or acute teeth, finely and slightly pubescent above, reticulate and densely pubescent below; petioles pubescent, glandless; flowers 2 to 4, about 1 cm. across; pedicels and calyx finely pubescent to rarely subglabrous; calyx lobes ovate, acute, entire or denticulate, pubescent on both sides; fruit subglobose to ellipsoid, about 15 mm. thick, usually red, slightly bloomy; stone oval, obtusish at both ends. *P. normalis* (T. & G.) Small. In sandy or dryish soils on open hills and thin woods, fencerows and fields mostly in e. Tex. and the Panhandle, fruiting June-Aug.; also Okla. and Ark.

13. *Prunus rivularis* Scheele. CREEK PLUM, HOG PLUM. Shrub to 2 m. high, forming dense thickets; bark gray; young branchlets glabrous or rarely pubescent, chestnut-brown; leaves lanceolate to ovate-lanceolate, 5-7 cm. long, acuminate, cuneate or rounded at base, crenately glandular-serrate, usually strongly trough-shaped or conduplicate, green and glabrous above, paler beneath and slightly pubescent (rarely densely so while young); petioles 7-12 mm. long, with 2 to 4 glands at apex, more or less pubescent (especially above); flowers 2 to 4, about 1 cm. across; pedicels glabrous or very sparsely pubescent, 6-10 mm. long; calyx sparingly hairy outside; calyx lobes oblong to ovate-oblong, glandular-ciliate, shorter than tube, pubescent within (especially near base), erect or spreading to finally reflexed; petals obovate to oblong-obovate; fruit globose to subglobose, 1.5-2 cm. across, usually yellow with crimson cheek, rarely red; stone oblong, pointed at the ends, smooth or slightly reticulate. (?) *P. venulosa* Sarg., *P. texana* Scheele, *P. Reverchonii* Sarg. Along creeks, edge of woods, roadsides, canyons, breaks on limestone ravines and slopes, mainly on the Edwards Plateau and n.-cen. Tex., fruiting July-Sept.; also Okla.

This species is quite variable. The plant described as *P. venulosa*, though placed here, had some characteristics of *P. gracilis*.

14. *Prunus angustifolia* Marsh. CHICKASAW PLUM. Twiggy shrub forming thickets or small trees to 4 m. high; branchlets slender, zigzag, sometimes spinulose, glabrous, reddish; leaves lanceolate to oblong-lanceolate, strongly trough-shaped or conduplicate, 2-8 cm. long, to 2 cm. wide, acute or short-acuminate, broadly cuneate or rounded at base, the appressed teeth prominently gland-tipped, glabrous and lustrous above, paler beneath and glabrous or pubescent along the midrib toward the base; petioles reddish, glandular or glandless; flowers 2 to 4, expanding with the leaves, creamy-white, 8-9 mm. across;

pedicels 3-6 mm. long, glabrous; calyx glabrous; calyx lobes ovate, shorter than the tube, glandless, glabrous inside except near base; fruit subglobose to ellipsoid, to 25 mm. long, 1-2 cm. across, red or yellow, with thin skin; stone plump, oval, obtuse at the ends or acute at apex. Forming thickets in old fields, edge of woods, along roadsides and fencerows throughout most of the e. two thirds of Tex., fruiting May-July; from Md. and Del., s. to Fla., w. to Ark. and Tex.

Some plants in the Panhandle have ellipsoid fruits to 25 mm. long. They are here referred to subsp. *varians* Wight & Hedr. which typically has larger foliage and stones that are oval to obovoid. The fruits are ripe in late June and early July.

FAM. 91. LEGUMINOSAE JUSS.⁸² LEGUME FAMILY

Trees, shrubs, vines or herbs; leaves and branches alternate; stipules usually well-developed and persistent; leaves usually compound (when simple then so through reduction or fusion), the leaflets often with stipels; flowers rarely solitary, usually in terminal or axillary panicles, racemes, spikes, heads or glomerules, usually perfect and complete, perigynous (but the floral cup sometimes evanescently short and the flowers essentially hypogynous), bilaterally symmetrical (in the Mimosoideae, genera 1 through 10, appearing radially symmetrical except for the gynoeceium) and often markedly zygomorphic (especially in the Papilionoideae, genera 20 through 69); calyx valvate at a very early stage of development or variously imbricate; sepals 5, these in most genera fused at least partly and in some genera only 4 in number through fusion; corolla basically of 5 petals attached at the rim of the floral cup, rarely fewer through reduction (and in the Papilionoideae, genera 20 through 69, often appearing to be only 4 because of fusion of the lower 2), in some genera of the Mimosa group the petals neotenually connate; aestivation valvate or variously imbricate; stamens 1 to numerous, separate or variously coalescent in groups or in some flowers of some genera modified into staminodia; gynoeceium of a single superior simple pistil with a ventral placentary suture oriented upward in most flowers, the ovules 1 to numerous and attached in 2 alternating rows to the coalescent margins of the placentary suture; style simple; fruit a "pod" or folliclelike usually dry structure, either indehiscent or breaking up into 1-seeded sealed units or most commonly splitting lengthwise both along the ventral suture and the dorsal "midrib" (when thus dehiscent the fruit is said to be a "legume"); seeds 1 to numerous, with 2 thin integuments, essentially none or very little endosperm and large well-developed embryos. *Fabaceae*; *Papilionaceae*.

The Leguminosae comprise over 500 genera and well over 10,000 species and are distributed in all parts of the world inhabitable by seed plants. They include some of the extremely important economic plants such as beans, peas, alfalfa and clovers.

The Leguminosae fall into three well-marked subfamilies, as follows: (1) Subfamily Mimosoideae: genera 1 through 10; leaves pinnately twice-compound; flowers radially symmetrical (except for the gynoeceium), small and mostly in spikes, heads or congested racemes; sepals united nearly their full length; petals 5, separate or coalescent, valvate in bud; stamens 4 to numerous, usually greatly exceeding the petals in length; (2) Subfamily Caesalpinoideae: genera 11 through 19; leaves pinnately once- or twice-compound or simple; flowers bilaterally symmetrical but not strongly so, often large and showy; sepals often separate to the top of the floral cup; petals 5, about equal in length, never valvate in bud, the uppermost petal internal in the bud; stamens 5 to 10 (functional stamens only 1 in 1 genus), usually shorter than the petals or only about twice as long; (3) Subfamily Papilionoideae: genera 20 through 69; leaves pinnately once-compound or simple, never pinnately twice-compound; flowers bilaterally symmetrical, usually strongly so, often showy; sepals united, forming a distinct calyx tube prolonged beyond the floral cup; petals (or most of them) usually separate, imbricate in bud with the banner (uppermost petal) external, the 2 lateral petals (wings) (absent in *Amorpha*) clawed and the 2 lower petals modified and partly coalescent into a boat-shaped structure ("keel") (the keel absent in *Petalostemon*, *Eysenhardtia*, *Amorpha* and certain other genera); stamens 10 or fewer, usually some or all of them coalescent by the filaments.

⁸² Much of the information has been adapted, with permission, from the work of B. L. Turner, "The Legumes of Texas," University of Texas Press, Austin, xii, 284 p., 1959.

1. Leaves (all of them) simpleKey A, p. 762.
1. Leaves compound, with 2 or more leaflets (2)
- 2(1). Leaves pinnately twice-compoundKey B, p. 762.
2. Leaves pinnately once-compound or palmateKey C, p. 763.

KEY A

1. Trees or thorny shrubs (2)
1. Herbs or unarmed shrubs (3)
- 2(1). Leaves cordate or reniform11. *Cercis*, p. 784.
2. Leaves linear or linear-lanceolate46. *Alhagi*, p. 853.
- 3(1). Glabrous shrubs with glossy cordate or reniform leaves11. *Cercis*, p. 784.
3. Herbs, or if shrubs then leaves narrower (4)
- 4(3). Shrubs; leaves narrow, 3 mm. wide or narrower; stems gland-dotted33. *Dalea*, p. 819.
4. Annual or perennial herbs; leaves 8 mm. broad or broader; stems not gland-dotted (5)
- 5(4). Leaves cordate or reniform, about as long as broad or shorter66. *Rhynchosia*, p. 884.
5. Leaves linear, lanceolate, ovate, obovate or spatulate, 3 to 8 times as long as broad (6)
- 6(5). Leaves sessile or nearly so, without conspicuous reticulate veins, glabrous to pubescent22. *Crotalaria*, p. 800.
6. Leaves with petioles 4-20 mm. long, obviously reticulate-veined, glabrous (7)
- 7(6). Flowers in terminal racemes; fruit a loment, constricted between the seeds ..52. *Desmodium*, p. 855.
7. Flowers sessile in the leaf axils; fruit a legume, not constricted between the seeds62. *Galactia*, p. 880.

KEY B

1. Flowers in open racemes or solitary, never in congested heads or spikes; petals 4 mm. broad or broader (2)
1. Flowers in dense or loose globose heads or spikes or glomerules; petals 2 mm. broad or narrower (6)
- 2(1). Pinnae of well-developed leaves 10 cm. long or longer; trees or shrubs 24 dm. tall or taller (3)
2. Pinnae 8 cm. long or shorter; shrubs 24 dm. tall or shorter (4)
- 3(2). Leaves with 3 to 7 pairs of pinnae; flowers greenish-white; unarmed trees to 20 m. tall15. *Gymnocladus*, p. 793.
3. Leaves with only 1 pair of pinnae; flowers yellow; small spinescent trees or shrubs16. *Parkinsonia*, p. 793.
- 4(2). Plants thorny17. *Cercidium*, p. 794.
4. Thorns absent (5)
- 5(4). Trees, shrublets or herbs with a woody base, when herbs with orange sessile glands on the lower leaf surface (black glands on dried specimens) except in *C. oxycarpa*18. *Caesalpinia*, p. 794.
5. Herbs without orange sessile glands on the lower leaf surface (dried specimens not black-dotted)19. *Hoffmanseggia*, p. 797.
- 6(1). Stamens numerous or at least more than 10 per flower (7)
6. Stamens 10 per flower or fewer (10)
- 7(6). Unarmed herbs or small shrubs 1 m. high or shorter; stipules membranous, not spinescent; flower heads loose, each with 2 to 15 flowers3. *Calliandra*, p. 769.
7. Spinescent or prickly shrubs or trees (rarely spines absent); flower heads congested, each with (10 to) 15 to many flowers (8)

- 8(7). Stamens free to the top of the floral cup or nearly so 4. *Acacia*, p. 770.
8. Stamens united above the floral cup forming a tube 2-5 mm. long (9)
- 9(8). Plants armed with paired spines (often much-reduced;) flower heads greenish-white, 1-3 cm. across; native plants of south Texas . 1. *Pithecellobium*, p. 768.
9. Plants unarmed; flower heads reddish to pink, 3-5 cm. across; introduced or cultivated plants (rarely escaped), widespread 2. *Albizia*, p. 769.
- 10(6). Flowers in spikes (3-) 4-8 cm. long; trees or shrubs usually armed with straight stout spines (11)
10. Flowers in globose heads or in short spikes 1-3 cm. long (12)
- 11(10). Fruit flattened, 15 mm. broad or more; larger spines often branched; leaves once-pinnate and twice-pinnate on the same tree ... 14. *Gleditsia*, p. 793.
11. Fruit terete or tightly coiled, 12 mm. broad or narrower; spines unbranched; leaves all twice-pinnate 10. *Prosopis*, p. 783.
- 12(10). Trees or shrubs (brier-vines in *Schrankia*) with spines, thorns or recurved prickles (13)
12. Unarmed trees, shrubs or herbs (15)
- 13(12). Plant a weak-stemmed wide-spreading brier; stems, leaves and peduncles armed with numerous recurved prickles 6. *Schrankia*, p. 775.
13. Trees or shrubs with usually erect stems (straggling and brierlike in *Mimosa malacophylla*); plant variously spiny or prickly but at least the peduncles without numerous recurved prickles (14)
- 14(13). Pod twisted, springlike; anthers with apical glands; leaves with 1 pair of pinnae 10. *Prosopis*, p. 783.
14. Pod straight or nearly so (rarely contorted but never springlike); anthers without glands 7. *Mimosa*, p. 777.
- 15(12). Trees (2-) 3-15 m. tall 5. *Leucaena*, p. 774.
15. Prostrate herbs or low shrubs (16)
- 16(15). Flower heads bright-yellow; roots orange; fruits abruptly narrowed at the base, forming a distinct stipe 9. *Neptunia*, p. 782.
16. Flower heads pink or pinkish to white, never bright-yellow; roots not orange; fruits without a distinct stipe (17)
- 17(16). Flowers bright-pink, in dense heads or short spikes; stems prostrate; fruit with valves separating from the margin at maturity 7. *Mimosa*, p. 777.
17. Flowers whitish or greenish-white; stems erect to prostrate; fruit splitting along the margin at maturity, the valves not separating from the margin 8. *Desmanthus*, p. 779.

KEY C

1. Sepals separate, not forming a calyx tube beyond the short floral cup; flowers only slightly bilaterally symmetrical; stamens separate (2)
1. Sepals united into a calyx tube prolonged beyond the short floral cup; flowers usually strongly bilaterally symmetrical OR if appearing nearly radially symmetrical then the petals 3 mm. wide or narrower (3)
- 2(1). Flowers white or pinkish-red; leaflets 2; woody shrubs or small trees 12. *Bauhinia*, p. 784.
2. Flowers yellow; if leaflets 2 then the plant herbaceous . 13. *Cassia*, p. 785.
- 3(1). Leaves or most of them on the plant with 4 or more leaflets (4)
3. Leaves with only 2 or 3 leaflets (40)
- 4(3). Perennial or annual herbs or herbaceous vines, the aerial stems dying back each winter, any new stems arising from the previous year's root or underground stem (5)
4. Shrubs, trees or woody vines, the stems of most of them persisting to produce new growth each year (31)

- 5(4). Leaves palmate or digitate (the central leaflet stalked in *Galactia Grayi*) (6)
5. Leaves (or most of them) pinnate, the leaflets arranged alternately or opposite on the rachis (9)
- 6(5). Plants with prostrate stems 1-2 m. long; leaves (at least some of them) with a leaflet having a distinct stalk 5-10 mm. long 62. *Galactia*, p. 880.
6. Plants erect to semierect or acaulescent (rarely with stems short and prostrate); leaflets all sessile or equally short-stalked (7)
- 7(6). Leaves with 2 to 4 leaflets, never more; flowers yellow 51. *Zornia*, p. 855.
7. Leaves with 4 to 8 leaflets; flowers lavender to blue, never yellow (8)
- 8(7). Leaves not gland-dotted; fruit several-seeded, 20-60 mm. long 23. *Lupinus*, p. 802.
8. Leaves gland-dotted; fruit 1-seeded, 2-6 mm. long 30. *Psoralea*, p. 811.
- 9(5). Leaves gland-dotted (these often hidden beneath a dense pubescence but readily seen when the hair is scraped off) (10)
9. Leaves not gland-dotted (12)
- 10(9). Rachis of mature leaves 60-150 mm. long; fruit a prickly pod 10-20 mm. long .. 45. *Glycyrrhiza*, p. 853.
10. Rachis of mature leaves mostly 5-60 mm. long; fruit included within the calyx, not prickly, 5 mm. long or less (11)
- 11(10). Flowers strongly bilaterally symmetrical with well-developed banner, wings and keel; stamens 8 to 10 33. *Dalea*, p. 819.
11. Flowers not as strongly bilaterally symmetrical, at least 4 of the petals essentially alike, not differentiated into wings and keel; stamens 5 34. *Petalostemum*, p. 827.
- 12(9). Leaves with an even number of leaflets or bearing tendrils toward the end of the leaves; leaf rachis not terminated by a leaflet (13)
12. Leaves not bearing tendrils and having an odd number of leaflets; leaf rachis terminated by a leaflet (15)
- 13(12). Stems stiffly erect, 4-20 dm. tall; leaves without tendrils; leaflets 20 to numerous; flowers yellow, red or orange 40. *Sesbania*, p. 835.
13. Stems weak, climbing by tendrils or if erect and without tendrils then the stem 4 dm. tall or shorter; leaflets 4 to 20; flowers blue, violet or purplish (14)
- 14(13). Style with a dense ring of hairs just below the stigma 54. *Vicia*, p. 872.
14. Style flattened, with a line of hairs down the inner surface 55. *Lathyrus*, p. 876.
- 15(12). Stamens (all of them!) separate; flowers white; leaves densely pubescent; fruit indehiscent, torulose 20. *Sophora*, p. 798.
15. Stamens (at least 5 of them) coalescent by their filaments (16)
- 16(15). Rachis of leaf 2-15 (-20) mm. long; flowers 1 to 3 (or 4), terminal on slender peduncles, never racemose along a central axis; leaflets 3 to 9 (17)
16. Rachis of leaf 15-150 mm. long or if shorter then the flowers in several-flowered racemes; leaflets 5 to numerous (18)
- 17(16). Stems and leaves appressed-pubescent or glabrate; plants of Trans-Pecos Texas 28. *Lotus*, p. 810.
17. Stems and leaves densely pubescent with widespreading glandular hairs; plants of eastern half of Texas 47. *Aeschynomene*, p. 853.
- 18(16). Stipules rigid, spinescent; flowers white; plants of Trans-Pecos Texas 38. *Peteria*, p. 835.
18. Stipules membranous or herbaceous or absent, not at all spinescent (19)

- 19(18). Fruit a loment, indehiscent, breaking into 1-seeded segments at maturity; stems stiffly erect or trailing or twining, 3-20 dm. long; flowers 1 to 4 in axillary fasciculate clusters, short racemes or solitary (20)
19. Fruits dehiscent or indehiscent but not breaking into 1-seeded segments at maturity; stems mostly 4 dm. long or shorter, but if longer AND stiffly erect then the flowers numerous in each raceme (22)
- 20(19). Leaves with 3 to 5 (to 7) leaflets; plants of Trans-Pecos mountains 49. *Nissolia*, p. 854.
20. Leaves with 5 or more leaflets; plants east of Trans-Pecos Texas (21)
- 21(20). Flowers yellow; eastern half of Texas 47. *Aeschynomene*, p. 853.
21. Flowers purple; Panhandle of Texas 48. *Hedysarum*, p. 854.
- 22(19). Plants perennial; stems erect or high-twining, 3-20 dm. long; legume 6 to 20 times as long as broad, not inflated; plants of central and eastern Texas (23)
22. Plants annual or perennial; stems prostrate to weakly ascending (often acaulescent), if stiffly erect and more than 3 dm. tall then the legume inflated and less than 6 times as long as broad (25)
- 23(22). Stems, leaves and legume densely long-pubescent with spreading hairs 36. *Tephrosia*, p. 832.
23. Stems, leaves and legume appressed short-pubescent to nearly glabrate (24)
- 24(23). Grayish-pubescent; erect subshrubs, not climbing .29. *Indigofera*, p. 810.
24. Not grayish-pubescent; high-climbing vines 60. *Apios*, p. 879.
- 25(22). Peduncle of mature flowering racemes 8-30 cm. long; legume flattened (26)
25. Peduncle of flowering racemes 1-8 (-9) cm. long (27)
- 26(25). Flowers pink or reddish-tinged 36. *Tephrosia*, p. 832.
26. Flowers white or cream-colored 43. *Astragalus*, p. 838.
- 27(25). Flowers of various colors but not brick-red or reddish; annuals or perennials (28)
27. Flowers when fresh brick-red or reddish (often fading to a lavender-color in dried specimens); perennials (29)
- 28(27). Keel petals acute, blunt or rounded apically 43. *Astragalus*, p. 838.
28. Keel petals with the apex extending into a sharp erect point; plants acaulescent; flowers purple 44. *Oxytropis*, p. 852.
- 29(27). Fruit inflated, bladderlike; leaflets opposite along the leaf rachis, without raised reticulate veins 42. *Sphaerophysa*, p. 837.
29. Fruit flattened to somewhat turgid but not inflated or bladderlike; leaflets with raised reticulate veins OR if without reticulate veins then the leaflets arranged alternately along the rachis (30)
- 30(29). Leaflets mostly alternate along the leaf rachis, without raised reticulate veins; leaf petioles 1 cm. long or shorter 29. *Indigofera*, p. 810.
30. Leaflets mostly opposite along the leaf rachis, reticulate-veined; leaf petioles mostly 1 cm. long or longer 36. *Tephrosia*, p. 832.
- 31(4). Leaves gland-dotted (best seen with lens on undersurface) (32)
31. Leaves not gland-dotted (34)
- 32(31). Flowers with only 1 petal present (the banner); leaves (most of them) 8 cm. long or longer OR if shorter then the leaflets densely pubescent; leaflets (4-) 5-30 mm. broad 31. *Amorpha*, p. 817.
32. Flowers with 4 or 5 petals; leaves (most of them) 8 cm. long or shorter OR if more than the leaflets glabrate or nearly so; leaflets 1-5 mm. broad (33)
- 33(32). Rachis of leaf on well-developed leaves 30-90 mm. long; fruit 3 to 6 times as long as the calyx; flowers white 32. *Eysenhardtia*, p. 818.
33. Rachis of leaf 5-25 mm. long; fruit not exceeding the calyx; flowers rose, reddish or purplish (rarely white) 33. *Dalea*, p. 819.

- 34(31). Leaflets 2 mm. broad or narrower 35. *Brongniartia*, p. 832.
34. Leaflets 4 mm. broad or broader (35)
- 35(34). Stamens (all of them!) separate to the top of the floral cup; fruit indehiscent, narrowly fusiform, torulose, 6-25 mm. thick 20. *Sophora*, p. 798.
35. Stamens united by their filaments into a tube; fruit flattened, or if nearly terete then not as in *Sophora* (36)
- 36(35). Rachis of leaf 1-8 cm. long; legume 15-35 mm. long; flowers 5-10 mm. long (37)
36. Rachis of leaf 8 cm. long or longer; legume 30 mm. long or longer; flowers 10 mm. long or longer (38)
- 37(36). Suffruticose herbs, appearing shrublike, 2 m. tall or shorter; rachis of leaf mostly 3-8 cm. long 29. *Indigofera*, p. 810.
37. Shrubs, intricately branched and 1-3 m. tall; rachis of leaf 1-3 cm. long 39. *Coursetia*, p. 835.
- 38(36). Herbs or if somewhat shrubby in the lower part of the plant then most of the plant with annual green easily broken stems; flowers 8-20 mm. long, pale-yellow, orange or reddish 40. *Sesbania*, p. 835.
38. Woody vines, shrubs or trees, the main stem developing a tough brown bark; flowers 15 mm. long or longer, white, lavender or rose-purple, never yellow, orange or red (39)
- 39(38). Shrubs or woody vines, never prickly or spiny, the ultimate stems twining 37. *Wisteria*, p. 834.
39. Erect trees or shrubs, often prickly or spiny, the ultimate stems never twining 41. *Robinia*, p. 837.
- 40(3). Leaves with tendrils 55. *Lathyrus*, p. 876.
40. Leaves without tendrils (41)
- 41(40). Leaflets 2 (42)
41. Leaflets 3 (43)
- 42(41). Leaflets 15-30 mm. broad, obtuse or rounded apically 21. *Baptisia*, p. 799.
42. Leaflets 4-15 mm. broad, acute apically, pubescent 51. *Zornia*, p. 855.
- 43(41). Twining vines (often trailing when support is lacking) (44)
43. Herbs or shrubs with erect or trailing stems, never twining (54)
- 44(43). Woody or semiwoody high-climbing vines; well-developed leaves 2 dm. long or longer (45)
44. Perennial or herbaceous vines, not at all woody; leaves mostly 2 dm. long or shorter (46)
- 45(44). Stipules inconspicuous, 6 mm. long or less; flowering racemes 2-5 cm. long .. 63. *Dioclea*, p. 882.
45. Stipules conspicuous, 8-15 mm. long; flowering racemes 7-40 cm. long 64. *Pueraria*, p. 883.
- 46(44). Flowers solitary or in clusters of 2 or 3 in the axils of leaves, seemingly without a common peduncle, never 1 to several on terminal peduncles or in racemes (47)
46. Flowers 1 to numerous on terminal peduncles or in short or elongate racemes (49)
- 47(46). Flowers yellow, 4-7 mm. long; legume 14-30 mm. long 66. *Rhynchosia*, p. 884.
47. Flowers not yellow, 10-30 mm. long; legume 40-100 mm. long (48)
- 48(47). Flowers subtended by conspicuous membranous bracts 3-5 mm. broad; legume tapering into a slender beak 1-3 cm. long; plants of central and east Texas 57. *Centrosema*, p. 878.
48. Flowers subtended by small subulate bracteoles 1 mm. broad or less; legume beakless or nearly so; plants of Trans-Pecos Texas 59. *Cologania*, p. 879.
- 49(46). Flowers of various colors but never yellow (50)
49. Flowers yellow (53)

- 50(49). Flowers 1 to several at the apex of an elongate peduncle, not at all racemose; leaves with petioles 1-4 cm. long67. *Strophostyles*, p. 885.
50. Flowers several along the sides of a central axis, or if the flowers 1 or 2 at the apex of a peduncle then the leaves sessile or nearly so (51)
- 51(50). Flower pedicels subtended by persistent bracts about as long as broad (2-4 mm. long); calyx lobes 4 (the uppermost occasionally shortly cleft); plants of east Texas58. *Amphicarpaea*, p. 878.
51. Flower pedicels without conspicuous bracts or bracts deciduous, if bracts persistent then these 2 or 3 times as long as broad and acute apically (52)
- 52(51). Calyx lobes 4, subulate, as long as the tube or longer; peduncles 1-6 (-7) cm. long62. *Galactia*, p. 880.
52. Calyx lobes 5, obtuse or broadly acute, scarcely longer than broad, shorter than the tube; peduncles of mature racemes (4-) 7-25 cm. long68. *Phaseolus*, p. 886.
- 53(49). Peduncles of mature racemes 1-8 cm. long; legume 15-25 mm. long66. *Rhynchosia*, p. 884.
53. Peduncles 8-30 cm. long; legume 30-60 mm. long69. *Vigna*, p. 888.
- 54(43). Banner not dark-red or if reddish then much shorter than 3 cm. (55)
54. Banner narrow, dark-red, 3-5 cm. long; plant a shrub or subshrub 1-3 m. tall61. *Erythrina*, p. 880.
- 55(54). Leaves and/or calyx gland-dotted (glands often hidden beneath a dense pubescence but readily seen when the hair is scraped off) (56)
55. Neither leaves nor calyx gland-dotted (57)
- 56(55). Flowers lavender or brick-red, never yellow30. *Psoralea*, p. 811.
56. Flowers yellow33. *Dalea*, p. 819.
- 57(55). Leaflets toothed or denticulate, at least near the apex (sometimes minutely so) (58)
57. Leaflets entire, not at all toothed (60)
- 58(57). Flowers in slender elongate racemes, at least 4 to 8 times as long as thick26. *Melilotus*, p. 806.
58. Flowers in short thick racemes or umbels, 3 times as long as thick or shorter (59)
- 59(58). Fruit coiled or curved, longer than the calyx; leaves trifoliate, not palmate ..25. *Medicago*, p. 804.
59. Fruit not coiled or curved, shorter than the calyx27. *Trifolium*, p. 806.
- 60(57). Flowers 4-6 cm. long56. *Clitoria*, p. 878.
60. Flowers 3 cm. long or shorter (61)
- 61(60). Leaves (or at least some of them) with petioles 15 mm. long or longer (62)
61. Leaves with petioles 14 mm. long or shorter (72)
- 62(61). Perennials; stems stiffly erect, 1-2 m. tall (63)
62. Annual or perennial herbs much less than 1 m. tall, or if the stems as much as 1 m. long then trailing and not stiffly erect (65)
- 63(62). Flowers yellow; fruit a several-seeded pod, not breaking at maturity into 1-seeded segments; known only from southern Brewster Co. in the Trans-Pecos ..24. *Genistidium*, p. 804.
63. Flowers of various colors but mostly violet or rose-tinged; fruit a 1- to several-seeded loment that breaks at maturity into 1-seeded segments (64)
- 64(63). Leaflets subtended by stipels; fruit a several-seeded loment52. *Desmodium*, p. 855.
64. Leaflets without subtending stipels; fruit 1-seeded53. *Lespedeza*, p. 869.
- 65(62). Leaves palmate, the terminal leaflet sessile or essentially so (66)
65. Leaves trifoliate, the terminal leaflet with a stalk 5-40 mm. long (67)

- 66(65). Flowers yellow; petioles pubescent with long hairs; pod inflated
.....22. *Crotalaria*, p. 800.
66. Flowers white; petioles glabrate; pod flattened62. *Galactia*, p. 880.
- 67(65). Stems prostrate, not at all erect, bearing subterranean fruit near the lower part;
leaflets leathery, elliptic to orbicular, with raised reticulate veins beneath
.....62. *Galactia*, p. 880.
67. Stems erect, ascending or trailing but never bearing subterranean fruit; leaflets various
(68)
- 68(67). Fruit 20-25 mm. broad; seeds 12-16 mm. broad; trailing plants on open beach-
sand65. *Canavalia*, p. 883.
68. Fruit 15 mm. broad or narrower; seeds 10 mm. broad or narrower (69)
- 69(68). Flowers yellow, never rose or purplish66. *Rhynchosia*, p. 884.
69. Flowers rose, violet or purplish, never completely yellow (70)
- 70(69). Leaflets not subtended by stipels; fruit 1-seeded .53. *Lespedeza*, p. 869.
70. Leaflets subtended by stipels; fruit several-seeded (71)
- 71(70). Fruit a loment, breaking at maturity into 2 to 6 1-seeded segments
.....52. *Desmodium*, p. 855.
71. Fruit a several-seeded pod, not breaking into 1-seeded segments; large trailing vines
of Trans-Pecos Texas68. *Phaseolus*, p. 886.
- 72(61). Stipules fused to the petiole, often forming a tube around the stem; flowers
small, yellowish-orange50. *Stylosanthes*, p. 854.
72. Stipules not or but slightly fused to the petiole, never forming a tube; flowers vari-
ously colored (73)
- 73(72). Stamens (all of them!) separate; fruit an inflated or globose pod
.....21. *Baptisia*, p. 799.
73. Stamens united, forming a tube; fruit a flattened 1- to several-seeded pod or loment,
never inflated or globose (74)
- 74(73). Stipels present, subtending each leaflet; fruit a 2- to several-seeded loment,
breaking at maturity into 1-seeded segments52. *Desmodium*, p. 855.
74. Stipels absent; fruit 1-seeded or several-seeded but not breaking into segments at
maturity (75)
- 75(74). Stipules minute, reduced to glands; fruit several-seeded
.....28. *Lotus*, p. 810.
75. Stipules not reduced to glands; fruit 1-seeded53. *Lespedeza*, p. 869.

1. PITHECELLOBIUM MART.

Trees or shrubs with spinescent stipules; leaves twice pinnately compound with 2 to several pinnae; leaflets numerous, smooth or with raised venation; a gland present on the adaxial side of the petiole or where the petiole and leaf rachis join (between the lowest pair of pinnae); flowers in heads or spikes, whitish, yellowish or cream-colored; stamens more than 10 per flower (usually 20 to 30) and basally united into a tube prolonged well beyond the floral cup; fruit a legume with 6 to 15 seeds, usually 5-15 cm. long, sometimes promptly (sometimes tardily) dehiscent.

A large genus with about 150 species widely distributed in the warmer parts of the Americas, the name is sometimes misspelled *Pithecollobium*.

1. Dense trees with dark-green foliage and short often forked or zigzag branches (less commonly of shrubby stature, usually in the north extreme of range); leaflets 3 to 6 pairs per pinna; petiolar gland elevated between the lowest pair of pinnae; flowers in spikes; fruit a thick woody tardily dehiscent legume
.....1. *P. flexicaule*.
1. Usually diffuse not dense-foliaged shrubs, rarely small trees, with relatively long straight branches; leaflets (6 or) 7 to 20 pairs per pinna; petiolar gland depressed, usually below the lowest pair of pinnae; flowers in heads or glomerules; fruit a thin-walled promptly deciduous legume2. *P. pallens*.

1. *Pithecellobium flexicaule* (Benth.) Coult. ÉBANO, TEXAS EBONY. Shrubs or usually small trees (to 15 m. in s. part of range) with rounded very dense dark crown and dark bark; trunk to 6 dm. thick but usually only about 1 dm. thick; branches stout and short, divaricate, usually formidably armed with valid stipular spines, the bark pale-gray on the younger branches; leaflets 3 to 6 pairs per pinna; petiolar gland elevated between the lowest pair of pinnae; flowers in dense spikes usually 2-3 cm. long and about 2 cm. thick; fruit thick, heavy-walled, woody, usually oblong or elliptic in transection, about 2 cm. broad and 1-2 dm. long, not or scarcely constricted between the seeds which are tightly held in nearly sealed compartments within the pods until the long-delayed dehiscence; seeds about 1 cm. long, red. *Ebenopsis flexicaulis* (Benth.) Britt. & Rose. Frequent in low woods in the coastal part of Rio Grande Plains, rare n. to just s. of Laredo and to the vic. of Sinton, San Patricio Co., Apr.-July (rarely to Nov.); Ver., S.L.P., Tam., N.L., and Tex.

Highly prized as an ornamental and shade tree, and also for the very dense red heartwood, which is used to make art objects and small furniture; the red seeds are used to make jewelry.

2. *Pithecellobium pallens* (Benth.) Standl. TENAZA. Shrubs usually 1-2 m. tall, rarely small trees to 6 m., diffuse and not at all dense-foliaged, the herbage pale-green; bark pale-brownish-gray and rather smooth; branches with pale epidermis or bark, often striate, often nearly straight with few branchlets; leaflets usually 7 to 20 per pinna; petiolar gland depressed, situated below the lowest pair of pinnae; flowers in heads or glomerules usually about 1 cm. long and broad; fruit thin-walled, linear in transection, about 1 cm. broad and 1 dm. long, thickest where each of the small blackish seeds bulges the pod (at each seed the pod about 3-4 mm. thick), the margins thin and rounded, the dehiscence prompt. *P. brevifolium* Benth., *Havardia brevifolia* (Benth.) Small. Locally abundant in brush, coastal part of Rio Grande Plains, n. to San Patricio Co., May-Aug.; also adj. Mex.

2. ALBIZIA DURAZZ.

SILK-TREE. MIMOSA-TREE

A genus of about 70 species of the warmer parts of the Old World. The generic name is often misspelled *Albizzia*.

1. *Albizia Julibrissin* Durazz. MIMOSA-TREE. Essentially unarmed shrubs or low weak-stemmed (brittle-stemmed) short-lived trees to 4 or 5 m. high; leaves twice pinnately compound with a number of pinnae and very numerous small pale-green leaflets; flowers borne in heads and the heads borne in clusters toward the ends of the branches, the clusters of heads very conspicuous and showy because of the masses of red or pink stamens; heads often 3-5 cm. thick; stamens more than 10 (usually 20 to 40), far-exceeding the other parts of the flower and red or pink in color; fruit a thin-walled legume about 1 cm. broad and about 1 dm. long, linear in transection except where each of the small seeds bulges the pod to about 4 mm. thickness; margins of pods smooth, rounded; dehiscence prompt. Frequently cult. and rarely escaped in the e. half of Tex., spring; introd. from Asia.

3. CALLIANDRA BENTH.

Shrublets, subshrubs or rhizomatous perennial herbs usually not more than 2-3 dm. tall, rarely to 6-7 (-10) dm. in some species, unarmed (the stipules membranous, not spinescent); leaves pinnately twice-compound, usually with only 1 or a few pairs of pinnae and crowded small leaflets; flowers small and inconspicuous, aggregated into 2- to 15-flowered glomerules or heads about 1 cm. long, usually whitish or cream-colored; stamens more than 10 (usually about 20) and the filaments coalescent basally into a tube prolonged above the top of the floral cup; fruit an elastically dehiscent persistent flattish legume usually only a few cm. long and tapered toward the base, with only (1 or) 2 to 6 seeds, linear in transection except for the slightly thicker margins and the slight bulges over the seeds; dehiscence prompt; seeds small and flattish; valves of pods sharply recurved after dehiscence, persistent. *Anneslia* Salisb.

A genus of about 130 species of the warmer parts of the Americas.

1. Leaves predominantly with 2 to 7 pairs of pinnae; stems herbaceous (2)
1. Leaves predominantly with 1 pair of pinnae (very rarely 2 pairs but these few on each plant); stems woody (3)
- 2(1). Flowers terminal on peduncles 1-5 cm. long or more (flowers in bud often sessile but the peduncle becoming pronounced at maturity); leaves copiously pubescent; pinnae 3 to 7 pairs1. *C. herbacea*.
2. Flowering heads axillary, not on a conspicuous peduncle; leaves moderately puberulent to nearly glabrate; pinnae 2 to 4 pairs2. *C. humilis*.
- 3(1). Flowers 2 on each peduncle, never more; legume 8-10 mm. wide3. *C. biflora*.
3. Flowers 3 to 15 on each peduncle; legume 5-7 mm. wide4. *C. conferta*.

1. *Calliandra herbacea* Gray. Most of the aboveground portion herbaceous and only 1-2 dm. long; the woody underground portion very strongly developed and with deep roots; petioles 1-3 cm. long; leaves rather copiously pilosulous; pinnae 3 to 7 pairs; flower heads at the ends of long peduncles (1-5 cm. long) emerging from uppermost axils, the peduncle often elongating as the flowers mature; heads several-flowered; stamens about twice as long as the corolla; legume 4-7 cm. long, about 7 mm. broad, pubescent when young, later glabrate. *Anneslia herbacea* (Engelm.) Britt. & Rose. Locally abundant in the Davis Mts. and Chisos Mts. of the Trans-Pecos at elev. above 4,000 ft., June-Aug.; Zac. and Jal., n. to N.M. and Ariz.

2. *Calliandra humilis* (Schlecht.) L. Benson. Most of the aboveground portion herbaceous and only 1-2 dm. long; the woody underground portion very strongly developed and with deep roots; petioles 1-3 cm. long; leaves sparingly puberulent to glabrate; pinnae 2 to 4 pairs; flower heads on axillary abbreviated peduncles; heads few- to several-flowered; stamens pinkish, 7-10 mm. long, mostly glabrate. *Anneslia humilis* (Schlecht.) Britt. & Rose. Rare in grasslands above 4,000 ft. elev. in Brewster and Presidio cos. in the Trans-Pecos, June-Aug.; Hgo. and Jal., n. and n.w. to Ariz. and N. M.

3. *Calliandra biflora* Tharp. Subshrubs from slender woody rhizomes; aerial stems usually 4-6 dm. tall, erect and sparingly branched; leaf rachises 1-4 cm. long; pinnae 1 pair, rarely 2 or 3 pairs; leaflets about 16 per pinna, oblong-lanceolate, sessile, 5-9 mm. long, 1-1.8 mm. broad; stipules subulate; peduncles solitary in the axils of reduced mid-stem leaves, 8-10 mm. long, each bearing at its summit 2 flowers; pods usually solitary, 8 cm. long or less, 8-10 mm. broad. A very few populations, grassland in DeWitt and Goliad cos. in the s. Tex. Coastal Plain, May-July; also Tam.

4. *Calliandra conferta* Gray. Shrublets usually only 1-3 dm. tall, usually much-gnarled from browsing and divaricately short-branched; leaves small, each with 1 pair of pinnae (very rarely 2 pairs in some leaves on some plants) and few small leaflets; peduncles 1 cm. long or less (longer in Trans-Pecos Texas); flowers several per peduncle, small and very inconspicuous; pod 5-7 mm. broad. Our plants have been mistaken for *C. eriophylla* Benth. (of n.w. Mex., N.M. and Ariz.) by some authors. Locally abundant on caliche and limestone, Rio Grande Plains, s. parts of Edwards Plateau and the Trans-Pecos, rare n. to Travis Co., Apr.-July and rarely again in fall; Tex., Coah., N.L. and Tam.

4. ACACIA MILL.*

Shrubs or small trees or rarely (*A. hirta*) subshrubs or even perennial herbs, variously with stipular spines or recurved prickles or unarmed; leaves twice pinnately compound with 1 to several pairs of pinnae and usually numerous leaflets; flowers very small, white to yellow, in usually short-pedunculate many-flowered heads or spikes; stamens numerous (20 to 100) per flower, all quite separate above the top of the floral cup; fruit a promptly to very tardily dehiscent thick- to thin-walled legume. *Vachellia* Wight & Arn.; *Poponax* Raf.; *Acaciopsis* Britt. & Rose; *Acaciella* Britt. & Rose; *Senegalia* Raf.

A genus of about 600 species widely distributed in the warmer parts of the world. Ours have some value as browse, and several, especially guajillo, are excellent honey plants.

* See Appendix.

1. Flowers (when open) in definite spikes, 2 to 6 times as long as broad (2)
1. Flowers (when open) in globose heads or very short spikes one and one half times as long as wide or less (4)
- 2(1). Legume somewhat woody, 7 mm. wide or less; spines straight, paired at each node 6. *A. rigidula*.
2. Legume fleshy, 12 mm. wide or more; spines recurved or absent, infrastipular, not paired at the nodes (3)
- 3(2). Leaflets mostly 6-12 mm. long; pods not contorting (twisting); seeds narrowly obovate to ovate 8. *A. Wrightii*.
3. Leaflets mostly 3-6 mm. long; mature pods often contorting; seeds nearly orbicular 7. *A. Greggii*.
- 4(1). Stipules not spinose; spines (prickles) recurved, infrastipular (not paired at the nodes) or absent (9)
4. Stipules spinose, straight, usually long (rarely absent or much-reduced) (5)
- 5(4). Bracts borne at summit of peduncle; plants of central and southern Texas (*A. Farnesiana* often introduced elsewhere) (6)
5. Bracts borne near middle of peduncle; plants of western Texas (7)
- 6(5). Fruit glabrous, less than 7 cm. long; petiolar gland borne near middle of petiole or absent 2. *A. Farnesiana*.
6. Fruit densely pubescent, 7 cm. long or more; petiolar gland borne between the two lowest pinnae 1. *A. tortuosa*.
- 7(5). Pinnae 4 to 7 pairs 3. *A. constricta*.
7. Pinnae 1 to 3 (or 4) pairs (8)
- 8(7). Leaflets linear, almost filiform, alternate, spaced 1 mm. or more apart; legume conspicuously brown or black glandular-dotted 5. *A. Schottii*.
8. Leaflets ovate, flattened, inconspicuously alternate, spaced 0.8 mm. apart or less; legume not conspicuously black-glandular 4. *A. neovernicosa*.
- 9(4). Low suffrutescent plants, rarely more than 1 m. tall; flowers white, pedicellate; petiolar gland absent (10)
9. Shrubs or trees, usually more than 1 m. tall or more; flowers yellow or whitish; petiolar gland present (11)
- 10(9). Pinnae 3 to 8 (to 10) pairs; stem glabrous; plants of southern and western Texas 12. *A. texensis*.
10. Pinnae 7 to many pairs; stem glabrous or with widespreading hairs 11. *A. hirta*.
- 11(9). Leaflets numerous (20 to 50 pairs); pinnae 3 to many pairs 10. *A. Berlandieri*.
11. Leaflets 4 to 15 pairs; pinnae 1 to 4 (or 5) pairs (12)
- 12(11). Leaflets 3 mm. long or less 3. *A. constricta*.
12. Leaflets 3-10 mm. long 9. *A. Roemeriana*.

1. *Acacia tortuosa* (L.) Willd. HUISACHILLO. Usually low rounded shrubs 5-15 (-20) dm. tall, often with several stems at the base, much-branched and armed with numerous paired pallid or blackish pinlike stipular spines; petiolar gland borne between the 2 lowest pinnae; leaves very similar to those of huisache; peduncles slender, pubescent, 1-4 cm. long, with a pair of bractlets at the very top usually hidden by the flowers; flowers in bright-yellow fragrant globes about 1 cm. thick; pods (3-) 4-13 cm. long, nearly terete in transection or (when immature) somewhat oblong in transection, velvety-pubescent or very commonly merely densely strigose, blackish, the valves (leathery when fresh) flexible, very tardily dehiscent; seeds in 1 row, nearly spherical, black. *Poponax tortuosa* (L.) Raf. Local in Rio Grande Plains, spring (later following rains in droughty years); W.I., Mex., n. to Tex. (See Appendix.)

Our plants have been mistaken for *A. Schaffneri* (Wats.) Herm. which is a very closely related species (or race of *A. tortuosa*) of the Mexican highlands. One population found

by R. O. Albert near Alice, Texas, combines characters of huisache and of *A. tortuosa* and doubtless represents evidence of hybridization between them.

2. *Acacia Farnesiana* (L.) Willd. HUISACHE. Shrubs or usually small trees 2-4 m. tall, often with several trunks and flaring upward, obconical in overall shape, with a densely branched crown and numerous slender branches armed with numerous paired (stipular) straight pallid pinlike spines; petiolar gland borne near middle of petiole or absent; leaves 3-8 cm. long, with a small gland on the petiole; pinnae 2 to 6 pairs; leaflets gray-green, numerous, linear-oblong, 3-5 mm. long; peduncles slender, 1-4 cm. long, pubescent, with a pair of bractlets at the very top usually hidden by the flower head; flowers in bright-yellow globes about 1 cm. thick, very fragrant; pods (2-) 3-8 cm. long, nearly terete, tapered to both ends, blackish, smooth, pulpy within, the valves coriaceous, very tardily dehiscent; seeds in 2 rows. *Vachellia Farnesiana* (L.) Wight & Arn. Abundant in much of s. Tex. n. to Travis Co. and n.w. to s.e. Brewster Co., cult. farther n., spring, occasionally again following rains in droughty years; very widespread in trop. Am., nearly ubiquitous, with several unnamed races; also widely cult. in the Old World, formerly the source of the fragrant oils of many "French" perfumes. (See Appendix.)

3. *Acacia constricta* Gray. MESCOT ACACIA. Shrubs 1-3 m. tall, diffuse to dense, with numerous slender pallid branches armed with slender paired pinlike stipular spines; petiole with a gland near the end; pinnae 4 to 7 pairs; leaflets several pairs, oblong or linear, 2-4 mm. long, glabrous or pubescent but viscid-verniceous; peduncles slender, 1-3 cm. long, pubescent, near the middle with a pair of minute bractlets; flowers borne in fragrant yellow globes about 1 cm. thick; legumes 5-10 cm. long, 3-5 mm. broad, about as thick as broad, much-constricted between the seeds, pallid-brown, the valves (2) thin-walled, separating into 2 layers when dry. *Acaciopsis constricta* (Gray) Britt. & Rose. Abundant in Trans-Pecos and s. part of Plains Country n.e. to Howard Co., rare in subdesertic areas near the Rio Grande in s. Tex. (Starr and Zapata cos.), spring or later following rains in droughty years; s.w. U.S., s.e. to cen. Mex. and isolated farther s.e. in s. Pue.

Probably has hybridized to some extent with *A. neovernicosa* but *A. constricta* flowers about 1 or 2 weeks earlier than does the former where the 2 species occur together.

4. *Acacia neovernicosa* Isely. Openly branched shrubs 1-2 m. tall, rather diffuse with several main branches from the base, the slender pale glabrous verniceous branchlets armed with slender paired pinlike stipular spines; petiole 3-7 mm. long, with a cup-shaped gland near the tip; entire leaf viscid-verniceous; pinnae 1 to 2 (or 3) pairs; leaflets 7 to 9 pairs per pinna, ovate, nearly touching one another (crowded); peduncles slender, 1-3 cm. long, viscid, usually pubescent and near the middle with a pair of minute bractlets; flowers borne in fragrant yellow globes about 1 cm. thick; legumes 4-7 cm. long, 3-5 mm. broad, nearly as thick as broad, thin-walled, 2-valved, the valves separating into 2 layers when dry, the whole much-constricted between the seeds. *Acaciopsis vernicosa* (Standl.) Britt. & Rose, *Acacia constricta* var. *vernica* (Standl.) L. Benson. Frequent throughout the Trans-Pecos in deserts, Apr.-July; N.M. n. to Ariz. and Tex. See remark under *A. constricta*.

5. *Acacia Schottii* Torr. Desert shrubs 1-2 m. tall, rather diffuse with several main branches from the base, the slender pale glabrous branchlets armed with slender paired pinlike stipular spines; petiole and rachis of leaf puberulent; pinnae usually only 1 pair each with 3 to 5 pairs of filiforms or at least linear-subterete leaflets about 4 mm. long and spaced out at about 1 mm. intervals on the pinna; peduncles slender, 2-3 cm. long, each near the middle with a pair of minute bractlets; flowers borne in fragrant yellow globes about 1 cm. thick; legumes 5-8 cm. long, very narrow (almost as thick as broad), thin-walled, 2-valved, the valves separating into 2 layers when dry, the whole much constricted between the seeds, glabrous, dotted with glands (these dark in dry specimens). *Acaciopsis Schottii* (Torr.) Britt. & Rose. Local in deserts, s.w. Brewster Co. in the Trans-Pecos, spring or rarely later; also Chih.

6. *Acacia rigidula* Benth. CHAPARRO PRIETO, BLACK BRUSH. Shrubs 1-3 m. tall with whitish bark on most branches; branches numerous and short, divaricate, very rigid with whitish needlelike straight stipules or spines; leaves green, usually with only 1 pair of pinnae and a few pairs of leaflets on each; leaflets 6-15 mm. long, glabrous, dark-green, glossy, blunt, inequilaterally obovate; flowers whitish, in spikes about 1 cm. thick and 2 to 6 times as long as thick; legumes almost as thick as broad, 6-8 cm. long, less than 7 mm. broad, not or only very slightly constricted between the seeds. This was long mistakenly

known as *A. amentacea* DC., a species of southwestern Mexico. Abundant in Rio Grande Plains, rare w. along the Rio Grande to Brewster Co., Feb.-July; S.L.P., Ver., Tam., N.L., Coah. and Tex.

7. *Acacia Greggii* Gray. CATCLAW. Shrubs usually not more than 1-2 m. tall, rounded and much-branched; branches usually rather formidably armed with recurved catclaw-like prickles which are situated usually on the internodes or only fortuitously associated with nodes; pinnae 1 to 3 pairs; leaflets 3 to 7 pairs, mostly 3-6 mm. long, obovate to narrowly oblong, usually pallid-green, obtuse; flowers creamy-white, in spikes about 1 cm. thick and 2 to 6 times as long as thick; pods flat, thin, usually falcate and markedly contorted, 5-8 cm. long, 15-20 mm. broad, only very tardily becoming rigid (usually somewhat flexible and elastic), brownish; seeds small and flat, not causing the pod to bulge, nearly orbicular in outline. *Senegalia Greggii* (Gray) Britt. & Rose. Locally frequent in brushy vegetation, Trans-Pecos and Rio Grande Plains, n.e. as far as Taylor and Coleman cos., spring (later, following rains in droughty years); s. U.S. and n. Mex. See remark under *A. Wrightii*. (See Appendix.)

8. *Acacia Wrightii* Benth. CATCLAW, UÑA DE GATO. Shrubs or small trees (1-) 2-3 m. tall; branches with catclawlike prickles which are situated on the stems below the nodes (not usually near leaves); leaves often fascicled; petioles 4-12 mm. long, bearing a small gland at the tip; pinnae 1 or 2 pairs; leaflets 2 to 6 pairs per pinna, mostly 6-12 mm. long; flowers creamy-white, in spikes about 1 cm. thick and 2 to 6 times as long as thick; pods flat, thin, occasionally somewhat falcate but usually not much contorted, 5-8 cm. long, about 2 cm. broad, only very tardily becoming rigid (usually somewhat flexible and elastic), reddish-brown; seeds small, not much bulging the pod, narrowly obovate to ovate. *A. Greggii* var. *Wrightii* (Benth.) Isely, *Senegalia Wrightii* (Benth.) Britt. & Rose. Locally frequent in brush and woodland along creeks and in canyons, Rio Grande Plains, Edwards Plateau and plateau outliers rarely as far n. as Shackelford Co. and n.w. to Crane and Terrell cos., spring (rarely later following rains); s. U.S. and n. Mex.

Closely related to *A. Greggii*; occasional specimens are difficult to assign to one or the other species except arbitrarily.

9. *Acacia Roemeriana* Scheele. CATCLAW. Diffuse straggling or even half-scandent shrubs 1-2 (-3) m. tall; stems weak and slender, nearly glabrous to pubescent, armed along the internodes with recurved catclawlike prickles; leaves glabrous to rarely softly pubescent, with 1 to 3 pairs of pinnae; leaflets 4 to 8 pairs per pinna, 3-10 (-15) mm. long, obtuse, usually somewhat anisilateral, strongly veined; peduncles slender, 2-3 cm. long; flowers creamy-white, in fragrant globes about 1 cm. thick; legume flat, thin, occasionally somewhat falcate or contorted, 5-10 cm. long, 15-30 mm. broad, reddish-brown, usually flexible and elastic and only very tardily becoming rigid after the prompt dehiscence; seeds small, thin, not much bulging the pod, narrowly obovate to ovate. *A. malacophylla* Gray, *Senegalia Roemeriana* (Scheele) Britt. & Rose. Frequent in brush in the s. part of the Trans-Pecos, infrequent throughout the Edwards Plateau, n. to Jones Co. and on caliche cuevas s. to Maverick Co. and e. to Travis Co., spring or later following rains in droughty years; also Chih., Coah. and N.L.

10. *Acacia Berlandieri* Benth. GUAJILLO. Shrubs 1-2 (-4) m. tall, usually with several main stems near the base, ascending and flaring out widely near the top, sparingly branched, the relatively thick striate internodes usually armed with scattered nearly straight prickles 1-3 mm. long; petiole bearing a sessile gland on top; stipules not spinescent, small and caducous or in some rare luxuriant specimens well-developed and anisilaterally cordate, to 1 cm. long; pinnae 10 to 12 pairs, more or less; leaflets numerous, 30 to 50 pairs per pinna, crowded, linear, 4 mm. long, tomentose to nearly glabrous; peduncles axillary, pubescent, 2-5 cm. long; flowers creamy-white, borne in heads (rarely these slightly elongated and about twice as long as thick) about 1 cm. thick, the heads sometimes collected into vaguely paniculate leafy aggregations; ovary densely whitish-tomentose when young; legume heavy and thick-walled, elliptic-oblong in transection when fully mature, somewhat linear in transection when immature, 8-15 cm. long, 15-25 mm. broad, usually retaining a good deal of velvety-pubescence when ripe but eventually glabrate, tardily dehiscent, the valves thick-walled. *Senegalia Berlandieri* (Benth.) Britt. & Rose. Exceedingly abundant on limestones ridges and caliche cuevas in the Rio Grande Plains and n.w. to e. Brewster Co. in the Trans-Pecos and s. part of Edwards Plateau, rare in deeper soils of Rio Grande Valley and delta, spring (often later following rains in droughty years); Tex. to Qro., S.L.P. and Hgo.

The occasional shrubs with elongate instead of globular heads have been given the name *A. Emoryana* Benth. but they seem not to be specifically distinct. *A. Berlandieri* is an important honey-plant.

11. *Acacia hirta* T.&G. FERN ACACIA. Rounded subshrubs or often forming colonies by means of woody rhizomes; aerial stems unarmed, (5-) 6-12 dm. tall, woody and persistent in the lower part, sparingly or not branched, usually graceful and wandlike where not damaged by browsing; petiole and rachis usually hirsutulous (glabrous forms exist), the herbage often taking on a slight brownish cast from the pubescence; pinnae 7 to many pairs (usually 10 to 13); leaflets very numerous (often 24 to 30 pairs per pinna) and crowded, linear; peduncles short; flowers in small (about 1 cm. thick) whitish or rufescent-white or creamy heads, the heads often assembled in vaguely paniculate somewhat leafy arrangements; fruit brownish, very flat, about 5-7 cm. long, 6-10 mm. broad, stipitate, promptly dehiscent, the valves very thin and papery and not separating into 2 layers; seeds nearly orbicular in outline, quite flat. *Acaciella hirta* (T.&G.) Britt. & Rose, *Acacia angustissima* (Mill.) O. Ktze. var. *hirta* (T.&G.) Robins. Frequent in grasslands and in open shrubby vegetation throughout the e. two thirds of Tex., rarely w. to the Plains Country and even to Brewster Co. in the Trans-Pecos, May-Sept.; Tex., Coah., Okla., Ark., Mo. and Fla.

12. *Acacia texensis* T.&G. Rounded subshrubs or shrublets (usually woody and persistent only in the lowest few cm. of height) forming colonies by means of woody rhizomes; aerial stems unarmed, only 1-3 (-5) dm. tall and sparingly or not branched, usually glabrous, wandlike or somewhat zigzag with striate internodes; petiole and rachis with scanty appressed pubescence; pinnae 3 to 8 (to 10) pairs; leaflets 6 to 20 pairs, linear, obtuse nearly glabrous or appressed-pubescent; peduncles short; flowers in small (about 1 cm. thick) whitish or cream-colored heads, the heads often assembled in vague leafy panicles; fruit brownish, very flat, about 4-6 cm. long, 4-8 mm. broad, acuminate at the very tip, long-stipitate, sparingly appressed-pubescent or glabrous, promptly dehiscent, the valves very thin and papery and not separating into 2 layers; seeds nearly orbicular in outline, quite flat. *Acaciella texensis* (T. & G.) Britt. & Rose. Abundant locally in the Trans-Pecos, especially in grasslands at moderate elev., May-Aug.; Dgo., Zac. and Chih. n. to Tex. and Ariz.

Plants intermediate between *A. texensis* and *A. hirta* occur in the Edwards Plateau and Rio Grande Plains; the name *A. texensis* is based on such plants, and the propriety of applying it to the populations of far western Texas is dubious. (See Appendix.)

5. LEUCAENA BENTH.

LEAD-TREE

Shrubs or usually trees 2-10 (-13) m. tall, weak- or brittle-stemmed, unarmed; leaves pinnately twice-compound, 8-30 cm. long; petioles elongate, with a gland on the upper side; pinnae (2 or) 3 to 25 pairs; leaflets numerous; flowers borne in whitish or yellowish globes 1-2 cm. thick, the heads often most abundant near the branch tips and in vaguely paniculate leafy aggregations; calyx valvate in bud; stamens 10 per flower, distinct to the top of the floral cup; legume linear, broad or narrow, flat with usually 10 or more seeds, often stipitate, the thin valves of two layers but remaining intact, promptly dehiscent; seeds usually obovate in outline, thin, brown, lying transversely in the pod or somewhat obliquely.

A genus of about 20 species in tropical and subtropical areas, only several venturing into the warm-temperature area of North America.

1. Pinnae (2 or) 3 (or 4) pairs per leaf; leaflets 4 to 9 pairs per pinna; flower heads bright-yellow1. *L. retusa*.
1. Pinnae 4 or more pairs per leaf; leaflets 10 to many pairs per pinna; flower heads creamy-white (2)
- 2(1). Leaflets mostly 8-12 mm. long, 1.5-4 mm. broad ..2. *L. leucocephala*.
2. Leaflets mostly 8 mm. long or shorter and mostly about 1 mm. broad
.....3. *L. pulverulenta*.

1. *Leucaena retusa* Gray. Tree 2-4 (-8) m. tall, the younger parts minutely pubescent, mostly glabrate; leaves with (2 or) 3 or 4 pairs of pinnae; leaflets 4 to 9 pairs per pinna, oblong to elliptic or obovate, 7-25 mm. long, reticulate-veined; glands present

usually between each pair of pinnae and often smaller ones between each pair of leaflets, slightly elevated; heads about 2 cm. thick, bright-yellow; pod narrowly to broadly linear, (10-) 15-25 (-35) cm. long, 8-12 mm. broad, acute at both ends. *Caudoleucaena retusa* (Gray) Britt. & Rose. Scattered in dry canyons, w. part of Edwards Plateau and w. to the Davis Mts. and Chisos Mts. of the Trans-Pecos, Apr.-July; also Coah.

2. *Leucaena leucocephala* (Lam.) de Wit. POPINAC. Tree 2-4 (-8) m. tall, the youngest twigs puberulent; leaves with 4 to 9 pairs of pinnae; leaflets 11 to 17 pairs per pinna, oblong to lanceolate, slightly anisolateral, apically acute, 7-12 mm. long; 2-3.5 mm. broad; heads about 15-20 mm. thick, creamy-white; pod strap-shaped, to 20 (usually 8-15) cm. long, 1-2 cm. broad, stipitate, usually denticulate apically, with 18 to 25 seeds. Scattered and infrequent in s. Tex., where introd. and commonly planted, May-June; trop. Am., now widely adv. around the world.

Used in plantings and as green manure. Where *L. leucocephala* and *L. pulverulenta* have been planted together, some hybridization has occurred. Our plants have for more than a century, through error, been called *L. glauca*.

3. *Leucaena pulverulenta* (Schlecht.) Benth. TEPEGUAJE. Tree 3-10 (-13) m. tall, with trunk to 7 dm. thick, the wood very soft and often brittle; leaves with 10 to 25 pairs of pinnae; leaflets 15 to 40 pairs per pinna, linear, 3-6 mm. long, about 1 mm. broad; heads about 1-2 cm. thick, creamy-white; pod strap-shaped, 8-22 cm. long, 3-19 mm. broad, shortly acute apically, long-stipitate. Locally abundant in extreme s. Tex. (Brownsville region), in Cameron and Hidalgo cos., planted but not persistent farther n., Mar.-June; Tex., N. L., Tam., S.L.P. and Ver.

6. SCHRANKIA WILLD.

SENSITIVE BRIER

Perennial herbs; taproots napiform or irregular, to 2 cm. thick; stems 1-20 cm. long, weak, sprawling, dying back each year, armed with numerous recurved prickles (or very rarely the prickles absent); stipules subulate; leaves pinnately twice-compound, 3-15 cm. long, 2-10 cm. broad, with (2 or) 3 to 10 pairs of pinnae, the rachis and rachillas usually with recurved prickles; leaflets 4 to numerous, glabrous; flowers in pink globes 1-2 cm. thick; peduncles axillary, (2-) 3-11 cm. long, with recurved prickles; stamens usually 8 to 12, separate above the floral cup; legume linear, in transection nearly linear to narrowly elliptic to rhombic, 2-12 cm. long, 4-6 mm. broad or broader, sometimes nearly as thick as broad, usually with numerous recurved prickles (prickles rarely absent), promptly dehiscent into 2 valves or often each valve splitting tardily into 2 merivalves; seeds several to numerous. *Leptoglottis* DC.; *Morongia* Britt.

A small warm-American genus, sometimes submerged in *Mimosa* but adequately distinct. The species in Texas intergrade somewhat where they grow together and might be treated as varieties of a single species, but this treatment is not particularly more rewarding than the present one.

1. Leaflets with raised reticulate veins beneath (2)

1. Leaflets smooth or the midvein prominent only (3)

2(1). Legume 1-4 cm. long, rounded at apex; peduncles 4-12 cm. long; flower heads in early bud with protruding bracts1. *S. hystericina*.

2. Legume 4-12 cm. long, acute or beaked at apex; peduncles 2-7 (-10) cm. long; flower heads in early bud with bracts completely hidden2. *S. uncinata*.

3(1). Lower portion of stem distinctly 4- or 5-sided, glabrous; stipules small, 1-3 (-4) mm. long; pod 4-sided, scarcely flattened at maturity; plants of southern Texas3. *S. latidens*.

3. Lower portion of stem rounded, not distinctly 4- or 5-sided; stipules 3-6 mm. long; pod various (4)

4(3). Mature legume 4-7 (-8) cm. long, flattened, the valves 3 to 6 times as wide as the thickened margin; pinnae 2 to 5 (or 6) pairs; leaflets mostly obtuse at apex; plants of central and north-central Texas.4. *S. Roemeriana*.

4. Mature legume 6-12 cm. long, tetragonal, not conspicuously flattened or if so the valves less than twice as wide as the margin; pinnae (3 or) 4 to 8 pairs; leaflets mostly acute at apex (rarely obtuse throughout); plants of easternmost or westernmost Texas (5)

- 5(4). Stems, ovary and pod puberulent; plants of western Texas
5. *S. occidentalis*.
 5. Stems, ovary and pod completely glabrous; plants of east Texas
6. *S. microphylla*.

1. *Schrankia hystericina* (Britt. & Rose) Standl. Essentially glabrous, the stems often very coarse and 2-4 m. long; pinnae usually 4 or 5 pairs; leaflets usually 10 to 15 pairs, with raised reticulate veins beneath, 4-7 mm. long, obtuse or acutish, apiculate; stipules 4-6 mm. long; flower heads in early bud with protruding bracts; peduncles 4-12 cm. long; legume 1-4 cm. long, apically rounded, subterete, very densely prickly. *Leptoglottis hystericina* Britt. & Rose, *Mimosa quadrivalvis* L. var. *Nuttallii* (Britt. & Rose) Beard subvar. *hystericina* (Britt. & Rose) Beard. Sandy forested areas, e. and s.e. Tex., Feb.-May; also La.

2. *Schrankia uncinata* Willd. Stems usually 6-12 dm. long; pinnae usually 4 to 8 pairs; leaflets 8 to 15 pairs, elliptic, firm, 4-8 mm. long, apically cuspidate, with raised reticulate veins beneath; stipules 4-6 mm. long; flower heads in early bud with bracts completely hidden; peduncles 3-9 cm. long; legume compressed to nearly terete, 5-10 cm. long, 3-4 mm. thick, densely or sparingly prickly. *S. Nuttallii* (DC.) Standl., *Leptoglottis mimosoides* Small, *Mimosa quadrivalvis* L. var. *Nuttallii* (DC.) Beard. Locally abundant in e., s.e. and n.-cen. Tex. and the Plains Country, usually in sandy soils, Apr.-June; cen. U.S., sparingly s.e. to S. C. and Ala., s.w. to Tex.

3. *Schrankia latidens* (Small) K. Schum. Lower portion of stems distinctly 4- or 5-sided; pinnae usually (1 or) 2 or 3 pairs; leaflets 4 to 12 pairs per pinna, smooth beneath or the midvein only prominent, oblong, 3-8 mm. long, about 2 mm. broad, obtuse, minutely apiculate; stipules 1-3 (-4) mm. long; fruiting peduncles about 4 cm. long; legume 4-sided to subterete, scarcely at all flattened (at maturity!) *Leptoglottis Berlandieri* Britt. Possibly not distinguishable from the *S. quadrivalvis* (L.) Britt. & Rose (that is, *Mimosa quadrivalvis*) described from the Coastal Plain of Ver. Frequent in sandy loam, Rio Grande Plains sparingly n.e. to Grimes Co., Apr.-Sept.; also Tam. (possibly much farther s. if inseparable from *S. quadrivalvis*).

4. *Schrankia Roemeriana* (Scheele) Blank. Lower portion of stem terete, not distinctly 4- or 5-sided, the stem usually 3-10 dm. long; occasionally with stems and pod pubescent as in *S. occidentalis*; pinnae 2 to 5 (or 6) pairs; leaflets 6 to 13 pairs per pinna, smooth beneath or only the midvein prominent, apically obtuse; stipules 3-6 mm. long, subulate; peduncles 2-6 cm. long; mature legumes (3-) 4-7 (-8) cm. long, flattened, the valves 3 to 6 times wide as the thickened margin. *S. platycarpa* Gray, *Leptoglottis Reverchonii* Britt. & Rose, *Mimosa quadrivalvis* L. var. *Roemeriana* (Scheele) Beard. Frequent in calcareous soil, n.-cen. Tex. and scattered in Edwards Plateau, Apr.-July; also Okla.

5. *Schrankia occidentalis* (Woot. & Standl.) Standl. Lower portion of stem terete, not distinctly 4- or 5-sided; stems, ovary and pod puberulent; pinnae 3 or 4 (to 8) pairs; leaflets usually about 12 to 16 pairs per pinna, smooth beneath or only the midvein prominent, mostly acute or rarely obtuse apically; stipules 3-6 mm. long; mature legume 6-12 cm. long, tetragonal, not conspicuously flattened or if so the valves less than twice as broad as the margin. *Mimosa quadrivalvis* L. var. *occidentalis* (Woot. & Standl.) Beard. Infrequent or locally abundant, in loose sand, s. part of Plains Country, May-July; also N.M.

6. *Schrankia microphylla* (Sm.) Macbr. Lower portion of stem terete, not distinctly 4- or 5-sided; stems, ovary and pod quite glabrous; pinnae 3 or 4 (to 8) pairs; leaflets 10 to 17 pairs per pinna, smooth beneath or only the midvein prominent, mostly acute or rarely obtuse apically; stipules 3-6 mm. long; mature legume 6-12 cm. long, tetragonal, not conspicuously flattened or if so the valves less than twice as broad as the margin; beak of legume 6-10 m. long. *Morongia angustata* (T. & G.) Britt., *S. Halliana* (Britt. & Rose) Small. Scattered in s.e. Tex., rare in s. part of e. Tex. where it intergrades with *S. latidens*, Aug.-Sept.; Coastal States, Va. to Tex.

According to L. S. Beard, this taxon is in reality not distinguishable from the true *Mimosa quadrivalvis*, i.e., what we here call *S. latidens*.

7. MIMOSA L. MIMOSA. CATCLAW

Shrubs or lianes or (in 1 species) prostrate perennial herbs, in most species the herbage and even the legumes armed with scattered recurved prickles; leaves pinnately twice-compound with 1 to 14 pairs of pinnae; leaflets few to numerous; stipules usually small and subulate, never spinescent; flowers small and aggregated into white, pink to reddish globes or rarely short spikes; stamens 8 to 10 (usually exactly twice as many as petals), usually colored, free above the floral cup; fruit a flattened (sometimes contorted) pod usually a few cm. long, with a unique mode of dehiscence, the margins remaining more or less intact and more or less persistent while the valves separate from them and often break up into 1-seeded sections somewhat like loment. *Mimosopsis* Britt. & Rose.

A large genus of about 400 species in tropical and subtropical regions, principally in North America and South America.

1. Plants with herbaceous prostrate stems 1. *M. strigillosa*.
1. Plants with woody erect or clambering stems, never prostrate (2)
 - 2(1). Stems clambering or straggling, briarlike; leaflets (the larger ones) ovate, 10 mm. long or more 2. *M. malacophylla*.
 2. Stems stiffly erect, ascending or recurved but never straggling and briarlike; leaflets linear to nearly orbicular, 2-8 mm. long (3)
 - 3(2). Leaves (at least some of them) with 8 to 14 pairs of pinnae; flower heads cylindric, spikelike 3. *M. dysocarpa*.
 3. Leaves with 1 to 8 pairs of pinnae (rarely more in *M. pigra*); flower heads globose (4)
 - 4(3). Pinnae (at least some of them) with 20 or more pairs of leaflets; prickles flattened, white at base, scarcely if at all recurved; valves of pod breaking at maturity into 8 or more transverse segments 4. *M. pigra*.
 4. Pinnae with 3 to 20 pairs of leaflets; prickles (when present) flattened to nearly conical, brown to white at base, usually recurved; valves of pod breaking at maturity into 7 or fewer segments, or remaining intact (5)
 - 5(4). Leaves (at least some of them) with 4 to 8 pairs of pinnae; valves of legume straight, separating entire from the margin at maturity (6)
 5. Leaves with 1 to 3 pairs of pinnae; pod valves remaining intact or breaking into joints (7)
 - 6(5). Prickles conical, not conspicuously flattened near base, only slightly recurved; pods short-villous, with straight prickles along the margin; leaflets very small, not exceeding 1.5 mm. in length; branches flexuous 7. *M. Warnockii*.
 6. Prickles not conical, flattened near the base, usually recurved; pods glabrate, not at all villous, the margins with short recurved prickles or these lacking; leaflets 2 mm. long or more; branches straight to somewhat flexuous 8. *M. biuncifera*.
 - 7(5). Valves of the pod densely covered with short yellow prickles; leaflets densely sericeous 5. *M. Emoryana*.
 7. Valves of the pod glabrous or merely scattered-puberulent; leaflets glabrous to sparsely pubescent (8)
 - 8(7). Leaves with 1 or 2 pairs of pinnae; leaflets 1 or 2 pairs to each pinna; petioles conspicuously flattened, broadened at the apex 10. *M. zygothylla*.
 8. Leaves with (1 or) 2 or 3 pairs of pinnae; leaflets (2 or) 3 to 8 pairs to each pinna; petioles not flattened or rarely flattened (9)
 - 9(8). Petals separate to the base or nearly so; pod often shiny and light-colored (yellowish), constricting and twisting between the seeds at maturity or the valves contorting and breaking into 1-seeded segments; stems essentially straight, not zigzag 6. *M. borealis*.
 9. Petals united for one half their length or more; pod dark-brown, straight with nearly parallel valves, not contorting or breaking into segments at maturity; stems usually slightly zigzag (10)

- 10(9). Flower heads in bud 4-5 mm. wide; leaflets 1.5-3 mm. long; plants of southern-most Texas 9. *M. Wherryana*.
 10. Flower heads in bud 5-8 mm. wide; leaflets 3-6 mm. long; plants of central and west Texas 8. *M. biuncifera*.

1. *Mimosa strigillosa* T.&G. POWDERPUFF, VERGONZOSA. Perennial herb with sprawling annual stems 1-2 (-4) m. long, usually copiously furnished with stiff spreading bristle-like emergences, but these not noxious; pinnae 4 to 6 pairs, more or less; leaflets usually 10 to 15 pairs per pinna, linear, usually 3-6 mm. long, 0.5-1 mm. broad; flowers in pink or purple globes; pod oblong, 15-20 mm. long, 10-12 mm. broad, setulose, with 1 to few joints. Frequent in grasslands and openings in forests on sandy loam, e. and s.e. Tex. and coastal parts of Rio Grande Plains, May-Oct.; s.e. U.S. w. to Okla. and Tex.; Tam., Parag. and Arg.

2. *Mimosa malacophylla* Gray. RASPILLA. Liane climbing in trees or forming a tangle, usually 3-4 m. high, less commonly a weak-stemmed shrub, the stems armed with recurved prickles; petioles and rachises with prickles also; pinnae 3 to 5 pairs; leaflets 3 to 6 pairs per pinna, pubescent or glabrous, ovate to oblong or obovate, the larger ones on any plant 10 mm. long or longer; flowers whitish, in heads about 1-2 cm. thick; legume broadly linear to oblong, 40-75 mm. long, 8-10 mm. broad, stipitate, several-jointed. Incl. var. *glabrata* Benth., *M. Wootonii* Standl. Rare in woodlands along streams, Rio Grande Plains, June-July; also Tam. and N.L.

3. *Mimosa dysocarpa* Benth. GATUÑO. Shrub 1-2 m. tall; branches short and numerous, divaricate, very prickly, the youngest twigs villosulous; pinnae on larger leaves 8 to 14 pairs; leaflets 7 to 16 per pinna, oblong-linear, acute, usually pubescent on both sides; flowers in pinkish cylindrical spikes 1-2 cm. long or longer, very showy; pod 25-50 mm. long, about 6 mm. broad, tomentose, usually slightly constricted between the seeds, the margins usually prickly. Locally abundant on brushy hillsides, Davis Mts. and Chisos Mts. in the Trans-Pecos, June-July; Tex., N.M., and Ariz. s. to Dgo.

4. *Mimosa pigra* L. var. *Berlandieri* (Gray) B. L. Turner. ZARZA, COATANTE. Shrub 1-2 (-3) m. tall, much-branched, the branches and leaves very noxiously armed with slightly recurved prickles, forming impenetrable thickets; pinnae 4 to 6 (to 12) pairs; leaflets (on at least some of the larger leaves of any plant) 20 or more pairs per pinna; prickles flattened, whitish basally; flowers in pinkish globes about 1 cm. thick; pod 4-5 cm. long; 8-10 mm. broad, the valves breaking into 8 or more joints. *M. Berlandieri* Gray. Locally abundant in dry lake beds and resacas and other seasonally inundated areas of clay soil. Cameron and Hidalgo cos. in extreme s. Tex., rare farther n. along the coast, Mar.-Nov.; var. *pigra* widespread in the tropics (probably originally nat. to Am.); var. *Berlandieri* in Tex., e. Mex. and scattered elsewhere.

5. *Mimosa Emoryana* Benth. Shrub about 1 m. tall with numerous short prickles that are recurved and basally somewhat flattened; pinnae 1 to 3 pairs per leaf; leaflets 3 to 5 pairs per pinna, oblong, 2-3 mm. long, obtuse, sericeous-villosulous above and below; flowers in small pink heads; pods 30-35 mm. long, 4-6 mm. broad, more or less constricted between the seeds, densely covered with short yellow prickles, the valves separating from the margins and breaking up into 3 to 5 joints. Locally abundant, deserts of s. Brewster and Presidio cos. in the Trans-Pecos, May-July; also Chih.

6. *Mimosa borealis* Gray. PINK MIMOSA. Rounded much-branched shrub about 1 m. tall (rarely to 25 dm.); branches only slightly zigzag, the prickles usually remote and strongly recurved and basally flattened; pinnae (1 or) 2 or 3 pairs per leaf; leaflets 3 to 8 pairs per pinna, oblong to ovate, 2-6 mm. long; petioles not or rarely flattened; flowers in pink globes; petals separate nearly to the top of the floral cup; pods linear-oblong, 25-50 mm. long, 6-8 mm. broad, glabrous, with 4 to 7 seeds, more or less constricted between the seeds, pallid (yellowish), the margins with or without recurved prickles, the valves contorting, breaking away from the margins and breaking into 4 to 7 1-seeded joints. *M. fragrans* Gray, *M. texana* (Gray) Small. Frequent in brushy vegetation in Trans-Pecos and Edwards Plateau, infrequent into the Plains Country, Apr.-July; Okla., N.M. and Tex.

7. *Mimosa Warnockii* B. L. Turner. Low rounded shrub, usually less than 1 m. tall; branches usually markedly zigzag, the numerous prickles conical, not conspicuously flattened near the base and only slightly recurved near the tip; pinnae 3 to 7 (or 8) pairs;

leaflets very small, about 7 to 12 pairs per pinna, usually not more than 1.5 mm. long, oblong to linear-oblong, obtuse; flowers in pinkish globes; pod linear, 2-5 cm. long, 2-3 mm. broad, short-villous, with straight prickles marginally, more or less constricted between the seeds, the valves separating at maturity from the margins but remaining intact, not breaking up into joints. *M. flexuosa* Benth. (not Poir.), *Mimosopsis flexuosa* (Benth.) Britt. & Rose. Local in the Davis Mts. at about 4,500-5,500 ft. elev. on soils derived from volcanic rock, May-Aug.; Tex., N.M., Ariz. and Son.

8. *Mimosa biuncifera* Benth. CAT'S-CLAW MIMOSA. Rounded shrub about 1 m. tall; branches numerous, only slightly zigzag, the numerous vicious prickles not conical but somewhat flattened basally and apically markedly recurved; pinnae on at least some of the larger leaves of the plant 4 to 8 pairs (rarely to 10 pairs); leaflets 5 to 12 pairs per pinna, 2 mm. or more long, linear-oblong; flowers in pinkish globes; petals united half their length or more; pod linear, curved or nearly straight, 20-35 mm. long, 3-4 mm. broad, the valves separating at maturity from the margins but remaining intact, not breaking up into joints, glabrate, the margins with short recurved prickles or these absent. Incl. var. *Lindheimeri* (Gray) Robins., *M. Lindheimeri* Gray, *Mimosopsis biuncifera* (Benth.) Britt. & Rose. Frequent in Trans-Pecos, infrequent and scattered in Plains Country and Edwards Plateau, Apr.-Sept.; N. M. and Ariz., s.e. to Son., Chih. and Coah.

9. *Mimosa Wherryana* (Britt. & Rose) Standl. Rounded much-branched shrub 5-15 (-20) dm. tall, the rather remote prickles somewhat flattened at the base and recurved; pinnae 1 to 3 pairs; leaflets 3 to 6 pairs per pinna, (1-) 2-3 mm. long, oblong, obtuse or rounded; flowers in heads which in bud are very small (only 4-5 mm. thick) and in flower are white; pod narrowly oblong, glabrate, 2-3 cm. long, about 5 mm. broad, with recurved prickles on both margins, the valves separating from the margins but remaining intact and not breaking up into 1-seeded joints, not much if any contorted; seeds few, small, oriented longitudinally in the pod. *Mimosopsis Wherryana* Britt. & Rose. Local on caliche and gravel hills near the Rio Grande in Starr and Zapata cos., spring-fall; also Tam.

10. *Mimosa zygophylla* Gray. Straggling diffuse shrub 1-2 (-3) m. tall, appearing leafless from a distance, with numerous basally flattened recurved prickles; pinnae only 1 or 2 pairs; leaflets only 1 or 2 pairs per pinna; flowers in pink globes; pods 1-3 cm. long, 6-7 mm. broad, the valves separating from the margins but remaining intact, not breaking into 1-seeded joints. Local in deserts, s. Brewster Co. and s. Hudspeth Co. in the Trans-Pecos, spring-fall; Zac., Chih., Coah. and Tex.

8. DESMANTHUS WILLD.

Perennial unarmed herbs (perhaps subshrubby in *D. Cooleyi*); roots often napiform, somewhat woody; stems several from the crown, annual (rarely with short woody extensions at the extreme base), (1-) 2-10 dm. long, erect or spreading; leaves pinnately twice-compound, usually 2-10 cm. long, with 2 to 10 long pairs of pinnae, the leaflets very small and numerous; stipules usually subulate, rarely evanescently small; peduncles axillary, long or short, each bearing terminally a head or partial head (glomerule) of few to several very small flowers; flowers usually white or whitish; sepals 5, free to the top of the floral cup; petals 5, essentially separate also; stamens 10 (or only 5 in *D. leptolobus* and *D. illinoensis*), separate to the top of the floral cup; some of the flowers in each head with sterile stamens; fruit a dry flattened 1- to several-seeded promptly dehiscent legume. *Acuan* Medic.

A genus of about 40 species of the warmer parts of the Americas; a few species also in the Old World tropics.

1. Legume falcate, 2 to 5 times as long as broad; stems erect; stamens 5 1. *D. illinoensis*.
1. Legume linear, at least 7 times longer than wide; stems decumbent to erect; stamens 5 or 10 (2)
- 2(1). Leaflets with raised somewhat reticulate veins (upper surface sometimes smooth); infructescence at maturity on peduncles 30-150 mm. long (3)
2. Leaflets without raised reticulate veins; infructescence on peduncle 4-60 mm. long (4)

- 3(2). Mature fruiting peduncles 8-15 cm. long; legume tapering to a point; the larger leaves with petioles 10 mm. long or more; leaflets glabrous or sparsely pubescent along the margins only2. *D. reticulatus*.
- 3. Mature fruiting peduncles 3-8 cm. long; legumes obtuse or abruptly mucronate, never tapering to a point; leaves with petioles 10 (rarely 15) mm. long or less; leaflets pubescent over the lower surface3. *D. obtusus*.
- 4(2). Stem densely short-villous throughout (rarely glabrate); petiolar glands orbicular, minute, 0.4 mm. long or less4. *D. velutinus*.
- 4. Stems glabrous or sparingly pubescent along the angles, never evenly pubescent throughout; petiolar glands 0.3-3 mm. long (5)
- 5(4). Stipules small or wanting, less than 2 mm. in length; peduncles 2 cm. long or less (exceptionally, 3 cm.)5. *D. Cooleyi*.
- 5. Stipules longer, setiform, 2-8 mm. long (sometimes appearing less when the tips are broken off); peduncles 0.4-6 cm. long (6)
- 6(5). Seeds placed lengthwise in pod, elliptic, 4.5-5 mm. long; legumes somewhat constricted along the margin between the seeds; pinnae 4 to 10 pairs; stamens 56. *D. leptolobus*.
- 6. Seeds placed obliquely in pod (most noticeable in immature fruit), variously shaped but less than 3 mm. long; legume margins straight; pinnae 1 to 7 pairs; stamens 10 (7)
- 7(6). Stipules conspicuously pubescent; stems prostrate, arising from a deep tuberous taproot; petiolar gland 0.7-1.5 mm. long7. *D. acuminatus*.
- 7. Stipules glabrous (rarely, with 5 or 6 scattered hairs); petiolar gland 0.7 mm. long or less if the stems are prostrate, OR 0.7-3 mm. long if the stems are erect (8)
- 8(7). Fruiting peduncles 2-6 mm. long; pinnae 1 to 2 pairs only8. *D. brevipes*.
- 8. Fruiting peduncles 10 mm. long or more; pinnae 2 to 7 pairs9. *D. virgatus*.

1. *Desmanthus illinoensis* (Michx.) MacM. Stems erect, 3-10 dm. long; stipules filiform, 6-8 mm. long; leaves 6-10 cm. long; pinnae 6 to 14 pairs, with a small oblong or suborbicular gland between them or between the lower pair of pinnae only; leaflets linear, acute, glabrous or ciliate, 2-3 mm. long; heads several-flowered; peduncles in fruit 3-7 cm. long; stamens 5 only; legumes flat, strongly falcate, in dense heads, 15-25 mm. long, 2 to 5 times as long as broad, about 5 mm. broad, glabrous. *Acuan illinoense* (Michx.) O. Ktze. Frequent in clay soils in n.-cen. Tex., infrequent or rare in Edwards Plateau and Plains Country, rare in s.e. Tex. and the Trans-Pecos, June-Sept.; Ala. to Tex. and n. to Ill., O., Minn., S.D. and Colo.

2. *Desmanthus reticulatus* Benth. Much-branched from the base; stems weak and at least in the basal part sprawling, 2-16 dm. long; pinnae 1 to 4 pairs; leaflets 4 to 10 pairs per pinna, with raised somewhat reticulate veins at least on the lower surface, glabrous or sparsely pubescent along the margins only, oblong to elliptic or the upper pair elliptic-obovate, 3-5 mm. long, apically rounded to mucronulate; petioles of the larger leaves 1 cm. long or more, the gland minute and orbicular or absent; stamens 10; fruiting peduncles 8-15 cm. long; legume linear, tapering to a point, 25-50 mm. long, at least 7 times longer than broad, about 3 mm. broad. *Acuan reticulatum* (Benth.) O. Ktze. Infrequent in s.-cen. Tex., w. to Edwards Co., n.e. to Travis Co. and s.e. to San Patricio Co., on limestone and caliche uplands, spring; endemic.

3. *Desmanthus obtusus* Wats. Much-branched from the base; stems weak and at least in the basal part usually sprawling, 1-6 dm. long; pinnae 1 to 4 pairs per leaf; leaflets 8 to 14 pairs per pinna, with raised somewhat reticulate veins at least on the lower surface, pubescent over the lower surface, oblong, obtuse, 3-5 mm. long; petioles of the larger leaves 10 (rarely 15) mm. long or less, the small gland orbicular and borne between the lower ' pinnae; stamens 10; fruiting peduncles 3-8 cm. long; legume linear, 15-35 mm. long, at least 7 times longer than broad, about 2 mm. broad, straight, never tapering to a point though sometimes abruptly mucronate. *Acuan obtusum* (Wats.) Heller, *A. fallax* Small. Infrequent in calcareous soils over limestone or caliche uplands, Edwards Plateau,

s. part of Plains Country, e. part of the Trans-Pecos and Rio Grande Plains, Apr.-Aug.; also N.M. and Coah.

4. *Desmanthus velutinus* Scheele. Much-branched from the base; stems usually diffuse and spreading, 2-5 dm. long, the herbage (except leaflets) densely short-villous (very rarely glabrate); pinnae 3 to 6 pairs; petiole about 1 cm. long, the gland between the lowest pair of pinnae orbicular and 0.4 mm. or less in diameter; leaflets not having raised reticulate venation, the midvein often prominent, 2.5-4 mm. long, linear-oblong, acute or obtuse; stamens 10; fruiting peduncles 3-6 cm. long; legume straight or nearly so, linear, 3-7 cm. long, at least 7 times longer than broad, about 3 mm. broad, subulate-tipped. *Acuan velutinum* (Scheele) O. Ktze. Abundant on limestone hills, e. part of Edwards Plateau and parts of n.-cen. Tex., less common w. to e. part of Plains Country, parts of the Trans-Pecos and on caliche cuestas in the Rio Grande Plains, Apr.-June; also N.M. and Coah.

5. *Desmanthus Cooleyi* (Eat.) Trel. Bushy-branched, decumbent or ascending, 2-5 dm. long, the angled stems and branches glabrous or merely puberulent; stipules less than 2 mm. long; pinnae 2 to 7 pairs, with an orbicular gland 0.3-3 mm. long between the lower pair; leaflets without raised reticulate venation, 8 to 15 pairs per pinna, oblong or linear-oblong, 3-4 mm. long, acutish or mucronulate, ciliate at least when young; peduncles 2 cm. long or less (exceptionally 3 cm.); stamens 10; legume straight or nearly so, linear, 3-7 cm. long, at least 7 times as long as broad, about 3 mm. broad, pointed. *Acuan Cooleyi* (Eat.) Britt. & Rose, *Desmanthus Jamesii* T. & G. Locally frequent in Plains Country and higher grasslands of Trans-Pecos, June-Aug.; Nebr. to Ariz. and s. to Dgo.

6. *Desmanthus leptolobus* T. & G. Stems several from the base, ascending, 6-10 dm. long, the stem and branches rough-angled; stipules setiform, 4-6 mm. long; pinnae 4 to 10 pairs, the small gland orbicular and borne between the lowest pair of pinnae or absent; leaflets 10 to 24 pairs, not reticulate-veined, linear-lanceolate, acute, ciliate or glabrous; peduncles 10-25 mm. long; stamens 5; legume straight or nearly so, linear, at least 7 times as long as broad, acuminate-tipped, glabrous, slightly constricted between the seeds; seeds usually 6 to 8, elongate, 4.5-5 mm. long, with the long axis oriented parallel to the long axis of the legume. *Acuan leptolobum* (T. & G.) O. Ktze. Local in n.-cen. Tex. and adj. cos., rare w. on Edwards Plateau and Plains Country (w. to Lipscomb Co.), May-Sept.; Kan., Mo., Ark. and Tex.

7. *Desmanthus acuminatus* Benth. Roots linear-cylindric (slenderly fusiform), deep, tuberous; stems several from the base, decumbent, (1-) 2-6 dm. long; pinnae 1 to 4 pairs, the gland between the lowest pair orbicular and 0.7-1.5 mm. broad; leaflets not reticulate-veined, 6 to 12 pairs per pinna, linear-oblong, mucronate, ciliate, 2.5-4 mm. long; stipules 3-7 mm. long, setiform, conspicuously pubescent; peduncle 1-4 cm. long; stamens 10; legume linear, straight or somewhat curved, 3-5 cm. long, at least 7 times as long as broad, about 3 mm. broad; seeds less than 3 mm. long, placed obliquely in the pod. *Acuan acuminatum* (Benth.) O. Ktze. S.-cen. Tex., n. to McLennan Co., s. to Goliad and Calhoun cos., w. to Llano Co. and e. to Waller Co, spring; endemic.

8. *Desmanthus brevipes* B. L. Turner. Stems somewhat erect, 3 dm. or more long, sparingly branched above, brittle, glabrous, with 5 reddish ridges; leaves glabrous; petiole 2-6 mm. long; rachis and petiole 6-18 mm. long; pinnae only 1 or 2 pairs, 2-5 cm. long, with a large elliptic gland 1.5-3 mm. long and 1-2 mm. broad between the lower pair of pinnae; leaflets 15 to 24 pairs per pinna, not reticulate-veiny, linear to linear-oblong, glabrous, 2-7 mm. long, obtuse to apiculate; stipules subulate, 2-4 mm. long; peduncle only 2-6 mm. long; stamens 10; pods straight or slightly curved, 25-50 mm. long, about 3 mm. broad, at least 7 times as long as broad, linear, glabrous, acute; seeds 12 to 18, oblong, about 2.5 mm. long, placed obliquely in the pod. Known from only 5 collections in Texas, all in scattered coastal cos. from Willacy Co. to Galveston Co., various times of the year; also Arg.

9. *Desmanthus virgatus* (L.) Willd. Rather variable, the stems usually several to numerous and sprawling to decumbent or ascending, glabrous to sparingly puberulent; stipules setiform, essentially glabrous, 2-8 mm. long; pinnae 2 to 7 pairs; gland between the lowest pair of pinnae or between several pairs of pinnae 0.3-2.5 mm. in diameter; leaflets not reticulate-veiny, often about 10 to 15 pairs per pinna, linear, 2-6 mm. long; stamens 10; peduncles 1-6 cm. long; legume linear, 3-6 cm. long, at least 7 times as long

as broad, not constricted between the seeds when mature; seeds placed obliquely in the pod. *Acuan virgatum* (L.) Medic. Widespread in the s. half of Tex. including the Trans-Pecos. Represented with us by 2 varieties as follows:

Var. *depressus* (Willd.) B. L. Turner. Stipules with a conspicuous auricle; petiolar gland at base of lower pair of pinnae only, 0.7 mm. long or shorter; stems prostrate, rarely ascending. *Acuan Tracyi* Britt. & Rose, *A. texanum* Britt. & Rose. Frequent in Rio Grande Plains and n. to Harris, Travis and Tom Green cos., Apr.-Nov.; widespread in warmer parts of Am., as also is the var. *virgatus*, not known from Tex.

Var. *glandulosus* B. L. Turner. Stipules not conspicuously auricled; glands 1 to 4 between at least some of the pinnae (not just the lowest pair), 0.7-2.5 mm. long; stems erect or ascending. Frequent in the Trans-Pecos, especially in the mts., e. to Val Verde Co., Apr.-Nov.; also N. M. and Coah.

9. NEPTUNIA LOUR.⁸³

Perennial unarmed herbs with somewhat thickened woody orangish-colored taproots and few to several sprawling prostrate or decumbent annual stems (rarely floating); leaves pinnately twice-compound; pinnae 2 to 11 pairs, with or without a gland between the lowest pair of pinnae; leaflets 8 to 43 pairs per pinna, usually linear to oblong or somewhat tapered toward the apex; stipules well-developed, lanceolate or lance-acuminate; peduncles axillary, several cm. long, often conspicuously bracteolate; flowers small, densely crowded in round or slightly elongated heads, yellow or yellow-green, often the lower flowers of the head lacking functional genitalia or at least functional gynoecia, the upper flowers perfect; sepals and petals 5 each, free above the floral cup; stamens 10 (at least in the upper flowers of the head), free above the floral cup, the anthers with a small gland apically between the 2 cells; fruit a thin legume, definitely stipitate, 1-5 cm. long, 6-17 mm. broad, flat, promptly dehiscent; seeds few to several, elongate, oriented transversely in the pod.

A genus of 11 species, scattered in warm-temperature parts of the Americas, Africa, Asia and Australia.

1. Petiole glandular; flowering peduncles bearing 2 large cordate bracts 4-8 mm. long and 3-5 mm. wide; leaflets without raised reticulate veins; plants semiaquatic or terrestrial3. *N. plena*.
1. Petiole eglandular; flowering peduncles bearing 1 or 2 subulate bracts 1-3 mm. long and 1-2 mm. wide, or bracts absent; leaflets with raised reticulate veins; plants terrestrial (2)
- 2(1). Flowers in head with stamens all alike, anther-bearing; flower heads (when in bud) with 30 to 60 flowers, subcylindric; stipe of pod 4-15 mm. long; leaflets 8 to 18 pairs; calyx 1-2 mm. long (including lobes) ..1. *N. lutea*.
2. Flowers in upper part of head with anther-bearing stamens, those in lower part smaller and with yellow (drying orange) petaloid staminodes; flower heads (in bud) with 20 to 30 flowers, ovoid; stipe of pod 0-4 mm. long (rarely 5 mm.); leaflets 14 to 43 pairs; calyx 2-2.7 mm. long (including lobes)2. *N. pubescens*.

1. *Neptunia lutea* (Leavenw.) Benth. YELLOW-PUFF. Plant of dry sandy areas; pinnae 2 to 11 pairs; petioles and rachises glandless; leaflets 8 to 18 pairs per pinna, with raised reticulate venation beneath; floral cup (plus sepals) 1-2 mm. long; flowering peduncles with 1 or 2 subulate bracts 1-3 mm. long and 1-2 mm. broad, or these absent; flower heads with 30 to 60 flowers, slightly elongate; stipe of pod (4-) 5-15 mm. long. Incl. var. *multipinnatifida* B. L. Turner. Scattered or locally frequent over the e. half of Tex. s. to Aransas and Goliad cos., w. to n.-cen. Tex. (one record for Runnels Co.), Apr.-Oct.; Ala., Miss., Ark., La., Okla. and Tex.

2. *Neptunia pubescens* Benth. Plant of dry sandy or grassland areas; pinnae 2 to 5 (or 6) pairs; petioles and rachises glandless; leaflets 14 to 43 pairs per pinna, with raised

⁸³ Partly adapted from D. R. Windler in Austral. Jour. Bot. 14:379-420. 1966.

reticulate venation beneath; flower cup (plus sepals) 2-2.7 mm. long; flowering peduncles with 1 or 2 subulate bracts 1-3 mm. long and 1-2 mm. broad, or these absent; flower heads with 20 to 30 flowers, essentially round or ovoid; stipe of pod 0-4 mm. long (rarely to 5 mm.). Frequent near the coast and inland to Val Verde Co. Represented with us by 2 varieties as follows:

Var. *pubescens*. Stipe of legume longer than the persistent calyx; legume usually tapering to the stipe; leaves with 3 to 6 pairs of pinnae. *N. floridana* Small, *N. Lindheimeri* Robins. Coastal Plain of Tex. inland to Anderson, Leon and Gonzales cos., May-Oct.; Gulf Coastal States; W.I., Mex., C.A., Col., Peru, Parag. and Arg.

Var. *microcarpa* (Rose) Windler. Stipe of legume usually shorter than the persistent calyx (shorter than 2 mm.); legume usually rounded to the stipe; leaves usually with 2 to 3 pairs of pinnae. *N. Palmeri* Britt. & Rose. N. part of Rio Grande Plains from McMullen and Atascosa cos. w. to Val Verde Co., May-July; Tex., Coah., N.L. and Jal.

3. *Neptunia plena* (L.) Benth. Terrestrial to semiaquatic; stems when in watery environment producing a thick spongy indument; pinnae 2 to 5 pairs; petioles with a gland just below the lowest pair of pinnae; leaflets 9 to 38 pairs per pinna, without raised reticulate veins; flowering peduncles bearing 2 large cordate bracts about 4-8 mm. long and 3-8 mm. broad; flower head ovoid; stipe of pod 3-9 mm. long, longer than the persistent calyx. Known from a single collection from a temporary lake just s. of Armstrong, Kenedy Co. in s. Texas, Oct. 17, 1938, probably not a persistent member of our flora; Braz. and Peru, n. to W. I. and Mex.; adv. in India.

10. PROSOPIS L. MESQUITE

Shrublets to medium-sized trees, often armed with straight needlelike solitary or paired stipular (?) spines; leaves pinnately twice-compound; petiolar or rachillar gland present; pinnae 1 to several pairs; leaflets 4 to 30 per pinna, usually linear and glabrous; flowers in spikes or heads, usually yellowish or creamy-white; sepals coalescent well above the top of the floral cup; petals 5, either free or coalescent above the floral cup; stamens 10, each anther bearing a short gland apically between the 2 locules; fruit a leathery often rather solid tough indehiscent several-seeded pod several cm. long; seeds partitioned from each other and often essentially embedded in fleshy parenchyma. *Neltuma* Raf.; *Algarobia* Benth.; *Strombocarpa* Engelm. & Gray.

A genus with about 40 species in the drier, warmer areas of the world.

- 1. Flowers in yellowish globose heads; pinnae 25 mm. long or shorter; pod in a tight spiral of uniform diameter; plants usually short (rarely as much as 6 dm. tall) and forming colonies by root budding 4. *P. reptans* var. *cinerascens*.
- I. Flowers in spikes, usually creamy-white to pale-yellow; pinnae usually longer than 25 mm.; pod coiled or straight; plants usually taller and not forming colonies by root budding (2)
- 2(1). Pod tightly coiled in a spiral of uniform diameter; leaflets 4 to 8 pairs per pinna; plants of Trans-Pecos Texas 3. *P. pubescens*.
- 2. Pods not coiled; leaflets usually 10 to many pairs per pinna (3)
- 3(2). Leaflets 20 to 30 pairs per pinna, 5-10 (-15) mm. long, 2 to 7 times as long as broad, approximate; pinnae (1 or) 2 (or 3) pairs .. 1. *P. laevigata*.
- 3. Leaflets usually fewer than 17 pairs per pinna or if that many then usually averaging longer than in *P. laevigata*, usually 5 to 15 times as long as broad, relatively remote; pinnae 1 (less commonly 2) pairs 2. *P. glandulosa*.

1. *Prosopis laevigata* (Willd.) M. C. Johnst. MESQUITE. Small tree; pinnae usually 2 pairs per leaf; leaflets 20 to 27 pairs per pinna, closely set, 4-6 (-9) mm. long, the foliage minutely and abundantly hispidulous; pods essentially straight, nearly as thick as broad, (5-) 7-15 cm. long. Rare, known in Tex. from one genetically dilute population 3 miles s.e. of Calallen, Nueces Co., Coastal Bend region, spring and other times; widespread in Mex. n. to Tam., N. L. and Dgo.; adv. in Tex.

2. *Prosopis glandulosa* Torr. HONEY MESQUITE. Shrub or tree; pinnae usually 1 pair per leaf, less commonly 2 pairs; leaflets relatively remote, usually 6 to 15 (to 20) pairs per pinna, (10-) 15-62 mm. long, the foliage usually glabrous; pods essentially straight, nearly

as thick as broad, (5-) 7-20 cm. long. Probably the commonest "legume" in Texas, and represented with us by 2 varieties as follows:

Var. *glandulosa*. Leaflets (25-) 30-45 (-62) mm. long, 8 to 15 times as long as broad, 6 to 13 (to 15) pairs per pinna. Abundant in Rio Grande Plains, parts of n.-cen. and s.e. Tex. and Plains Country, scattered in the Trans-Pecos, e. Tex. and Edwards Plateau, spring and later; Kan., Okla. and e. N.M., s. to Tam., N.L. and Coah.

Var. *Torreyana* (L. Benson) M. C. Johnst. Leaflets (10-) 15-25 (-30) mm. long, 5 to 8 times as long as broad, (8 to) 10 to 15 (to 20) pairs per pinna. Common in the Trans-Pecos, spring and later; Tex., N. L., Coah., Chih., N. M., Ariz., Son., Baja Calif. and Calif.

This plant has been known, through error, as *P. "juliflora"* or *P. "chilensis"* in many publications, and is the famous one that furnishes important fodder (the pods) for horses, cattle, goats, men, etc., and which has increased greatly in abundance (though it has not much extended its total overall geographic range) in the last 120 years, becoming especially abundant on disturbed grasslands.

3. *Prosopis pubescens* Benth. SCREWBEAN, TORNILLO. Large shrub or small tree 2-10 m. tall; pinnae 1 pair (less commonly 2 pairs); leaflets 5 to 8 pairs per leaf, 7-11 mm. long, 2.5-4 mm. broad; flowers in a spike 40-55 mm. long, pale-yellowish; pod 25-50 mm. long overall but tightly spirally coiled, the coil about 4-5 mm. thick, the turns about 1.5-3 mm. high, markedly pubescent. Alluvial soil, desert washes, near the Rio Grande in the Trans-Pecos, spring and later; Calif. and Baja Calif. e. to Tex.

4. *Prosopis reptans* Benth. var. *cinerascens* (Gray) Burk. TORNILLO. Shrublet (rarely clambering up through shrubbery to 15 dm. tall) usually about 2-4 dm. tall and forming colonies by means of root budding; pinnae 1 pair; leaflets 7 to 13 pairs, 2.5-4 mm. long, 0.8-1.2 mm. broad; flowers in a globose dark-yellow head; pod 15-37 mm. long overall, tightly spirally coiled, the coil about 4-6 mm. thick, the turns about 2-3 mm. high, pubescent or glabrate. Clay soils, Rio Grande Plains and s. coastal Tex., spring and later; Tex., N.L., Tam. and S.L.P. The typical variety occurs in Arg.

11. CERCIS L. REDBUD

A genus of half a dozen species of temperate areas of North America, Asia and Europe.

1. *Cercis canadensis* L. Deciduous unarmed small tree; leaves alternate, simple, cordate to somewhat reniform; stipules not persistent; petioles well-developed; flowers appearing in spring before or as the leaves expand, rose or pink-purplish, in sessile umbel-like aggregations along the preceding year's growth; floral tube and essentially gamosepalous calyx purplish, persistent, basally oblique, broadly and irregularly campanulate, enlarged on the lower side, the 5 minute calyx lobes short and broadly triangular; corolla appearing papilionaceous, markedly bilaterally symmetrical; petals 5, the uppermost bannerlike one internal in bud; stamens 10, filaments free to the top of the floral cup, the anthers all functional; fruit a slightly stipitate dark-brown oblong to broadly linear thin-walled legume, blunt or acutish; seeds several too many. Widespread in e. U. S. and the mts. of e. Mex. Represented with us by three varieties as follows:

Var. *canadensis*. Mature leaves thinnish, dull green on both surfaces, generally cordate in outline, generally acute. Forested sandy areas of e. and n.-cen. Tex., in the latter area intergrading with the next, Mar.-May; e. U. S.

Var. *texensis* (Wats.) Rose. Mature leaves coriaceous, rich deep-green, shiny, distinctly glaucous above, reniform to cordate-reniform in outline, obtuse to emarginate or often merely rounded at apex; petioles and young branchlets quite glabrous or nearly so. *C. reniformis* Engelm. Edwards Plateau and calcareous soils of n.-cen. Tex. and e. parts of Plains Country, spring; also Okla.

Var. *mexicana* (Rose) M. Hopk. Leaves as in var. *texensis* but petioles and young branchlets densely woolly-tomentose both in youth and maturity. In mts. of the Trans-Pecos and e. to Crockett and Val Verde cos., spring; Tex. and mts. of n. Mex.

12. BAUHINIA L.

A large genus with about 250 species in the warmer parts of the world, of which we have only one.

1. *Bauhinia congesta* (Britt. & Rose) Lundell. Shrub or small tree 2-4 m. tall, unarmed, deciduous; leaves alternate, petiolate, consisting of 2 leaflets 15-30 mm. long and almost as broad; stipules present; flowers in sessile umbel-like aggregations among the leafy twigs; calyx of 5 free sepals; petals 5, white or light-pink, at least some of them clawed, the uppermost internal in bud; stamens 9 or 10 but only one of them functional, the rest staminodia, all free to the top of the floral cup; fruit a flattened promptly dehiscent several-seeded legume several cm. long. *Casparea jermiana* Britt. Rare, known only from canyons and arroyos in limestone hills ("Anacacho Mountains") in Kinney Co.; reported (apparently erroneously) from Presidio Co. and Gillespie or Llano Co., Mar.-May; also n.e. Mex.

Now becoming rather common in the nursery trade, especially in the Houston area. This attractive shrub deserves wider cultivation.

13. CASSIA L.⁸⁴

SENNA

Annual and perennial herbs, shrubs or rarely small trees (and large trees and woody vines in tropics); leaves paripinnate, spiral or distichous, the leaflets in 2 to 20 (to 60) pairs, the petiole bearing 1 or more glands between or below leaflets, or glandless; flowers mostly in axillary racemes, sometimes solitary or in terminal racemes or panicles; sepals obtuse to acuminate, subequal to very unequal; petals yellow (very rarely white), subequal or one larger; stamens 10, loculicidally dehiscent and trimorphic (3-4-3) (the uppermost set reduced, the lowest with longer anthers and/or longer filaments), or stamens 10 or 5, equal and porose; gynoecium often enantiostylous; pod flat, turgid or terete, erect to pendent, indehiscent or dehiscent by both sutures or elastically dehiscent by twisting valves; seeds few to many, transverse or oblique or longitudinal.

About 400 species, mostly in tropical America, but nearly cosmopolitan in tropics and subtropics. Various species are used as ornamentals, for plantation shade (coffee, cacao, etc.), soil improvement, pharmaceuticals and timber. Some authors follow Rafinesque and Britton in distributing the species among 28 segregate genera (9 in Texas). The genus is treated conservatively here.

- 1. Leaflets one pair, more or less gray-green (2)
- 1. Leaflets two or more pairs, yellow-green or medium-green (gray-green in *C. Lindheimeriana* and *C. Orcuttii*) (5)
- 2(1). Flowers solitary on long peduncles in the leaf axils; fruit ovoid, indehiscent; low perennial herb from knobby tuberous roots1. *C. pumilio*.
- 2. Flowers in axillary or terminal corymbiform racemes or panicles; fruit linear, flattened, apically dehiscent; erect or ascending perennial herbs from deep branching roots (3)
- 3(2). Leaflets lanceolate2. *C. Roemeriana*.
- 3. Leaflets ovate-lanceolate to ovate (4)
- 4(3). Leaflets 2 or 3 times longer than wide, densely short-pubescent, the hairs not more than 2 mm. long; pod 2-3 cm. long, curved, ascending3. *C. bauhinioides*.
- 4. Leaflets less than 2 times longer than wide, silvery-pubescent, the hairs 3-5 mm. long; pod 3-4 cm. long, straight or little-curved, mostly erect4. *C. durangensts*.
- 5(1). Plant shrubby, the stems definitely woody below (*C. alata* usually grown as an herb in Texas) (6)
- 5. Plant herbaceous, dying at least to the ground in fall (9)
- 6(5). Leaflets less than 1 cm. long; pod flat (7)
- 6. Leaflets 2 cm. long or longer; pod terete or bearing a conspicuous longitudinal wing on each valve face (8)
- 7(6). Shrub with spreading or ascending stems, less than 5 dm. tall; petiole with a sessile turbinate gland near base; pod 3-4 cm. long ..5. *C. Greggii*.
- 7. Shrub with erect or ascending stems to 30 dm. tall or taller; petiole without glands; pod 6-10 cm. long6. *C. Wislizenii*.

⁸⁴ Contributed by Howard S. Irwin.

- 8(6). Leaflets 2 or 3(5) pairs, oblanceolate, the rachis bearing a gland between at least the lower pair of leaflets or commonly between all pairs; bracts small, not petal-like; pedicels longer than the flowers; fruit pendent, terete, light-green, maturing light-brown 7. *C. corymbosa*.
8. Leaflets 6 to 12 pairs, broadly oblong, the rachis eglandular; bracts 1.5-2.5 mm. long, petal-like; pedicels much shorter than the flowers; fruit more or less horizontal, the valves each with a conspicuous scalloped longitudinal wing, dark-green, maturing black 8. *C. alata*.
- 9(5). Herbs with distichous leaves; inflorescences axillary or supra-axillary, short, few-flowered; pod elastically dehiscent (10)
9. Herbs with spiral phyllotaxy; inflorescences terminal or (if axillary) either the pedicels shorter than the peduncle or the plants malodorous; pods indehiscent or latently but not elastically dehiscent (18)
- 10(9). Procumbent perennials with deeply penetrating swollen roots (11)
10. Erect or ascending annuals (*C. fasciculata* var. *Ferrisiae* occasionally a short-lived perennial in extreme southern Texas) with shallow unthickened roots (12)
- 11(10). Leaflets 12 or more pairs, not more than 1 mm. wide; pedicels 2.5-5 cm. long; sepals with indistinct venation; petals yellow-orange; pod glabrescent, mostly 6- to 8-seeded, the septa oblique 9. *C. texana*.
11. Leaflets 10 pairs or fewer, about 1.5 mm. wide; pedicels to 1.5 cm. long; sepals finely striate; petals 7-10 mm. long, pale-yellow; pod spreading-pubescent, mostly 12- or more-seeded, the septa nearly transverse 10. *C. aristellata*.
- 12(10). Pedicels 1-5 mm. long; petals less than 8 mm. long; stamens 5 (13)
12. Pedicels 5-10 mm. long; petals 10 mm. long or longer; stamens 10 (14)
- 13(12). Stipules 3-8 mm. long; leaflets ciliate, the hairs 0.6-1 mm. long 11. *C. leptadenia*.
13. Stipules 5-10 mm. long; leaflets eciliate 12. *C. nictitans*.
- 14(12). Stems stiffly erect, mostly unbranched below, the upper branches pubescent with spreading hairs 2-3 mm. long; leaflets glabrate .13b. *C. fasciculata* var. *robusta*.
14. Stems erect to prostrate, simple to diffusely branched; pubescence (when present) short or appressed, never spreading and 2-3 mm. long (15)
- 15(14). Leaflets glabrate on face (16)
15. Leaflets densely pubescent with incurved hairs (17)
- 16(15). Plant mostly less than 5 dm. tall; petiolar gland less than 0.5 mm. wide; leaves mostly with 6 to 10 pairs of leaflets; anthers purple .13c. *C. fasciculata* var. *rostrata*.
16. Plant commonly 10 dm. tall or taller; petiolar gland 0.5-1.5 mm. wide; leaves with 9 to 15 pairs of leaflets; anthers yellow (purple or mottled in introgressants) .. 13a. *C. fasciculata* var. *fasciculata*.
- 17(15). Stems erect, branched above; petiolar gland sessile or nearly so; pods 5-6 mm. wide 13e. *C. fasciculata* var. *puberula*.
17. Stem branched from base, widespreading; petiolar gland distinctly stipitate; pod 3-5 mm. wide 13d. *C. fasciculata* var. *Ferrisiae*.
- 18(9). Petiolar glands occurring between 1 or more pairs of leaflets (19)
18. Petiolar glands solitary, below lowest pair of leaflets (21)
- 19(18). Annual, glabrous, yellow-green to medium-green, malodorous; petiolar gland appressed to rachis; leaflets 2 or 3 pairs, obovate; peduncle nearly obsolete (but pedicels to 2 cm. long); pod 12-20 cm. long, 3.5-5 mm. wide, scarcely flattened, the seeds longitudinal 14. *C. obtusifolia*.
19. Perennials, gray-pubescent to -puberulent or glabrate, odorless; petiolar glands erect; leaflets 4 or more pairs; pod not more than 10 cm. long, flattened, the seeds transverse or oblique (20)

- 20(19). Stems angulate; rachis glands between (2-) most pairs of leaflets; leaflets 4 to 8 pairs, densely soft-pubescent, oblong to elliptic; petals 12-15 mm. long; pod 4-6 cm. long, 7-8 mm. wide15. *C. Lindheimeriana*.
20. Stems terete; rachis gland between only the lowest pair of leaflets; leaflets 4 to 6 pairs, puberulent or glabrate, lanceolate; petals 8-10 mm. long; pod 8-10 (-12) cm. long, 3-4 mm. wide16. *C. Orcuttii*.
- 21(18). Malodorous annual, the stem simple or branched from ordinary root; flowers 2 to 5 per raceme, usually wilting by mid-day, borne on peduncles less than 2 cm. long; pods brown and turgid at maturity, somewhat raised over the seeds but without distinct septations; seeds ovoid, brown17. *C. occidentalis*.
21. Odorless perennial, commonly with few to several simple stems from a yellowish woody root; flowers numerous, remaining open for several days, borne on peduncles 3-8 cm. long; pods flat, pendent, maturing black, the cross septations clearly impressed; seeds flat, black or dark-brown ..18. *C. marilandica*.

1. *Cassia pumilio* Gray. DWARF SENNA. Small tufted strigulose subcaulescent perennial herb to 2 dm. tall, usually much lower, arising from a deep few-branched tuberous root; leaves spirally arranged; leaflets 1 pair, linear or narrowly lanceolate (the first of the season commonly much shorter and broader), glabrate or ciliate, cuspidate, (1-) 2-5 cm. long, 1-2 (-3) mm. wide, the rachis about as long as the leaflets and tipped with a setaceous bristle; stipules setaceous-subulate, 4-10 mm. long, persistent; flowers exceeding the leaves, solitary, the buds nodding; pedicels 10-15 cm. long, with a pair of bracts one fifth of the distance below the flower; sepals 7-10 mm. long, rounded or obtuse, few-nerved, persistent, the margins pale; petals a little longer than the sepals, pale-yellow, with conspicuous brown venation when dry; stamens 10, the 3 uppermost much-reduced; pod inflated, subglobose, membranous, indehiscent, 10-15 mm. long, 7-10 mm. wide, puberulent; seeds few. Rocky or sandy ground, mostly on limestone soils, locally abundant and sometimes showy on roadsides, Throckmorton Co. s. through Edwards Plateau to Zapata Co., w. to Dawson and Presidio cos., Apr.-June, intermittently to Aug.; also in s. N. M. and s. in Mex. to Coah. and S.L.P.

This, the smallest of all *Cassias*, is sometimes placed alone in the segregate genus *Tharpia* Britt. & Rose. The grasslike foliage, thick pod and diminutive stature clearly distinguish this species from all others.

2. *Cassia Roemeriana* Scheele. TWO-LEAVED SENNA. Erect or ascending gray-pubescent perennial herb with few to many stems 3-6 dm. tall from a thickened root; leaves spirally arranged; leaflets 1 pair, more or less parallel, longer than the petiole, lanceolate or lance-linear, 3-6 cm. long, 7-12 mm. wide, straight or slightly falcate, the base inequilateral, more or less appressed-pubescent on both sides; petiole without a terminal bristle but bearing a slender erect dark-brown gland between the leaflets; stipules setaceous, 7-10 mm. long, more or less persistent; flowers exceeding the leaves, 2 to 5 on axillary peduncles or at the branch ends forming terminal panicles; sepals ovate, membranous, 6-7 mm. long, sparingly pubescent, not persisting to fruit; petals about twice as long as the sepals, yellow, prominently nerved when dry; stamens straw-colored to light-brown, the 3 uppermost much-reduced; ovary pubescent; pod straight or slightly falcate, turgid, compressed, 2-3 cm. long, 5-7 mm. wide, sparingly strigose, dehiscent part way down both sutures; seeds numerous, transverse. *Earleocassia Roemeriana* (Scheele) Britt. Common in fields and open woods on limestone soils in cen. and w. Tex. from Ellis and Navarro cos. s. to the Rio Grande and w. to Bailey, Gaines, Culberson and Presidio cos., Apr.-May and again in Sept., sparingly from June through Aug.; also in N. M. and s. in Mex. to N. L. and Coah.

This species is easily grown from seed and makes a good garden perennial on limestone and black clay soils. It and *C. Lindheimeriana* are the commonest *Cassias* of central and west Texas.

3. *Cassia bauhinioides* Gray. TWO-LEAVED SENNA. Spreading or ascending perennial herb or shrub, the gray-tomentose stems 1-4 dm. long and usually branched, from a thick woody root; leaves spirally arranged; leaflets 1 pair, slightly divergent, oblong or oblong-ovate, rounded at both ends, the base very asymmetric, 2-4.5 cm. long, 1-1.5 cm. wide, softly pubescent on both sides; petiole bearing a slender erect gland between the leaflets; stipules linear-setaceous, 3-6 mm. long, more or less persistent; flowers 1 or 2 (or 3) on peduncles as long as or longer than the leaves, forming corymbs at branch ends; sepals thin, elliptic or oblong, pubescent, 6-8 mm. long; petals about 1.5 times longer than the

sepals, yellow, conspicuously veiny when dry; stamens 10, brown, the 3 uppermost much-reduced; ovary pubescent, the style glabrous; pod subfalcate, turgid, compressed, oblique, 2-4 cm. long, 5-8 mm. wide, villous, dehiscing along both sutures; seeds 8 to 15, transverse. Hills, flats and gulches in various soils, Loving Co., w. and s. through the Trans-Pecos and in scattered localities eastw. along the Rio Grande to Hidalgo Co., May-June; also N. M. and Ariz., s. to Zac. and Hgo.

Sometimes placed in the segregate genus *Earleocassia* Britt. The specific name, *bauhinoides*, suggests the superficial resemblance of the leaves to those of *Bauhinia*, especially to the Texas species, *B. congesta*.

4. *Cassia durangensis* Rose. TWO-LEAVED SENNA. Erect or ascending perennial herb with few to several densely grayish- or yellowish-pubescent stems 2-5 dm. tall; leaves spirally arranged; leaflets 1 pair, broadly oblong to nearly orbicular, 3-5 cm. long, 2-3.5 cm. wide, densely and softly grayish-pubescent, the incompletely expanded leaflets varying from silvery to olive or yellowish; petiole generally longer than the leaflets, bearing a slender erect brownish gland between the leaflets; flowers 1 to 6 on axillary peduncles that exceed the leaves; sepals about 7 mm. long, pilose; petals 12-15 mm. long, pale-yellow, conspicuously veined when dry; stamens yellow-brown, the 3 uppermost much-reduced; ovary pilose; pod usually erect, straight or slightly falcate, compressed, 3-4 cm. long, 6-8 mm. wide, densely pubescent; seeds numerous, glossy, transverse. Dry areas at 1,500-3,500 ft. elev., principally on limestone soils, in Brewster and Presidio cos., May-July and sparingly on to Oct.; also s. to Dgo.

This species is quite variable in hairiness, the hairs ranging from about 1 mm. to nearly 3 mm. long. The much broader leaflets and straighter, more erect pods of *C. durangensis* readily distinguish it from the preceding. *C. durangensis* is sometimes included, along with several other Texas Cassias, in the segregate genus *Earleocassia*.

5. *Cassia Greggii* Gray. Shrub to 1 m. tall with tortuous spreading stems bearing numerous short whitish-puberulent branchlets, the more vigorous branchlets flexuous; leaves distichous (more or less fasciculate on slow-growing spurs); leaflets 2 to 5 pairs, oblanceolate to obovate, 5-15 mm. long, 3-5 mm. wide, glabrous, coriaceous, somewhat nitid, the veins prominent; petiole bearing a minute sessile or short-stipitate gland below the lowest pair of leaflets; rachis bristle-tipped; stipules linear, subulate, persistent for the season or falling earlier; flowers commonly few, solitary on slender axillary pedicels 1-2 cm. long, the buds spherical or ovoid; sepals ovate, obtuse or broadly acute, 5-7 mm. long, puberulent; petals obovate, the fifth cupped and incurved, 10-14 mm. long, yellow; stamens yellow to straw-colored; ovary puberulent; pod linear or linear-lanceolate, 3-4 cm. long, 4-6 mm. wide, glabrate, elastically dehiscent; seeds black, glossy. Caliche hills near Orange Grove, Jim Wells Co., May-July; also Coah., N.L. and Tam.

C. Greggii is sometimes included in the segregate genus *Chamaecrista* Moench, but it is readily separated from other Texas *Chamaecristas* by its shrubby habit and the rounded or blunt (not pointed) buds. Although Bentham, in his 1871 revision of the genus, gave Texas as the provenance of the species, the first authentic collection for the state was made in 1959 by Fred B. Jones.

6. *Cassia Wislizenii* Gray. Shrub 15-30 dm. tall, with many short rigid leafy branches, the young branchlets appressed-pubescent to glabrate; leaves spirally arranged on spurs, often apparently fasciculate; leaflets 3 to 7 pairs, thickish, obovate or cuneate-obovate, rounded or retuse, apiculate, 4-9 mm. long, 2-4 mm. wide, glabrous; stipules 2-5 mm. long, long-persistent; flowers in crowded panicles, becoming corymbose at branch ends; sepals oblong or suborbiculate, 6-10 mm. long; petals 2-2.5 mm. long, yellow; stamens 10, the 3 uppermost much-reduced; ovary puberulent, soon glabrous; pod pendent, 6-15 cm. long, 5-6 mm. wide, flat but raised over the numerous seeds, glabrous, somewhat nitid; seeds ovoid, dark-brown, 4-5 mm. long. *Palmerocassia Wislizenii* (Gray) Britt. Igneous soils, mostly between 3,000 and 4,000 ft. elev., Presidio Co., May-July; also in s. N. M. and s.e. Ariz., s. to Son. and Chih.

This species, the largest of the Texas Cassias, is also the most conspicuous in flower, the masses of large yellow flowers contrasting sharply with the small leaflets and dark branches.

7. *Cassia corymbosa* Lam. ARGENTINE SENNA. Glabrous shrub or occasionally a small short-trunked tree to 35 dm. tall, the widespreading crown supported by 1 to several smooth lenticellate stems; leaves spirally arranged, evergreen or in severe winters only

partially evergreen; leaflets 2 or 3 pairs, oblanceolate to lanceolate or lance-elliptic, acute to acuminate at the apex, obliquely rounded at the base, 2-5 cm. long, 4-10 mm. wide, the terminal pair largest; petiolar gland erect, between the lower pair of leaflets or occasionally between all pairs; stipules caducous; flowers in corymbs in the upper axils, surpassing the leaves; sepals very unequal, narrowly elliptic or ovate; petals oblong or obovate, subequal, 10-12 mm. long, bright-yellow; stamens 10, the 3 uppermost much-reduced, the 3 lowest with long arching filaments; ovary white-puberulent; pod pendent, terete, obtuse, 6-8 cm. long, 7-9 mm. thick, light-green, maturing brown, indehiscent; seeds numerous, buried in a gummy pulp, obovoid, shining, about 4 mm. long. Nat. of Arg. and Urug., cult. in cen. and s. Tex. and occasionally escaped; Aug.-Sept.

Increasingly popular as a garden shrub, Argentine senna withstands temperatures as low as 15° F. The closely related but less hardy *C. bicapsularis* L. (obovate leaflets rounded at apex) and *C. laevigata* Willd. (lanceolate leaflets to 8 cm. long) are tropical American shrubs occasionally cultivated in the Rio Grande Valley and lower Gulf Coast region; rarely occurring as escapes.

8. *Cassia alata* L. EMPEROR'S CANDLESTICKS. Shrub (usually dying back to the ground in Texas) to 2 or 3 m. tall, the few thick branches and immature leaves puberulent; leaves spirally arranged, 30-75 cm. long; leaflets 6 to 12 pairs, broadly oblong or obovate, 6-17 cm. long, 3-7 cm. wide, the terminal pair largest, obliquely rounded or truncate at base, obtuse or somewhat retuse at apex; petiole marginate, eglandular; stipules lanceolate, acuminate, 1-2 cm. long, often greenish-orange or yellowish, firm, more or less persistent; flowers in dense elongate spikelike simple or few-branched racemes 1-3 dm. long, borne terminally or in the upper axils; bracts petal-like, ovate-orbicular, imbricate, 15-25 mm. long, deciduous; pedicels very short; sepals straw-colored or light-yellow, about 1 cm. long; petals nearly equal, obovate, clawed, 1.5-2 cm. long, yellow, drying with conspicuous venation; stamens 10, the 3 uppermost much-reduced, the 3 lowest with larger anthers; ovary pubescent; pod held horizontally, linear-oblong, straight, 1-2 dm. long, with a scalloped longitudinal medial wing on each valve face, membranaceous, glabrous, maturing black, indehiscent or tardily dehiscent; seeds many, brown, 4-angled, about 4 mm. long. Nat. of Am. trop., cult. as a perennial herb in s. and cen. Tex., sometimes as a shrub in the lower Rio Grande Valley; Aug.-Oct.

A comparative newcomer to the garden scene in Texas, *C. alata* is especially common in the Gulf Coast area but the roots survive inland where temperatures do not fall much below 15° F. The only *Cassia* with winged pods, this species is sometimes placed alone in the segregate genus *Herpetica* Raf. The purgative properties of leaf extracts of *C. alata* have been found to equal those of commercial senna, *C. acutifolia* Delile.

9. *Cassia texana* Buckl. TEXAS SENNA. Prostrate perennial herb with numerous stems 2-6 dm. long radiating from the crown of a deep taproot; stems slender, more or less flexuous, the youngest portions whitish-puberulent and ascending; leaves distichous; leaflets 10 to 16 pairs, narrowly oblong or lanceolate, acute, 6-8 mm. long, about 1 mm. wide, puberulent beneath, 3- or 4-veined, the costa very excentric; petiolar glands below lowest pair of leaflets, sessile, indistinct; stipules triangular-ovate, cordate, acuminate, 2-4 mm. long; flowers axillary, mostly solitary, the slender pedicels exceeding the leaves and sometimes to 5 cm. long; sepals ovate, acute, 7-8 mm. long, puberulent; petals broadly ovate, 10-13 mm. long, the fifth one large and turned inward, yellow, the upper 4 with a red spot at base, wilting by midday and then turning pinkish-orange; stamens 10, equal, yellow or straw-colored; ovary whitish-puberulent; pod erect or ascending, 2.5-4 cm. long, puberulent or glabrate; seeds shining, black-brown, 4-6 mm. long. Open places in sandy soil, DeWitt and Maverick cos. s. to the Rio Grande and farther s. in Mex. to Tam.

Apparently a northerly variant in the *C. chamaecristoides* Collad. complex, the status of this species is as yet uncertain. It is sometimes cited as *Chamaecrista texana* (Buckl.) Penn.

10. *Cassia aristellata* (Penn.) Cory & Parks. Perennial herb with several slender decumbent stems to 5 dm. long from a deep swollen root; stems puberulent and sparsely pilose; leaves distichous; leaflets 6 to 8 (to 12) pairs, linear to oblanceolate, obliquely acuminate, 10-15 mm. long, about 2 mm. wide, ciliate but otherwise glabrous, strongly several-nerved; petiolar gland arising near pulvinus, stipitate, disciform; stipules lanceolate, acuminate, several-nerved, 4-6 mm. long, scabrous-persistent; flowers solitary, axillary, on slender pedicels 8-12 mm. long; sepals lanceolate, finely striate, puberulent,

about 10 mm. long; petals about as long as sepals, pale-yellow, wilting at midday; stamens 10, yellow; ovary hirsute; pod linear, slightly falcate, 3-4 cm. long, 3-5 mm. wide, loosely strigose, opening suddenly by the elastic twisting valves; seeds trapezoidal, light-brown. *Chamaecrista aristellata* Penn. Sandy fields and open woods, Bexar Co., s. to lower Rio Grande Valley, July-Aug.; endemic.

Aside from its frost-tolerance and reduced pubescence, this species, known only from Texas, is scarcely distinct from *C. calycioides* DC. of the American tropics.

11. *Cassia leptadenia* Greenm. Slender annual, commonly very small and unbranched but under favorable conditions branching and reaching 4 dm.; stems puberulent; leaves distichous; leaflets 12 to 16 pairs, linear-oblong, acute, mucronate, 8-12 mm. long, 1-2 mm. wide, ciliolate, obscurely veined except for the subcentral costa; rachis strongly ciliate; petiolar gland discoid, stipitate; stipules narrowly lanceolate, long-acuminate, ciliate, 5-7 mm. long, persistent; flowers borne in supra-axillary condensed few-flowered clusters; sepals lanceolate, acuminate, 4-5 mm. long, hirsute; petals very unequal, in a single flower ranging from 2.5 to 7 mm. long, yellow, wilting by midday; stamens 5 to 8, yellow or stramineous; ovary pubescent; pod linear, erect, somewhat arcuate, 3-4 cm. long, 3-4 mm. wide, puberulent, elastically dehiscent; seeds 8 to 12, dark-brown, nitid. *Chamaecrista leptadenia* (Greenm.) Cockill. Mountainous areas, mainly in igneous soils, 3,000-6,000 ft., Jeff Davis, Brewster and Presidio cos., July-Sept., especially after late summer rains; also in s. N. M. and Ariz., s. to Qro. and Sin.

This species differs from *C. nictitans* of east Texas chiefly by its pubescence.

12. *Cassia nictitans* L. SENSITIVE PEA. Small annual herb 1-4 dm. tall, commonly branched and spreading; stems slender, puberulent; leaves distichous, somewhat touch-sensitive; leaflets mostly 10 to 20 pairs, linear-oblong, obtuse or rounded and mucronate at apex, 7-15 mm. long, 2-3.5 mm. wide, glabrous, finely ciliate, the costa subcentral; petiolar gland discoid or cupulate, stipitate or subsessile; stipules linear-lanceolate, acuminate, ciliate, 5-8 mm. long, persistent; flowers 1 to 3 together in supra-axillary clusters, inconspicuous, on puberulent pedicels 1-3 mm. long; sepals lanceolate, acuminate, puberulent; petals unequal, varying in a single flower from 3 to 8 mm. long, yellow, wilting by midday; stamens 5, the anthers pinkish to rose; ovary pubescent; pod erect, linear-oblong, flat, 2.5-5 cm. long, 3.5-5.5 mm. wide, lightly appressed-pubescent; seeds mostly 5 to 10, oblique, black, nitid. *Chamaecrista nictitans* (L.) Moench. In sandy open woods and fields, abundant in disturbed places, n.e. Tex., w. to Grayson and Tarrant cos., s. to Bastrop and Jefferson cos., Sept.-Oct.; also throughout most of the e. half of the U.S.

Several varieties are recognized, that in Texas being var. *nictitans*.

13a. *Cassia fasciculata* Michx. var. *fasciculata*. PARTRIDGE PEA. Erect glabrate annual to 1.25 m. tall, commonly slender and few-branched in dense stands but (with adequate room) lower and diffusely branched; leaves distichous; leaflets mostly 8 to 15 pairs, linear-oblong, mucronate, 1-2 cm. long, 2-4 mm. wide, glabrous, ciliolate; petiole bearing a single sessile or short-stipitate truncate gland (about 1.5 mm. across) below lowest pair of leaflets; stipules linear, attenuate, ciliolate, 5-10 mm. long; flowers borne in abbreviated 2- to 7-flowered supra-axillary racemes, one flower opening at a time; pedicels puberulent, 1-2 cm. long; sepals lanceolate, acuminate, 10-15 mm. long; petals obovate, yellow (rarely white), wilting by midday, the 4 upper each with a red spot at base, the lowest larger and incurved, 10-17 mm. long; stamens 10, subequal, yellow; ovary conspicuously enantiostylous, short-pubescent, 6-8 mm. long; pod linear, usually somewhat falcate, obtuse, mucronate, 5-7 cm. long, 4-6 mm. wide, glabrous or sparingly puberulent; seeds 10 to 20, flattened, oval or more or less triangular, 3-5 mm. long, dark-brown. Fields and open woods, mainly on sandy soils, e. and cen. Tex., w. to Wichita, Callahan, Hays and Karnes cos., July-Oct.; in much of the e. half of the U.S.

The partridge pea is occasionally grown as an ornamental and, as the roots bear nodules, is sometimes included in soil-improving cover crops. However, it has been reported to be toxic to stock when green, in hay or by seeds. Besides the typical variety, 4 additional ones occur in Texas. Introgression occurs among some of them in the south-eastern part of the state.

13b. *Cassia fasciculata* var. *robusta* (Pollard) Macbr., also erect and sometimes taller, has younger stems conspicuously hirsute with spreading yellowish or whitish hairs 2-3 mm. long, hirsute sepals, petals to 2 cm. long, and hirsute pods. In fields and cleared woodlands in extreme e. Tex., w. only to Rusk and Polk cos.; e. to Fla. and n. to O.

13c. *Cassia fasciculata* var. *rostrata* (Woot. & Standl.) B. L. Turner is lower, commonly 2-6 dm. tall, often ramose, with 5 to 10 pairs of leaflets 7-12 mm. long and 2-3 mm. wide, a short-stipitate petiolar gland not more than 0.5 mm. across, smaller flowers with purple anthers on pedicels not more than 1 cm. long, and pods not more than 45 mm. long. The most westerly variety, ranging from Frio and LaSalle cos. to the Rio Grande, n. to Wichita, Wheeler and Winkler cos.; n. to Kan.

Locally abundant, but apparently in widely scattered stations, this variety is found in open places mainly on calcareous soils. It was originally published as *Chamaecrista rostrata* Woot. & Standl. Introgression with var. *fasciculata* occurs along the eastern margin of the Edwards Plateau, especially in the vicinity of Austin.

13d. *Cassia fasciculata* var. *Ferrisiae* (Britt.) B. L. Turner is strikingly different with decumbent much-branched reddish stems forming a mat often 1 m. across, the leaflets pubescent on both sides, the petiolar gland stipitate and not more than 0.5 mm. across, the anthers purple and the pod pubescent. Primarily a plant of the coastal dunes from Brazoria Co. to the Rio Grande, but it is found in sandy places inland to Robertson, Hays, Atascosa and Zapata cos.

Introgression with var. *fasciculata* occurs in south-central Texas, mainly from Lee to Jackson cos. west to Guadalupe and Karnes cos., and with var. *puberula* in Jackson and Victoria cos.

13e. *Cassia fasciculata* var. *puberula* (Greene) Macbr. is an eastern taxon, having the habit and general proportions of var. *fasciculata* but the peculiar incurved pubescence of var. *Ferrisiae*; the anthers are purple. Found mainly on the littoral prairies of the Galveston-Houston-Beaumont area but extends inland in the sandy oak-hickory and pine woodlands n. to Shelby Co., and w. to DeWitt Co.

To the north it intergrades with var. *fasciculata*, to the west with var. *Ferrisiae*. This variety was originally treated at specific rank and named *Chamaecrista puberula* Greene.

14. *Cassia obtusifolia* L. SICKLE-POD. Erect malodorous herb to 1.5 m. tall, usually lower and widespreading with numerous ascending essentially glabrous branches; leaves spirally arranged; leaflets mostly 3 pairs, symmetrically obovate, the apex rounded and apiculate, the base cuneate, 2.5-5 cm. long, 1-3 cm. wide, the terminal pair largest, glabrous or the undersurface puberulent; petiolar gland usually 1, slender, between the lowest pair of leaflets, appressed to the rachis; stipules linear-subulate, falcate, 1-1.5 cm. long; flowers 1 to 3 on a short axillary peduncle, the pedicels to 2 cm. long (to 35 mm. in fruit); sepals oblong or oval, obtuse, 5-10 mm. long, membranaceous; petals 8-15 mm. long, nearly equal, yellow, wilting by midday; stamens 10, the 3 uppermost much-reduced, the 3 lowest with very large anthers; ovary glabrous or puberulent; pod linear, usually arcuate downward, more or less tetragonal, 16-20 cm. long, 4-5.5 mm. wide; seeds numerous, longitudinal, 5 mm. long, dark-brown, shining, with a linear areole 0.3-0.5 mm. long. Disturbed ground on sandy soils, e. Tex. w. to Dallas and Gonzales cos., July-Sept.; e. and n. to Pa., Ind. and Mo., s. through the Am. trop. and in the Old World.

This species has been much confused with the very similar Old World species *C. Tora* L., from which it differs by the longer pedicels (not over 10 mm. in flowers of *C. Tora*, to 15 mm. in fruit) and the linear areole (1.5-2 mm. wide in *C. Tora*). *Cassia obtusifolia* is commercially important as the alternate host of the tobacco etch virus disease. The seeds, known to contain antibiotic substances, have been reported fatal to quail but, in a feeding experiment, were not toxic to poultry.

15. *Cassia Lindheimeriana* Scheele. Erect perennial herb 1-2 m. tall, with 1 to several velvety-pubescent shallowly sulcate stems arising from a deep woody root; leaves spirally arranged; leaflets 5 to 8 pairs, oblong to elliptic, acute or obtuse, mucronate, the base asymmetric, 2.5-5 cm. long, 1-2 cm. wide, sericeous on both sides; petiolar glands setaceous, 1 between each pair of leaflets; stipules linear-subulate, 8-15 mm. long, deciduous; flowers in racemes about as long as the leaves, borne in upper axils; sepals ovate to elliptic, 6-8 mm. long, pubescent; petals elliptic, 12-15 mm. long, light-golden-yellow; stamens straw-colored to light-brown, the 3 uppermost much-reduced; ovary densely pubescent; pod broadly linear, compressed, straight or curved, 4-6 cm. long, 6-8 mm. wide, apiculate, sparsely pubescent; seeds numerous, irregularly ovoid, margined or rugose, dark-brown. *Earleocassia Lindheimeriana* (Scheele) Britt. Limestone soils of Edwards Plateau from Travis, Bexar and Dimmit cos. w. through the Trans-Pecos, Aug.-Oct.; N. M. and s.e. Ariz., s. in Chih. and Tam.

This species is especially suitable as an ornamental on limestone and black clay. In a feeding experiment, the leaves were found toxic (but not fatal) to sheep.

16. *Cassia Orcuttii* (Britt. & Rose) B. L. Turner. Perennial herb 3-6 dm. tall; stems few to several, erect or ascending, striate, glabrate or puberulent and sparingly hirsute (at least when young), arising from a thick woody root; leaves spirally arranged; leaflets 4 to 6 pairs, lanceolate, acute or acuminate, apiculate, 15-25 mm. long, 5-8 mm. wide, finely appressed-pubescent, becoming glabrate above with age; petiolar glands setaceous, one between each of the 3 to 5 lower leaflet pairs; stipules linear-subulate, 6-10 mm. long, deciduous; flowers in racemes borne in the upper axils, equaling or surpassing the subtending leaves, the buds nodding; pedicels slender, 1-1.5 cm. long; sepals oblong, about 6 mm. long, obtuse; petals orbicular, 5-8 mm. long, light-yellow; stamens 10, the 3 uppermost much-reduced; ovary puberulent; pod narrowly linear, acuminate, compressed, 8-11 cm. long, 3-4 mm. wide, glabrous, raised over the obliquely arranged seeds; seeds numerous, slightly flattened, dark-brown. Limestone slopes at 3,000 to 5,000 ft. in the Del Norte Mts., farther s. near Sanderson, apparently only in Brewster Co., July-Aug.; also in adj. Mex.

This species, sometimes placed in the segregate genus *Peirantsia* Raf., has been likened to *C. Lindheimeriana* but, beside its much lower stature, it differs strikingly with its lightly hirsute young stems, pendent buds, small flowers and very different pod.

17. *Cassia occidentalis* L. COFFEE SENNA, BRICHO. Erect glabrous malodorous annual 1-2 m. tall; stem sulcate, usually with few to several strongly ascending branches; leaves spirally arranged; leaflets 4 to 6 pairs, lanceolate to ovate, acute or acuminate, the base only slightly asymmetric, terminal pair largest, 3-6 cm. long, 1-2.5 cm. wide, somewhat glaucous beneath; petiolar gland borne on the pulvinus in the axil, sessile, globose or conical; stipules linear-lanceolate, acuminate, 4-6 mm. long, caducous; flowers few together in short bracteate axillary racemes; sepals oblong, obtuse, 6-9 mm. long; petals broadly ovate or elliptic, yellow or yellow-orange, wilting by mid-day, 10-18 mm. long; stamens 10, the 3 uppermost much-reduced, the 3 lowest with elongate filaments; ovary pubescent on faces; pod linear, obtuse, mucronate, erect, more or less arcuate, at first flat, maturing turgid, 8-12 cm. long, 7-10 mm. wide, medially dark-brown and elevated over the seeds, the margins paler; seeds many, ovoid, compressed, dull-brown, 4-5 mm. long, transverse. Roadsides, waste ground and other disturbed places, Gulf Coast and inland n. and n.w. to Cherokee, Robertson, Travis and Comal cos., Aug.-Nov.; in the s.e. U.S. and in the trop. and subtrop. of the New World and Old World.

A pantropic weed, probably of American origin, coffee senna is sometimes placed in the segregate genus *Ditremexa* Raf. The seeds are still used in some regions as a coffee substitute and in various folk medicines. Increased soil fertility is ascribed to this species in Africa. In this country the plant occurs commonly in old pastures. It is known to be weakly toxic to various stock animals which, however, ordinarily avoid it. A number of experiments have demonstrated the antibiotic activity of seed extracts.

18. *Cassia marilandica* L. MARYLAND SENNA. Perennial herb from woody root, few to several erect mostly simple glabrous or very sparingly pubescent stems 1-2 m. tall; leaves spirally arranged; leaflets mostly 6 to 10 pairs, oblong to elliptic, broadly acute to obtuse, mucronate, slightly asymmetric at base, glabrous, glaucous beneath, 3-6 cm. long, 1-2 cm. wide, subequal; petiolar gland ovoid-conic, sessile or short-stipitate, borne upon or just distal to the pulvinus; stipules linear-lanceolate, caducous; flowers in dense short multiflorate racemes in the upper axils or in terminal panicles, the filiform bracts caducous; sepals ovate, obtuse, light-yellow, 4-6 mm. long; petals obovate or elliptic, yellow, 9-11 mm. long; stamens 10, the 3 uppermost much-reduced, the 3 lowest with somewhat longer anthers; anthers brown; ovary pubescent; pod linear, usually arcuate downward, flat, the margin undulate, 7-11 cm. long, 8-11 mm. wide, glabrous or sparsely pubescent, maturing black, impressed and septate between the seeds, the segments about half as long as wide; seeds transverse, flat, ovate, 4-5 mm. long, black, nitid. Moist sandy fields, open woods and creek borders, e. Tex., w. to Johnson and Washington cos., Aug.-Sept.; also in e. U.S.

An attractive plant occasionally cultivated as a garden subject and of some value as a nectar plant in apiaries. It is commonly confused with *C. hebecarpa* Fern., an extra-Texas species with fewer pod segments, each about as long as wide. The Texas species is sometimes cited as *Ditremexa marilandica* (L.) Britt. & Rose.

14. GLEDITSIA L.

Trees or tall shrubs often armed with stout straight or branched thorns; leaves alternate, deciduous, pinnately once- or twice-compound (both kinds of leaves often on the same plant); stipules minute, caducous; leaflets crenulate, usually ovate-oblong to oblong-lanceolate, numbering 9 to 18 pairs on once-pinnate leaves or on individual pinnae; pinnae (on twice-pinnate leaves) several (up to 8) pairs; flowers in spikelike axillary racemes (3-) 4-8 cm. long, polygamous, only slightly bilaterally symmetrical; floral cup campanulate; sepals equal or subequal, free; petals 3 to 5, subequal, 4-5 mm. long, very narrow, yellowish or greenish-yellow, the uppermost internal in bud; stamens 3 to 10, the filaments free, the anthers of the pistillate flowers abortive; fruit several-seeded, dehiscent or indehiscent, flattened, 15 mm. broad or broader.

A genus of 11 species of North America, South America, Asia and Africa. The name is sometimes spelled "Gleditschia."

- 1. Pods linear-oblong, elongate, many-seeded, indehiscent; ovary pubescent 1. *G. triacanthos*.
- 1. Pods oval, oblique, 1- to 3-seeded, tardily dehiscent; ovary glabrous 2. *G. aquatica*.

1. *Gleditsia triacanthos* L. HONEY LOCUST. Trees or shrubs; leaflets usually appressed-pubescent at least along the midvein; ovary densely pubescent along both margins, sessile or nearly so; fruit broadly linear, 7-40 cm. long, indehiscent, with many seeds embedded in packing tissue. Scattered in e. half of Tex., s.w. to Bexar and Karnes cos., rare as far w. as Tom Green Co., spring; e. U. S.

2. *Gleditsia aquatica* Marsh. WATER LOCUST. Trees or shrubs; leaflets glabrous at maturity even along the midvein; ovary glabrous laterally, long-stalked; fruit a legume, ovate to elliptic, 5 cm. long or less, tardily dehiscent; seeds 1 to 3, not embedded in packing tissue. Scattered in swamps, along rivers and low bottomland forests, e. and s.e. Tex., May-June; cen. U. S. to Fla.

15. GYMNOCLADUS LAM.

A genus of 2 species, of United States and China.

1. *Gymnocladus dioica* (L.) K. Koch. KENTUCKY COFFEE-TREE. Unarmed trees; leaves deciduous, alternate, pinnately twice-compound, very large, 3-9 dm. long, 3-6 dm. broad, with 3 to 7 pairs of pinnae, each pinna more than 1 dm. long and with 4 to 7 pairs of leaflets plus a terminal leaflet (!), sometimes the lowest pair of pinnae replaced by a pair of large leaflets; leaflets 4-7 cm. long, 2-3 cm. broad; flowers in terminal spikelike racemes, only slightly bilateral; sepals 5, separate above the floral cup; petals 5, subequal, broad, white, separate, the uppermost one internal in bud; stamens 10, the filaments free above the floral cup; ovary sessile; fruit oblong, (5-) 10-20 (-25) cm. long, about 3-5 cm. broad, persistent and indehiscent over-winter but tardily dehiscent the second year; seeds 15-20 mm. long, embedded in packing tissue. Reported to occur in the Panhandle but we have not seen Tex. collections; perhaps the report is based on a cult. specimen; n.e. U.S. s.w. to Okla.

16. PARKINSONIA L.

A genus of 3 or 4 species in the warmer parts of America and in South Africa.

1. *Parkinsonia aculeata* L. RETAMA. Small diffuse trees to 10 m. tall, with green branches very formidably armed with needle-sharp slightly recurved spines that represent the modified rachises of the leaves; foliage feathery; leaves alternate, pinnately twice-compound, nearly sessile; pinnae 1 (or 2) pairs, elongate, to 5 dm. long (usually 1-3 dm.), with flattened green rachis; leaflets very numerous and small (only 2-4 mm. long); flowers in short racemes, sometimes appearing solitary in the axils, about 1 cm. across, only slightly bilaterally symmetrical; sepals 5, separate; petals 5, subequal, bright-yellow, broad, the uppermost enclosed by the others in bud; legumes torulose, (3-) 5-10 cm.

long, only slightly flattened, brown, deciduous, thin-valved; seeds few to several, oriented longitudinally in the pod, almost as thick as broad. Frequent weed in Rio Grande Plains, especially in low poorly drained areas, perhaps adv., n. at least to Williamson Co., spring-fall; widespread in Am., perhaps nat. in S. A.

17. CERCIDIUM TUL. PALOVERDE. RETAMA CHINA

Green-limbed deciduous shrubs or small trees, much-branched; branches green, zigzag and some of them thornlike terminally, armed at each node with a short (2-7 mm.) nearly straight needlelike spine or thorn; leaves alternate, twice-pinnately-compound; pinnae 1 to 3 pairs, only 1-3 (-4) cm. long; leaflets few pairs, rotundly oblong, 4-6 mm. long, pallid or glaucous-green; flowers in very short axillary (1-3 cm. long) racemes or corymbs, or sometimes appearing solitary, about 1 cm. across, bright-yellow; sepals 5, valvate or induplicate-valvate in bud, free above the floral cup; petals 5, broad, subequal, yellow, clawed, the uppermost enclosed by the others in bud; stamens 10, the filaments free above the floral cup, all alike; fruit a flattish oblong or linear firm-valved legume (1-) 2-6 cm. long, with 1 to few seeds, apically acute.

A genus of 9 species of the warmer Americas; we have 2 taxa which intergrade and which no doubt are merely geographic races of 1 species.

- 1. Ovary glabrous or nearly so; base of pod glabrous; pinnae mostly (1 or) 2 or 3 pairs 1. *C. macrum*.
- 1. Ovary densely pubescent; base of pod appressed-pubescent; pinnae mostly 1 or rarely 2 pairs 2. *C. texanum*.

1. *Cercidium macrum* I. M. Johnst. Small tree (2-) 3-4 m. tall, with a rather dense crown; pinnae usually 2 or 3 pairs; ovary and base of pod glabrous or nearly so. Locally frequent in brush on clay loam, Rio Grande Plains inland to McMullen, Duval and Starr cos., spring-summer; Tex., N.L., s. to 22°30' N. in Tam. with one record in extreme s.e. S.L.P.

2. *Cercidium texanum* Gray. Shrubs, often several-stemmed from the base, flat-topped; pinnae usually 1 pair, less commonly 2 pairs; ovary and base of pod appressed-pubescent. Locally abundant in semidesert scrub, Rio Grande Plains n.w. to Val Verde Co., s.e. to Starr Co.; spring-summer; also Coah. and N.L.

18. CAESALPINIA L.⁸⁵

Unarmed trees, shrubs or shrublets; leaves bipinnate; pinnae 3 to 30; leaflets 2 to 10 pairs, oblong or orbicular to ovate or obovate; stipules small, entire or lacinate; inflorescence terminal, in some species overtopped by the lateral branches, therefore seemingly lateral; bracts ovate, caducous; bracteoles absent; pedicels 2-30 mm. long; calyx tube short; calyx teeth 5, oblong to ovate, their margin entire or fimbriate; petals 5, yellow, the uppermost dissimilar; stamens 10; filaments free, pubescent or glandular at base; anthers uniform, longitudinally dehiscent; ovary sessile or stipitate; ovules few to several; fruit falcate, ovate or lunate, acute, compressed, dehiscent; seeds few to several.

A very large, heterogenous genus with about 150 species, distributed all over the world, especially abundant in the warmer parts of the Americas. *Erythrostemon* Kl.; *Poinctanella* Britt. & Rose; *Pomaria* Cav.; *Schrammia* Britt. & Rose. The genus *Hoffmanseggia* is included by some authors in *Caesalpinia*.

- 1. Leaflets without orange sessile glands on the lower surface (2)
- 1. Leaflets with orange sessile glands (black on dried specimens) (7)
- 2(1). Pinnae 14 to 30; leaflets 7 to 10 pairs on each pinna, oblong; stamens bright-red, 70-90 mm. long; introduced species of central and west Texas 1. *C. Gilliesii*.
- 2. Pinnae 3 to 11; leaflets 2 to 8 pairs on each pinna; stamens 5-20 mm. long; native species (3)

⁸⁵ Contributed by Imre J. Eifert.

- 3(2). Leaflets 10-25 mm. long; shrubs or small trees, 15 dm. tall or more 2. *C. mexicana*.
3. Leaflets 3-7 mm. long; small shrublets, 5 dm. tall or less (4)
- 4(3). Leaflets ovate to orbicular, 2 to 3 pairs on each pinna 3. *C. phyllanthoides*.
4. Leaflets oblong, 3 to 8 pairs on each pinna (5)
- 5(4). Mature leaves with 5 to 11 pinnae; petiole 3-10 cm. long; inflorescence 10- to 20-flowered; stems woody only at base; plants of southwestern Texas 4. *C. oxycarpa*.
5. Mature leaves with 3 pinnae; petiole 1-2 cm. long; intricately branched low shrublets (6)
- 6(5). Plants 15-30 cm. high; stem and leaves glabrous or somewhat puberulent, glandless or with a few stalked glands; peduncle and calyx with a few scattered stalked glands, glabrous or the calyx ciliate 5. *C. Drummondii*.
6. Plants 10-20 cm. high, densely short-pubescent and densely covered by stalked glands 6. *C. texensis*.
- 7(1). Leaflets with conspicuous raised reticulate veins beneath, broadly ovate, subcordate, acute; terminal pinna much longer than the lateral ones 7. *C. caudata*.
7. Leaflets smooth, without raised veins beneath (except for the midvein), elliptic to obovate; terminal and lateral pinnae of about equal length (8)
- 8(7). Leaflets 5 to 10 pairs on each pinna 8. *C. Jamesii*.
8. Leaflets 2 to 5 pairs on each pinna (9)
- 9(8). Plant glabrous or sparingly pubescent; pod elliptic, 20 mm. long or less 9. *C. brachycarpa*.
9. Plants conspicuously pubescent; pod lunate or obliquely oblong, 23 mm. long or more (10)
- 10(9). Pinnae 5 to 7; leaflets 3 to 5 pairs, pubescent; inflorescence 10-15 cm. long, 10- to 15-flowered; pod lunate, broadest in the upper half 10. *C. atropunctata*.
10. Pinnae 3 to 5; leaflets 2 to 3 pairs, very densely villous; inflorescence 15-30 cm. long, 15- to 25-flowered; pod obliquely oblong, its sides parallel 11. *C. Parryi*.

1. *Caesalpinia Gilliesii* (Hook.) Benth. BIRD-OF-PARADISE. Shrub or tree to 5 m. high or less; leaves 1-3 dm. long; pinnae 7 to 15; leaflets 7 to 10 pairs, oblong, glabrous; stipules ovate, fimbriate, 4-8 mm. long; inflorescence 1-3 dm. long, densely covered with stalked yellow glands; pedicels 2-3 cm. long; calyx 25-30 mm. long; petals obovate, yellow, 25-30 mm. long; filaments bright-red, short-pubescent at base, 7-9 cm. long; ovary densely covered with stalked yellow glands; fruit obliquely oblong-lanceolate, pubescent, 6-9 cm. long; seeds 6 to 8. *Poinciana Gilliesii* Hook., *Erythrostemon Gilliesii* (Hook.) Link, Kl. & Otto. Widely cult. for its showy flowers, more commonly found as an escape in cen. and w. Tex. in dry habitats, May-Sept.; nat. of S. A.

2. *Caesalpinia mexicana* Gray. MEXICAN CAESALPINIA. Small tree; branches, leaves and inflorescence glabrous; stipules small, ovate, caducous; pinnae 5 to 9; leaflets 4 to 5 pairs, submembranous, ovate or oblong, 10-25 mm. long, reticulate-veined; inflorescence 10- to 30-flowered, 1-3 dm. long; pedicels 10-22 mm. long, jointed near the top; calyx segments oblong, pubescent, 6-10 mm. long; petals obovate, 9-13 mm. long, with stalked glands on their claws; stamens about as long as the petals; ovary pubescent, with stalked glands; pod oblong, acute, 5-6 cm. long, pubescent or glabrous, usually with glands (at least below the middle). Only in southernmost Tex. (Cameron and Hidalgo cos.) where it is frequently grown as an ornamental, Feb.-July; also Tam. to Sin. and s. to Gro.

3. *Caesalpinia phyllanthoides* Standl. Low slender shrub with glabrous branches; leaves 5-9 cm. long; pinnae 5 to 9, long-stalked; leaflets 2 to 3 pairs, 3-7 mm. long, 3-4.5 mm. wide, orbicular to ovate, subcoriaceous, with rather prominent veins beneath, glandless;

inflorescence few-flowered; pedicels finely puberulent, with scattered stalked glands; sepals 6-7 mm. long, puberulent, glandular or glandular-ciliate; petals obovate, 1 cm. long; stamens densely covered with thick hairs at base; fruit 25 mm. long, glabrous, with a few scattered dark glands; seeds 1 or 2. Rare, Live Oak and Jim Wells cos. in s. Tex., Mar.-Apr.; also Tam.

4. *Caesalpinia oxycarpa* (Gray) Fisher. Low suffrutescent plant 1-3 dm. high; branches rather densely pubescent, with stalked glands; stipules ovate, glandular; petiole and rachis pubescent and glandular; pinnae 5 to 11; leaflets 5 to 9 pairs, oblong, glabrous or puberulent at the margin, 3-5 mm. long; inflorescence 10-15 cm. long, 10- to 20-flowered, rather densely covered with stalked red glands; bracts ovate, pubescent, glandular, caducous; pedicels 1-3 mm. long; calyx lobes ovate, glandular; petals obovate, glandless or with a few glands; filaments pubescent below the middle; ovary densely covered with long-stalked red glands; pod falcate, acute, 2-3 cm. long, 6-8 mm. broad, pubescent, glandular; seeds 4 to 6. *Hoffmanseggia oxycarpa* Gray, *Larrea oxycarpa* (Gray) Britt. In rocky limestone habitats in s.w. Tex. (Maverick, Terrell and Val Verde cos.), Mar.-May; also Coah. and N. L. (Subsequent study reveals that this should be retained in *Hoffmanseggia*.)

5. *Caesalpinia Drummondii* (T. & G.) Fisher. Intricately branched shrublet 15-30 cm. high; the slender branches glabrous or somewhat puberulent, with a few scattered stalked glands; stipules ovate, entire or denticulate; pinnae 3; leaflets 4 or 5 pairs, oblong to obovate, 4 mm. long, 1 mm. broad, glabrous or somewhat puberulent, glandless or with a few stalked glands on the lower surface; calyx persistent; calyx lobes ovate, glabrous or long-ciliate, 3-4 mm. long, 1 mm. broad; inflorescence 10- to 20-flowered; pedicels 4-5 mm. long; petals broadly obovate, exerted, glandular at base; fruit lunate, broadest in the upper half, glabrous, glandular, 2 cm. long; seeds 1 or 2. *Hoffmanseggia Drummondii* T. & G., *Larrea Drummondii* (T. & G.) Britt. Rare in sandy-clay soil in s. Tex. (Atascosa, Bee, Goliad, Karnes and San Patricio cos.), Apr.-Sept.; also Tam.

6. *Caesalpinia texensis* (Fisher) Fisher. Intricately branched shrublet 1-2 dm. high; branches gray, finely pubescent, with many stalked glands; stipules ovate, entire or denticulate; pinnae 3; leaflets 4 or 5 pairs, oblong, 2 mm. long, less than 1 mm. broad, finely pubescent; calyx glandular, finely pubescent, persistent; calyx lobes linear, 3 mm. long, 1 mm. broad or less, with many stalked glands; inflorescence 2- to 10-flowered; pedicels 3-4 mm. long; petals 3-4 mm. long, enclosed in the calyx or slightly exerted, glandular at base; filaments short-pilose at base; pod lunate, broadest in the upper half, glabrous, glandular, 10-15 mm. long; seed 1. *Hoffmanseggia texensis* Fisher, *Larrea texensis* (Fisher) Britt. Rare in s. Tex. (collected once in 1829 "on the Nueces river," probably in McMullen Co.), May-July; also Tam. (Subsequent study places this in *C. Drummondii*.)

7. *Caesalpinia caudata* (Gray) Fisher. Low branched shrub 3-5 dm. high; pinnae 3 to 11, the lateral ones 2-4 cm. long and with 3 to 5 pairs of leaflets, the terminal one 4-10 cm. long and with 9 to 11 pairs of leaflets; leaflets broadly ovate, subcordate, acute, 2.5-12 mm. long, with conspicuous raised reticulate veins beneath; sepals 8-10 mm. long, imbricate, glandular, pubescent, deciduous; petals about twice as long as the sepals, densely covered with large yellow sessile glands on the outer surface; pod lunate, broadest in the upper half, short-tipped, with sessile and stalked glands, elastically dehiscent, 2-4 cm. long, 10-17 mm. broad; seeds 2 to 4. *Hoffmanseggia caudata* Gray, *Schrammia caudata* (Gray) Britt. & Rose. In loose sandy soil in s. Tex., Mar.-June; also N. L. and Tam.

8. *Caesalpinia Jamesii* (T. & G.) Fisher. Herbaceous from a suffrutescent base, with a 1-4 dm. long woody spindle-shaped root; stems 2-4 dm. high, appressed-pubescent, glandular; pinnae 5 to 7; leaflets 5 to 10 pairs, ovate to short-oblong, 4-5 mm. long, glabrous or puberulent above, pubescent and glandular beneath; inflorescence 5-10 cm. long, 5- to 15-flowered; calyx lobes linear-lanceolate, acute, pubescent, glandular, 5-6 mm. long; petals glandular, somewhat longer than the calyx; stamens shorter than the petals; pod lunate, broadest in the upper half, acute, with hairy emergences and sessile glands, 20-25 mm. long, about 8 mm. broad; seeds 2 or 3. *Hoffmanseggia Jamesii* T. & G., *Larrea Jamesii* (T. & G.) Britt. In dry sandy or alluvial soils in the Trans-Pecos and Plains Country, May-Sept.; widespread species in cen. and s.w. U. S. and Mex.

9. *Caesalpinia brachycarpa* (Gray) Fisher. Strongly branched shrublet with woody rootstock, 1-4 dm. high; branches glabrous or sparingly pubescent, with scattered stalked glands; stipules obovate, denticulate; pinnae 5 to 7; leaflets 3 to 6 pairs, elliptic, 3-6 mm.

long, glabrous or puberulent, with large sessile glands beneath; inflorescences 5-10 cm. long, 6- to 12-flowered; bracts obovate-oblong, 3-4 mm. long, lacerate, caducous; pedicels 3-5 mm. long; calyx 5-6 mm. long, pubescent, the lobes linear-lanceolate, glandular; petals somewhat longer than the calyx lobes; stamens shorter than the petals; pod ovate to short-oblong, acute, puberulent or short-pubescent, sparingly glandular, the margin with short hairy emergences; seeds 1 or 2. *Hoffmanseggia brachycarpa* Gray, *Larrea brachycarpa* (Gray) Britt. In gravelly or rocky limestone soil, restricted to Edwards Plateau (Crockett, Edwards and Kinney cos.), May-June; endemic.

10. *Caesalpinia atropunctata* Eifert. CAMOTE DEL RATON. Shrub 4-6 dm. high, much-branched; branches villous, glandular; stipules pinnatifid, 6-8 mm. long, purplish; pinnae 5 to 7; leaflets 3 to 5 pairs, elliptic to obovate, pubescent on both sides, with many orange sessile glands beneath; inflorescence 10-15 cm. long, pubescent, 10- to 15-flowered; bracts pinnatifid, purplish, caducous; pedicels 2-4 mm. long; calyx 5-6 mm. long, the lobes oblong, densely pubescent, glandular; petals somewhat longer than the sepals, dark-yellow; pod 20-25 mm. long, lunate, acute, broadest in the upper half, glandular, with hairy emergences; seeds 2 to 4. *Pomaria melanosticta* Schauer, *Hoffmanseggia melanosticta* (Schauer) Gray, *Caesalpinia melanosticta* (Schauer) Fisher, non Spreng. Rare, Rio Grande Plains, in sandy or rocky soil, Mar.-June; Tex. and Coah. to Hgo. and Qro.

A widespread variable species.

11. *Caesalpinia Parryi* (Fisher) Eifert. Shrub, 4-5 dm. high, densely villous; stipules pinnatifid, 2-3 mm. long; pinnae 3 to 5; leaflets 2 or 3 pairs, obovate, 4-10 mm. long, pubescent on both sides, glandular beneath; inflorescence 15-30 cm. long; 15- to 25-flowered; pedicels 3-4 mm. long; calyx about 8 mm. long, densely pubescent, glandular; petals somewhat longer than the sepals; pod with hairy emergences, glandular, obliquely oblong, 25 mm. long, about 1 cm. broad; seeds 3 or 4. *Hoffmanseggia melanosticta* var. *Parryi* Fisher, *Caesalpinia melanosticta* var. *Parryi* (Fisher) Fisher, *Hoffmanseggia Parryi* (Fisher) B. L. Turner. In rocky limestone soil, known in w. Tex. only from s. Brewster Co.; also in adj. Mex.

19. HOFFMANSEGGIA CAV.⁸⁶

RUSH-PEA

Unarmed perennial herbs, often very glandular; leaves oddly bipinnate; pinnae 5 to 11; leaflets 4 to 11 pairs, small; inflorescence a terminal raceme; bracts caducous; bracteoles absent; pedicels short, not jointed; calyx tube very short, its 5 segments valvate; petals 5, yellow, the uppermost dissimilar, with orange spots and stripes; stamens 10, free; filaments often glandular at the base; anthers uniform, longitudinally dehiscent; ovary sessile; ovules few to several; fruit flat, straight or falcate, often glandular, usually tardily dehiscent, its valves chartaceous; seeds 2 to 8, ovate, with little endosperm. *Larrea* Ort. The genus is sometimes included in *Caesalpinia*.

- 1. Peduncle and calyx with stalked glands; petals conspicuously clawed (the claw 4-6 mm. long), densely glandular1. *H. glauca*.
- 1. Peduncle and calyx without stalked glands (2)
- 2(1). Pinnae 7 to 11; inflorescence 5- to 10-flowered; pod 25-40 mm. long, strongly falcate2. *H. drepanocarpa*.
- 2. Pinnae 3 to 7; inflorescence 3- or 4-flowered; pod 12-15 mm. long, straight3. *H. tenella*.

1. *Hoffmanseggia glauca* (Ort.) Eifert. Stem 1-3 dm. high, glabrous or puberulent; stipules ovate; petiole and rachis glandular; pinnae 5 to 11; leaflets 5 to 11 pairs, oblong to obovate, glabrous or puberulent, 3-8 mm. long; inflorescence terminal, glandular, pubescent, 1-2 dm. long, 5- to 15-flowered; bracts ovate, caducous; pedicels 2-5 mm. long; calyx pubescent and glandular, its oblong lobes 6-7 mm. long; petals 10-12 mm. long, with long glandular claws; stamens shorter than the petals, glandular and pubescent; pod falcate, 2-4 cm. long, 5-8 mm. broad, glandular, glabrous or puberulent, reticulate-veined; seeds 4 to 8. *Hoffmanseggia falcata* Cav., *H. densiflora* Gray, *Larrea densiflora* (Gray) Britt. Common along roadsides in w. Tex., Mar.-Sept.; cen. and s.w. U. S. to Mex. and w. S. A. A highly variable species.

⁸⁶ Contributed by Imre J. Eifert. See Appendix.

2. *Hoffmanseggia drepanocarpa* Gray. SICKLEPOD RUSH-PEA. Stems 1-2 dm. high, glandless, finely pubescent; stipules ovate, acute; petiole and rachis finely pubescent; pinnae 7 to 11; leaflets 4 to 10 pairs, oblong, pubescent, glandless; inflorescence about 1 cm. long, 5- to 10-flowered; pedicels 2-5 mm. long; calyx lobes oblong, pubescent, persistent, 5-8 mm. long; petals somewhat longer than the calyx, short-clawed; pod puberulent, reticulate-veined, 2-4 cm. long, strongly falcate, curved into part of a circle, rounded at both ends; seeds 6 to 11. *Caesalpinia drepanocarpa* (Gray) Fisher, *Larrea drepanocarpa* (Gray) Britt. In sandy or limestone soils in w. Tex., Apr.-July; s.w. U. S. and n.-cen. Mex.

3. *Hoffmanseggia tenella* Tharp & L. O. Wms. Stem 8-15 cm. high, terminated by a 3- to 5-flowered raceme; pinnae 3 to 7, sparingly soft-pubescent; petiole 5-13 cm. long; stipules small, 1-2 mm. long; leaflets 5 or 6 pairs, oblong, 2-4 mm. long, 1-2 mm. broad, glabrous above, sparingly pubescent beneath; calyx 4 mm. long, its lobes linear-oblong, finely but densely pubescent; petals obovate, with a very short claw, 3-4 mm. long, 1.5-2 mm. broad; filaments with a few short hairs; pod 12-15 mm. long, 4-6 mm. broad, straight, finely and rather densely pubescent, glandless; seeds 2 to 4. Known only from Nueces and Kleberg cos., Apr.-Nov.; endemic.

20. SOPHORA L.

Perennial herbs or unarmed deciduous or evergreen shrubs or small trees; leaves alternate, once-imparipinnately-compound; stipules minute, deciduous; flowers in terminal or axillary usually densely flowered racemes several cm. long; calyx of 5 sepals united above the floral cup; corolla white, yellow, bluish-purple or rosy-pink, strongly bilaterally symmetrical and papilionaceous, the banner external in bud; stamens 10, the filaments free above the top of the floral cup; fruit a 1- to several-seeded indehiscent or very tardily dehiscent woody or fleshy pod which is usually strongly constricted between the seeds and essentially as thick as broad.

A very heterogeneous genus of about 70 species in the warmer parts of the world.

1. Plants herbaceous, 6 dm. tall or lower1. *S. Nuttalliana*.
1. Plants woody shrubs or small trees (2)
- 2(1). Leaves densely and conspicuously pubescent; flowers bright-yellow; plants of coastal southernmost Texas5. *S. tomentosa*.
2. Leaves glabrous or slightly pubescent at maturity; flowers white to rosy to purplish (3)
- 3(2). Leaves (well-developed ones) with 13 to 17 leaflets; flowers white to rosy-pink; fruit black at maturity, 8 mm. thick or less; leaves deciduous4. *S. affinis*.
3. Leaves with 5 to 11 (13) leaflets; flowers violet-blue to purplish; leaflets coriaceous, thickened; fruit grayish to brown, 11 mm. thick or more; leaves persisting through the winter (evergreen); flowers bluish-purple (4)
- 4(3). Leaflets 17 mm. broad or broader, glabrous above; inflorescence 5-15 cm. long2. *S. secundiflora*.
4. Leaflets 10-15 mm. broad, the upper surface somewhat pubescent; only in Guadalupe Mts. in Trans-Pecos Texas3. *S. formosa*.

1. *Sophora Nuttalliana* B. L. Turner. WHITE LOCO. Perennial herb usually only 3-5 dm. tall, the aerial shoots forming colonies by means of rhizomes; herbage grayish-silky-pubescent; flowers in slender racemes, pure-white. *S. sericea* Nutt., an illegit. name. Frequent in grama grasslands in the higher parts of the Plains Country and the Trans-Pecos mts. and High Plains, spring; S. D. to Ariz., N.M. and Tex.

The plants are often mistaken for species of *Astragalus* but can readily be excluded from that genus by the separate stamens.

2. *Sophora secundiflora* (Ort.) DC. TEXAS MOUNTAIN LAUREL, MESCAL BEAN, FRIJOLILLO. Evergreen shrub 5-35 dm. tall, with usually dense dark-green glossy foliage; leaflets very firm, 5 to 11 (to 13) per leaf, often 17 mm. broad or broader and glabrous above; racemes 5-15 cm. long, 5-10 cm. broad, bluish-purple and very showy, the individual flowers 1-2 cm. long, the banner external to the others in bud; fruit woody, 2-12 cm. long, 11 mm. thick or thicker, only moderately constricted between the seeds; seeds red. Fre-

quent in brushy vegetation, s. edge of Edwards Plateau (n. to Travis Co.) and caliche cuestas in Rio Grande Plains, scattered in w. part of Edwards Plateau and Trans-Pecos mts., isolated records from Cameron Co., spring; Tex. and N.M. s. in the mts. to S.L.P.

Cultivated for the beautiful evergreen foliage and showy flowers. The red seeds are made into jewelry. The flowers and seeds are said to contain poisonous compound(s).

3. *Sophora formosa* Kear. & Peeb. Shrub 1-2 m. tall, much like *S. secundiflora* but the leaflets narrower and the upper surfaces somewhat pubescent and not glossy. Rare in scattered mts. of Ariz., N.M. and known from one record from the Guadalupe Mts. in Trans-Pecos Tex. Probably only a western race of *S. secundiflora*.

4. *Sophora affinis* T. & G. EVE'S NECKLACE. Shrub 2-5 m. tall or occasionally a tree to 10 m. high; foliage deciduous, at least when young sericeous-pubescent; leaflets 13 to 17 per leaf; flowers in racemes 3-10 cm. long, whitish or rosy-pink; fruit 3-15 cm. long, black, leathery, 8 mm. thick or narrower, strongly torulose. Limestone soils, Edwards Plateau and n.-cen. Tex. spring; Okla., Ark., La. and Tex. The seeds are said to contain poisonous substance(s).

5. *Sophora tomentosa* L. YELLOW SOPHORA. Rounded shrub about 1 m. tall (in our latitudes often freezing back in winter time and behaving as subshrubs); foliage densely pubescent, grayish; flowers in terminal racemes, bright-yellow. Infrequent near and along the coast in s. Tex. as far n. as Aransas Co., Mar.-Oct.; widely distributed along warm coastal areas of the world.

21. BAPTISIA VENT.⁸⁷

WILD INDIGO

Perennial herbs from deeply buried large rootstocks; stems stout (often 4-8 mm. thick at base), usually solitary at ground level, bushy-branched higher up; leaves alternate, palmately 3-foliolate, either sessile or petiolate, with large to obsolescent persistent or caducous stipules; leaflets usually narrowly obovate to oblanceolate, usually cuneate at base and rounded (rarely acute) at apex, entire, firm; flowers in terminal or axillary few-to many-flowered racemes; calyx campanulate, often somewhat bilabiate, 5-lobed (or by fusion of upper 2 lobes becoming 4-lobed), the lobes usually shorter than the tube; corolla papilionaceous, usually about 2 cm. long, white or yellow (rarely bluish); stamens free; fruit usually a 2- to many-seeded very tardily dehiscent (or perhaps in some cases indehiscent) beaked pod.

A genus of perhaps 25 species of eastern United States. Taxonomic difficulties in the genus arise because of past and perhaps continuing hybridization and introgression; the descriptions below are intended in the main to reflect the more or less genetically "pure" species, but many plants will be found which exhibit combinations of the characters of 2 or more species. Some species of the genus have been reported to be toxic to livestock.

- 1. Flower pedicels at maturity 15-35 mm. long; bracts of the racemes persisting 2. *B. leucophaea*.
- 1. Flower pedicels 10 mm. long or shorter; bracts of the raceme early deciduous (2)
- 2(1). Flowers blue; stipules broad and conspicuous, most of them persisting, 10 mm. long or longer 5. *B. australis*.
- 2. Flowers yellow or white; stipules lanceolate, deciduous or much-reduced, 0.5-5 mm. long (3)
- 3(2). Petioles of mature lower leaves slender, (3-) 5-12 mm. long; flowers white 3. *B. leucantha*.
- 3. Petioles short and broad, 0.5-5 (-10) mm. long; flowers yellow (4)
- 4(3). Stems glabrous to occasionally pubescent; flowers in terminal racemes 4. *B. sphaerocarpa*.
- 4. Stems densely short-pubescent; flowers either all axillary or both axillary and terminal 1. *B. Nuttalliana*.

1. *Baptisia Nuttalliana* Small. Stems 4-12 dm. tall, densely short-pubescent at least on the younger parts; petioles absent or to 1 mm. long; leaflets 25-35 mm. long, 13-20 mm. broad; stipules deltoid to setaceous, usually caducous, very small; flowers solitary in upper

⁸⁷ This treatment is based in part on unpublished monographic work of B. L. Turner.

axils or forming short terminal racemes; bracts of raceme 2-4 mm. long, caducous; pedicels 2-5 mm. long; calyx tube 7-9 mm. long; corolla yellow, the banner 8-15 mm. long; pod villous to glabrate, subglobose to ovoid, 4-13 mm. long, 2-11 mm. thick, the short beak recurved. Frequent in woodlands on sandy loam, e. and n.-cen. Tex., spring; Miss., La., Ark., Mo., Okla. and Tex. Occasionally hybridizes with *B. leucophaea*.

2. *Baptisia leucophaea* Nutt. PLAINS WILD INDIGO. Stems 3-8 dm. tall; petioles 2-4 mm. long or less; leaflets 3-10 cm. long; stipules large, 1-4 cm. long, ovate-lanceolate, persistent; racemes 10-25 cm. long, many-flowered, secund, declined; floral bracts ovate- to cordate-lanceolate, 1-3 cm. long, persistent; pedicels about 15-35 mm. long at maturity; calyx tube 1 cm. long, the lobes 3-5 mm. long; corolla white or yellow, the banner about 20-22 mm. long; pod 3-5 cm. long, 15-25 mm. thick, with a slender beak. E. half of state in sandy soils, spring; represented with us by 2 intergrading varieties as follows:

Var. *leucophaea*. Leaflets predominantly narrow-spatulate, obtuse, rounded or gradually narrowed into an acute apex, mostly 10-35 mm. broad. N.e. and n. part of n.-cen. Tex.; Ark., Okla. and Tex., n.e. to N. E. and Wisc.

Var. *laevicaulis* Canby. Leaflets predominantly ovate-rhombic to obovate-cuneate, broadly acute or abruptly obtuse at apex, mostly 20-25 mm. broad. *B. laevicaulis* (Canby) Small. S. parts of e. and s.e. Tex. and s. along the coast to Willacy and Cameron cos.; also La.

3. *Baptisia leucantha* T. & G. Stems 15-20 dm. tall; petioles (3-) 5-12 mm. long or upper (miniature) leaves often nearly sessile; leaflets 25-65 mm. long, 15-30 mm. broad; stipules lanceolate, usually about 5 mm. long or less, mostly caducous; racemes 2-6 dm. long; pedicels 3-10 mm. long; floral bracts caducous; calyx tube 7-9 mm. long, the lobes a third to half as long as tube; corolla white, the banner 13-15 mm. long and white with purple splotches; pod 25-40 mm. long, short-beaked. Rare in pine and oak woodlands on sandy soil, e. and s.e. Tex., Apr.-June; most of e. U. S.

4. *Baptisia sphaerocarpa* Nutt. Plant 1 m. high or less; stems usually glabrate; petioles 0.5-10 mm. long; stipules minute, to 5 mm. long, caducous; leaflets 3 on lower leaves, often reduced to 2 or 1 on upper leaves, broadly oblanceolate to obovate or often broadly elliptic, 25-80 mm. long; racemes terminal and 2-3 dm. long or lateral and 15-25 cm. long; flowers numerous; pedicels 2-10 mm. long; floral bracts caducous; calyx tube 4-10 mm. long; corolla yellow, the banner 10-18 mm. long; pod 12-18 mm. long, with beak 3-13 mm. long. *B. viridis* Larisey. Frequent in loamy soils, e., s.e. and n.-cen. Tex., Apr.-May; Mo., Ark., Okla., La. and Tex.

5. *Baptisia australis* (L.) R. Br. WILD BLUE INDIGO. Stems 6-12 dm. tall, glabrous, more or less glaucous; petioles 2-4 mm. long; leaflets obovate to obovate-lanceolate, 4-8 cm. long, 15-30 mm. broad; stipules lanceolate, 10-15 mm. long, usually persistent; racemes terminal, 2-5 cm. long; bracts 7-9 mm. long, caducous; pedicels 5-8 mm. long; calyx tube 9-10 mm. long; corolla blue, the banner about 22 mm. long; pod 3-6 cm. long. *B. minor* Lehm. Infrequent, n.-cen. Tex., with an outlying station in Childress Co. in the Plains Country, Apr.-May; the species as a whole in n.e. and cen. U. S.

22. CROTALARIA L. RATTLEPOD

Annual or perennial herbs with taproots; leaves simple or trifoliate, alternate; stipules usually small; flowers in terminal or axillary racemes; each pedicel with a small or large bract at the base and with a pair of bractlets near the upper end; calyx gamosepalous, the tube often obliquely campanulate, the lobes often free and often subequal; corolla usually somewhat exceeding the calyx, papilionaceous, yellow (the banner often with red diffused in the yellow); banner orbicular to ovate, longer than the wings or keel, external in bud; wings oblong; keel often scythe-shaped, sometimes beaked; stamens 10, monadelphous; ovary nearly sessile, less commonly short-stiped; legume greatly inflated, typically several to many-seeded, a few cm. long, globose to oblong or cylindrical.

A genus of perhaps 300 species of the warmer parts of the world, most numerous in Africa.

1. Leaves trifoliate (2)
1. Leaves simple (3)

- 2(1). Legume densely tomentose with spreading hairs; petioles with wide-spreading hairs 1-3 mm. long1. *C. incana*.
2. Legume appressed-pubescent to nearly glabrate; petioles glabrate or with appressed hairs 1 mm. long or less2. *C. pumila*.
- 3(1). Leaves (the larger ones) 20 mm. wide or more; cultivated species (4)
3. Leaves 15 mm. wide or less; native species (5)
- 4(3). Stipules minute, setaceous or absent; inflorescence without bracts or the small bracts subulate3. *C. retusa*.
4. Stipules broad, ovate, conspicuous; inflorescence with conspicuous ovate bracts
.....4. *C. spectabilis*.
- 5(3). Pubescence on calyx and stem mostly of spreading hairs 1-2 mm. long
.....5. *C. sagittalis*.
5. Pubescence of appressed hairs 0.3-1 mm. long6. *C. Purshii*.

1. *Crotalaria incana* L. CHIFLÍN. Taprooted annual (occasionally overwintering!) 3-10 dm. tall; stipules small, setaceous, caducous; leaflets uniformly 3, ovate to obovate or orbicular, 15-40 cm. long, 10-25 mm. broad, pubescent beneath or glabrescent; petiole longer than the terminal leaflet, with wide-spreading hairs 1-3 mm. long; inflorescence long, terminal or subterminal or lateral, 5- to many-flowered; bracts setaceous; calyx very deeply lobed, the tube almost lacking; calyx lobes almost linear, acuminate, about 1 cm. long; corolla yellow to brownish-yellow (the banner often slightly reddish); legume densely tomentose with spreading brownish hairs, not attenuate basally, sessile, pendulous, 25-35 mm. long. Sandy soils, coastal s. Tex., very local, Mar.-Sept.; trop. Am., H.I., Phil., Java, India, Afr.; probably originally nat. to Am.

2. *Crotalaria pumila* Ort. Annual or perennial, erect or decumbent, 4-30 cm. tall; stipules minute, setaceous, caducous; petioles glabrate or with appressed hairs 1 mm. long or shorter; leaflets uniformly 3 per leaf, narrowly obovate to oblong, 7-35 mm. long; inflorescence longish, terminal or subterminal or lateral, usually 1- to 5-flowered; calyx lobes shorter than to about as long as the tube, the lobes about half as long as the corolla; corolla yellow; keel bent at a sharp right angle, its beak attenuate, 6-11 mm. long; back of the banner pubescent apically; legume 12-15 mm. long, puberulent, almost sessile, yellowish. Infrequent in high grama grasslands, Trans-Pecos mts., Aug.-Sept.; Fla., s.w. U.S., Mex., Guat., Br. Hond., W.I. and S. A.

3. *Crotalaria retusa* L. Erect annual herb 3-9 dm. tall, the stems not flexuous; leaves uniformly simple, obovate, 3-8 cm. long, 10-15 (-20) mm. broad, glabrous above, short-pubescent beneath, not margined or recurved; stipules minute, setaceous or absent; bracts minute, linear to subulate or nearly absent, caducous; inflorescence a simple terminal raceme 1-2 (-3) dm. long; calyx lobes broadly ovate, slightly pubescent; calyx tube campanulate, broadly truncate basally; corolla yellow or yellowish-red; banner 20-25 mm. long, its back glabrous (or pubescent only on the midvein); keel rounded, about half as long as banner; legume elongate, stipitate, many-seeded, not enclosed by the calyx, more or less cylindrical, 2.5-4 (-5) cm. long and 1 cm. thick, glabrous. Probably not a persistent member of our flora, occasionally escaped from cult. (one report from Tarrant Co.); Afr., Asia, Austral., C.A., W.I., rarely s.e. U. S.

4. *Crotalaria spectabilis* Roth. SHOWY CROTALARIA. Erect taprooted annual; stems not flexuous, 5-10 (-20) dm. tall, puberulent to glabrous; leaves uniformly simple, obovate, basally cuneate, 5-15 (-20) cm. long or the upper ones smaller; stipules broad, ovate, conspicuous, persistent; bracts conspicuous, ovate; racemes clustered near the top of the stem, terminal or axillary, 15-50 cm. long; pedicels (5-) 10-20 mm. long; calyx essentially glabrous, glaucous; corolla yellow; banner 15-25 mm. long, its back glabrous or pubescent only along the primary vein; keel much shorter than banner, densely pubescent along the suture; legume elongate, stipitate, many-seeded, 3-5 cm. long, oblong but broadening apically, wide-spreading or drooping. Probably not a persistent member of our flora, escaping from cult. at scattered places, e. half of Tex., spring-fall; Old World trop., scattered in New World trop.

5. *Crotalaria sagittalis* L. Annual or short-lived perennial, the pubescence spreading-hirsute; stems ascending, 1-5 dm. tall; leaves all simple, lanceolate or linear to elliptic,

3-8 cm. long; 8-15 mm. broad; stipules usually present, triangular, very narrowly decurrent on the stems for about half the length of the internode; racemes 2- to 4-flowered; bracts ovate-lanceolate, slender-stalked; floral cup about 2 mm. long; calyx with spreading hairs, 1-2 mm. long, the unequal lobes lanceolate to linear; corolla about as long as the calyx, yellow; pod oblong, glabrous, 20-35 (-40) mm. long, about 1 cm. thick. *C. fruticosa* Mill. Sandy soils, e. half of Tex., w. to Parker, Bastrop and Wilson cos., Apr.-Sept.; e. and cen. U.S., Mex., C. A., W.I. and S. A.

6. *Crotalaria Purshii* DC. Erect perennial herb; taproot woody; stems 2-4 (-5) dm. tall; pubescence appressed, sericeous, the hairs 0.3-1 mm. long; leaves all simple, lanceolate to linear, 3-6 (-8) cm. long, usually 4-10 mm. broad, tapering to the base; stipules usually present, decurrent narrowly on the stem, often at least half the length of the internode; racemes usually with (2 to) 4 to 6 flowers; floral cup about 2 mm. high; calyx above the floral cup 7-9 mm. long, strigose; corolla yellow; pod glabrous, oblong, 25-40 cm. long, about 1 cm. thick. Reported to occur in scattered localities, e. half of Tex., but probably on the basis of misdetermined specimens of *C. sagittalis*; s.e. U.S., Mex. and Guat.

23. LUPINUS L. BLUEBONNET

Biennials or winter annuals (or perennial herbs in *L. plattensis*), forming rosettes in the fall, flowering the next spring; taproots slender; leaves alternate, palmately compound with 3 to 10 leaflets; leaflets mostly narrowly obovate to oblanceolate, long-tapered to the base, apically rounded or truncate to acute at apex, often with rather dense sericeous pubescence (at least on the lower surface); petioles well-developed; stipules adnate to the base of the petiole; flowers in conspicuous terminal racemes, papilionaceous, each flower mostly blue or lavender but with some areas of white and maroon on some of the petals, never yellow; calyx 2-lipped, the lips nearly entire and the lower 1 longer; banner external to the other petals in bud; stamens 10, monadelphous, dimorphic, the longer with more or less globose versatile anthers, the shorter with linear basifixed anthers; ovary sessile; legume oblong or broadly linear, flattened, 2- to 12-seeded, usually sericeous-pubescent; seeds pebblelike.

A genus of perhaps 200 species in the temperate regions of both hemispheres (not Africa or Australia).

1. Pubescence of stem and petioles spreading at right angles; leaflets long-hairy on both surfaces; plants mostly 15 cm. high or less, rarely to 25 cm.; in Trans-Pecos Texas1. *L. concinnus*.
1. Pubescence of stem and petioles predominantly ascending or appressed; leaflets sparsely hairy or glabrous on upper surface (2)
- 2(1). Racemes (including peduncle) 18-45 cm. long; wing petals 10-12 mm. long, 5-7 mm. wide; banner with creamy or yellowish eye; in Trans-Pecos Texas 2. *L. Hvardii*.
2. Racemes 6-25 cm. long; wing petals 7-10 mm. long (often 12 mm. in *L. plattensis*); banner with bright white eye; in Panhandle, central and east Texas (except *L. texensis* cultivated or occasionally introduced along roadsides in Trans-Pecos Texas and *L. plattensis* in Panhandle) (3)
- 3(2). Leaves with predominately 7 to 10 (very rarely 6 or 5) leaflets; perennial herb to about 5 dm. high 5. *L. plattensis*.
3. Leaves with predominately 5 or 6 (very rarely 7) leaflets; winter annual herbs (4)
- 4(3). Wing petals on fresh flowers inflated, cheeklike in front view, light blue; pubescence of flower buds and mature pod yellowish-gray or brown; tip of incompletely expanded raceme rounded, not very conspicuous from a distance; leaflets mostly obtuse or broadly rounded at apex, usually some truncate at apex and cuneate below; plants occurring in sandy or sandy-clay soils of oak and pine areas 3. *L. subcarnosus*.
4. Wing petals on fresh flowers not inflated, nearly straight in front view, dark blue (except for occasional albinos); pubescence of flower buds and mature pod silvery or white; tip of incompletely expanded raceme white, pointed or acute, conspicuous from a distance; leaflets mostly acute to obtuse at apex, not truncate nor cuneate;

plants occurring in calcareous, gravelly or sandy-clay soils but often growing in sand along roadways 4. *L. texensis*.

1. *Lupinus concinnus* Agardh. ANNUAL LUPINE. Winter annual, simple or much-branched from the base, 4-15 (-25) cm. tall, densely villous, the spreading hairs 1-3 mm. long; leaves numerous, very villous, the petioles 2 to 4 times as long as the longest leaflets; leaflets 5 to 8, oblanceolate with obtuse apices, 1-2 cm. long, 2-5 mm. broad, with a pubescence of long spreading hairs on both surfaces; racemes nearly sessile, 3-6 cm. long, surpassed by the leaves; flowers 7-9 mm. long, usually well-scattered; pedicels about 1 mm. long; calyx upper lip bifid, about 4 mm. long, the lower lip 3-toothed and somewhat longer; petals edged with rich reddish-purple; banner 7-9 mm. long, 4-5 mm. broad, rounded or emarginate apically, white centrally, the lateral portions lavender; wings 7-8 mm. long, about 3 mm. broad, lavender-tipped; keel usually straight, 6-7 mm. long, about 2 mm. broad, naked, often red-tipped; pods oblong, 10-15 mm. long; seeds 2 to 4, 2-3 mm. long, angled, nearly square, mostly dull-spotted on a pale background. Infrequent in local populations, grama grasslands in the Trans-Pecos above 4,500 ft. elev., spring; s.w. U.S. and n.w. Mex.

2. *Lupinus Havardii* Wats. CHISOS BLUEBONNET. Erect winter annual, (2-) 3-8 dm. tall, averaging much taller than most of our other bluebonnets, with more vigorous ascending branches; herbage with silky appressed or ascending (not spreading) pubescence; leaflets usually 7, oblanceolate, glabrous on the upper surface, 8-20 mm. long or larger; raceme (including peduncle) 18-45 cm. long, the pedicels equaling or exceeding their calyxes at anthesis; calyx narrow, slightly gibbous; petals about 12 mm. long, purple-blue with a pale spot on the banner; banner with a creamy-white center-spot, becoming yellow and finally red with age; legume narrowly linear, 24-36 mm. long, about 4 mm. broad; seeds 6 to 8, nearly square, the maximum diameter 3-3.5 mm. Frequent in deserts, usually in alluvium or fine talus, s. parts of Hudspeth, Presidio and Brewster cos. in the Trans-Pecos, spring; also Chih.

3. *Lupinus subcarnosus* Hook. TEXAS BLUEBONNET. Winter annual, mostly branched at the base, the branches more or less decumbent, entire plant 15-40 cm. tall, subappressed-silky-pubescent, often with some spreading hairs; leaves several, very silky below and on the margins, glabrous or nearly so above; petioles fully twice as long as their longest leaflets; leaflets usually 5 (or 6), very rarely 7, oblanceolate, apically rounded to occasionally truncate or obtuse, the lower leaves sometimes with more fleshy obovate leaflets, 12-25 mm. long, 6-12 mm. broad; peduncles 3-8 cm. long, erect; racemes 6-12 cm. long, several-flowered; tip of the bracts 5-6 mm. long, lanceolate, deciduous; incompletely expanded raceme rounded, not very conspicuous from a distance; flowers 10-13 mm. long, crowded; pubescence of flower-buds and mature pod yellowish-gray or faintly brownish-gray; pedicels 3-6 mm. long; calyx 5-6 mm. long, its upper lip bifid and 4-5 mm. long, its lower lip entire or acutely 3-toothed and about 5-6 mm. long; petals broad, bright-blue; banner with white center that may turn purplish with age, suborbicular, 11-13 mm. long, 9-13 mm. broad; wings 10-11 mm. long, 6-7 mm. broad, in fresh flowers inflated and cheeklike in front view; keel nonciliate, the usually slender point sharply upturned; pods silky, 25-35 mm. long, 6-8 mm. broad, stout and at maturity somewhat constricted between the large seeds; seeds 4 or 5, gray or tawny, unmarked or obscurely spotted, about 5 mm. broad. Locally abundant in loose deep fine sandy loam or podsol, s.-cen. Tex. from Leon Co. s.w. to LaSalle Co. and in scattered populations to n. Hidalgo Co., scattered in some areas by humans but rarely persisting (e.g., in Orange Co.), spring; endemic.

This species is named by law as the State Flower of Texas.

4. *Lupinus texensis* Hook. TEXAS BLUEBONNET. Very similar to *L. subcarnosus* but from a distance the half-mature raceme appearing slightly thicker and more crowded, the tip portion silvery white (owing to bud-pubescence) and pointed or acute, conspicuous and showy; leaflets usually more acute apically; calyx slightly larger on the average (6-8 mm.); wing petals on fresh flowers not inflated, nearly straight in front view, dark-blue (except for occasional albinos). Widespread in usually calcareous soils, in a N.-S zone through Tex., w. to Taylor, Tom Green and Val Verde cos., e. to Fannin, Kaufman, Leon and Washington cos., spring; endemic.

This is the species that is widely spread by our highway department, garden clubs and

other such organizations. Because of its apparent unpalatability to grazing animals and the prevalent practice of abusive overstocking of ranges where it grows, the species is greatly increasing in numbers and distribution.

5. *Lupinus plattensis* Wats. Perennial erect herb to about 5 dm. tall; leaflets usually more than 6 per leaf. Rare in dunes of higher parts of the Plains Country (Hartley Co.), Apr.-May; w.-cen. U.S., s. to Okla. and Tex.

24. GENISTIDIUM I. M. JOHNST.

A monotypic genus of the Chihuahuan Desert.

1. *Genistidium dumosum* I. M. Johnst. Shrub 25-50 cm. or more tall, erect, rounded, much-branched, unarmed; branchlets rigid, slender, strigose; leaves alternate, pinnately trifoliolate, densely strigose; leaflets oblanceolate, 5-18 mm. long, firm, apically acute, the terminal one petiolulate and larger than the 2 lateral ones, petioles 1-4 mm. long; stipules subulate, 1-1.5 mm. long; flowers in axillary racemes; pedicels 2-3 mm. long; calyx campanulate, basally more or less oblique, with a tube 2.5-3 mm. long, sparsely strigose, more or less 2-lipped, the lips about 3 mm. long and longer than the tube, the upper one connate high up; banner yellow or reddish, with a greenish eyespot, the blade suborbicular and about 8 mm. broad, the claw about 3 mm. long; wings yellow or reddish, lunate-oblong, the curved claw 4 mm. long and to 0.8 mm. broad, the blade 6 mm. long and near the middle 2.5 mm. broad, 1-2 mm. longer than the keel; keel whitish, the claws 3.8 mm. long and blade 4.5 mm. long and 2.8 mm. broad; stamens 10, 9 with filaments coalescent and the tenth (upper) one free; anthers all alike; ovules 4 to 6; pod straight, when immature 20-25 mm. long, about 4 mm. broad, coriaceous, dry and dehiscent. Exceedingly rare, known only from 1 or 2 plants on very dry limestone hills between Terlingua and Lajitas, s. Brewster Co. in the Trans-Pecos, June-Sept.; also 1 locality in Coah.

25. MEDICAGO L.

BUR-CLOVER. MEDICK

Annual, biennial or perennial herbs, taprooted, 3-10 cm. tall; leaves alternate, pinnately trifoliolate; leaflets cuneate to obovate or nearly orbicular, the distal margin serrulate; stipules partially fused to the base of the petiole; flowers papilionaceous, solitary or in very short few-flowered axillary clusters, or in crowded spikelike racemes in the upper axils; calyx campanulate, the lobes almost equal; corolla yellow or in one species violet-blue, 2-12 mm. long; banner obovate to oblong; wings oblong; keel obtuse; stamens 10, diadelphous, 9 filaments coalescent, the tenth (upper) free from the rest; fruit arching or slightly curved to strongly spirally coiled, usually indehiscent, smooth or prickly; seeds 1 to several.

A genus of about 120 species of temperate regions of the Old World, some of the species widely cultivated and introduced in America.

1. Flowers (6-) 7-12 mm. long, violet-blue (rarely white); plant perennial 1. *M. sativa*.
1. Flowers 2-5 mm. long, yellow; plant annual or biennial (2)
- 2(1). Stipules acuminate, slightly dentate to entire along the margin; leaves, stems, stipules and calyxes more or less pubescent (3)
2. Stipules deeply divided, very conspicuously lacerate; plant essentially glabrous except for occasional stem pubescence (4)
- 3(2). Fruit a prickleless or nearly prickleless black or dark-brown pod at maturity; flowers 1.5-2 mm. long 2. *M. lupulina*.
3. Fruit a prickly coiled pod (bur) at maturity; flowers 2.5-4 mm. long 3. *M. minima*.
- 4(2). Fruit a tightly coiled prickleless flattened pod, 10-15 mm. in diameter at maturity; flower pedicels 2-3 mm. long; stipules divided to the midrib 4. *M. orbicularis*.
4. Fruit a loosely curled barrel-shaped pod, 4-7 mm. in diameter; flower pedicels 0.5-2 mm. long; stipules deeply divided but arising from a distinct membranous base (5)

5(4). Stipules mostly divided deeply beyond the middle (individual stipule lacerations mostly 2-6 mm. long); leaflets mostly longer than wide, without a central spot5. *M. polymorpha* var.

vulgaris.

5. Stipules not divided beyond the middle (individual stipule lacerations mostly 0.5-2 mm. long); leaflets as broad as long or broader, usually with a central purple spot6. *M. arabica*.

1. *Medicago sativa* L. ALFALFA. Perennial herb 3-10 dm. tall; leaflets 1-3 cm. long, 3-8 mm. broad, obovate to oblong or oblanceolate; stipules (5-) 8-15 (-20) mm. long, usually fused to the petiole for the basal 2-5 mm.; peduncles 1-3 cm. long in the upper axils; racemes crowded, 1-4 cm. long, 1-2 cm. thick, with 10 to 20 (to 30) flowers; petals 7-12 mm. long, violet-blue; pod loosely and spirally coiled in 1 or 2 turns, the coils about 4-5 mm. in diameter, prickleless. Widespread as an escape along roadsides and in abandoned fields (apparently absent only from Rio Grande Plains and Coastal Bend region), Apr.-July; nat. of Eur., now very widely distributed as a forage crop and a weed.

2. *Medicago lupulina* L. BLACK MEDICK. Annual; stems and branches usually decumbent, 1-4 (-6) dm. long, usually pubescent; leaflets broadly obovate or nearly orbicular to almost elliptical, pubescent, 1-2 cm. long, 3-10 mm. broad; stipules lanceolate to ovate-lanceolate, 5-10 mm. long, adnate to the petiole for about 2-3 mm.; peduncles 5-40 mm. long, axillary, slender; racemes very compact, 10- to 50-flowered, about 7-10 mm. long; petals 1.5-2 mm. long, yellow; pod dark-brown or nearly black at maturity, making one partial revolution, vaguely reniform, prickleless, 2-3 mm. in diameter; seed solitary. Scattered and weedy in the e. half of Tex., spring; nat. of Euras., now widely introd.

3. *Medicago minima* (L.) L. SMALL BUR-CLOVER. Annual; stems decumbent to erect, softly and densely spreading-pubescent, 1-3 (-5) dm. long; leaflets obovate to cuneate-oblong, mostly 5-10 (-15) mm. long; stipules ovate-lanceolate, entire or short-toothed, 4-7 mm. long; peduncles 10-25 mm. long, axillary, slender; racemes capitate, with (1 to) 3 to 5 (to 8) flowers; petals 2.5-4 mm. long, yellow; pod almost globose, coiled, with nearly straight flexible prickles 2-3 mm. long (each prickle hooked at the very tip), including the prickles 5-12 mm. in diameter. Frequent in n.-cen. Tex. and e. edge of Edwards Plateau, rare farther e., spring; nat. of Euras., now widely introd.

4. *Medicago orbicularis* (L.) Bartal. BURTON CLOVER. Annual; stems decumbent to ascending, 1-5 dm. long, essentially glabrous or with occasional pubescence; leaflets obovate to obcordate or rhombic, 8-18 mm. long, 5-10 mm. broad; stipules deeply divided nearly to the midrib, conspicuously lacerate, mostly less than 1 cm. long; peduncles mostly 1-2 cm. long, arcuate; pedicels 2-3 mm. long; flowers 1 to 5 per peduncle; petals about 3 mm. long, yellow; pod prickleless, flattened and tightly coiled into 4 to 6 spirals, the coils 1-2 cm. in diameter, glabrous, strongly reticulate. Infrequent, scattered in n.-cen. Tex. and e. part of Plains Country, spring; nat. of Medit. area, now widely introd.

5. *Medicago polymorpha* L. var. *vulgaris* (Benth.) Shinn. BUR-CLOVER. Annual; stems 5-50 dm. long, decumbent to ascending, puberulent or usually essentially glabrate; leaflets cuneate-obovate to obcordate, 6-15 mm. long, mostly longer than broad; stipules 6-10 mm. long, at least those of the distal leaves deeply incised, the individual lobes 2-6 mm. long; peduncles 1-3 cm. long; pedicels 0.5-1 mm. long; flowers (1 to) 3 to 5 (to 8) per head; petals 2.5-4 mm. long, yellow; pod with 2 rows of flexible prickles (2-3 mm. long) which are straight except for the hooked tip, spirally coiled 2 to 5 times, the coils 4-6 mm. in diameter (excluding prickles). *M. hispida* Gaertn. Widespread in the e. half of Tex. rare in w. half, a common lawn weed, spring; nat. to Old World, now widely introd.

6. *Medicago arabica* (L.) Huds. SPOTTED BUR-CLOVER. Annual; stems 1-6 dm. long, ascending to decumbent, usually essentially glabrous; leaflets obovate to obcordate, about as broad as long or broader, usually with a purplish central spot, 10-25 mm. long; stipules ovate-lanceolate, mostly 5-10 mm. long, incised but the lobes less than half the total length (about 0.5-2 mm. long); peduncles mostly 10-25 mm. long; pedicels 0.2-0.5 (-1) mm. long; flowers 1 to 5 per head; petals about 4-5 mm. long, yellow; pod with 2 rows of flexible recurved prickles about 2-3 mm. long, spirally coiled with 4 to 7 coils, the coils 5-6 mm. in diameter (excluding the prickles). Scattered in e. half of Tex., spring; nat. of Old World, now widely introd.

26. MELILOTUS MILL.

SWEET CLOVER

Biennial or annual herbs, taprooted, 3-30 dm. tall, the stems erect and usually nearly glabrous; leaves alternate, pinnately trifoliolate; leaflets usually oblanceolate to obovate, serrulate on the distal margin, the terminal leaflet petiolulate; stipules partially fused to the base of the petiole, obliquely ovate; peduncles axillary, usually several cm. long; flowers usually only a few mm. long, papilionaceous, white or yellow, in lax to crowded usually many-flowered spikelike racemes; calyx campanulate, minute, with nearly equal subulate to lanceolate acute to acuminate lobes; petals white or yellow, only a few mm. long, deciduous after anthesis; stamens 10, diadelphous, 9 of the filaments coalescent, the tenth (upper) one free; fruit ovoid to globose, straight or nearly so, usually 1-seeded and minute, commonly reticulate, indehiscent or essentially so.

A genus of about 20 species native to the Old World, widely introduced in the New World, valuable as forage crops. The genus is only very weakly distinguished from *Medicago*, and probably should be merged with it.

1. Flowers white; pod reticulate-veined, dark-brown to black at maturity 1. *M. albus*.
1. Flowers yellow; pod appearing cross-ribbed or smooth, gray or light-brown to tan at maturity (2)
- 2(1). Flowers 1-3 mm. long; pod globose; stipules widened below with scarios margins; annual 2. *M. indicus*.
2. Flowers 3-5 mm. long; pod ovoid (longer than broad); stipules not widened below with scarios margins; biennial 3. *M. officinalis*.

1. *Melilotus albus* Lam. WHITE SWEET CLOVER, HUEAM. Annual or biennial 3-15 (-30) dm. tall; racemes with 30 to 80 flowers; petals white; banner about 3-5 mm. long, somewhat exceeding the wing and keel in length; pod 2-3.5 mm. long, 2-2.5 mm. broad, about 1.5-2 mm. thick, glabrous, very short-stalked, usually dark-brown to blackish at maturity, reticulate-veined. Scattered as a weed over Tex. (seemingly rare on Edwards Plateau and in far e. Tex.), spring; nat. of Euras., now widely introd.

2. *Melilotus indicus* (L.) All. SOUR CLOVER, ALFALFILLA. Annual 1-5 dm. tall; stipules lanceolate, those of the lower leaves widened below the middle, scarios and partially encircling the stem and with a small free basal lobe; racemes with 10 to 60 flowers; flowers 1-3 mm. long; petals yellow; banner about 3 mm. long; pod flattened, nearly orbicular, 1.5-2.5 mm. long, yellowish or reddish at maturity, very short-stalked, not reticulate-veined. Scattered over Tex. (rare in Rio Grande Plains and higher parts of Plains Country, infrequent in Trans-Pecos and Edwards Plateau), spring; nat. of Medit. area, now widely introd.

3. *Melilotus officinalis* (L.) Lam. YELLOW SWEET CLOVER. Biennial or rarely annual, 4-10 (-20) dm. tall; stipules lanceolate, acute, mostly 5-8 mm. long, entire, not widened below nor with scarios margins; racemes with 30 to 70 flowers; flowers 3-5 mm. long; petals yellow; banner about 5 mm. long; pod ovoid, 2.5-4 mm. long, 2-2.5 mm. broad, about 1.5 mm. thick, distinctly short-stalked, glabrous, usually light-brown to tan at maturity, the transverse ridges more prominent than the longitudinal ones. Frequent in n.-cen. Tex. and scattered elsewhere, spring; nat. of Euras., now widely introd.

27. TRIFOLIUM L.

CLOVER

Annual, biennial or perennial herbs; stems usually weak and with some of them at least partially decumbent; leaves alternate, trifoliolate (either palmately so or the terminal leaflet longer-stalked in 2 species), typically obovate to nearly orbicular, serrulate on the distal margin, rarely more than 3 cm. long; petioles well-developed; stipules conspicuous, persistent and usually at least partially adnate to the base of the petiole; inflorescence axillary and/or terminal, sessile or peduncled capitate or spikelike racemes or umbel-like aggregations (flowers rarely solitary, as in *T. amphianthum*); flowers sessile or pedicellate; calyx persistent, the tube campanulate or cylindrical and with 5 to 10 (to 20) nerves, the lobes linear to deltoid and equal or unequal; corolla papilionaceous,

never blue nor purple (except in *T. carolinianum*); petals united below with the filament tube in some species; stamens 10, diadelphous, 9 filaments coalescent into a tube, the tenth (uppermost) one free; pod often enclosed within the calyx tube and typically enveloped by the persisting petals, obovoid to oblong-linear, usually membranous, indehiscent or opening by a suture, or more rarely circumscissile; seeds 1 to 4.

A large genus of 300 species of temperate regions of the world.

1. Leaves pinnately trifoliolate (the terminal leaflet with a longer stalk than the lateral ones); flowers yellow (2)
1. Leaves palmately trifoliolate (all the leaflets sessile or nearly so); flowers not yellow (3)
- 2(1). Banner 2-4 mm. wide; flowers 20 to 40 in each head 1. *T. campestre*.
2. Banner 1-2 mm. wide; flowers 5 to 18 in each head 2. *T. dubium*.
- 3(1). Leaflets more than 3 times as long as wide 3. *T. Willdenovii*.
3. Leaflets rarely more than twice as long as wide, usually one to one and one half times as long as wide (4)
- 4(3). Flower heads sessile or nearly so at the ends of main branches (peduncles less than 5 mm. long) 4. *T. pratense*.
4. Flower heads on peduncles 10 mm. long or more (5)
- 5(4). Flower heads at least twice as long as wide (3 cm. long or more), spikelike 5. *T. incarnatum*.
5. Flower heads globose (umbellate or capitate), about as long as wide (6)
- 6(5). Flowers sessile in the heads or nearly so (pedicels 1 mm. long or less); cultivated or rare introduced species 6. *T. resupinatum*.
6. Flowers distinctly pedicelled (mature pedicels 1-8 mm. long); native or common introduced species (7)
- 7(6). Mature flowering heads 25-40 mm. across; stems erect or ascending, not creeping 7. *T. reflexum*.
7. Mature flowering heads 25 (rarely 30) mm. across or less, if somewhat more than the stems prostrate and creeping (8)
- 8(7). Flower heads short-racemose; pedicels arising along a distance of 2-5 mm. at the end of the peduncle; calyx lobes shorter than the tube; stems creeping; flowers white 8. *T. repens*.
8. Flower heads umbellate; pedicels all arising at the end of the peduncle; calyx lobes (at least some of them) as long as the tube; stems erect or ascending, if creeping then fruits developing below the ground; flowers deep-rose-red to yellowish-white (9)
- 9(8). Peduncles arising from creeping stolons; stems rooting at the nodes; petals (at maturity) 2 to 4 times as long as the calyx 9. *T. amphianthum*.
9. Peduncles arising from erect or ascending stems; stems not rooting at the nodes; petals one to two times as long as the calyx (10)
- 10(9). Calyx lobes (some of them) about as long as wide ..10. *T. bejariense*.
10. Calyx lobes (all of them) 2 to 3 times as long as wide ..11. *T. carolinianum*.

1. ***Trifolium campestre* Sturm.** LOW HOP CLOVER. Annual or biennial; stems decumbent or commonly ascending, usually densely appressed-short-pubescent at least on the younger parts, the older ones often glabrate; leaves pinnately trifoliolate; terminal leaflet with a longer stalk (1-3 mm.) than the lateral ones; leaflets mostly (6-) 8-12 (-15) mm. long and usually about twice as long as broad but very variable, oblong-obovate to cuneate-obovate or obovate-lanceolate; peduncles mostly 1-3 cm. long; pedicels 0.2-0.8 mm. long; flowers 2.5-5.5 mm. long, 20 to 40 per head; heads globose to ovoid or very short-cylindrical, 5-15 mm. long, 8-12 mm. thick; calyx glabrous, the 5-nerved tube campanulate and 0.5-0.8 mm. long, the lobes very unequal; corolla yellow, turning brownish when dry; banner 2-4 mm. broad, conspicuously longer than the wing or keel; pod oblong, about 3 mm. long including the stipe. Sandy soils along roads, wooded areas of e. and s.e. Tex., spring; nat. of Eur., now widely introd.

2. *Trifolium dubium* Sibth. SHAMROCK, SMALL HOP CLOVER. Annual; stems erect or decumbent, to 35 cm. long, appressed-pubescent; leaves pinnately trifoliolate; petiole 3-8 (-10) mm. long; stipules 4-8 mm. long; terminal leaflet with a longer stalk (1-3 mm. long) than the lateral ones; leaflets largely glabrous, cuneate-obovate, 6-12 mm. long, about half as broad as long to as broad as long; heads hemispherical to spherical, 5-8 mm. thick; peduncles 5-25 mm. long; flowers 5 to 18 per head, 2.5-3 mm. long; pedicels 0.2 mm. long; calyx 5-nerved, the tube about 1 mm. long, the lobes very unequal; corolla yellow; petals grooved and ribbed lengthwise, inconspicuously so at first, markedly so in age; banner 1-2 mm. broad, longer than the wing and keel, only inconspicuously veined; legume oblong, about 2.5-3 mm. long including the stipe which is about 1 mm. long. Nat. of n. Eur., introd. and found in grassy places.

3. *Trifolium Willdenovii* Spreng. MOUNTAIN CLOVER. Short-lived perennial or biennial, 1-2 (-8) dm. tall, the stems shortly decumbent basally; leaves palmately trifoliolate; petioles several cm. long; stipules connate to petiole practically their entire length; leaflets all sessile or nearly so, 1-3 cm. long, 3 to 7 times as long as broad, serrulate nearly the entire length, mostly oblanceolate; peduncles 3-11 cm. long; heads nearly globose, 15-25 mm. thick, immediately subtended by about half a dozen deeply lobed bracts about as long as the flowers; flowers about 20 to 40 per head, 8-15 mm. long; corolla partly white but mostly purplish. *T. fistulosum* Vaughan, *T. Ortegae* Greene. Rare in creek-beds, Davis Mts. at about 4,000-6,000 ft. elev., summer; Rocky Mts. and s. in the mts. to Mexico City.

This is sometimes united with the allegedly pan-boreal species *T. Wormskjoldii* Lehm.; perhaps our plants should go under the latter name.

4. *Trifolium pratense* L. RED CLOVER. Perennial or sometimes biennial; stems usually decumbent at least basally, 2-7 dm. long, commonly with spreading pubescence; leaves palmately trifoliolate; petioles 10-25 mm. long; stipules adnate nearly the total length to the petiole; leaflets all sessile or nearly so, less than 3 times (usually twice) as long as broad, ovate to elliptic or cuneate-obovate, 1-3 (-5) cm. long, nearly entire; peduncle very short or absent; heads subglobose to ovoid, 1-3 cm. long, (1-) 2 (-3) cm. thick; flowers 30 to 90 per head, 12-18 mm. long; calyx tube campanulate, basally narrowed, 10-nerved, 3-4 cm. long; calyx lobes subulate; corolla reddish to reddish-purple (rarely white); banner longer than wing or keel; pod about 3 mm. long and 2 mm. thick. Scattered escape in e. half of Tex., May-July; nat. of Eur., now widely introd. and cult.

5. *Trifolium incarnatum* L. CRIMSON CLOVER. Winter annual or annual; stems ascending, 2-4 (-8) dm. tall; leaves palmately trifoliolate; petioles of the lowest leaves much-elongated, 5-20 cm. long; stipules mostly 1-2 cm. long and adnate to the petiole base more than half the length; leaflets all sessile or nearly so, less than 3 (usually 1 to 2) times as long as broad, broadly obovate and somewhat cuneate to nearly orbicular, mostly 1-3 (-4) cm. long; peduncle 4-12 cm. long, terminal; heads spikelike, at least twice as long as thick, (2-) 3-7 cm. long; flowers nearly sessile and very numerous, 8-12 mm. long; calyx tube cylindrical to campanulate, 3.5-5 mm. long, 10-nerved, the lobes subulate; banner much longer than wing or keel, scarlet or red (rarely white); legume sessile, ovoid. Scattered as a roadside escape, e. half of Tex., spring; nat. of s. Eur., now widely introd.

6. *Trifolium resupinatum* L. PERSIAN CLOVER. Annual or winter annual; stems largely glabrous, to 45 cm. long, decumbent to ascendent; leaves palmately trifoliolate; petioles 3-80 mm. long; stipules long-adnate to petiole base; leaflets all sessile or nearly so, less than 3 (usually 1 to 2) times as long as broad, mostly 1-2 cm. long and 7-10 mm. broad, mostly obovate to oblanceolate; peduncle 2-6 cm. long; heads about as long as thick, hemispherical, burlike in age, 5-10 mm. thick, with about 6 to 18 flowers; pedicels 1 mm. long or less; flowers 4-6 mm. long; calyx pilose, inflated at one side, strongly bilabiate, the tube 1.5-2 mm. long; corolla lavender-pink, basally twisted so the banner appears to be the lowest petal; banner conspicuously longer than the wing or keel; pod oblong to ovoid, 1- or 2-seeded, completely enclosed by the bladderly calyx. Rare roadside escapee in e. Tex., spring; nat. of Old World, now widely introd.

7. *Trifolium reflexum* L. BUFFALO CLOVER. Annual; stems pilose to nearly glabrous, spreading or erect, to 3 dm. long; leaves palmately trifoliolate; petioles 5-150 mm. long; stipules adnate to the petiole for about a fourth their length; leaflets all sessile or nearly so, 2 to 3 times as long as broad, mostly 10-35 mm. long, ovate or elliptic to oblong or

cuneate-obovate; peduncle 1 cm. long or longer, half to twice as long as the thickness of the head; heads about as long as thick, the mature ones 25-40 mm. thick, umbel-like; pedicels 2-5 mm. long at anthesis, later elongating to 10 mm. long in fruit; flowers 8-10 (-12) mm. long; calyx tube campanulate to cuplike, 1.5-2 mm. long, 10-nerved; corolla deep-red, or at least the banner red (keel and wing petals sometimes whitish); banner exceeding wing and keel; pod oblong, 4-6 mm. long including the stipe which is about 1.5 mm. long; seeds often 4. Sandy forested areas, n.e. Tex., s.w. to Robertson Co., May-July; most of e. U.S.

8. *Trifolium repens* L. WHITE CLOVER. Perennial, mat-forming; stems creeping, glabrous or nearly so, rooting at the nodes; leaves palmately trifoliolate; petioles 5-20 cm. long; stipules mostly 8-15 mm. long; leaflets all sessile or nearly so, less than 3 times as long as broad, broadly elliptic-obovate to cuneate-obcordate, mostly 1-2 (-3) cm. long; peduncle 10-25 cm. long; heads about as long as thick, mature ones less than 25 (rarely 30) mm. thick, somewhat racemose, the axis of the raceme 2-5 mm. long; pedicels at anthesis about 1.5 mm. long, afterwards elongating to as much as 3-5 mm. long; calyx lobes shorter than calyx tube, the cylindrical tube 10-nerved and 2-3 mm. long; corolla white (some petals sometimes pinkish), (6-) 8-10 (-12) mm. long, the banner conspicuously longer than the wings; pod oblong-linear, 4-5 mm. long, 3- or 4-seeded. Scattered escape in e. half of Tex., spring and fall; nat. of Eur., now widely introd.

A species somewhat resembling white clover but not having the creeping stems is alsike clover, *T. hybridum* L., widely cultivated and present as a lawn weed in adjacent states; it will probably eventually be found in Texas.

9. *Trifolium amphianthum* T. & G. PEANUT CLOVER. Perennial; stems glabrous or nearly so, creeping, stoloniferous, rooting at the nodes; leaves palmately trifoliolate; leaflets all sessile or nearly so, less than 3 times as long as broad; flowers of 2 sorts; *cleistogamous flowers* solitary, short-peduncled, borne just above the ground, after anthesis thrusting down into the sand and producing underground fruit; *chasmogamous flowers* with peduncle 1 cm. long or longer, arising from the creeping stolon; heads about as long as thick, mature ones less than 25 (rarely 30) mm. thick, umbellate; pedicels (1-8 mm. long) all arising at the end of the peduncle; corolla deep-red, 2 to 4 times as long as the calyx; some fruit borne underground. Frequent in wooded sandy areas, e., s.e. and n.-cen. Tex., s. to Caldwell, DeWitt and Victoria cos., spring; also La.

10. *Trifolium bejariense* Moric. Annual or winter annual; stems glabrous or nearly so, ascending or decumbent, 1-2 dm. long; leaves palmately trifoliolate; leaflets all sessile or nearly so, less than 3 times as long as broad, mostly 5-10 mm. long; peduncle 1 cm. long or longer, 2 to 6 times as long as the head is thick, several times longer than the subtending leaves; heads about as long as thick (15-20 mm. thick), mature ones less than 25 (rarely 30) mm. thick, umbel-like; pedicels 1-8 mm. long, all arising at the end of the peduncle; flowers numerous; calyx reticulate-veined, 2-lipped, the tube campanulate, the lobes (at least some of them) about as long as broad and very unequal; corolla slightly longer than the calyx, white or yellowish-white, turning brown on drying; banner and wings toothed, the banner much longer. Sandy or sandy clay soils of prairies and open woods, e. and n.-cen. Tex., s. to Wilson, DeWitt and Victoria cos., spring; endemic.

11. *Trifolium carolinianum* Michx. Annual (*vide* some authors) or perennial (*vide* others); stems glabrous or sparsely pubescent, erect or decumbent, to 3 dm. long; leaves palmately trifoliolate; petioles commonly 1-5 cm. long; stipules adnate to petioles about a third to half their length; leaflets all sessile or nearly so, only about 1 to 1.5 times as long as broad, obovate to obcordate, basally cuneate, 4-10 (-15) mm. long, 3-10 mm. broad; peduncle 3-10 (-12) cm. long or longer, 2 to 6 times as long as the head is thick; heads about as long as thick, mature ones 15-25 (-30) mm. thick, umbel-like; pedicels all arising at the end of the peduncle, 1-3 mm. long at anthesis but elongating to 3-4 mm. in fruit; flowers 4-6 (-7) mm. long; calyx villosulous, the campanulate tube about 1 mm. long and 10-nerved, the lobes (all of them) 2 to 3 times as long as broad; corolla 1 to 2 times as long as the calyx; petals longitudinally lined or ribbed, yellowish-white changing to brown (purplish according to some authors); pod oblong, 2.5-3.5 mm. long, 2- to 4-seeded. E. and s.e. Tex., s.w. to Travis, Caldwell and Wharton cos., spring; s.e. U.S. n.w. to Kan. and Okla., n. to Mo. and Va.

28. LOTUS L. DEER VETCH. TREFOIL

Annual or perennial erect herbs, usually 1-5 dm. tall; leaves alternate, once-pinnately 3- to 5-foliolate or by reduction palmately trifoliolate; petioles short, often shorter than the rachis or not much longer; stipules in one species well-developed and in the others nearly obsolescent and glandlike; leaflets small, rarely more than 1 cm. long, linear to nearly orbicular, usually with appressed pubescence, usually entire; stipules absent; peduncles usually several cm. long, emerging from the upper axils and longer than the leaves; flowers about 1 cm. long, solitary or paired or in umbel-like groups at the end of the peduncle; calyx cylindric to campanulate with more or less equal lobes at the end of the tube; corolla papilionaceous, the petals usually basically yellowish or whitish but with red, rose or purple areas; banner external to the rest in bud, ovate to obovate; wings obovate or oblong and adhering to the incurved keel of usually fused petals; stamens 10, diadelphous, 9 with filaments coalescent and the tenth (uppermost) free, the filaments (all or part of them) expanded just below the anthers; ovary sessile; legume linear, usually 1-3 (-4) cm. long, nearly straight, dark-brown, thin-walled, promptly dehiscent, acute; seeds numerous.

A genus with about 120 species in temperate areas of the Old World and New World.

- 1. Stipules well-developed, leafletlike; each peduncle with 4 to 10 flowers and later with several legumes 3. *L. corniculatus*.
- 1. Stipules glandlike or obsolete; each peduncle with 1 or 2 (rarely 3) flowers and later usually only 1 pod (2)
- 2(1). Perennial of Trans-Pecos Texas; leaflets usually 5; style pubescent just below the stigma 2. *L. oroboides*.
- 2. Annual east of Trans-Pecos Texas; leaflets 3; style glabrous 1. *L. Purshianus*.

1. *Lotus Purshianus* (Benth.) Clem. & Clem. DEER VETCH. Annual, bushy-branched; leaflets 3, lance-elliptic, mostly 1-2 cm. long; stipules glandlike; bract at the top of the peduncle usually leafletlike; petals whitish with pink veins or pinkish with darker veins, rarely yellowish with pink-tinge. *L. americanus* (Nutt.) Bisch., not Vell. Abundant in n.-cen. Tex., infrequent in Llano region and e. and s.e. Tex., usually on sandy soils, Apr.-Jan.; most of U.S. w. of Miss. River; also n.w. Mex.

2. *Lotus oroboides* (H.B.K.) Kearn. & Peeb. Perennial from woody taproots; stems very numerous from the base, usually 1-2 dm. long; leaflets usually 5, oblanceolate to linear (those of the lowest earliest leaves broader), (3-) 5-12 mm. long; stipules glandlike; bract at the top of the peduncle usually linear; petals yellow or the banner more or less red dorsally. *L. rigidus* of Tex. ref. Abundant in parts of the Trans-Pecos, especially in soil derived from basaltic rock, above 4,000 ft. elev., Mar.-Sept.; s.w. U.S. and n.w. Mex.

The closely allied *L. Wrightii* (Gray) Greene, native to the mountains in adjacent New Mexico and Mexico, has been reported, without verification, from west Texas. It may be superficially distinguished by its much-abbreviated or obsolete leaf rachis that usually results in a pedate appearance to the leaf.

3. *Lotus corniculatus* L. BIRD'S FOOT TREFOIL. Perennial from woody taproots; stems very numerous from the base, usually 2-5 dm. tall; leaflets usually 3 (but sometimes appearing to be 5 because the stipules are leafletlike), obovate to rhombic-obovate or rarely nearly oblanceolate, about 1 cm. long; petals golden-yellow, varying in part to orange or brick-red. A cult. species, rarely escaping, summer; nat. of Old World, now widely introd. as forage and hay crops.

29. INDIGOFERA L. INDIGO

Perennial herbs, usually gray-pubescent all over, the pubescence appressed with the hairs often medifixed (with 2 ends free); leaves alternate, once-imparipinnately-compound; petioles short; stipules herbaceous, subulate to setaceous; leaflets 5 to 15, usually oblanceolate to obovate or elliptic, rarely linear, either or not opposite on the rachis; flowers in axillary sometimes spikelike racemes; calyx teeth 5; corolla papilionaceous, brick-red (less often pinkish or purplish); banner orbicular or obovate, short-clawed; wings oblanceolate

or oblong or linear, short-clawed, slightly adherent to the keel, the blade forming a basal auricle; keel petals united distally, the claws separate, the blades spurred or pouched; stamens 10, diadelphous, 9 with coalescent filaments, the tenth (uppermost) free, the anther connective glanduliferous; pod not much if at all compressed, promptly dehiscent, several-seeded, straight or falcate, linear or curvilinear; seeds usually separated in the pod by partitions, not stipitate.

A genus of about 400 species of warm regions.

1. Stems procumbent or prostrate to somewhat ascending; leaflets 5 to 9, never more, arranged alternately along the rachis; well-developed racemes much-surpassing the subtending leaf 1. *I. miniata*.
1. Stems stiffly erect; leaflets 7 to 15, opposite or nearly so along the rachis; racemes as long as or but slightly exceeding the subtending leaf (2)
- 2(1). Mature pods with a small swollen reddish glabrous knob at the base; leaves densely strigose on both surfaces 2. *I. Lindheimeriana*.
2. Mature pod acute at base, without a swollen reddish knob; leaves sparsely strigose, the upper surface less densely so to glabrous 3. *I. suffruticosa*.

1. *Indigofera miniata* Ort. SCARLET PEA. Stems several from the somewhat woody tap-root, procumbent or decumbent; leaflets 5 to 9, alternate on the rachis; well-developed racemes much-surpassing the subtending leaf; calyx teeth subulate, twice as long as the calyx tube; pod 1-3 cm. long, 2-3 mm. thick. A very abundant legume of open areas of the e. two thirds of Tex., represented with us by 3 varieties as follows:

Var. *miniata*. Stem hairs appressed; petals 5-8 mm. long; stipules 3-5 mm. long. *I. argentata* Rydb. Rio Grande Plains, rare n. to Lavaca and Wilson cos., intergrading with the next, Apr.-Sept.; Tex., Cuba, Fla. and Mex.

Var. *leptosepala* (Nutt.) B. L. Turner. Nearly all stem hairs appressed; petals 8-20 mm. long. E. two thirds of Tex. except extreme s. part and Llano region, rare w. to e. part of Panhandle and to Terrell Co.

Var. *texana* (Buckl.) B. L. Turner. With predominately curled or nonappressed hairs on the stems and long stipules (5-8 mm. long). Abundant in sandy soils derived from granite, gneiss and sandstone in the Llano region (Llano, Gillespie, Mason and San Saba cos.)

2. *Indigofera Lindheimeriana* Scheele. Erect stems 5-10 dm. tall; leaflets 7 to 15, opposite or nearly so on the rachis, densely strigose on both surfaces; racemes in flower somewhat shorter than the leaves but in fruit slightly longer; calyx less than half as long as the corolla, the teeth lanceolate or deltoid and not or only slightly exceeding the calyx tube; pod 20-25 mm. long, basally with a small swollen reddish glabrous knob. Local in alluvial soil of creeks in limestone hill areas, s. margin of Edwards Plateau from Crockett and Terrell cos. to Comal Co., May-Aug.; also N. L. and Coah.

3. *Indigofera suffruticosa* Mill. INDIGO. Erect stems 5-20 dm. tall; leaflets 9 to 15, opposite or nearly so on the rachis, sparsely strigose; racemes shorter than the leaves; calyx less than half as long as the corolla, the teeth lanceolate or deltoid and not or only slightly exceeding the calyx tube; pods (when mature) 15-20 mm. long, acute basally. Local, Coastal Plains, Hardin Co. to Cameron Co. and inland to Brazos, Gonzales and Wilson cos., July-Nov.; nat. to trop. Am., now widely introd.

This species and *I. tinctoria* L. are the sources of the substances which are the chemical precursors of the blue dye indigo, formerly important in commerce.

30. PSORALEA L.⁸⁸

Caulесcent or acaulescent perennial herbs, the herbage and calyx glandular-punctate (rarely not); leaves alternate, palmately or once impari- or pinnately compound; petioles well-developed, stipules well-developed, usually persistent and entire; leaflets variously shaped, usually widest in the distal half, marginally entire; stipels present; flowers in dense to loose axillary or terminal spikelike racemes, usually with 2 or 3 flowers associated with each bract; calyx with a tube (basally often gibbous and becoming inflated in fruit) and

⁸⁸ Partly adapted from L. H. Shinnors in Field & Lab. 19:14-25. 1951 and partly from David J. Ockendon in Southw. Nat. 1:81-124. 1965.

5 lobes, the 4 upper lobes equal, the lower usually longer and broader than the upper; corolla papilionaceous, whitish, bluish, purplish, lavender or reddish-brown (never yellow), often fading and becoming discolored in age; banner tapering into a short claw, the blade obovate; wings short-clawed, the blades oblong or oblanceolate with a distinct basal lobe; keel petals rounded and apically united, each attached to the base of the adjacent wing petal; stamens 10, diadelphous, 9 of the filaments coalescent into a tube, the tenth (uppermost) free (occasionally absent); pod with globose to ovoid body slightly if at all compressed and a flat narrow tapering beak, thin, papery, pubescent or glandular, indehiscent or rupturing irregularly or tardily circumscissile; seeds ovoid to ellipsoid with tapering margins, usually rather thin and smooth but occasionally thicker and with reticulate margins.

About 130 species, mainly in the tropics and subtropics throughout the world. The northern plains species, *P. esculenta* Pursh, with edible tuberous roots, has been reported (but not seen by us) from Texas.

1. Leaves pinnately 3-foliolate (2)
1. Leaves palmately 3- to 7-foliolate or the uppermost only 1- or 2-foliolate (the middle leaflets rarely stalked in aberrant forms of *P. scaposa*) (5)
 - 2(1). Leaflets lanceolate to oblong-lanceolate, 3 to 7 times as long as wide; flowers in elongate spikelike racemes (3)
 2. Leaflets rhombic-lanceolate to ovate or orbicular, about one to two (or three) times as long as wide; flowers few, in heads or very short spikes (4)
 - 3(2). Corolla deep-purple, 7-10 mm. long; calyx 3.2-4 mm. long 1. *P. simplex*.
 3. Corolla lilac or lavender, 4-7 mm. long; calyx 2-3 mm. long 2. *P. psoralioides* var. *eglandulosa*.
 - 4(2). Plant with elongate prostrate leafy stems; leaves membranous, upper and lower not markedly different, variously pubescent to nearly glabrous, without white veins 15. *P. rhombifolia*.
 4. Plant scapose (stem not evident); leaves leathery, the lower surface densely appressed-pubescent, the upper glabrous or nearly so except for the prominent white veins 13. *P. Rydbergii*.
 - 5(1). Inflorescence a slender loose raceme or slender interrupted spike less than 15 mm. thick; bracts of inflorescence 4 mm. or less long; calyx 2-7 mm. long (enlarging in fruit) (6)
 5. Inflorescence a dense spikelike raceme 20-40 mm. thick; bracts of inflorescence 4-15 mm. or more long; calyx 8-17 mm. or more long (9)
 - 6(5). Branches and under surface of leaflets glabrous and prominently resin-dotted; calyx lobes 1 mm. long or less 3. *P. lanceolata*.
 6. Branches and under surface of leaflets minutely or conspicuously pubescent, not prominently resin-dotted; calyx lobes (1-) 1.5-6 mm. long (7)
 - 7(6). Pedicels of many or all the flowers longer than the calyxes; calyxes 2-4 mm. long (slightly enlarged in fruit) (8)
 7. Pedicels absent or shorter than the calyxes; calyxes 5-7 mm. long (conspicuously enlarged in fruit) 6. *P. digitata*.
 - 8(7). Leaflets linear to lanceolate, 7 to 16 times as long as wide 4. *P. linearifolia*.
 8. Leaflets oblanceolate to obovate, 2 to 6 times as long as wide 5. *P. tenuiflora*.
 - 9(5). Plant with a well-developed mainstem at least 1 dm. long (10)
 9. Plant acaulescent or with a short mainstem less than 1 dm. long or with several lateral stems to 3 dm. long (13)
 - 10(9). Flowers in terminal groups of 3 to 7; bracts conspicuous, broadly ovate, enclosing the calyx 7. *P. Reverchonii*.
 10. Flowers in dense many-flowered racemes; bracts rather inconspicuous and not enclosing the calyx (11)

- 11(10). Leaflets narrow, linear, the longest at least 5 cm. long 8. *P. cyphocalyx*.
11. Leaflets broader, elliptic or obovate, seldom reaching 4 cm. long (12)
- 12(11). Stems 3-6 dm. long, procumbent to ascending, with many well-developed erect branches; stipules of middle and upper leaves linear-lanceolate 9. *P. cuspidata*.
12. Stem less than 3 dm. tall, erect, unbranched or with 1 or 2 short lateral branches; stipules of middle and upper leaves ovate 10. *P. latestipulata*.
- 13(9). Leaflets narrow, 3 or 4 times as long as broad 14. *P. hypogaea*.
13. Leaflets broader, up to twice as long as broad (14)
- 14(13). Leaflets elliptic or rhomboid, eglandular; hairs spreading, at least 2 mm. long; beak of fruit very narrow, less than 1 mm. broad ... 11. *P. subulata*.
14. Leaflets obovate, glandular; hairs appressed or if spreading then less than 2 mm. long; beak of fruit usually more than 2 mm. broad .. 12. *P. trinervata*.

1. *Psoralea simplex* T.&G. Perennial with fusiform tuberous roots; stems erect, simple, 3-9 dm. tall, more or less strigose throughout; stipules subulate, about 1 cm. long; leaves pinnately trifoliolate, the lower petioled, the upper subsessile; petioles 5 cm. long or shorter; leaflets 2-7 cm. long, 5-15 mm. broad, linear-lanceolate, acute or mucronate, gland-dotted above, strigose beneath; peduncles 4-10 cm. long; racemes 2-5 cm. long, dense, spikelike; calyx sparingly strigose, purple, the tube 3.2-4 mm. long; calyx lobes lanceolate, acute, a little longer than the tube, the lowest one a little longer than the rest; corolla deep-purple, 7-10 mm. long; pod obliquely orbicular, flat, transversely wrinkled, with a short incurved beak; seed brown, 2.5 mm. long. *Orbexilum simplex* (T.&G.) Rydb. Infrequent in sandy soils, e. and s.e. Tex., spring; s.e. U.S.

2. *Psoralea psoralioides* (Walt.) Cory var. *eglandulosa* (Ell.) F. L. Freeman. **SAMPSON'S SNAKEROOT**. Perennial with fusiform tuberous roots; stems several from the base, 3-8 dm. tall, glabrous or sparingly strigose; stipules 4-5 mm. long, subulate; petioles 1-6 cm. long or the upper ones much shorter; leaves pinnately trifoliolate; leaflets 4-7 cm. long, 1-2 cm. broad, lanceolate (or those of the lower leaves elliptic), 4 to 7 times as long as broad, sparingly dotted with minute glands; peduncles 8-15 cm. long; racemes 4-10 cm. long, dense, spikelike; calyx strigose, 2-3 mm. long (3-6 mm. including the lobes) its lanceolate lobes slightly longer than the tube with the lowest one slightly longer than the rest; corolla lilac or lavender, 4-7 mm. long; pod obliquely orbicular, flat 4 mm. long, transversely wrinkled, with a short incurved beak; seed dark-brown, 3 mm. long. *Orbexilum pedunculatum* (Mill.) Rydb. Sandy wooded areas, e. and s.e. Tex., frequent, spring; s.e. U.S. n. to Va. and Ill. (The var. *psoralioides* from Va. to Fla., not in Tex.).

3. *Psoralea lanceolata* Pursh. Perennial with creeping branched rootstocks, stem 15-40 cm. tall, glandular-punctate throughout, sparingly strigose; leaves palmately 3-foliolate; stipules linear-lanceolate to subulate, 3-10 mm. long; petioles 1-2 cm. long; leaflets 1-4 cm. long, narrowly linear to oblanceolate, beneath nearly glabrous and prominently gland-dotted; peduncles 2-5 cm. long; racemes slender, loose, 10-25 mm. long and less than 15 mm. thick; bracts minute; calyx campanulate, sparingly strigose, the tube 2 mm. long, the nearly equal lobes obtuse and gland-dotted; corolla white or slightly purple-tinged, 5-6 mm. long; banner almost orbicular; blades of the wings obliquely oblong-oblanceolate; keel petals scarcely lobed at the base and usually purple-tipped; pod globose, 5 mm. long, conspicuously glandular-warty, sparingly strigose or glabrate, the short beak erect. *P. micrantha* Gray, *Psoralidium lanceolatum* (Pursh) Rydb. Sandy soils, higher parts of the Plains Country, June; Great Plains s. to Tex. and s.w. to Ariz.

4. *Psoralea linearifolia* T. & G. Perennial with creeping rootstock; stem 3-8 dm. tall, sparingly gland-dotted, sparingly strigose or glabrate, striate, with long slender branches; leaves palmately trifoliolate (those of the branches often 1-foliolate); stipules lanceolate or subulate, 3-7 mm. long; petioles 1-5 mm. long; leaflets linear to lanceolate, 7 to 16 times as long as broad, 2-6 cm. long, 1-3 mm. broad, with numerous small glands, glabrous above, sparingly strigose beneath, acute at both ends; peduncles 4-8 cm. long; racemes loose, few-flowered, 3-6 cm. long, less than 15 mm. thick; flowers 1 to 4 at each node; bracts lanceolate, acuminate, less than 4 mm. long; pedicels 4-8 mm. long, often longer than the calyxes; calyx tube 3-4 mm. long, conspicuously punctate, sparingly strigose, only slightly enlarging after anthesis; calyx lobes lanceolate, acute, as long as the tube; corolla blue, 7-8 mm. long; banner rounded-obovate; pod about 8 mm. long, ovoid, flattened, gradually tapering into a straight beak; seed dark-brown, broadly obliquely

reniform. *Psoralidium linearifolium* (T. & G.) Rydb. Rocky calcareous soils, frequent in n.-cen. Tex., rare in Plains Country, May-June; Neb. and Wyo., s. to Tex.

5. *Psoralea tenuiflora* Pursh. SCURFY PEA. Perennial with long rootstocks; stem 2-6 dm. tall, more or less strigose, glandular-dotted, much-branched; leaves digitately trifoliolate or the lower rarely 5-foliolate; stipules lanceolate, 2-3 mm. long; petioles 3-12 mm. long; leaflets 1-5 cm. long, 5-12 mm. broad, 2 to 6 times as long as broad, oblong-ob lanceolate to linear, rarely even obovate, obtuse, mucronate, gland-dotted on both sides, glabrate above, strigose beneath; peduncles 2-3 cm. long; racemes 15-40 mm. long; bracts minute, ovate or lanceolate, acuminate; flowers solitary or two at each node; pedicels often longer than the calyxes; calyx tube 2-2.5 mm. long, sparingly strigose, densely gland-dotted; calyx lobes nearly equal, lanceolate, acute, nearly equaling the calyx tube; corolla blue, about 5-7 mm. long; banner rounded-obovate, nearly orbicular; pod ovoid, 7-8 mm. long, glabrous, densely gland-dotted, with a short straight beak; seed brown, reniform, shiny. *Psoralea Bigelovii* (Rydb.) Tidestr., *P. floribunda* T.&G., *P. obtusiloba* T.&G., *Psoralidium tenuiflorum* (Pursh) Rydb. Frequent in n.-cen. Tex. and local in Trans-Pecos and parts of the Plains Country, scattered in Edwards Plateau and e. and s.e. Tex., May-July; cen. U.S. from Ill. to Mont. and s. to Tex. and Ariz.

6. *Psoralea digitata* T.&G. Perennial with rootstocks; stems erect, simple below, with ascending-spreading branches, 3-8 dm. tall, appressed-canescens throughout; leaves mostly palmately 5-foliolate or some of those on the branches 3-foliolate; stipules lanceolate, 5-10 mm. long; petioles 2-5 cm. long; leaflets linear or linear-ob lanceolate, 2-5 cm. long, 3-5 mm. broad, glabrous above except the midvein, densely silky beneath; peduncles 10-15 mm. long; racemes spikelike, interrupted, 3-6 cm. long; bracts broadly obovate, 5 mm. long, nearly as broad, sparingly gland-dotted, abruptly short-acuminate; flowers 2 to 4 at each node, subsessile; calyx 5-7 mm. long, accrescent after anthesis, conspicuously enlarged in fruit; calyx lobes ovate-lanceolate, abruptly short-acuminate, the lowest somewhat longer; banner obovate; pod ovoid, 7-8 mm. long, with a flat straight beak; seed ellipsoid, brown, 4-5 mm. long. Usually in sandy soils; represented with us by 2 varieties:

Var. *digitata*. Leaflets narrowly oblong-lanceolate, those of the middle leaves 4-8 mm. broad. *Psoralidium digitatum* (T.&G.) Rydb. Locally abundant in n.-cen. Tex., w. to Erath Co., reported from Wheeler Co. in the Panhandle, May-July; S. D. to Colo., Tex. and Ark.

Var. *parvifolia* Shinn. Leaflets linear, those of the middle leaves 2-4 mm. broad. Oak and pine woodlands, e. Tex., spring; endemic.

7. *Psoralea Reverchonii* Wats. Erect herb 5-12 dm. tall; rootstock large, fusiform or elongate; mainstem unbranched below, much-branched above with many lateral ascending slender branches; pubescence sparse, appressed, inconspicuous except for that on the margins of the bracts and calyxes which appear silky; leaves palmately 3- (to 5-) foliolate, the lower leaves caducous; stipules subulate, to 6 mm. long; petioles short, 2-8 (-28) mm. long; upper leaves almost sessile; leaflets elliptic or broadly elliptic with an acute often mucronate apex, 15-30 (-45) mm. long, 5-9 (-14) mm. broad, glabrous and punctate above, pubescent beneath; racemes short, congested, turbinate or subcapitate, each with 3 to 7 flowers; branches bearing the flowers much-branched, giving the appearance of a panicle; peduncles to 2 cm. long; flowers partly enclosed by the large persistent ovate-caudate bracts which are 11-20 mm. long and 8-12 mm. broad; bracts and calyxes conspicuously glandular-punctate; flowers 10-15 mm. long, on pedicels to 7 mm. long; calyx lobes 5-12 mm. long; petals bluish-lavender; fruit enclosed by the calyx, 6-8 mm. long, with a beak 2-3 mm. long, densely glandular-punctate. Rocky calcareous soils or rarely on sandy soils, rare in n.-cen. Tex. (Cooke, Hood and Johnson cos.), June-July; also Okla.

8. *Psoralea cyphocalyx* Gray. Tall erect slender herb with a small globose or short-fusiform rootstock which is 12-25 mm. long and 10-18 mm. thick; stem 3-7 (-9) dm. tall, unbranched except near its apex; branches very slender; leaves palmately 3- to 5-foliolate, rather sparse, often only 5 to 10 per plant, distributed almost all the way up the stem but lower leaves often caducous; petioles (8-) 12-35 (-50) mm. long; leaflets elongate, narrowly lanceolate or elliptic to linear, 35-85 mm. long, 3-9 (-13) mm. broad, upper surfaces glabrate and glandular-punctate, lower surface with an inconspicuous sparse appressed pubescence which covers most of the plant; stipules lanceolate below, linear or subulate above, to 1 cm. long; racemes dense, subglobose or somewhat elongate, 3-7

(-9) cm. long; peduncles 3-8 cm. long, about as long as or longer than the petioles; pedicels short, 1-3 mm. long; bracts ovate or lanceolate, shortly acuminate, 5-7 mm. long; flowers as in *P. cuspidata*, lavender, purple or bluish; fruit about 8 mm. long, completely enclosed within the expanded calyx, the beak about 3 mm. long. *Pediomelum cyphocalyx* (Gray) Rydb. Barren limestone hills, e. edge of Edwards Plateau and w. part of n.-cen. Tex. from Bandera and Medina cos. n. to Wise Co., May-June; endemic.

9. *Psoralea cuspidata* Pursh. Procumbent to ascending or erect herb with fusiform or elongate thickened rootstocks 1-2 cm. thick and 5-25 cm. long; stems (25-) 30-60 (-80) cm. long, unbranched below, with ascending branches above; pubescence appressed, somewhat sparse; lowest stipules broadly ovate, about 13 mm. long and 6 mm. broad, tending to clasp the stem and usually not associated with leaves or branches; stipules becoming progressively narrower toward the top but remaining about the same length; upper stipules lanceolate to linear-lanceolate or linear-subulate, 8-13 mm. long, 0.5-1.5 mm. broad; leaves digitately 3- to 5-foliolate; petioles shorter than the peduncles, 1-3 (-4) cm. long; leaflets broadly to narrowly elliptic or obovate, apically acute to obtuse or even rounded, more or less apiculate, 10-20 (-24) mm. broad, 25-50 mm. long, lower surfaces pubescent, upper glabrate and gland-dotted; inflorescence a dense or interrupted conical or elongate raceme 4-7 (-9) cm. long; bracts broadly to narrowly ovate or elliptic, long-acuminate or cuspidate, becoming narrower and more elongate in age, 7-14 mm. long, 2-5 mm. broad; bracts and calyx conspicuously gland-dotted; flowers 12-20 mm. long, the calyx a little more than half this length; calyx gibbous basally, becoming inflated in fruit; calyx lobes lanceolate or ovate, acute or sometimes long-acuminate; lower calyx lobe 7-12 (-15) mm. long, the upper 4 lobes 3-7 (-10) mm. long; petals light- or deep-blue, purplish-blue or violet; fruit completely enclosed in the expanded calyx, 6-8 mm. long, with a small curved beak about 2 mm. long. *P. caudata* (Rydb.) Cory, *Pediomelum Parksii* Tharp & Barkl. Frequent, usually in calcareous soils, n.-cen. Tex., Plains Country and Edwards Plateau, infrequently s. to DeWitt and Lavaca cos., spring; Great Plains, S. D. to Tex.

10. *Psoralea latestipulata* Shinnars. Erect herbs 1-3 dm. tall, with a globose turnip-shaped or rarely narrowly elongate tuberous rootstock 25-45 mm. long and 15-30 mm. thick, typically with no lateral branches except for a few short ones near the apex; leaves usually fewer than 12, clustered with the inflorescences along the upper half or third of the length; stem with dense spreading pubescence or less dense appressed pubescence; leaves palmately 5- to 7-foliolate; stipules broadly ovate to lanceolate, 7-14 mm. long, 3-7 mm. broad, yellowish below, greenish above, the upper stipules not much narrower than the lower ones; petioles to 7 cm. long, generally a little longer than the peduncles; leaflets narrowly elliptic or obovate, 20-45 mm. long, 6-15 mm. broad, gland-dotted; racemes dense, globose, to 35 mm. long; bracts similar to the stipules; flowers similar to those of *P. cuspidata*; pod 10-12 mm. long, with a narrow beak 5-6 mm. long, inconspicuously gland-dotted. Represented with us by two varieties as follows:

Var. *latestipulata*. Pubescence rather dense, spreading; plants often only 5-10 cm. tall but occasionally reaching 3 dm.; leaflets less than 10 mm. broad. Rocky or sandy calcareous soil or on bare limestone, n.-cen. Tex., s. part of Plains Country and n. part of Edwards Plateau, s.w. to McCulloch and Tom Green cos., Apr.-May; endemic.

Var. *appressa* Ockendon. Pubescence sparse, appressed; plants 15-35 cm. tall; leaflets 6-15 mm. broad. Frequent, hillsides, Travis to Kerr cos., s.e. to Gonzales Co., Mar.-Apr.; endemic.

11. *Psoralea subulata* Bush. Rootstocks 20-45 (-60) mm. long, 10-25 (-40) mm. thick, globose or fusiform; stem absent or rarely to 8 cm. long, with densely crowded nodes; pubescence of dense spreading hairs 2-3 mm. long; leaves palmately (3- to) 5-foliolate; stipules scarious, lanceolate, 10-15 mm. long; petioles 5-15 (-18) cm. long; leaflets elliptic to rhomboid or obovate, with an acute to obtuse or rounded apex, densely pubescent below; sparsely so above, 25-55 (-73) mm. long, 13-26 (-37) mm. broad; racemes dense, (1-) 3-6 cm. long; peduncles about as long as or somewhat shorter than the petioles; calyx lobes of roughly equal length, 6-10 mm. long, the upper 4 linear-subulate, the lower lanceolate, to 2 mm. broad; petals purplish or lavender, the banner paler, often cream-colored below; pod 15-20 mm. long, with a subulate beak 10-15 mm. long, densely pubescent, projecting well beyond the expanded calyx. Incl. var. *minor* Shinnars, *Pediomelum subulatum* (Bush) Rydb. Local in openings in woods on loose sandy soil, e., s.e. and

n.-cen. Tex., s. to Bexar, Wilson and Goliad cos., Mar.-May; endemic as far as known, but probably La., too.

12. *Psoralea trinervata* (Rydb.) Standl. Short erect herbs with enlarged fusiform rootstocks 40-55 mm. long and 12-20 mm. thick; stems absent or less commonly to 12 cm. long; pubescence conspicuous, appressed or somewhat spreading; leaves palmately 5-foliolate; petioles 6-15 cm. long; leaflets cuneate-obovate or elliptic, with an obtuse mucronate apex and crinkly margins, 25-40 mm. long, 15-23 mm. broad, gland-dotted and less densely pubescent above; stipules scarious, lanceolate to linear, to 15 mm. long; racemes dense, globose or more elongate, to 6 cm. long; peduncles 3-9 cm. long, shorter than the petioles; pedicels short, to 2 mm. long; flowers 12-18 mm. long; corolla not projecting far beyond the calyx lobes; calyx tube (in flower) 4-5 mm. long; calyx lobes 10-12 mm. long, enlarging considerably in fruit, very unequal, the upper 4 linear-subulate, the lower 1 elliptic, about 3 mm. broad in flower and to 7 mm. broad in fruit; lower calyx lobe (in fruit glabrate) sparsely punctate, with 3 prominent veins; beak of fruit stout, flat, broad, 10-15 mm. long, projecting somewhat beyond the calyx lobes; seed large, rather thick and of uniform thickness, markedly reticulate. *Pediomelum trinervatum* Rydb. Very rare and perhaps not a persistent member of our flora, collected once in August, about 1853, in "fields near the Presidio del Norte," Presidio Co. in the Trans-Pecos. Otherwise known from Grant Co., N. M. and near Chihuahua, Chih.

13. *Psoralea Rydbergii* Cory. Root tuberous, often expanded above and elongate below, 4-11 cm. long, 18-27 mm. thick; stem absent; pubescence appressed or tending to become spreading; leaves pinnately 3-foliolate; stipules scarious, lanceolate or broadly lanceolate, to 12 mm. long; petioles 30-95 mm. long; petiolule of middle leaflet 5-12 mm. long; leaflets broadly elliptic or obovate, acute, obtuse or becoming rounded apically, 15-23 (-32) mm. long, 10-19 (-24) mm. broad, gland-dotted, densely pubescent below, more sparsely so above with hairs more or less restricted to the veins; raceme dense, globose, to 3 cm. long; peduncle 20-65 mm. long, generally shorter than the petioles; pedicels to 3 mm. long; bracts inconspicuous, scarious, lanceolate, to 8 mm. long, similar to the stipules; flowers 12-20 mm. long; corolla projecting well beyond the calyx; calyx 10-17 mm. long; calyx lobes about as long as the tube and linear or narrowly lanceolate, subequal, the lower 1 slightly broader than the upper 4; calyx expanding and elongating in fruit; pod to 15 mm. long with a tapering beak almost as long as the body of the pod, the beak barely projecting beyond the calyx lobes. *Pediomelum humile* Rydb. Rare in calcareous soil, in Val Verde Co., s.w. Tex., Apr.-May; also Coah.

14. *Psoralea hypogaea* T.&G. Rootstock globose or fusiform; stem absent; whole plant covered with dense whitish appressed pubescence; upper surfaces of leaflets becoming glabrate; leaves palmately 3- to 7-foliolate, mostly 5-foliolate; stipules lanceolate or ovate, scarious, to 2 cm. long; petioles 4-9 (-12) cm. long; leaflets narrowly obovate to linear-elliptic or linear-ob lanceolate, (15-) 25-50 mm. long, 4-9 (-13) mm. broad; spike dense, globose, to 25 mm. long; peduncle from very short to about as long as the petioles, 5-70 (-100) mm. long; bracts inconspicuous, scarious, ovate; flowers 8-12 mm. long, almost sessile; upper 4 calyx lobes subulate, lower 1 lanceolate or elliptic, in fruit to 4 mm. broad and often with 3 conspicuous veins; banner whitish to pale-lavender or lavender; wings and keel dark-lavender or purple; fruit 13-18 mm. long, with a narrow beak 7-12 mm. long which projects well beyond the calyx. Represented with us by 2 varieties as follows:

Var. *hypogaea*. Root fusiform or elongate, 2-4 cm. long, (4-) 8-20 mm. thick; leaflets mostly rather narrowly elliptic, up to 8 times as long as broad; peduncles markedly shorter than the petioles, 5-30 mm. long. *Pediomelum hypogaeum* (T.&G.) Rydb. Higher parts of the Plains Country, s. to Lubbock Co., May-June; Mont. and Wyo., s. to Tex. and N.M.

Var. *scaposa* Gray. Rootstocks usually globose, 12-25 mm. long, 11-25 mm. thick; leaflets often broader and shorter than in var. *hypogaea*; peduncles (2-) 3-7 (-10) cm. long, about the same length as the petioles or just a little shorter. *P. scaposa* (Gray) Macbr. and var. *breviscapa* Shinnery, *Pediomelum Goughae* Tharp & Barkl. Calcareous hillsides, n.-cen. Tex. and e. edge of Edwards Plateau, locally w. to Martin and Mitchell cos., Apr.-May; endemic.

15. *Psoralea rhombifolia* T. & G. Rootstock deep, about 25 mm. long and 1 cm. thick; 1 or more long slender trailing shoots to 1 m. long, branching from the crown, these stems occasionally ascending near the ends; pubescence usually short-appressed and rather sparse but occasionally longer, denser and spreading; leaves pinnately trifoliolate; stipules small,

linear or lanceolate, 2-6 cm. long; petioles slender, 3-7 (-11) cm. long; petiolule of middle leaflet to 15 mm. long; leaflet shape variable; basal leaves commonly with orbicular leaflets that are rounded or emarginate apically; leaflets of midstem ovate to rhomboid or broadly lanceolate to broadly elliptic, 10-35 mm. long, 1-3 cm. broad; spikes short, dense, capitate, commonly with only 3 to 8 flowers, in some plants the inflorescence elongate and forming distinct internodes; peduncles slender, (2-) 3-7 (-10) cm. long; bracts similar to the stipules, small, linear, inconspicuous; flowers small, 5-8 (-10) mm. long; calyx 4-6 mm. long, the lobes subequal and slightly longer than the tube; petals brick-red or orange-brown, the banner somewhat paler than the wings and keel; fruit 8-11 mm. long, body enclosed by the calyx, the linear beak 4-6 mm. long and projecting well beyond the calyx. Usually sandy soil, Grayson Co., w.-s.w. to Andrews Co. and s. to Rio Grande Plains, infrequent in e. and s.e. Tex., Mar.-July; Tex., La., Okla., Tam., N.L., Ver., Hgo., Pue., Oax., Mor., Jal., Son. and Baja Calif.

31. AMORPHA L.

Unarmed erect shrubs, often rhizomatous, the herbage and calyx often gland-dotted; leaves alternate, deciduous, usually 8 cm. or more long, once-imparipinnate with 7 or more leaflets; leaflets (4-) 5-30 mm. broad; stipules setaceous, caducous; stipels present; flowers in dense spikelike racemes; calyx obconoid, 5-toothed, persistent; corolla very irregular, reduced to 1 petal (the uppermost one, banner), the rest absent, this banner purplish, bluish or whitish; stamens 10, exserted; filaments all united briefly at the base, free for most of their length; fruit 4-8 mm. long, gland-dotted, not much if at all compressed, slightly exserted from the calyx, 1- or 2-seeded, very tardily dehiscent or seemingly indehiscent.

A genus of about 20 species in the temperate regions of North America.

- 1. Leaflets (15-) 20-30 mm. wide; calyx uniformly pubescent (2)
- 1. Leaflets 8-18 (-22) mm. wide; calyx glabrous to variously pubescent (3)
- 2(1). Leaflets with conspicuous raised veins beneath; spikes of inflorescence (mature ones) (15-) 20-40 cm. long3. *A. paniculata*.
- 2. Leaflets inconspicuously veined beneath; spikes of inflorescence 10-20 cm. long
.....4. *A. texana*.
- 3(1). Leaves sessile or subsessile, the petioles 8 mm. long or less
.....1. *A. canescens*.
- 3. Leaves distinctly petiolate, the petioles 10 mm. long or more (4)
- 4(3). Stalk of the leaflet conspicuously warty with raised glands; calyx conspicuously glandular; mature flowering racemes 15-30 cm. long ..2. *A. laevigata*.
- 4. Stalk of the leaflet inconspicuously glandular, if at all; calyx indistinctly glandular; flowering racemes 10-15 (-20) cm. long5. *A. fruticosa*.

1. *Amorpha canescens* Pursh. LEAD PLANT. Rhizomatous, usually canescent or less commonly glabrous; shrub 3-10 dm. tall; leaves 3-15 cm. long, sessile or subsessile, the petiole (0.5-) 1-3 (-5) mm. long; leaflets (11 to) 27 to 41 (to 47), usually (3-) 10-18 (-25) mm. long, (2-) 4-7 (-12) mm. broad, ovate-oblong to oblong-elliptic or oblong to elliptic or even ovate, the venation usually obscured by the pubescence or inconspicuous even when the pubescence is absent; racemes usually numerous in the axils of the uppermost leaves and often forming a dense compound cluster, (2-) 7-15 (-25) cm. long, 10-15 mm. thick; calyx tube 1.5-2.5 mm. long; calyx lobes narrowly triangular-lanceolate, unequal, 0.6-2.5 mm. long; banner 4.5-6 mm. long, bright-violet. Incl. var. *glabrata* Gray. Infrequent or rare and local and with a very peculiar disjunct distribution, occurring in sandy prairies, e. Panhandle and again scattered in s.e. and s.-cen. Tex., s. to Aransas Co., May-July; s.-cen. Can. s. to N.M. and Tex.

2. *Amorpha laevigata* T.&G. Glabrous shrub, 10-25 dm. tall; leaves 1-2 dm. long; petioles slender, 2-3 cm. long; leaflets 7 to 21, oblong or obovate, 2-3 cm. long, 1-2 cm. broad, rounded at both ends or cuneate basally and sometimes emarginate apically, thin, conspicuously gland-dotted beneath; petiolules conspicuously warty-glandular; flowering racemes usually 2 or 3 (sometimes more), slender, 15-30 cm. long; calyx glabrous, gland-

dotted; calyx lobes short, the upper 2 rounded, the lower 3 lanceolate, acute; banner blue or purple; pod about 5 mm. long, conspicuously gland-dotted, nearly straight dorsally. Rare in n.e. Tex. (Cass and Van Zandt cos.), June; also Okla. Perhaps only a form of *A. texana*.

3. *Amorpha paniculata* T.&G. Stout shrub 2-3 m. tall; branchlets sulcate, tomentose; leaves 20-35 cm. long; petioles 4-5 cm. long; leaflets 15 to 19, ovate or oblong, 3-8 cm. long, (15-) 20-30 mm. broad, rounded at both ends or rarely emarginate apically, when young finely short-pilose above and densely tomentose beneath, at maturity glabrous and glossy above and still tomentose on lower surface, with prominent venation beneath; spikes of inflorescence (15-) 20-40 cm. long; calyx oblique, narrowly campanulate, pubescent, the lobes lanceolate and about half as long as the tube; banner purple; pod 6-8 mm. long, more or less curved dorsally, pubescent and with large resinous gland-dots. Deep acid woodlands and bogs, e. Tex., May-June; Ark., La. and Tex.

4. *Amorpha texana* Buckl. Shrub 1-3 m. tall, with spreading branches; branches, foliage and inflorescence more or less pubescent to glabrous; leaves 10-15 cm. long; petioles 1-2 cm. long; leaflets 7 to 15, broad-oblong or ovate, 15-40 mm. long, 15-30 mm. broad, rounded at both ends or emarginate apically, firm, dark-green and glossy above, paler and pubescent beneath at least along the inconspicuous veins; petiolules 3-5 mm. long, usually pubescent and conspicuously glandular; spikes of inflorescence solitary or few, (5-) 10-15 (-20) cm. long, rather loosely flowered at least near the base; rachis puberulent; calyx narrow-campanulate, 4-5 mm. long, uniformly pubescent or glabrous, gland-dotted; calyx lobes all much shorter than the tube, the 2 upper ones blunt or round, the 3 lower short-lanceolate and acute; banner blue or violet; pod 6-7 mm. long, nearly straight dorsally, conspicuously gland-dotted. Incl. var. *glabrescens* E. J. Palm. Scarce along Edwards Plateau creeks and rivers in Bandera, Blanco, Comal, Gillespie, Kendall and Kerr cos., spring; endemic.

5. *Amorpha fruticosa* L. BASTARD INDIGO. Shrub 2-3 m. tall; branches and foliage more or less pubescent with short-appressed hairs; leaves 1-2 dm. long; petioles (1-) 2-3 cm. long; leaflets 11 to 27 (to 35), oblong or elliptic, rounded or narrowed at base, rounded or rarely abruptly pointed apically, 15-30 mm. long, 7-15 (-20) mm. broad, firm but thin at maturity, dark-green and slightly reticulate-veined above, paler and sparingly gland-dotted and more or less pubescent at least along veins beneath, not crowded on rachis; petiolules short, not glandular-warty; spikes solitary or several, 8-15 (-20) cm. long, peduncled; calyx 3-4 mm. long, nearly glabrous or pubescent; calyx lobes all much shorter than the tube, the upper 2 broad and obtuse, the lower 3 triangular and acute, villous or ciliate along the margins; banner dark-blue; pod 6-7 mm. long, slightly curved dorsally, glabrous and conspicuously gland-dotted. Widespread, Apr.-June; represented with us by 4 subtaxa:

Var. *fruticosa*. Leaflets broad, elliptic. Rare in e. Tex.; e. U. S.

Var. *angustifolia* Pursh. Leaflets narrower. Widespread in Tex. except absent in Rio Grande Plains and rare in e. and far w. Tex.; widely scattered in U. S.

Var. *croceolanata* (P. W. Wats.) Mouillef. With densely pubescent leaves and calyxes. Rare in s.e. Tex.; s.e. U. S.

Var. *occidentalis* (Abrams) Kearn. & Peeb. With oval or oblong glabrate leaflets and mostly solitary spikes. Scattered in w. half of Tex.; Wyo., Calif., Tex., N.M., Ariz., Son., etc.

32. EYSENHARDTIA H.B.K.

KIDNEY WOOD

Shrubs unarmed, much-branched, 5-35 dm. tall, the branches slender; all the herbage and many flower parts gland-dotted and aromatic; leaves alternate, deciduous, once-imparipinnate, 1-6 (-9) cm. long; petioles short; stipules subulate; leaflets 13 to 47, 3-12 mm. long, oblong or oblong-lanceolate; stipels subulate, 0.3-0.5 mm. long, about equaling or shorter than the petiolules; flowers in axillary or subterminal spikelike racemes 1-11 cm. long, slender, sometimes somewhat interrupted; calyx unequally lobed, the anterior (uppermost) lobe longest, the tube split more deeply between the posterior lobes; corolla nearly regular but vaguely papilionaceous; petals white to pale-yellow, nearly equal, 4-5 mm. long, with oblanceolate to obovate blades and narrow claws; stamens 10, diadelphous,

9 with filaments coalescent about half their length, the tenth (uppermost) free; pod indehiscent or very tardily dehiscent, 5-10 mm. long, 1.7-2.5 mm. broad, laterally flattened, with only 1 mature seed, gland-dotted.

More than a dozen species from southwestern United States to Guatemala.

- 1. Shrub usually 2-3 m. tall; leaves 3-9 cm. long; leaflets 15 to 47, mostly 5-12 mm. long; racemes 3-11 cm. long1. *E. texana*.
- 1. Shrub usually not more than 1 m. tall; leaves 1-3 cm. long; leaflets 13 to 17, 3-4 mm. long; racemes usually not more than about 3 cm. long; rare species in mountains in Presidio Co.2. *E. spinosa*.

1. *Eysenhardtia texana* Scheele. VARA DULCE. Shrub, usually 2-3 m. tall, rarely small trees; leaves 3-9 cm. long; leaflets 15-47 per leaf, mostly 5-12 mm. long; racemes 3-11 cm. long. *E. angustifolia* Penn. Frequent in brushy vegetation, usually on highly calcareous soils, s. Tex., n. to Bell, San Saba, Crockett and Brewster cos., Apr.-Sept.; Tex. s. to Qro. and Ver.

2. *Eysenhardtia spinosa* Gray. Shrub, usually not more than 1 m. tall; leaves 1-3 cm. long; leaflets 13 to 17, 3-4 mm. long; racemes usually about 3 cm. long. Rare, known from one population on Capote Peak in w. Presidio Co., Trans-Pecos Tex., Aug.; also Chih.

33. DALEA L.⁸⁹

Annual or perennial herbs or low shrubs, unarmed; leaves alternate, once-imparipinnately-compound or in *D. scoparia* simple, or rarely palmately trifoliolate, gland-dotted; stipules and stipels present, the latter sometimes reduced to glands; flowers in terminal heads, racemes or spikes, of various colors; calyx usually gland-dotted, usually obconoid or campanuloid, its cup often ribbed, the 5 lobes often as long as the cup or longer and often subulate; corolla papilionaceous or in a few species very obscurely so, the banner (uppermost) petal attached near the rim of the floral cup, the other 4 petals attached either near the rim of the floral cup or else seemingly attached at various levels on the "stamen tube" (this may represent in part an extension of the floral cup tissue) but never at the terminal rim of that "stamen tube;" stamens 5, 6, 7, 8, 9 or 10, the filaments monadelphous, coalescent for most of their lengths; fruit a dry indehiscent slightly if at all flattened 1- or 2-seeded pod mostly included in the persistent calyx or but very slightly exceeding it. *Parosela* Cav.

A genus of perhaps 250 to 300 species in the warmer parts of the Americas, not well-delimited from *Petalostemum* Michx. but technically distinguished by the placement of the petals on the "stamen tube."

- 1. Leaves simple (rarely, 3-foliolate) 1. *D. scoparia*.
- 1. Most leaves on any one specimen compound (2)
- 2(1). Plants more or less shrubby or suffrutescent, the stems persisting to produce new branchlets each year (straggling and stoloniferous in *D. Greggii*) (3)
- 2. Plants annual or perennial, the stems not persisting (the very lowest portions of the stem sometimes persisting in *D. Wrightii*) (7)
- 3(2). Branches and leaves glabrous (4)
- 3. Branches and leaves villous to puberulent (5)
- 4(3). Calyx lobes as long as the tube or longer22. *D. formosa*.
- 4. Calyx lobes much shorter than the tube 8. *D. frutescens*.
- 5(3). Plants straggling, the stems decumbent and rooting at the nodes; calyx lobes lanceolate, 1-3 mm. long; leaves densely sericeous ..21. *D. Greggii*.
- 5. Plants with stiffly erect stems; calyx lobes triangular, 0.5-1 mm. long or (if longer) subulate and some of them recurved at tip; leaves variously pubescent but not densely sericeous (6)

⁸⁹ We are grateful to Rupert C. Barneby for reading and making some additions and corrections to the manuscript.

- 6(5). Calyx lobes subulate, at least some of them recurved at the tip; plants of extreme southern Texas23. *D. thyrsiflora*.
6. Calyx lobes deltoid, 0.5-1 mm. long, not recurved at tip; plants of western Texas
..... 9. *D. argyraea*.
- 7(2). Flowers short-pedicel (best seen on old spikes after the flowers fall), spreading at right angles or reflexed at maturity; racemes densely covered with long brown or tawny hairs (8)
7. Flowers sessile or nearly so, ascending, never reflexed; spikes variously pubescent (10)
- 8(7). Bracts ovate, 10-15 mm. long; stems stiffly erect, sparsely pubescent, conspicuously glandular-pustulate 2. *D. lachnostachys*.
8. Bracts lanceolate, 8 mm. long or less; stems straggling, densely soft-pubescent, with scattered glands but not pustulate (9)
- 9(8). Leaflets cuneate-obovate, truncate or retuse at apex, with conspicuous crenulate margins, the glands nearly all marginal 4. *D. neomexicana*.
9. Leaflets mostly elliptic, rounded at apex (rarely retuse), without crenulate margins, the glands scattered and not conspicuously marginal
..... 3. *D. longipila*.
- 10(7). Leaflets completely glabrous (11)
10. Leaflets variously pubescent (17)
- 11(10). Plants annuals (Doubtful cases should be keyed under both alternatives) (12)
11. Plants perennials (15)
- 12(11). Stamens 5; 4 of the petals inserted slightly below the end of the "stamen tube," the fifth near the base of the "stamen tube"24. *D. emarginata*.
12. Stamens more numerous; all 5 petals inserted near the top of the floral cup, not on the "stamen tube" (13)
- 13(12). Stems 3-10 dm. tall; bractlets caducous 7. *D. leporina*.
13. Stems 1-3 dm. tall; bractlets not caducous (14)
- 14(13). Flowering peduncles mostly 3-9 cm. long at maturity
..... 5. *D. polygonoides*.
14. Flowering peduncles mostly 1-3 cm. long at maturity .. 6. *D. brachystachys*.
- 15(11). Spikes very lax; corolla white; stems mostly single .14. *D. enneandra*.
15. Spikes not very lax; corolla purplish; plants with several stems from the base (16)
- 16(15). Calyx lobes subulate, 6 to 40 times as long as broad, usually as long as the calyx tube or longer13. *D. pogonathera*.
16. Calyx lobes acute to acuminate, 6 times as long as broad or less, shorter than the calyx tube12. *D. lasiathera*.
- 17(10). Stems prostrate, widely spreading; flowers red to pink (18)
17. Stems erect to suberect or decumbent but not prostrate and spreading; flowers yellow (sometimes fading to a pinkish color when dry) (19)
- 18(17). Calyx tube and lobes densely villous10. *D. lanata*.
18. Calyx tube glabrous, the lobes villous11. *D. terminalis*.
- 19(17). Main stem leaves 5- or 7- (9-) foliolate, the majority always 5-foliate (20)
19. Main stem leaves 3-foliate (the uppermost sometimes simple) (22)
- 20(19). Stipules setiform, over 4 mm. long; bracts 6-12 mm. long; calyx teeth mostly 6-9 mm. long19. *D. Wrightii*.
20. Stipules subulate, sometimes up to but exceptionally over 3 mm. long; bracts 2.5-5.5 mm. long; calyx teeth mostly 3.5-5 mm. long (21)
- 21(20). Stems coarser, erect, 30-75 cm. long, if branched distally commonly over 40 cm. long; spikes mostly 14-21 mm. thick; petals permanently yellow (unchanged in age or in drying), the keel blades 5-7 mm. long ...15. *D. aurea*.
21. Stems slender, commonly both diffuse and branched distally, 5-35 cm. long; spikes 7-13 (15) mm. thick; petals yellow fading pink or brown, the keel blades 3-5 mm. long16. *D. nana*.

- 22(19). Leaflets linear to linear-elliptic; pubescence of stems appressed; north-central Texas17. *D. Hallii*.
22. Leaflets obovate or elliptic-obovate, if narrowly so then the stems loosely pilose; Plains and Trans-Pecos (23)
- 23(22). Spikes relatively loose, not conelike; bracts subhomomorphic, deciduous; blade of banner 3-4 mm. long, over half as long as its claw; keel blades 5-6 mm. long18. *D. Jamesii*.
23. Spikes dense and conelike; bracts dimorphic, those at base of spike broadly ovate-acuminate, those between the flowers narrower; blade of banner about 2 mm. long, 2 or 3 times shorter than its claw; keel blades 3-4 mm. long20. *D. laniceps*.

1. *Dalea scoparia* Gray. BROOM PEA. Shrub 5 dm. tall or taller, with ascending canescent and conspicuously gland-dotted branches; leaves simple, spatulate-linear or oblanceolate, 1 cm. long or shorter, canescent and gland-dotted; peduncles 2-7 cm. long; spikes subglobose or oblong, 12-15 mm. broad, dense; bracts lanceolate, 2 mm. long; calyx tube turbinate, strongly 10-ribbed, with a row of 2 to 4 glands in each interval, 2.5 mm. long, white-villous; calyx lobes deltoid, 1 mm. long; corolla dark-blue; blade of the banner broadly ovate, subcordate basally and retuse apically, usually with a single gland near the apex, the claw 2.5 mm. long; blades of the wings oblong, with a rounded basal lobe, 5 mm. long, those of the keel petals broadly obliquely obovate, 5 mm. long, the claws of the wings and keel petals 2 mm. long; pod obliquely obovate, pubescent and gland-dotted, glabrous only at the very base; body about equaling the calyx. *Psorothamnus scoparius* (Gray) Rydb. Dunes and coppice mounds along the Rio Grande in El Paso and Hudspeth cos. (downstream to Ft. Hancock), (May) Aug.-Sept.; Ariz., N. M., Tex., Chih. and Coah.

2. *Dalea lachnostachys* Gray. Perennial herb with deep roots; stems erect, branched, 1-3 dm. tall, straw-colored, conspicuously gland-dotted and -pustulate and finely villous; leaves spreading, 4-8 cm. long; stipules subulate, 3-5 mm. long; petioles 1-3 cm. long; rachis gland-dotted and villous; stipules glandlike; leaflets 9 to 11, ovate or obovate, silky-villous on both sides, conspicuously gland-dotted along the margins beneath, 8-15 mm. long; peduncles opposite the leaves and terminal, 3-6 cm. long; racemes long-hairy, dense, cylindrical, 4-8 cm. long, fully 15 mm. thick; bracts ovate, concave, scarious-margined, often tinged with lilac, pubescent, long-acuminate, 10-15 mm. long, longer than the buds, deciduous; pedicels present; calyx tube turbinate, 3 mm. long, silky-pilose, strongly 10-ribbed, the calyx lobes twice as long as the tube; corolla bright-blue; blade of the banner broadly ovate, cordate basally, 4 mm. long, the claw 3 mm. long; blades of the wings and keel petals obliquely ovate, with a rounded basal lobe, about 4 mm. long, the claws 3 mm. long; pod very villous. *Parosela lachnostachys* (Gray) Heller. Locally abundant in the Trans-Pecos (Brewster, Hudspeth, Jeff Davis and Presidio cos.), 3,500-5,500 ft. elev., June-Oct.; Tex., N. M., Ariz. and Chih.

3. *Dalea longipila* (Rydb.) Cory. Perennial herb with slender roots; stem straggling, branched at the base, decumbent or spreading, 1-2 dm. long, densely and softly long-villous; leaves 3-5 cm. long, spreading; stipules small, subulate; leaflets 9 to 13, elliptic, rounded apically, rather sparingly silky-villous with long hairs, conspicuously gland-dotted, 6-12 mm. long; peduncles opposite the leaves, 3-7 cm. long; racemes long-hairy, rather dense, 2-3 cm. long; bracts narrowly lanceolate, 8 mm. long or shorter, gradually attenuate, not exceeding the calyxes; pedicels present; calyx long-silky; calyx tube about 3 mm. long, the lobes 4 mm. long; blade of the banner acutish-cordate, 3.5 mm. long, yellowish-white, gland-dotted near the base; wings yellowish-white, the blades obliquely obtusate, slightly retuse apically, with a rounded basal lobe, 4 mm. long, the claws 2 mm. long; keel petals with a purple tip, the blades obliquely obovate, with a rather large rounded basal lobe, with small glands at the base, 5 mm. long, the claw 3 mm. long; pods glabrous. *Parosela longipila* Rydb. Very dry limestone hills, Brewster, Val Verde and Terrell cos. of s.w. Tex., June-Oct.; also Coah., Tam. and N.L.

4. *Dalea neomexicana* (Gray) Cory. Perennial herb with slender roots; stems branched from the base, straggling, decumbent or prostrate, 1-2 dm. long, densely short-villous, almost velutinous; leaves 15-30 mm. long; stipules subulate, minute; petioles 3-6 mm. long; rachis densely short-villous; leaflets 7 to 11, cuneate-obovate, retuse, densely villous, gland-dotted near the margins, 3-8 mm. long, marginally crenulate; peduncles opposite the leaves, 2-3 mm. long; racemes long-hairy, dense, 1-2 cm. long;

bracts narrowly lanceolate, acuminate, 8 mm. long or shorter, scarcely longer than the calyx, long-villous; pedicels present; calyx tube turbinate, strongly 10-ribbed, densely silky-villous, 3 mm. long, the lobes about 5 mm. long; corolla mostly yellowish with purple- or rose-tinged keel, rarely rose-colored; blade of the banner broadly cordate, 3.5 mm. long, acute, conspicuously gland-dotted toward the base, equaling the claw; blades of the wings obliquely obcuneate-ovate, acutish, with a rounded basal lobe, 3.5-4 mm. long, those of the keel petals broadly obovate, with a rounded basal lobe, 4 mm. long, the claws of both 2-3 mm. long; pod villous. *Parosela neomexicana* (Gray) Heller. Deserts and desert-grasslands of the Trans-Pecos, frequent, Mar.-Nov.; s. Ariz., N. M., Tex., Chih., Son., Coah. and Tam.

5. *Dalea polygonoides* Gray. Slender taprooted annual 1-2 dm. tall, erect, branched, glabrous; leaves 2-3 cm. long; stipules subulate, 2 mm. long; petiole 5-10 mm. long; rachis glabrous, slightly gland-dotted; leaflets 3 to 9, broadly linear or linear-oblong, 6-15 mm. long, glabrous on both sides, sparingly gland-dotted beneath; peduncles terminating the branches, 3-9 cm. long; spikes dense, 1-2 cm. long; bracts ovate or obovate, acuminate, equaling the calyx, rather persistent, dark-colored with a few large glands, ciliate; flowers sessile or nearly so; calyx tube narrowly turbinate, somewhat extended by the fruit, silky-villous, 1.5 mm. long, 10-ribbed; calyx lobes subulate, acuminate, about equaling the tube; corolla bluish, pinkish or white; blade of the banner about 1 mm. long, rounded-ovate, truncate or subcordate basally, slightly longer than the claw; wings and keel petals inserted at the middle of the staminal tube, the blades obliquely ovate, with a rounded basal lobe, about 1 mm. long, those of the keel petals united along the lower edge, the claws 1 mm. long; pod villous, obliquely obovate, equaling the calyx. *Parosela polygonoides* (Gray) Heller. Rare on the higher parts of the Davis Mts., Jeff Davis Co. in the Trans-Pecos, Sept.; Tex., N. M., Ariz., Dgo. and Chih.

6. *Dalea brachystachys* Gray. Slender taprooted annual; stems 1-3 dm. tall, glabrous, much-branched, sparingly gland-dotted; leaves 1-3 cm. long; stipules minute, subulate; petiole 4-8 mm. long; rachis glabrous, margined, sparingly gland-dotted; stipels represented by glands; leaflets 5 to 11, cuneate-oblong to linear, glabrous, gland-dotted and glaucous beneath, 5-15 mm. long; peduncles terminating the branches or opposite the leaves, 1-3 cm. long at anthesis; spikes subglobose; bracts ovate, acute or acuminate, green to dark-brown, conspicuously gland-dotted, glabrous, tardily deciduous; flowers sessile or nearly so; calyx tube turbinate, 10-ribbed, silky-hirsute, 2 mm. long; calyx lobes with a deltoid base, subulate-filiform, longer than the tube; corolla yellowish, tinged with rose; blade of the banner subcordate, 2 mm. long and fully as broad; wings and keel petals inserted far below the middle of the "staminal tube," blades of the wings 2-2.5 mm. long, those of the keel petals broader and with a smaller basal lobe, 3 mm. long, the claws of both nearly 2 mm. long; pod silky-villous. *Parosela brachystachys* (Gray) Heller. Davis Mts. in the Trans-Pecos, at elev. of 4,000-6,000 ft., Aug.-Sept.; N. M., Ariz., Tex. and Son., s. to. Aguasc. and Pue.

7. *Dalea leporina* (Ait.) Bullock. FOXTAIL DALEA. Slender taprooted annual; stem striate, glabrous, gland-dotted, somewhat tubercled, with ascending branches, 3-10 dm. tall; leaves ascending, 4-8 cm. long; stipules subulate, 2-3 mm. long; petiole 5-8 mm. long; rachis glabrous, margined, sparingly gland-dotted; stipels glandlike; leaflets 21 to 41, 4-10 mm. long, glabrous, rather oblong, gland-dotted beneath; peduncles at the ends of the branches and opposite the leaves, 3-10 cm. long; spikes dense, 2-8 cm. long, about 8 mm. thick; bracts lanceolate or lance-ovate, acuminate, caducous, membranous, mostly pale, ciliate marginally and pilose dorsally; flowers sessile or nearly so; calyx tube turbinate, silky-pilose, 3 mm. long; calyx lobes lanceolate, subulate-acuminate, about equaling the tube; corolla white or tinged with rose or lilac; blade of the banner hastately obovate, with a truncate base and acute basal lobes, 2.5-3 mm. long; blades of the wings obliquely oblong, 2 mm. long, with a rounded basal lobe, those of the keel petals more obovate, with a less distinct basal lobe, soon distinct; stamens more than 5; pod pilose apically. *D. alopecuroides* Willd., *D. oreophila* (Cory) Cory, *D. leporina* var. *alba* (Michx.) Harrington, *Parosela alopecuroides* (Willd.) Rydb., *Petalostemum oreophilum* Cory. Scattered in Trans-Pecos mts., Sept.-Oct.; widespread in cen. N. A. and s. to C. R. and the Arg.-Bol. Andes.

8. *Dalea frutescens* Gray. BLACK DALEA. Rounded or often spreading shrub 2-10 dm. tall; branches striate, glabrous, very sparingly gland-dotted; leaves spreading, 10-25 mm.

long; stipules setaceous-subulate, 2 mm. long; petiole 5 mm. long; rachis glabrous, slightly margined; leaflets 13 to 17, glaucous-verdigris, glabrous, minutely gland-dotted beneath, obovate, retuse, 3-8 mm. long; peduncles terminating the branches, 1-5 cm. long, glabrous; spikes at first subcapitate, dense, about 1 cm. long or in some populations loose and to 6 cm. long; bracts ovate, acute, conspicuously gland-dotted; calyx tube turbinate, 3 mm. long, with conspicuous orange gland-dots between the 10 strong ribs; calyx lobes deltoid, with short subulate tips, villous-ciliate marginally, much shorter than the calyx tube; corolla purple; blade of the banner cordate, nearly 5 mm. long, the claw 3 mm. long; blades of the other petals 6 mm. long, the claws 1.5 mm. long; pod broadly obliquely obovate, glabrous, conspicuously gland-dotted. Incl. var. *laxa* (Rydb.) B. L. Turner, *Parosela frutescens* (Gray) Vail, *P. laxa* Rydb. Cen. and Trans-Pecos Tex. e. to Montague, Dallas, Bell, Williamson and Travis cos., usually on dry limestone hills in brushy vegetation, absent from higher parts of Plains Country and from Rio Grande Plains, July-Oct.; s.e. Okla., Tex., N.M., Chih., Coah. and N.L.

Formerly an important browse but quickly eliminated from browsed ranges, thus absent from much of its former range. In the western part of the distribution, these shrubs are hosts of *Pilostyles Thurberi*.

9. *Dalea argyrea* Gray. SILVER DALEA. Erect shrub 3-10 dm. tall, corymbosely branched above; branches canescent-tomentose and gland-dotted or glandular-tuberculate, leafy; leaves spreading, 1-2 cm. long; stipules subulate, about 2 mm. long; petiole 3-5 mm. long; rachis canescent-tomentose; stipels glandlike; leaflets 7 to 13, obovate or obovate-oblong, closely sericeous on both sides, gland-dotted beneath, 5-8 mm. long; peduncles terminating the branches, 1-2 cm. long; spikes dense, short, 10-25 mm. long; bracts lance-ovate, acuminate, about equaling the calyx, canescent; calyx tube broadly campanulate, silky-villous, 2.5 mm. long; calyx lobes deltoid, acute, 0.5-1 mm. long, not recurved, shorter than the tube; banner yellowish, fading purplish, the blade orbicular, 3-4 mm. long, equaling the claw; wings and keel petals purple, the blades of the keel petals united along the lower edge; pod silky-villous. *Parosela argyrea* (Gray) Heller. Scattered on limestone hills and mts. in the Trans-Pecos e. to Val Verde Co., July-Sept.; N. M., Tex., Chih., Coah. and N. L.

This plant is reputedly poisonous to stock.

10. *Dalea lanata* Spreng. WOOLLY DALEA. Perennial with long woody roots; stems several, essentially prostrate, 3-5 dm. long, densely and shortly villous-tomentose; leaves spreading, 2-3 cm. long; stipules subulate, 3-5 mm. long; rachis villous-tomentose; stipels represented by glands; leaflets 9 to 13, obovate to cuneate or rarely oblong, usually emarginate, 4-12 mm. long, densely short-villous; peduncles opposite leaves, 1-3 cm. long; spikes elongate, in fruit lax, 3-8 cm. long; bracts broadly obovate, abruptly acuminate, equaling the calyx, persistent, villous and with a few conspicuous glands on the back; flowers sessile or nearly so; calyx all densely villous externally; calyx tube turbinate, membranous, 2.5 mm. long; calyx lobes lanceolate, acuminate, shorter than the tube; corolla blood-red to purple, rarely white; blades of the banner rounded-cordate, with a deep sinus, more or less cucullate, 3 mm. long, the claw 2 mm. long; blades of the wings ovate and with a rounded basal lobe, 3 mm. long, those of the keel petals broadly obliquely obovate, with a smaller basal lobe, 3 mm. long, the claws of both 1 mm. long; pod half-reniform, finely villous. *Parosela lanata* (Spreng.) Britt. Local in deep loose sand, usually in dune areas, higher parts of the Plains Country and along the Red River e. to Grayson Co.; also isolated in extreme s. Tex. (Kenedy, Brooks, Jim Hogg and Starr cos.), June-Oct.; Kan. and Colo. to Tex.

11. *Dalea terminalis* M. E. Jones. Essentially identical to *D. lanata* but the calyx tube glabrous (lobes villous). *Parosela terminalis* (M. E. Jones) Heller. Local in deep loose sand in the Trans-Pecos near the Rio Grande, June-Sept.; Tex. to Ut., Ariz. and Chih.

12. *Dalea lasiathera* Gray. PURPLE DALEA. Perennial with woody roots and short caudexes; stems several from the base, 1-3 dm. tall, slender, glabrous, almost glandless; leaves 20-35 mm. long; stipules subulate, 1-2 mm. long; rachis margined, glabrous, slightly gland-dotted; leaflets 7 to 13, glabrous, linear-oblong or oblanceolate, rounded or retuse apically, 5-15 mm. long, glabrous, minutely gland-dotted beneath; peduncles 3-5 cm. long; spikes moderately dense, 3-6 cm. long; bracts broadly ovate, short-acuminate, bluish-green and conspicuously gland-dotted dorsally, somewhat scarious-margined; flowers sessile or nearly so; calyx tube broadly turbinate, 3 mm. long, silky-villous and gland-dotted; calyx lobes 6

times as long as broad or shorter, plumose, with a deltoid base and a short subulate tip, 2 mm. long; corolla purple; blade of banner round-reniform, 4 mm. long, 5 mm. broad; wings and keel petals inserted a little below the middle of the "stamen tube," the blades strongly curved, those of the former 5 mm. long, of the latter 6 mm. long; pod densely villous above. *Parosela lasiathera* (Gray) Heller. Limestone hills and cuestas, Trans-Pecos (Jeff Davis Co.), Edwards Plateau and Rio Grande Plains s. to Duval Co., Mar.-June; Tex., Coah., N. L. and Tam.

13. *Dalea pogonathera* Gray. **HIERBA DEL CORAZÓN, BEARDED DALEA.** Perennial herb with woody roots and short caudexes; stems many, ascending or erect to decumbent, 1-2 dm. long, seldom 3 dm. long, glabrous, slender; leaves spreading, 1-2 cm. long; stipules subulate-setaceous, 2-3 mm. long; rachis slightly margined, glabrous, gland-dotted; stipels glandlike; leaflets 5 or 7, linear-oblong or linear-cuneate, truncate or retuse apically, glabrous, gland-dotted beneath, bluish-green; peduncles opposite the leaves, 10-25 mm. long; spikes 2-6 cm. long, moderately to very dense; bracts broadly ovate, abruptly short-acuminate, glabrous, scarious-margined, bluish-green and gland-dotted dorsally, persistent; flowers sessile or nearly so; calyx tube broadly turbinate, 3 mm. long, 10-ribbed, silky, not conspicuously gland-dotted; calyx lobes filiform from a deltoid base, 6 to 40 times as long as broad, silky-plumose, 4 mm. long; corolla purple to nearly flesh-colored; blade of the banner rounded-reniform, 2 mm. long, 3 mm. broad, the claw 3 mm. long; wings inserted near the middle of the "stamen tube," the keel petals higher up, the blades of the former 2.5-3 mm. long, the claws 1 mm. long; blades of the keel petals similar but with a comparatively smaller basal lobe, 4-4.5 mm. long; pod densely villous above. *Parosela pogonathera* (Gray) Vail, *P. Walkerae* Tharp & Barkl. Frequent in the Trans-Pecos and Rio Grande Plains, scattered n.e. to Wichita Co., Mar.-Sept.; Tex. to Ariz. s. to Zac. and S. L. P.

Plants of Trans-Pecos and westward that have calyx teeth over 4 mm. long and relatively large flowers (keel blades mostly 4.5-6 mm.) are var. *pogonathera*; south and east from Uvalde Co. the species is represented by the smaller flowered var. *Walkerae* (Tharp & Barkl.) B. L. Turner, with calyx teeth mostly less than 4 mm. and keel blades, often paler purple, only 3.5-4.5 mm. long. Intergrades occur on the lower Rio Grande.

14. *Dalea enneandra* Nutt. Perennial with woody roots; stems mostly solitary at base, 3-10 dm. tall, glabrous, branched above; leaves 2-3 cm. long; stipules subulate; rachis margined, gland-dotted; leaflets 5 to 9, linear or narrowly oblong, conspicuously gland-dotted beneath, 5-12 mm. long, glabrous and bluish-green; peduncles slender, 2-4 cm. long; spikes very lax, 5-12 cm. long; bracts broadly ovate, short-acuminate, densely gland-dotted dorsally, conspicuously scarious-margined; flowers sessile or nearly so; calyx tube turbinate, 3 mm. long, densely silky; calyx lobes filiform with a deltoid base, 4 mm. long, plumose; corolla white; blade of the banner rounded-cordate, gland-dotted below, 3 mm. long, the claw 3 mm. long; wings inserted near the middle of the "stamen tube," the keel petals higher up, the blades of the former 4 mm. long, those of the latter 5 mm. long, the claws of both 1.5-2 mm. long; pod densely villous above, glabrous below. *D. laxiflora* Pursh, *Parosela enneandra* (Nutt.) Britt. Frequent, mostly in alluvial soils, n.-cen. Tex. w. to Plains Country, rare s.e. to Austin Co., May-Oct.; Ia. to N. D., N. M., Tex. and Miss.

15. *Dalea aurea* Nutt. **GOLDEN DALEA.** Perennial herb, slightly woody at the extreme base; stems 1 to several, erect, 3-5 dm. tall, silky-canescens, leafy but the upper leaves reduced and scattered; leaves pinnately 5- or rarely 7-foliolate, ascending, 2-5 cm. long; stipules subulate, (1-) 2-3 mm. long; petiole about 1 cm. long; rachis sericeous, obscurely if at all dotted; leaflets oblong-oblongate to narrowly obovate, sparingly silky above, densely so and minutely gland-dotted beneath, 1-2 cm. long; peduncles terminating the stems, 1-10 cm. long; spikes dense, 2-5 cm. long, 15-25 mm. thick; bracts ovate, short-acuminate, densely silky, equaling the calyx; flowers sessile or nearly so; corolla yellow; blade of the banner flabelliform-cordate, about 4 mm. long and broad, the claw 4-5 mm. long; wings and keel petals inserted slightly above the middle of the "stamen tube," blades obliquely ovate, with a large rounded basal lobe, those of the wings about 5 mm. long, those of the keel petals 6-7 mm. long, the claws of both 1 mm. long; pods silky-villous. *Parosela aurea* (Nutt.) Britt. Widespread and locally common in w. two thirds of Tex. e. to n.-cen. Tex., occasional on Gulf Coastal Plain (Bee and Brooks cos.), May-July; S. D. to Wyo. and s. to Coah.

16. *Dalea nana* Torr. DWARF DALEA. Perennial herb, branched at the base; stems 1-2 (-3) dm. tall, decumbent at the base or usually ascending, silky-canescens; leaves numerous, spreading, 2-3 cm. long; stipules subulate-setaceous, 1-3 (-4) mm. long; petioles 4-8 mm. long; rachis silky-canescens; leaflets 5 to 9 (rarely 3), obovate, 5-15 mm. long, sericeous on both sides; peduncles opposite the leaves and at the ends of the branches, 5-20 mm. long; spikes oblong, dense, 1-3 cm. long, 8-13 mm. thick; bracts ovate or lance-ovate, short-acuminate, pubescent, about equaling the calyx; flowers sessile or nearly so; calyx tube turbinate, 10-angled, 3 mm. long, sericeous; calyx lobes filiform from a broad base, longer than the tube; corolla yellow, fading rose-colored; blade of the banner reniform, 2 mm. long, 3.5 mm. broad, the claw 3 mm. long; blades of the other petals 3-3.5 mm. long, those of the keel petals slightly larger than those of the wings, the claws 1 mm. long; pod villous.

The var. *nana* [*Parosela nana* (Gray) Heller], characterized by relatively loose spikes and broadly ovate bracts 2-4 mm. wide, is calcifuge and found usually in sandy soil throughout the Rio Grande Plains and, disjunctly, in a relatively large-flowered form in the Trans-Pecos and Northern Plains; the strongly calciphile var. *carnescens* (Rydb.) Kearn. & Peeb. (*Parosela rubescens* Wats., *P. carnescens* Rydb., *P. Whitehouseae* and *P. Lesueurii* Tharp & Barkl.), distinguished by dense conelike spikes and lanceolate bracts mostly less than 2 mm. wide, is the common form from the Edwards Plateau westward through the Trans-Pecos. Occasional intergrades occur along the Rio Grande. The var. *nana* to w. Kan., Colo., s.e. Ariz., Chih., N. L.; the var. *carnescens* to s. Ariz., Tam. and Dgo., flowers both in spring and fall.

17. *Dalea Hallii* Gray. Perennial herb with woody caudexes; stems slender, decumbent (ascending toward the ends), 1-2 dm. tall, strigose-canescens; leaves digitately ternate, 2-4 cm. long; stipules subulate, 1-3 mm. long; petiole 10-15 mm. long, strigose; leaflets 3, linear, acute or even minutely cuspidate, 10-25 mm. long, glabrous above, strigose-canescens beneath, obsolete gland-dotted; peduncles terminal, 1-2 cm. long; spikes at first dense, in age laxer, 1-4 cm. long; bracts ovate-lanceolate, acuminate, villous-canescens, equaling the calyx; flowers sessile or nearly so; calyx tube turbinate, 2 mm. long, silky-canescens; calyx lobes filiform from a broad base, silky-plumose, nearly twice as long as the tube; corolla yellow, fading rose-colored; blade of the banner flabelliform-reniform, 2 mm. long, shorter than the claw; wings and keel petals inserted below the middle of the "stamen tube;" blades of the wings 3.5-4 mm. long, those of the keel petals 5 mm. long; pods villous. *Parosela Hallii* (Gray) Heller. N.-cen. Tex., n. and n.e. to Parker, Dallas, Tarrant and Fannin cos., s. to Hays and Kerr cos., May-June; endemic.

18. *Dalea Jamesii* (Torr.) T. & G. Perennial herb with thick woody caudexes; stems numerous, ascending, usually about 1 dm. high, densely silky; leaves palmately 3-foliolate, 10-25 mm. long; stipules subulate-setaceous, indurate, 5-9 mm. long; petioles about 1 cm. long, densely silky; leaflets obovate or cuneate, rounded or acutish apically, 8-15 mm. long, densely silky-canescens on both sides; peduncles terminal, very short, sometimes obsolete; spikes dense, 15-60 mm. long, 15-18 mm. thick; bracts deciduous, membranous, ovate or broadly lanceolate, acuminate, equaling the calyx, often purple-tinged; flowers sessile or nearly so; calyx tube turbinate, 25-30 mm. long, densely silky, the lobes filiform from a broad base, plumose, and longer than the tube; corolla yellow, fading purplish; blade of the banner cordate, 3 mm. long, equaling the claw; wings and keel petals inserted below the middle of the "stamen tube;" blades of the wings 4-4.5 mm. long, those of the keel petals 7-8 mm. long; pod villous. *Parosela Jamesii* (Torr.) Vail. Local in Trans-Pecos mts. and very rare in Plains Country and one record for Crockett Co., Apr.-July; s. to n. Dgo.

19. *Dalea Wrightii* Gray. Low perennial herb with woody roots and short caudexes; stems several, ascending or erect, rarely more than 1 dm. long, densely silky-canescens, leafy; leaves pinnately 5- to 7-foliolate, 2-4 cm. long; stipules setiform, (4-) 5-9 mm. long, indurate; petioles about 1 cm. long; rachis sericeous, not gland-dotted; leaves oblanceolate to obovate or elliptic, 5-20 mm. long, silky-canescens on both sides; spikes subsessile at the ends of the stems, 2-6 cm. long, nearly 2 cm. thick; bracts lanceolate, acuminate, longer than the calyx; flowers sessile or nearly so; calyx tube turbinate, 3 mm. long, densely silky, 10-ribbed; calyx lobes filiform from a broad base, plumose, almost twice as long as the tube; corolla yellow, fading rose-colored or purplish; blade of the banner cordate-flabelliform, nearly 3 mm. long and broad, the claw 6 mm. long; wings and keel

petals inserted a little above the middle of the "stamen tube;" blades of wings 3.5 mm. long, those of keel petals 4 mm. long; pod villous. *Parosela Wrightii* (Gray) Vail, *P. Warnockii* Tharp & Barkl. Frequent in the Trans-Pecos, Apr.-Sept.; Tex. to s. Ariz., n. Chih., Son. and Coah.

20. *Dalea laniceps* Barneby. Dwarf perennial herb, silvery-pilose throughout, not visibly glandular but aromatic; stems usually 1 to 3, rarely several, including the solitary terminal disproportionately large heads 2.5-8 cm. long; leaves 1-3.5 cm. long, pedately 3-foliolate the leaflets rhombic-ovate to elliptic-oblong and 5-18 mm. long, the terminal one largest; stipules linear-setiform, (3-) 4-8 mm. long; spikes sessile among the upper leaves, densely many-flowered, plumply ovoid-oblong to subglobose, 1-3 (-3.5) cm. long, 1.5-2 cm. thick; bracts dimorphic, the outermost broadly ovate-acuminate, 6-9 long, 3.5-5 mm. wide, the inner ones about as long but narrower, elliptic, acuminate; flowers sessile; calyx tube densely pilose, 2.5-3 mm. long, the triangular-aristate teeth 5-6 mm. long, in age plumose; petals clear-yellow drying orange- or pinkish-brown; blade of the banner reniform, about 2 mm. long, the claw 5-6 mm. long; wings and keel petals inserted well above the middle of the "stamen tube;" blades of wings 3 mm. long, those of keel petals 3-4 mm. long; pod barbate above the middle. Rare and scattered, dry stony hillsides, often on limestone, in Tex. known only from s. Pecos Co., Apr.-May, again in fall; Trans-Pecos Tex. to N.L., Zac. and e. Chih.

21. *Dalea Greggii* Gray. Subshrub with thick caudex; branches several, decumbent or prostrate, grayish-tomentose, gland-dotted, usually several dm. long, woody near the base, rooting at the nodes and often forming tight colonies 1 m. or more across; leaves 5-20 mm. long, densely sericeous-grayish-tomentose; stipules subulate, 1-2 mm. long; petiole not more than twice as long as the lowest internode of the rachis; rachis 1-2 cm. long; leaflets 5 or 7 (rarely up to 11), often crowded, obovate, 3-6 mm. long; heads erect, terminal, dense, usually 1-2 cm. long and 1 cm. or less thick (not including protruding corollas), sessile or short-peduncled; flowers sessile; bracts ovate-lanceolate, densely silky-villous, shorter than the calyx, early-deciduous, the upper ones 4-5 mm. long and broadly lanceolate; calyx 5-6 mm. long; calyx tube broadly turbinate, weakly 10-ribbed, 2.5 mm. long, densely silky-villous, inconspicuously gland-dotted between the ribs; calyx lobes subulate, pilose, 1-3 mm. long, about equaling the tube; corolla reddish-lavender to purple (rarely the banner and claws yellowish); petals often with a gland near the tip; banner blade rhombic-ovate, longer than broad, the claw 2 mm. long; wing blades 4 mm. long, the wings shorter than the keel petals; keel petals 5-7 mm. long, their blades 5 mm. long, claws about 1.5 mm. long; pod densely villous and minutely gland-dotted above, glabrate below. *Parosela Greggii* (Gray) Heller. Scattered in limestone hills, s.e. part of the Trans-Pecos, Mar.-Aug.; Tex., Chih., Coah., Tam., N. L., Hgo., Dgo., Zac., S.L.P., Pue, and Oax.

22. *Dalea formosa* Torr. FEATHER PLUME. Shrub 3-10 dm. tall, divaricately branched; branches glabrous and sparingly gland-dotted; leaves usually less than 1 cm. long; stipules subulate, persistent; rachis glabrous; stipels conic, thick; leaflets 7 or 9, oblong-spatulate, 1.5-2 mm. long, involute, glabrous, gland-dotted beneath; spikes headlike, few-flowered, short-peduncled, terminal; bracts broadly ovate, glabrous, conspicuously gland-dotted, short-acuminate, deciduous; calyx tube deeply campanulate, pilose, 10-ribbed, with a row of glands in each interval; calyx lobes filiform from the deltoid base, plumose, 6 mm. long, longer than the tube; corolla rose-colored with the banner usually yellowish; blade of the banner cordate, 4 mm. long, the claw nearly as long; blades of the wings 5 mm. long, those of the keel petals 6-7 mm. long, the claws of both 4 mm. long; pod pilose and gland-dotted above, glabrate below. *Parosela formosa* (Torr.) Vail. Frequent in dry scrubby vegetation in the Trans-Pecos, infrequent in Plains Country and e. to Taylor, Kimble and Webb cos., June-Sept.; Okla. and Colo., s. to Son., Chih. and Coah.

This is reputedly a good browse; it is a host-species of *Pilostyles Thurberi*.

23. *Dalea thyrsoflora* Gray. Erect subshrub 5-12 dm. tall, with many thick short grayish-brown villous branches; leaves 2-5 cm. long; stipules subulate, 3-5 mm. long; rachis short-villous; stipels glandlike; leaflets 3 to 9, obovate or ovate, often retuse, 6-18 mm. long, short-villous on both sides, gland-dotted beneath; spikes short, dense, usually oblong and subsessile in the axils of the leaves; bracts ovate, about equaling the calyx tube; calyx tube pubescent, strongly 10-ribbed, conspicuously gland-dotted in the intervals, 2.5-3 mm. long; calyx lobes filiform, plumose, the lowest 5 mm. long and recurved at the tips, the

rest 4 mm. long; corolla yellowish, turning brownish-purple. *D. domingensis* var. *paucifolia* Coult., *Parosela humilis* (Mill.) Rydb. Local in open brushlands in the Brownsville region, Cameron Co., extreme s. Tex., Sept.-Dec.; lowlands in Tex., Mex., Guat.

24. *Dalea emarginata* (T. & G.) Shinn. Slenderly taprooted annual, often with several spreading nearly simple branches from the base, 2-5 dm. long or longer; leaves 2-5 cm. long, spreading; stipules subulate; leaflets 13 to 17, glabrous, cuneate or oblong-cuneate, 2-7 mm. long, emarginate apically, glabrous, verdigris-green above; minutely gland-dotted beneath; spikes oblong or cylindric, long-peduncled, in fruit 1-3 cm. long, about 1 cm. thick; bracts about as long as the calyxes, obovate, abruptly acuminate, villous dorsally, with glabrate tips; flowers sessile or nearly so; calyx villous, 3 mm. long, oblique; calyx lobes lanceolate, acuminate, fully equaling the tube; corolla rose-purple; blade of the banner broadly rectangular-oblong, retuse or truncate apically, truncate basally, 2.5 mm. long, shorter than the claw; other 4 petals inserted not far below the end of the stamen tube, their blades oblong, rounded apically, 2.5 mm. long, the claws short; stamens 5; pod obliquely obovate, somewhat lunate, villous above. *Petalostemum emarginatum* T. & G. Sandy soils of s. Tex., often abundant, n. to Real, Llano and Brazos cos., Mar.-Dec.; Tex. s. to Ver.

34. PETALOSTEMUM MICHX.

PRAIRIE CLOVER

Unarmed perennial herbs, the herbage and/or the flowers gland-dotted; leaves alternate, once-imparipinnately-compound with 3 to numerous leaflets; stipules linear or subulate, persistent; flowers in dense terminal heads or spikes, each flower subtended by a bract; calyx comprising an obconoid or campanuloid often longitudinally ribbed tube and 5 usually narrow lobes; corolla subpapilionaceous, of 5 separate and similar petals usually attached in different places, the uppermost petal (banner, though not much if any larger than the rest) inserted near the rim of the floral cup, the other 4 inserted at the terminus of a structure which appears to be formed by the coalescence of the lower portions of the stamens and is thus called a stamen tube (though it may be formed partly of floral cup tissue); petals white, yellowish, pink or purplish; stamens 5, monadelphous in that the lower parts of the filaments are coalescent with only the most distal portion free; fruit a short obovate or semiorbicular 1- or 2-seeded usually indehiscent dry pod, enclosed in or but slightly exerted from the persistent calyx.

A wholly North American genus with about 35 species, not at all well-delimited from *Dalea* but technically keyed out on the basis of the insertion of 4 of the petals at the rim of the "stamen tube" instead of along the length of it. According to some authors, on etymological grounds the name should be spelled "Petalostemon," and is masculine instead of neuter as here treated.

1. Leaflets (on well-developed leaves) 25 to 41; flowers white; calyx tube pubescent 6. *P. microphyllum*.
1. Leaflets 3 to 25 (2)
- 2(1). Calyx glabrous or ciliate on the margins of the lobes only; flowers white (3)
2. Calyx or at least the calyx lobes densely pubescent; flowers yellowish, rose or purplish (6)
- 3(2). Flower heads (spikes) globose or subglobose, 12 mm. long or shorter 1. *P. multiflorum*.
3. Flower heads elongate, cylindric, 15-100 mm. long (rarely less on late-flowering branches) (4)
- 4(3). Calyx tube with a ring of small glands at the top (rarely glandless); calyx not noticeably oblique 2. *P. candidum*.
4. Calyx tube covered with large scattered glands; calyx strongly oblique (5)
- 5(4). Leaflets 13 to 25; tips of bracts glabrous 4. *P. glandulosum*.
5. Leaflets 9 to 13 (to 17); tips of bracts pubescent 5. *P. phleoides*.
- 6(2). Leaves and stem both glabrous (rarely sparingly pilose) or the stems short-pubescent and the leaves glabrous (7)
6. Leaves and stems densely short-pubescent to long-hirsute (see also *P. purpureum*) or the stems rarely sparsely pilose (14)

- 7(6). Petals pale-yellowish; bracts narrowly lanceolate, brownish-pubescent throughout 7. *P. compactum*.
7. Petals rose or purplish; bracts ovate, often abruptly acuminate, if narrowly lanceolate then the upper portion glabrate (8)
- 8(7). Bracts narrowly lanceolate; stems decumbent or weakly ascending; plants of the Gulf Coast grassland (and Oklahoma) 16. *P. decumbens*.
8. Bracts ovate to broadly lanceolate; stems stiffly erect or ascending; plants of central and northern Texas (9)
- 9(8). Spikes slender, 1 cm. thick or less (10)
9. Spikes 1 cm. thick or more (12)
- 10(9). Calyx tube and lobes covered with a dense spreading usually tawny pubescence; plants of Panhandle and northwest areas of Texas .. 12. *P. tenuifolium*.
10. Calyx tube and lobes unevenly pubescent with a short white appressed pubescence, or else the calyx glabrate; plants of central Texas (11)
- 11(10). Calyx lobes completely glabrate or merely ciliate along the margin; south-central Texas (intergrading with the species below) 3. *P. sabinale*.
11. Calyx lobes conspicuously pubescent 13. *P. tenue*.
- 12(9). Calyx densely villous throughout with spreading hairs 11. *P. purpureum*.
12. Calyx with a dense appressed pubescence, the tube or lobes often with some degree of glabrousness (13)
- 13(12). Mature plants 3-6 dm. high; peduncles 4-12 cm. long; widespread plants of central and north-central Texas 15. *P. pulcherrimum*.
13. Mature plants 1-2 dm. high; peduncles 3 cm. long or less; rare restricted endemic of north-central Texas 14. *P. Reverchonii*.
- 14(6). Flowers pale-yellow; spikes 15-30 mm. thick 8. *P. obovatum*.
14. Flowers pink; spikes 8-13 mm. thick (15)
- 15(14). Calyx (including lobes) 4-5 mm. long; spikes 10-13 mm. thick; stems densely villous; Panhandle area of Texas 10. *P. villosum*.
15. Calyx 3-4 mm. long; spikes 10 mm. thick or less; stem sparsely pubescent; eastern Texas 9. *P. griseum*.

1. *Petalostemum multiflorum* Nutt. Perennial herb with woody caudex; stems several, 3-6 dm. tall, glabrous, grooved, much-branched, the upper branches short and with few reduced leaves; leaves numerous, 2-4 cm. long, spreading; stipules lance-subulate; leaflets 3 to 9, linear, linear-oblong or linear-oblancheolate, obtuse or mucronate, often involute, conspicuously gland-dotted beneath, glabrous, 6-12 mm. long; spikes usually numerous, subglobose, in fruit 8 mm. thick and about 1 cm. long; bracts rhombic-lanceolate, with subulate tips, shorter than the calyxes, deciduous; calyx 3 mm. long; calyx tube glabrous, strongly 10-ribbed; calyx lobes deltoid-lanceolate, 1 mm. long, marginally ciliolate but otherwise glabrous; corolla white; blade of the banner reniform, 2-2.5 mm. long, 3 mm. broad, the claw 3 mm. long; blades of the other petals elliptic, 3 mm. long, the claws 1.5 mm. long; pod obliquely obovoid, 3.5 mm. long, the beak at right angles to the long axis. *Dalea multiflora* (Nutt.) Shinnery. Locally abundant in cen. Texas, e. to Harris and Grimes cos., s. to Maverick and Nueces cos., w. to Taylor and Crockett cos., (reported by Rowell from Hemphill Co. in the Panhandle), June-July; Mo. to Kan. and s. to Tex.

2. *Petalostemum candidum* (Willd.) Michx. Perennial with woody base; stems 3-10 dm. long, glabrous, striate, with ascending or spreading branches; leaves scattered, ascending, 3-5 cm. long; stipules subulate; leaflets 5 to 9, oblong or linear-oblancheolate to linear, 1-3 cm. long, acute or mucronate, minutely gland-dotted beneath, acute basally; spikes dense (or in some populations the internodes elongating after anthesis), oblong to cylindrical, in fruit about 8 mm. thick and 15-100 mm. long; bracts lanceolate with a long subulate tip, longer than the calyxes or the buds; calyx 3 mm. long; calyx tube glabrous, 10-angled or -ribbed, with a ring of small glands near the top or rarely glandless,

not noticeably oblique; calyx lobes deltoid-lanceolate, villous-ciliolate, acute, 1 mm. long; corolla white; blade of the banner reniform, cordate, 2 mm. long, 3 mm. broad, the claw 2.5 mm. long; blades of the other petals ovate to oblanceolate, cuneate basally, 2.5 mm. long, about equaling the claws; pod obliquely obovoid, 3 mm. long. Represented with us by 2 intergrading varieties as follows:

Var. *candidum*. Leaflets relatively broad, most of them more than 2 mm. broad; spikes remaining dense even after anthesis; bracts not completely dehiscent, a minute "heel" remaining on the rachis after abscission; calyx glabrous and with low rounded bony ridges after anthesis. *Dalea candida* Willd. Scattered in e., s.e. and n.-cen. Tex., rarely w. into the Plains Country where intergrading with the next.

Var. *oligophyllum* (Torr.) Herm. Leaflets relatively narrow, most of them less than 2 mm. broad; after anthesis the dense spikes becoming looser by the elongation of internodes; bract completely dehiscent; calyx puberulent and after anthesis with sharp wing-like prominent ridges. *P. oligophyllum* (Torr.) Rydb. (illegit. name), *P. truncatum* Rydb., *P. occidentale* (Heller) Fern. Scattered populations in higher parts of Plains Country and Trans-Pecos, May-Sept.; N.D. and Mont. s. to Chih. and Dgo.

3. *Petalostemum sabinale* Wats. Perennial, woody only at the base; stems ascending, 2-4 dm. tall, glabrous, somewhat striate; leaves yellowish-green, about 3 cm. long; leaflets 11 to 15, linear or linear-oblanceolate, 10-15 mm. long, flat, gland-dotted beneath, blunt, glabrous; spikes cylindric, in age 4-6 cm. long and 1 cm. thick or less; bracts broadly lanceolate, acuminate, glabrous, deciduous, about equaling the calyxes; calyx 3 mm. long; calyx tube glabrous, 10-ribbed, with conspicuous yellow glands; calyx lobes short, triangular, ciliolate (but otherwise glabrous), acute; corolla rose-colored; blade of the banner broadly cordate, notched at the apex, 2 mm. long, 3 mm. broad, the claw 2 mm. long; blades of the other petals oblong-oblanceolate, obtuse apically, 2.5 mm. long; pod glabrous, obliquely obovoid. *Dalea sabinale* (Wats.) Shinn. Known only from Bandera Co., s. part of Edwards Plateau, at the entrance to Sabinal Canyon, May-July; endemic.

Closely related to *P. tenue* and perhaps only a form of that species, seeming to intergrade with it.

4. *Petalostemum glandulosum* Coult. & Fish. Perennial with woody base; stems striate, leafy, glabrous, 2-6 dm. tall, branched; leaves 2-4 cm. long, ascending; stipules subulate-setaceous; leaflets 13 to 25, oblong or oblong-obovate, 5-8 mm. long, obtuse or retuse, conspicuously gland-dotted beneath, dark-green above, paler beneath, glabrous or sparingly pilose above; spikes dense, cylindric, in fruit 8 mm. thick and 2-9 cm. long; bracts linear-lanceolate, caudate-attenuate, longer than the calyxes and buds, glabrous; calyx rose-tinged, 3-4 mm. long; calyx tube strongly oblique, gibbous on the upper side, glabrous, conspicuously gland-dotted, not ribbed; calyx lobes small, all near the lower side, ciliolate on the margins, the lower 3 lance-subulate, the upper 2 broadly deltoid, with a subulate tip; corolla white; blade of the banner cordate, 3-4 mm. long, 4 mm. broad, the claw fully 3 mm. long; blades of the other petals linear, 3 mm. long, the claws 1.5 mm. long; pod obliquely obovoid, 3 mm. long, pubescent. *Dalea glandulosa* (Coult. & Fish.) Shinn. Scattered on the Tex. Coastal Plain from Hardin and Trinity cos. s.w. to Aransas and Dimmit cos., rare inland to Val Verde Co., May-July; endemic.

Apparently closely related to *P. microphyllum* and *P. phleoides*.

5. *Petalostemum phleoides* T.&G. Perennial, branched at the base; stems 3-7 dm. tall, simple or branched, striate, glabrous or nearly so; leaves 3-5 cm. long, ascending; stipules subulate-setaceous; leaflets 9 to 13 (to 17), oblong or cuneate-oblong, 5-10 mm. long, usually rounded apically, conspicuously gland-dotted beneath, sparingly pilose on both sides; spikes cylindric, dense, in fruit 15-60 mm. long and about 8 mm. thick; bracts lanceolate, with long subulate-filiform long-ciliate tips, much-exceeding the calyxes of the buds; calyx 3 mm. long; calyx tube turbinate, strongly oblique, glabrous, 10-nerved, covered with large scattered glands; calyx lobes near the lower side, similar to those of *P. glandulosum*, ciliolate marginally; corolla white; blade of the banner cordate, 3 mm. long, 3-4 mm. broad, the claw 3 mm. long; blades of the other petals linear or linear-oblanceolate, 3 mm. long, the claws 2 mm. long; pod obliquely obovoid. *Dalea phleoides* (T.&G.) Shinn. Rare in sandy woodlands of e. Tex., June; also Ark.

6. *Petalostemum microphyllum* (T.&G.) Heller. Perennial, branched at the woody base; stems erect or ascending, 2-6 dm. tall, grooved or striate, more or less pilose, often

branched; leaves numerous, 3-5 cm. long, spreading or ascending; stipules subulate; leaflets 25 to 41, oblong or oblong-cuneate, 4-6 mm. long, emarginate, conspicuously gland-dotted beneath, more or less pilose or in age glabrate; spikes dense, cylindrical, in fruit 8 mm. thick and 2-5 cm. long; bracts linear-lanceolate, densely pubescent, with long-subulate persistent tips, longer than the calyxes; calyx 2.5-3 mm. long; calyx tube oblique, gibbous above, densely pubescent; calyx lobes very short, the lower 3 triangular-ovate; corolla white; blade of the banner cordate, 2 mm. long, 3 mm. broad, the claw 3 mm. long; blades of the other petals linear-oblong, 3 mm. long, the claws 2 mm. long; pod 2-2.5 mm. long, obliquely and very broadly obovoid, pubescent, the beak at right angles to the axis. *Dalea Drummondiana* Shinn. Frequent in e., s.e. and n.-cen. Tex., w. to Young, Gonzales, Goliad and Nueces cos., June-July; endemic.

7. *Petalostemum compactum* (Spreng.) Swezey. Perennial with woody taproot; stems several, 4-8 dm. tall, glabrous, striate, leafy; leaves numerous, ascending, 5-8 cm. long; stipules subulate; leaflets 5 to 7, oblong to oblong-lanceolate or linear-oblong, acute or obtuse, short-petiolate, glabrous, pale-green above, gland-dotted and paler beneath, 15-25 mm. long; spikes cylindrical, dense, in fruit 10-12 mm. thick and 2-15 cm. long; bracts narrowly lanceolate, attenuate, densely pubescent with long brownish silky hairs; calyx 4.5 mm. long, densely silky-villous with brown hairs; calyx lobes narrowly lanceolate and equaling the tube; corolla pale-yellowish; blade of the banner cordate, 2 mm. long, the claw 4 mm. long; blades of the other petals lanceolate or oblanceolate, 2 mm. long, the claws about 1 mm. long; pod broadly obliquely obovate, almost half-round, 2 mm. long, sparingly pubescent. *Dalea compacta* Spreng. Infrequent or rare in w. Tex. (Mitchell, Martin, Presidio and Hudspeth cos.), June-July; Wyo. and Neb. to Tex.

8. *Petalostemum obovatum* T.&G. Pussyfoot. Perennial; stems decumbent or ascending, 3-5 dm. long, densely silky-villous; leaves numerous, 3-5 cm. long; stipules subulate; leaflets obovate or ovate, 8-10 mm. long, truncate, rounded or acutish apically, densely silky-villous on both sides; spikes cylindrical, in fruit 15-30 mm. thick and 5-11 cm. long; bracts broadly elliptic to ovate, acuminate, silky-villous, longer than the calyxes; calyx 6 mm. long, silky-villous; calyx lobes lanceolate, caudate-attenuate, twice as long as the tube; corolla pale-yellow; banner blade cordate, 2 mm. long, the claw 2 mm. long; blades of the other petals oblong, 3 mm. long, the claws less than 1 mm. long; pod broadly obliquely obovate, nearly orbicular, villous. *Dalea obovata* (T.&G.) Shinn. Sandy prairies of s. Tex., n. to Travis and Colorado cos., Apr.-July; endemic.

9. *Petalostemum griseum* T.&G. Perennial; stems 2-7 dm. tall, usually erect, often reddish, striate, sparsely pilose, branched above; leaves numerous, 3-4 cm. long, spreading; stipules subulate; leaflets 9 to 17, oblong to oblanceolate or linear-oblong, 6-12 mm. long, mucronate, finely long-pilose, conspicuously gland-dotted beneath; spikes many, very short-peduncled, cylindrical, in fruit 25-60 mm. long and 6-7 mm. thick; bracts deciduous, linear-lanceolate, caudate-attenuate, longer than the calyxes, pubescent; calyx 10-ribbed, densely pubescent, 3 mm. long; calyx lobes lanceolate or deltoid-lanceolate, acute, a little longer than the tube; corolla pink or pink-purple; blade of the banner cordate, 2 mm. long and as broad, equaling the claw; blades of the other petals oblong, 2 mm. long, the claws scarcely 0.5 mm. long; pod 2 mm. long, obliquely obovoid, pubescent. *Dalea grisea* (T. & G.) Shinn. Sandy woodlands, e. and s.e. Tex., spring-summer; endemic.

Closely related to *P. villosum*.

10. *Petalostemum villosum* Nutt. Perennial with woody taproot and caudex, branched at the base, bushy; stems ascending or decumbent, 3-6 dm. tall, densely villous; leaves very numerous and crowded, 3-5 cm. long, often with fasciculate ones in their axils; stipules subulate; leaflets 9 to 17, close, oblong or oblanceolate, acute or obtuse, 5-10 mm. long, 2-4 mm. broad, densely villous; spikes terminating the branches, usually sessile, sometimes clustered, cylindrical, in fruit 8 mm. thick and 2-10 cm. long, dense; bracts lanceolate, caudate-attenuate, longer than the calyxes, deciduous, villous; calyx (including lobes) 4-5 mm. long, densely villous, 10-ribbed, the lanceolate lobes acute and shorter than the tube; corollas pale-rose-purple, rarely white; blade of the banner cordate, 2 mm. long and broad, the claw 2.5 mm. long; blades of the other petals elliptic, 2.5 mm. long, the claws 0.5 mm. long; pod obliquely obovate, somewhat lunate, 3 mm. long, villous. *Dalea villosa* (Nutt.) Spreng. Scattered or rare in the Plains Country, in sandy soil, June-Aug.; Mich. to Mo., Tex., Mont. and Sask.

11. *Petalostemum purpureum* (Vent.) Rydb. Perennial, branched at the woody base; stems 2-9 dm. tall, striate, glabrous to villous, more or less branched; leaves numerous, 3-5 cm. long, often with fasciculate ones in their axils; stipules subulate; leaflets often 5, linear, glabrous or villous, 8-20 mm. long, 1-3 mm. broad, involute; spikes short-peduncled, oblong or cylindric, dense, in fruit 15-50 mm. long and about 1 cm. thick or more; bracts broadly oblanceolate, abruptly acuminate, densely pubescent, with a dark almost glabrous subulate tip; calyx silky-villous, 3-4 mm. long, the lanceolate lobes acute and shorter than the tube; corolla rose-purple; blade of the banner cordate, obtuse, 2 mm. long, the claw about 3 mm. long; blades of the other petals oblong, rounded apically, 3 mm. long, the claws 1 mm. long; pod obliquely obovate, 3 mm. long, pubescent. *Dalea purpurea* Vent., *P. molle* Rydb. Rare and scattered in n. Tex. in cos. bordering the Red River, isolated in Guadalupe Mts. in the Trans-Pecos, June-July; Ind. to Sask., N.M. and Tex.

Some populations seem to show the effect of introgression of this species with *P. tenuifolium* and *P. pulcherrimum*.

12. *Petalostemum tenuifolium* Gray. Perennial with woody base; stems ascending or erect, slender, 15-30 cm. tall, pale, glabrous, striate, branched; leaves ascending, 3-4 cm. long; stipules subulate-setaceous; leaflets 3 to 5, linear or narrowly linear-oblanceolate, 8-18 mm. long, involute, blunt, glabrous or nearly so, sparingly glandular; spikes cylindric, in fruit 2-5 cm. long and about 8 mm. thick; bracts silky-villous throughout, ovate, abruptly contracted into a subulate tip, slightly exceeding the buds; calyx 4 mm. long, externally with a dense spreading usually tawny pubescence all over, the deltoid-lanceolate lobes about as long as the tube; corolla rose-purple; blade of the banner cordate, 3 mm. long and as broad, nearly equaling the claw; blades of the other petals oblanceolate, 3 mm. long; pod pubescent. *P. Porterianum* Small, *Dalea tenuifolia* (Gray) Shinn. Frequent in higher parts of Plains Country, along the Red River e. to Wichita Co., May-Sept.; Kan. to Ark. and Tex.

The population in Wichita Co. seems to indicate intergradation between this species and *P. pulcherrimum*.

13. *Petalostemum tenue* (Coul.) Heller. Perennial with woody base; stems much-branched, glabrous, slender, terete, about 3 dm. tall; leaves numerous, spreading, 2-3 cm. long; stipules subulate-setaceous; leaflets 3 to 5, linear, strongly revolute, 5-12 mm. long, acute, glabrous or nearly so, strongly punctate; spikes usually long-peduncled, subglobose to cylindric, 10-30 mm. long and 7-10 cm. thick in fruit; bracts ovate-lanceolate, pubescent, much shorter than the calyxes, apically often glabrous; calyx 4 mm. long, appressed-silky; calyx lobes deltoid-ovate, shorter than the tube, conspicuously pubescent; corolla pink-purple; blade of the banner broadly cordate, 2 mm. long, shorter than the claw; blades of the other petals elliptic, 3 mm. long; pod obliquely obovate, finely pubescent. *Dalea Stanfieldii* (Small) Shinn. Edwards Plateau s.w. to Tom Green and Medina cos. and n. to Wise and Denton cos., in rocky limestone areas, May-July; endemic.

14. *Petalostemum Reverchonii* Wats. Perennial, branched at the woody base; stems diffuse, 1-2 dm. long, glabrous or finely pubescent; leaves 2-3 cm. long; stipules subulate; leaflets 5 to 11, linear or linear-oblanceolate, glabrous, 5-10 mm. long, acutish, somewhat involute; peduncles 3 cm. long or less; spikes subglobose or oblong, in fruit 1-7 cm. long and about 1 cm. thick or thicker; bracts shorter than the calyxes, deciduous, silky throughout, broadly lanceolate, acuminate; calyx about 4 mm. long, with appressed silky pubescence; calyx lobes deltoid, acute or acuminate, about equaling the tube; corolla deep-pink or rose; pods silky, obliquely obovate, 3 mm. long. *Dalea Reverchonii* (Wats.) Shinn. Known only from the limestone summit of Comanche Peak, Hood Co., Tex., where collected once in June, about 1880; endemic.

15. *Petalostemum pulcherrimum* (Heller) Heller. Perennial with woody taproot, branched at the base; stems simple, erect, striate, glabrous or sparingly pubescent, 3-7 dm. tall; leaves 4-6 cm. long, numerous; stipules subulate-filiform; leaflets 3 to 7, linear, 2-4 cm. long, 1-3 mm. broad, acute at both ends, often somewhat involute, yellowish-green above, somewhat glaucous, sparingly pubescent or glabrous, gland-dotted beneath; peduncles 4-12 cm. long; spikes oblong, in fruit 2-4 cm. long and 12-15 mm. thick; bracts broadly ovate, short-acuminate, pubescent, with a dark almost glabrous subulate tip; calyx 4 mm. long; calyx tube glaucous, silvery-pubescent; calyx lobes much shorter

than the tube, the 3 lower deltoid-lanceolate, the upper 2 triangular-ovate; corolla deep-rose-purple; blade of the banner 2.5 mm. long, cordate, rounded or retuse apically, the claw 3 mm. long; blades of the other petals oblong or elliptic, rounded apically, 3 mm. long, the claws 1 mm. long; pod broadly obliquely obovoid, slightly pubescent, 3 mm. long. *Dalea Helleri* Shinners. Frequent in calcareous soils, n.-cen. Tex., infrequent s.e. to Goliad, Jackson and Montgomery cos., w. to Irion Co., rare in the Trans-Pecos (Hudspeth Co.), May-July; Mo. and Ark. to Tex. and N.M.

Apparently intergrading with *P. purpureum* and other species in parts of its range.

16. *Petalostemum decumbens* Nutt. Perennial; stems solitary or several, decumbent or weakly ascending, glabrous or sparingly pubescent, striate; leaves numerous, 3-5 cm. long, ascending; stipules subulate; leaflets 5 to 7, linear or linear-oblong, 8-20 mm. long, acute or mucronate, slightly involute marginally, sparingly pilose, gland-dotted beneath; spikes ovoid or short-oblong, 1-2 cm. long and fully 1 cm. thick in fruit; bracts lanceolate, attenuate, much longer than the calyxes and buds, the tips glabrous; calyx with short silky-appressed pubescence, 4 mm. long; calyx lobes lanceolate or ovate-lanceolate, shorter than the tube, acute; corolla pink or rose-purple; blades of the banner oblong-ovate, cordate basally, 3 mm. long, equaling the claw; blades of the other petals linear-oblong, fully 3 mm. long, the claws less than 1 mm. long; pod broadly and obliquely obovate, strigillose. Black clay soils of s.e. Tex. and n. to Polk and Tyler cos. in local prairies or gumbo glades, Apr.-June; also Okla.

35. BRONGNIARTIA H.B.K.

A genus with about 40 species in the drier parts of tropical America, of which we have one:

1. *Brongniartia minutifolia* Wats. Unarmed shrub 3-13 dm. tall, much-branched; branches somewhat zigzag, glaucous-green, nearly glabrous; leaves alternate, approximate, once-imparipinnately-compound, 3-7 cm. long, glabrous; stipules herbaceous, lanceolate, 2-3 mm. long, rather persistent; petioles 3-8 mm. long; leaflets 19 to 41, linear, revolute, 2-5 mm. long; stipels essentially absent; flowers solitary in the axils; pedicels 6-15 mm. long, near the top with 2 minute bractlets less than 1 mm. long; calyx 7-9 mm. long, with an obliquely obconoid or campanuloid tube, puberulent internally; calyx lobes lanceolate, acute, the lower 3 free from each other nearly to the top of the floral cup, the upper 2 united much higher up; corolla papilionaceous, pale-purplish to cream-colored or yellow-white; banner with a nearly orbicular blade about 8 mm. long and a claw about 3 mm. long; wings obovate, somewhat falcate, with an auricle at the base of the blade on the upper side; keel petals broadly lunate, coalescent near the apex; stamens 10, monadelphous, the filaments coalescent about half their length; pod dry, dehiscent, much-flattened, glabrous, obovate, 18-25 mm. long, attenuate below, the stipe equaling the calyx tube. Rare in the Chisos Mts. of s. Brewster Co. in the Trans-Pecos, 2,500-3,500 ft. elev., June-Aug.; also Chih.

36. TEPHROSIA PERS.⁹⁰

HOARY PEA

Perennial usually pubescent herbs from woody taproots; leaves alternate, once-imparipinnately-compound with (3 to) 5 to 31 leaflets; stipules mostly slender, herbaceous, persistent or deciduous; stipels absent; flowers in terminal or axillary racemes; calyx with an obconoid or campanuloid tube and 5 usually lanceolate lobes; corolla papilionaceous, white, pink, red or purple, the banner broad and dorsally silky-pubescent and clawed; wings usually broadly oblong, clawed, the blade with an auricle near the base on the upper side, coalescent near the tip; stamens monadelphous in a special way, the uppermost filament free near the base but coalescent with the rest near the middle of its length then free the rest of the length, the other 9 filaments coalescent variously for a third to two-thirds their lengths; anthers all alike; ovary surrounded at the very base

⁹⁰ The characters, except those of *T. tenella*, are adapted from the work of Carroll E. Wood, Jr. in *Rhodora* 51:193-231, 233-302, 305-364, 369-384. 1949.

by a collarlike disk attached to the floral cup; fruit a linear straight or somewhat curved flattened often obliquely striate dehiscent legume 2-6 cm. long; seeds several. *Cracca* L., a rejected name.

A large genus of about 300 species in the warmer parts of the world. Some species are the sources of fish-poisons.

1. Style glabrous; plants of Trans-Pecos Texas1. *T. tenella*.
1. Style minutely barbate on the ventral (upper) side; plants of Panhandle, central, and eastern areas of Texas (2)
- 2(1). Leaflets broadly to narrowly linear, 3 to 6 times as long as wide (3)
2. Leaflets obovate to nearly orbicular, 1 to 2 times as long as wide (4)
- 3(2). Racemes short, broad, 3-10 cm. long; stems stiff and erect; leaflets acute apically2. *T. virginiana*.
3. Racemes narrow, elongate, 10-40 cm. long; stems reclining, not stiffly erect; leaflets apically obtuse to truncate3. *T. onobrychoides*.
- 4(2). Leaflets 5 to 19, mostly 9 or 11, densely hirsutulous to nearly glabrous above but with at least a few appressed hairs near the margins, the margins conspicuously bordered with white hairs; calyx and back of banner with whitish hairs; ovules and seeds 5 or 64. *T. Lindheimeri*.
4. Leaflets 3 to 9, mostly 5 or 7, completely glabrous above, the margins not conspicuously bordered; indument of calyx and banner golden; ovules and seeds 4 to 8 ...
.....5. *T. potosina*.

1. *Tephrosia tenella* Gray. Perennial with deep woody rootstock; stems slender, branched, sparingly strigose or glabrate, angled; leaves 6-10 cm. long; stipules subulate-filiform, 3-5 mm. long; petiole 1-3 cm. long; rachis sparingly strigose; leaflets 7 or 9, rarely 11, or on the lower leaves 3 or 5, linear or oblong, acute; racemes opposite the leaves, lax, few-flowered, including the peduncle 1-2 dm. long; flowers solitary or 2 together at each node; bracts subulate; calyx sparingly strigose, the tube 2 mm. long, the lance-subulate lobes 2 mm. long; corolla about 8 mm. long, reddish; style not barbate ventrally; pod nearly straight, 30-45 mm. long, 2-4 mm. broad, short-strigose, 6- to 8-seeded. *Cracca tenella* (Gray) Rose. Rare in the Trans-Pecos, Chinati Mts., Presidio Co., summer; Tex. to Ariz., s. to Baja Calif., Son. and Chih.

2. *Tephrosia virginiana* (L.) Pers. DEVIL'S SHOESTRING, CATGUT, GOAT'S-RUE. Pubescent herb with woody crown and woody roots; stems stiff and erect, (2-) 3-7 dm. tall, not or sparingly branched; leaves 5-14 cm. long; petioles mostly shorter than the lowermost leaflets; leaflets 9 to 31, usually 15 to 25, elliptic to linear-oblong, acute, 11-31 (-33) mm. long, (2-) 4-8 (-10) mm. broad, 2 to 7 times as long as broad; racemes 3-10 cm. long, short-peduncled; pedicels 4-17 (20) mm. long; flowers 14-21 mm. long; corolla usually bicolored, the banner lemon-yellow to cream-colored dorsally and cream to white ventrally, the wings and keel rose or rarely white, the petals often brown in dried specimens; style barbate; legume straight to slightly downwardly falcate, (25-) 35-55 mm. long, (3.5-) 4-5.5 mm. broad; seeds 6 to 11. *T. leucosericea* (Rydb.) Cory, *Cracca virginiana* L. Frequent in sandy soils, n. Tex. s. to Lubbock, Callahan, Guadalupe, DeWitt and Jefferson cos., Apr.-June; N.H. to Fla., w. to Wis., Kan. and Tex.

3. *Tephrosia onobrychoides* Nutt. Perennial herb with woody crown and taproot; stems stout, terete, 1 to several, decumbent or reclining (never stiffly erect), to 6 or 7 dm. long; stems, petioles, rachises and petiolules pubescent; principal leaves 8-22 cm. long; petioles shorter than the lowermost leaflets; leaflets mostly (11 or) 13 to 25 (to 29), linear-oblongate or narrowly elliptic to oblong-elliptic or elliptic-cuneate, the apex obtuse to rounded or truncate, 17-55 (-60) mm. long, 4-16 (-20) mm. broad, 2.5 to 6 times as long as broad; racemes 1-4 dm. long; pedicels ascending, 4-10 mm. long; flowers 15-20 mm. long; corolla white becoming purple or crimson in age, pink or purple on drying; style barbate; legume straight or the proximal half slightly curved downward, 35-85 mm. long, (3.5-) 4.5-5 mm. broad, ascending or spreading, pubescent; seeds 3 to 10. *T. angustifolia* Featherm., *T. texana* (Rydb.) Cory. *Cracca onobrychoides* (Nutt.) O. Ktze. Sandy soils of e. and s.e. Tex., s.w. to Wilson, Goliad and Aransas cos., Apr.-June; Ala. to Tex. and Okla.

4. *Tephrosia Lindheimeri* Gray. Decumbent-stemmed perennial herb with woody crown and taproot; stems several, to 1 m. long; herbage densely pubescent; leaves 5-15 (-20) cm. long, ascending; petioles shorter or often longer than the lowermost leaflets; leaflets mostly (5 or) 7 to 15 (to 19), obovate to broadly ovate-cuneate or nearly orbicular or elliptic, apically obtuse or retuse, (11-) 18-33 (-37) mm. long, (7-) 12-21 (-27) mm. broad; racemes 7-30 cm. long; pedicels (4-) 5-9 mm. long, ascending; flowers 13-15 mm. long; corolla rose-purple, the banner with a white spot near the base of the blade; style barbate; legume roughly parallelogramiform, somewhat curved and narrowed near the base, (25-) 40-50 mm. long, 7-8.5 mm. broad, pubescent; seeds usually 4 to 6. Mostly sandy soils of Rio Grande Plains, n. to Llano region, Apr.-Sept.; endemic.

5. *Tephrosia potosina* Brandeg. Rather similar to *T. Lindheimeri*; stems to 5 dm. long; leaves 7-22 cm. long; petioles longer than the lowest leaflets; leaflets 3 to 9 (usually 5 or 7), obovate to broadly obovate-cuneate or orbicular, apically obtuse or retuse, 1-5 cm. long, 7-40 (-45) mm. broad; racemes to 27 cm. long; flowers 13-20 mm. long; corolla rose-purple with a green spot at the base of the blade of the banner; pedicels, calyx and back of banner usually hirsutulous with golden or rusty hairs; legume 20-55 mm. long, 6-8 mm. broad; seeds usually 4 to 8. Rare in calcareous soils, s. edge of Edwards Plateau in Hays and Uvalde cos., Apr.-Aug.; Tex., Coah., N.L., S.L.P. and Tam.

37. WISTERIA NUTT.

WISTERIA

Unarmed woody vines or lianes, twining and high-climbing, nearly glabrous; leaves alternate, once-imparipinnately-compound; petioles developed; stipules present; leaflets 5 to 15, usually 2-7 cm. long, thin; stipels present; flowers in large terminal and axillary drooping racemes, very showy; peduncles short; pedicels 5-25 mm. long; calyx more or less 2-lipped, the upper lip with 2 broad teeth united to near the apex, the lower lip with 3 longer and narrower teeth; corolla papilionaceous, 15-20 mm. long, purple to lilac and bluish-purple (rarely nearly white); petals subequal in length; banner with suborbicular blade and short claw, reflexed, the blade with 2 callosities or appendages; wings free, clawed, the blades obliquely obovate, falcate, with a prominent basal auricle on the upper margin; keel petals clawed, coalescent apically, the blade lunate with a salient basal lobe; stamens diadelphous, 9 filaments coalescent into a tube, the uppermost free or peculiarly nonadelphous with the uppermost filament shortly coalescent to the rest near the middle of its length, free above and below; fruit a linear flattened dehiscent legume 7-20 cm. long, 2-valved, the valves slightly convex; seeds several to numerous. *Kraunhia* Raf.

A genus with 7 species in the temperate region of North America, China and Japan, some of the species being widely cultivated. L. H. Bailey noted that, horticulturally, these plants are "the noblest of the woody vines for temperate regions." They are frequently trained as large shrubs.

1. Legume and ovary glabrous; pedicels 5-10 mm. long; native species
.....1. *W. macrostachya*.
1. Legume and ovary pubescent; pedicels 10-25 mm. long; introduced species
.....2. *W. sinensis*.

1. *Wisteria macrostachya* T.&G. Leaves 1-3 dm. long; leaflets mostly 9, ovate to elliptic-lanceolate, 3-7 cm. long, acuminate apically, rounded or cordate basally, racemes 2-3 dm. long; pedicels 5-10 mm. long; legume and ovary glabrous. *W. frutescens* (L.) Poir. var. *macrostachya* (T.&G.) T.&G. Moist woods and along river banks, e. and s.e. Tex., Apr.-Aug.; Ind. and Ill. s. to La. and Tex.

This should probably be treated as only a variety of the *W. frutescens* of southeastern United States.

2. *Wisteria sinensis* (Sims) Sweet. CHINESE WISTERIA. Leaflets 7 to 13; legume and ovary pubescent; pedicels 10-25 mm. long. Widely cult. in Tex., occasionally found as an escape.

Wisteria floribunda (Willd.) DC., the JAPANESE WISTERIA, with 15 to 19 leaflets and puberulent peduncles, is also occasionally cultivated.

38. PETERIA GRAY⁹¹

A genus of 4 species; Utah and Nevada, southeast to central Mexico.

1. *Peteria scoparia* Gray. CAMOTE DEL MONTE. Bushy perennial herb 5-10 dm. tall, the numerous slender rather stiff glabrous stems ascending or somewhat divaricate, pale-green and striate; leaves alternate, once-imparipinnately-compound, 5-10 cm. long; rachis slender, persistent, with internodes 3-5 mm. long; stipules spinescent, a pair of divaricate setose spines (2-) 3-5 (-6) mm. long; leaflets 9 to 15, narrowly elliptic to oblong, (2-) 3-6 (-11) mm. long, 1-2 mm. broad, usually deciduous in the dry season, glabrous except on margin above, strigose beneath, acutish and mucronate apically; flowers several in loose pedunculate racemes 1-2 dm. long; pedicels slightly glandular-puberulent; calyx with a campanuloid tube about 5 mm. long and 5 lobes 2-3 mm. long, the tube slightly gibbous at the base above, the 2 uppermost lobes united slightly higher up than the 3 lower ones; corolla papilionaceous, 13-16 mm. long, white; petals clawed; banner strongly folded lengthwise and laterally reflexed; wings smaller than the banner and with blades slightly auricled on the upper side; keel petals a little shorter than the wings, their blades auricled; stamens diadelphous, 9 of the filaments coalescent, the uppermost (tenth) one free; style barbate; fruit a narrow linear dehiscent legume 35-60 mm. long and 4-5 mm. broad. Infrequent in Trans-Pecos mts. at elev. of 4,000-5,000 ft., July-Aug.; Tex., Ariz., Chih. and N.M.

The Spanish name attributed to this plant implies that the roots are tuberous, rather like sweet potatoes, and edible; related species are known to have such roots but the root system of the Texas plants is thus far unknown to science.

39. COURSETIA DC.

A genus of about 15 species in the warmer, drier regions of America.

1. *Coursetia axillaris* Coult. & Rose. BABY-BONNETS. Rounded shrub 5-15 dm. tall, unarmed; branches cinereous-strigose when young, with ashen bark, numerous, short, divaricate; leaves alternate, once even-pinnately compound, 1-3 cm. long; rachis strigose, terete; petiole very short; leaflets 6 to 10, reticulate, broadly elliptic or obovate, 3-8 mm. long, 2-5 mm. broad, rounded at both ends, glabrous or nearly so, sparingly strigose beneath; stipels small or obsolescent; flowers in short inconspicuous terminal and axillary racemes usually not much (if any) longer than the foliage, 1 to 4 per raceme; pedicels 5-8 mm. long; bracts linear-lanceolate; calyx strigose; calyx tube 2 mm. long, campanuloid; calyx lobes 5, 3 mm. long, deltoid-lanceolate, acute; corolla mostly pale-pink, about 1 cm. long, papilionaceous; petals subequal; banner blade broadly obovate, retuse, the claw short; wing blades broadly and obliquely oblanceolate, with a rounded basal auricle on the upper side; keel petal blades nearly semiorbicular, with a small basal auricle; stamens 10, diadelphous, 9 filaments coalescent to about the middle, the tenth (uppermost) filament free, bent near the base; style barbate on upper side; fruit a dry 4- to 8-seeded linear torulose glabrate legume 35-40 mm. long and 5 mm. broad. Infrequent or rare in scrubby vegetation, caliche ridges of Rio Grande Plains (San Patricio, Duval, Jim Hogg and Hidalgo cos.), spring-fall; also Tam. and S.L.P.

40. SESBANIA SCOP.

Annual or perennial herbs or subshrubs or weak deciduous shrubs, unarmed, with long green glabrous rarely branched branches and stems; leaves alternate, remote, once even-pinnately compound, often 2-3 dm. long; petioles short; stipules herbaceous, caducous; leaflets numerous, usually linear or narrowly oblong, often 2-3 cm. long, glabrous, green; stipels absent; flowers in axillary racemes usually shorter than the foliage; peduncle 1-12 cm. long; each flower subtended by a caducous bract; calyx closely subtended by a pair of caducous bractlets, the broadly campanulate tube usually broader than high and regular or nearly so; calyx lobes much shorter than the tube, nearly equal, deltoid, acute;

⁹¹ Adapted from C. L. Porter in *Rhodora* 58:344-354. 1956.

corolla papilionaceous, yellowish, red to orange, 6-20 mm. long; banner reflexed, longer than the other petals, the blade suborbicular, the claw short; wing blades oblanceolate to oblong, the claws a fourth to a third as long as the blade; keel petals auriculate, strongly arching, with elongate claws about as long as the blades; stamens diadelphous, 9 of the filaments coalescent basally, the tenth (uppermost) one free; fruit a dry elongate linear 2-valved or 4-sided or 4-winged dehiscent or indehiscent pod. *Daubentonia* DC.; *Glottidium* Desv.

A genus with about 40 species in the tropical and subtropical regions of both hemispheres, usually growing in seasonally wet places. The native species are troublesome weeds in the Texas Gulf Coastal Plain rice fields.

1. Peduncle 5-12 cm. long; flowers 6-9 mm. long; pods with 2 seeds 1. *S. vesicaria*.
1. Peduncle 1-5 cm. long; flowers 10-20 mm. long; pods with several to many seeds (rarely 2 by abortion) (2)
- 2(1). Racemes of 2 to 6 flowers; pods elongate, linear, not winged 2. *S. macrocarpa*.
2. Raceme of 10 to 30 flowers; pods short, thickened, 4-winged (3)
- 3(2). Banner yellow, 12-15 mm. long; native species common in east and southern Texas 3. *S. Drummondii*.
3. Banner orange-red or rose-colored, 15-20 mm. long; introduced species of eastern Texas, rarely escaping cultivation 4. *S. punicea*.

1. *Sesbania vesicaria* (Jacq.) Ell. BAG-POD, BLADDER POD. Annual herb; leaves 10-15 cm. long; leaflets 20 to 40 (52), 1-4 cm. long, 3-6 mm. broad; peduncle 5-12 cm. long; flowers 6-9 mm. long; corolla yellowish or tinged with pink or red; stipe of legume 1-2 cm. long, 1-1.5 mm. thick; legume body oblong to ellipsoid, 25-80 mm. long, 15-20 mm. thick, the valves separating at maturity into 2 layers (the outer thicker, the inner thin and papery-membranous); legume beak about 5-7 mm. long. *Glottidium vesicarium* (Jacq.) Harper. Frequent, e. third of Tex. w. to Palo Pinto, Erath, Bastrop, Gonzales, Karnes and San Patricio cos., Aug.-Sept.; Coastal States, N.C. to Tex.; also W.I. Perhaps adv. on the continent from the W.I.

2. *Sesbania macrocarpa* Muhl. BEQUILLA. Robust annual 7-40 dm. tall, rather gracefully ascending with few or no branches or occasionally with some wide-spreading branches; leaves 1-3 dm. long; leaflets up to 70, mostly 1-3 cm. long and 2-6 mm. broad; peduncle 2-4 cm. long; flowers 11-16 mm. long, yellow; legume linear, glabrous, 1-2 dm. long, 3-4 mm. broad, 1 mm. thick, with much-thickened sutures and a beak 5-10 mm. long; seeds 30 to 40. *Sesbania exaltata* (Raf.) A. W. Hill. Infrequent or locally abundant, e. third of Tex., w. to Denton, Tarrant, Travis, Hays, Comal, San Patricio and Cameron cos., Aug.-Oct.; Fla. to Tex. and n. to Mo.; locally waived in n.e. U.S.

3. *Sesbania Drummondii* (Rydb.) Cory. RATTLEBUSH, POISON BEAN, COFFEE BEAN. Shrub (in the north extremity of distribution the branches often die back during the winter, only the lowest part of the plant remaining alive and becoming woody) 4-30 dm. tall; leaves mostly 1-2 dm. long; leaflets 20 to 50, mostly 15-35 mm. long and 4-7 mm. broad; peduncle 1-5 cm. long; flowers 13-16 mm. long, yellow (often with red lines); pod often 5-6 cm. long, about 1 cm. broad, short-stiped and short-beaked, the body 4-winged the full length, the wings about 3 mm. broad. *Daubentonia Drummondii* Rydb. Coastal Plain inland to Denton, Williamson, Travis, Comal, Wilson, McMullen and Starr cos., locally very abundant, June-Sept.; Coastal States, Fla. to Ver. and inland to S.L.P.

The seeds are loose in the mature pods which rattle when the bush is in motion, hence the common name. The seeds, if eaten, are known to be poisonous to sheep and goats.

4. *Sesbania punicea* (Cav.) Benth. Shrub 1-2 m. tall; leaves 1-2 dm. long; leaflets 12 to 40, mostly 1-3 cm. long and 4-7 mm. broad; peduncle 1-3 cm. long; flowers about 15-20 mm. long, at least the banner red, rose-red or orange-red; pod 5-8 cm. long, about 12-15 mm. thick, strongly 4-winged, the stipe 5-15 mm. long. *Daubentonia punicea* (Cav.) DC. Infrequent or rare in e. and s.e. Tex. (Nacogdoches, Tyler and Hardin cos.), spring; nat. of S.A., widely adv. in the warmer parts of s.e. U.S.

41. ROBINIA L.

Shrubs or trees to 10 m. high, often forming colonies by means of root sprouts; stipules spinescent, paired, nearly straight, to 1 cm. long; leaves alternate, 5-15 (-30) cm. long, once-imparipinnately-compound, deciduous in fall; petioles short; leaflets 7 to 19, usually obovate-elliptic, glabrous or pubescent; stipels present but early deciduous; flowers in conspicuous axillary usually nutant short-peduncled racemes that are usually shorter than the foliage; calyx campanulate, more or less 2-lipped, the upper 2 lobes shortest and coalescent for part of their length, the lower 3 lobes longer and more deeply divided and about equal; corolla papilionaceous, white or red or reddish-purple; petals clawed, 1-3 cm. long; banner blade obcordate or suborbicular or nearly so, more or less reflexed; wing blade obliquely oblong to obovate, free, with a basal auricle on the upper side; keel petal blades incurved, coalescent near the tip, basally auriculate; stamens 10, monadelphous, the uppermost filament coalescent to the filament tube for about two-thirds its length but free at both ends; ovary somewhat stipitate; style barbate on the upper side; fruit a legume, broadly linear, compressed, short-stipitate and with 2 thin valves; seeds few to several.

A genus of perhaps 10 species of the temperate parts of the United States and Mexico; difficult taxonomically because of widespread hybridization.

1. Ultimate stems and leaves densely hispid 1. *R. hispida*.
1. Ultimate stems and leaves glabrous, only the axis of raceme hispid, if at all (2)
- 2(1). Pod and axis of raceme densely hispid 2. *R. neomexicana*.
2. Pods and axis of raceme glabrous 3. *R. Pseudo-Acacia*.

1. *Robinia hispida* L. BRISTLY LOCUST. Shrub 3-30 dm. tall, much-branched, with densely hispid and usually somewhat pilose branches; petals purple to reddish-purple or rosy; legume densely glandular-hispid. Rare in e. Tex., where probably introd., spring; mts. from Va. to Ky., s. to Ga. and Ala.; cult. over a wider area.

2. *Robinia neomexicana* Gray. Shrub 3-30 dm. tall, much-branched, the numerous branches gray-puberulent or in age reddish or purplish, occasionally glandular-hispid; petals rose-pink or so pale as to be almost white; legume glandular-hispid as well as hirsutulous. Rare in the Trans-Pecos, known only from the Guadalupe Mts. and Franklin Mts., spring; N.M., Col., Ariz., Nev., Son. and Tex.

Probably our only native species of *Robinia*.

3. *Robinia Pseudo-Acacia* L. BLACK LOCUST. Tree to 15 m. tall, nearly glabrous; petals white (the banner with a yellowish center-lozenge); legume glabrous. Scattered localities in e., n.-cen. and s.e. Tex., where probably introd. through cult., spring and occasionally later; probably nat. to parts of s.e. U.S., now very widely cult. in temp. climates.

Black locusts are weedy, "dirty" trees and root-sprout perniciously, therefore they are to be avoided in cultivation, although they are widely touted by unscrupulous nursery-dealers as "million-dollar shade trees."

42. SPHAEROPHYSA DC.

A genus with about 30 species in Australia, New Zealand and northern Asia.

1. *Sphaerophysa salsula* (Pall.) DC. Perennial herb spreading into colonies by means of rhizomes; leaves alternate, once-imparipinnately-compound, 3-10 cm. long, sessile or shortly petioled; leaflets (15 or) 17 to 25, oblong-obovate to narrowly oblong or in some upper leaves narrowly elliptic, 3-18 mm. long; flowers in loose axillary racemes; peduncles 3-9 cm. long; calyx 5-6 mm. long, white-strigulose, the tube campanuloid and 3.8-4.6 mm. long, the deltoid teeth 1.2-2 mm. long, the whole becoming papery, persistent; corolla papilionaceous, brick-red (drying lavender or brownish); banner recurved, 12-14 mm. long, suborbicular-cuneate, 11.5-14 mm. broad; wings 10-12 mm. long (including claws 2.8-3.4 mm. long); keel 11.3-12.5 mm. long (including claws 4.5-5 mm. long); stamens 10, diadelphous, 9 filaments coalescent, the uppermost (tenth) one free; fruit an inflated nearly globose bladderlike pod with thin papery walls; pod stipe 4.5-7 mm. long, the body 13-24 mm. long and 9-20 mm. thick. *Swainsona salsula* (Pall.) Taub. Scattered

near roads in El Paso Co., extreme w. Trans-Pecos, May-July; nat. to n. Asia, but occasionally introd. in w. Am.

43. ASTRAGALUS L.⁹²

MILK-VETCH. LOCO WEED

Unarmed perennial or annual herbs, caulescent or not, leaves once-imparipinnately-compound, petioled; stipules present, often well-developed and forming sheaths or other structures but never spinescent in our species, leaflets several to many; stipels absent; flowers in axillary racemes (rarely single), often these nearly spikelike; calyx with a campanuloid to cylindric tube and 5 equal to unequal deltoid to setaceous lobes; corolla papilionaceous, white, yellow to purplish or lavender, never red; banner reflexed, the blade oblanceolate to broadly cuneate, claw present; wings clawed, the blade auricled at the base on the upper side and with a depression; keel petals coalescent distally, the blades auricled basally and with a low prominence which fits into the wing's socket; keel petals obtuse to acute; stamens diadelphous, 9 of the filaments coalescent, the tenth (uppermost) one free; fruit a linear to globose dry to fleshy (often very tardily) dehiscent legume exerted from the calyx; dehiscence sometimes occurs after the fruit has fallen to the ground; seeds 1 to several.

A very large, difficult genus with about 1,500 species occurring throughout the subtropical and temperate parts of the world except Australia. Many plants of this genus accumulate selenium ions in toxic concentrations, and when ingested in sufficient quantity by stock cause the symptoms known as "loco disease;" other species which do not accumulate selenium are useful forage.

1. Pubescence of the herbage dolabriform, the hairs attached laterally above their bases with one ascending and a shorter descending arm (2)
1. Pubescence basifixed, the simple hairs attached at base (6)
- 2(1). Tall erect leafy plants, more or less rhizomatous, the stems 4.5-10 dm. long; racemes densely many-flowered, the flowers nodding; pods erect, bilocular; stipules connate 7. *A. canadensis*.
2. Low tufted or loosely matted and prostrate plants, the stems arising together from the root crown or shortly forking caudex; racemes relatively few-flowered, the flowers ascending or spreading; pods 1-locular (3)
- 3(2). Flowers large, the deeply campanulate or cylindric calyx tube 6.5-10.5 mm. long, the keel 12-19 mm. long (4)
3. Flowers smaller, the campanulate calyx tube 3-4.5 mm. long, the keel 4-10 mm. long (5)
- 4(3). Pod straight or nearly so, a little laterally compressed its whole length, carinate by the sutures, persistent on the receptacle until after dehiscence; a widespread plains species, extending south to the Panhandle, Trans-Pecos, and north-central areas of Texas 10. *A. missouriensis*.
4. Pod crescent-shaped, laterally compressed at both ends, dorsiventrally compressed at the middle, readily disjoining from the receptacle and dehiscent on the ground; a western species just entering Texas in El Paso County 9. *A. amphioxys*.
- 5(3). Stipules connate; slender prostrate caulescent plants of the Davis Mountains, the stems 1-6 dm. long 4. *A. humistratus*.
5. Stipules free; tufted acaulescent or shortly caulescent plants, the stems 0-1 dm. long; peduncles and racemes often dimorphic, the early peduncles well-developed and bearing chasmogamous flowers, the later ones very short (often subradical) and bearing cleistogamous flowers, sometimes the inflorescences all of either one sort or the other 20. *A. lotiflorus*.

⁹² Adapted from Rupert C. Barneby in Mem. N.Y. Bot. Gard. 13:1188 pp. 1964. We are grateful to Mr. Barneby for having read the manuscript.

- 6(1). Plants perennial (doubtful cases should be keyed under both alternatives) (7)
 6. Plants annual (22)
- 7(6). Flowers large; calyx tube 5-11.5 mm. long; banner 12-25 mm. long, the keel 10.5-19 mm. long (keel as little as 9 mm. in densely villous-tomentose *A. mollissimus* var. *Earlei* of Trans-Pecos Texas) (8)
7. Flowers small; calyx tube 1.5-4.5 mm. long; banner mostly 4.5-10 mm. long but to 15.5 mm. in *A. distortus* of east Texas, the keel 3.5-10 mm. long (17)
- 8(7). Stipules near the base of the stem connate (9)
 8. Stipules all free; pod sessile, spreading or erect (10)
- 9(8). Pedicels in anthesis 1-1.8 mm. long, in fruit 1.5-2.9 mm. long; pod horizontal or declined, sessile, turgid or inflated, subterete (except at the beak); ovules 25 to 36 3. *A. puniceus*.
9. Pedicels in anthesis 2-3.5 mm. long, in fruit 3-8 mm. long; pod pendulous, stipitate (the stipe 3.5-7 mm. long), triquetrously compressed; ovules 12 to 22 5. *A. racemosus*.
- 10(8). Herbage densely silky-villous or villous-tomentose with shorter, curly and longer, straight, spirally twisted hairs to 1-3 mm. long (the vesture becoming tawny after a short period in the herbarium); stipules silky-pilose dorsally (11)
10. Herbage variously pubescent to nearly glabrous but (if the hairs over 1 mm. long) then all of one sort (not twisted) and the stipules then glabrous or nearly so dorsally (12)
- 11(10). Stems few, erect, 2-6 dm. long; peduncles stiffly erect; flowers nodding; pedicels becoming 4-9 mm. long in fruit; pod persistent on the receptacle until after dehiscence; Davis Mountains; flowering after summer rain 12. *A. giganteus*.
11. Stems usually numerous, decumbent or closely tufted, 0-1.5 (-2) dm. long; peduncles humistrate in age; flowers ascending; fruiting pedicels to 3 mm. long; pod readily deciduous, dehiscent on the ground; widespread, Edwards Plateau north and west; flowering in the spring 11. *A. mollissimus*.
- 12(10). Flowers ochroleucous; calyx very sparsely strigulose; pod subunilocular, the septum very narrow and incomplete; coarse ill-scented (seleniferous) plants entering northwestern Texas in Bailey, Martin and Midland counties 6. *A. praelongus*.
12. Flowers mostly purple, if ochroleucous then the calyx densely tomentulose and of east Texas; pod fully 2-locular, the septum broad (13)
- 13(12). Pod plumply ovoid, subglobose or if oblong-cylindroid then 10-20 mm. in diameter; valves of the pod very thick and succulent when first formed, 1-5 mm. thick when dry; widespread (14)
13. Pod narrowly oblong-ellipsoid, 17-38 mm. long, 5-8 mm. thick, obtusely triquetrous, grooved dorsally, the valves stiffly papery, less than 0.5 mm. thick; Tran-Pecos Texas, (Hudspeth, Culberson, El Paso cos. and apparently isolated in Reagan and Terrell cos.) 8. *A. Waterfallii*.
- 14(13). Ovary and pod glabrous; calyx early-circumscissile, leaving the pod naked (15)
 14. Ovary and pod pubescent (16)
- 15(14). Pod broadly oblong-ellipsoid or subglobose, seven eighths to one and one half times as long as its diameter; stipules glabrous or nearly so dorsally; leaflets commonly glabrous or medially glabrescent on the upper surface; widespread 13. *A. crassicaarpus*.
15. Pod cylindroid, three to four times longer than wide; stipules strigulose dorsally, at least above the middle; leaflets subequally cinereous or silvery-strigulose on both sides; confined to gypseous soils of the Pecos Valley in Reeves and Culberson counties and adjoining New Mexico 14. *A. gypsodes*.

- 16(14). Stems arising singly or few together from loosely forking subterranean caudex branches or oblique rootstocks; walls of the ripe pod 1-1.5 mm. thick; calyx persistent about the base of the fruit; widespread and common over the prairies east of the Pecos 15. *A. plattensis*.
16. Stems arising in a clump together from the root crown; pod walls 2-5 mm. thick; calyx early-circumscissile, leaving the fruit naked; a rare taxon, (Irion and Brewster counties) 13. *A. crassicarpus*.
- 17(7). Stipules (at least those at base of the stems) connate; stems partly subterranean, arising from a buried root crown and emerging singly from the ground (18)
17. Stipules all free; stems arising together from the root crown at soil level (19)
- 18(17). Pod small, 4-8 mm. long, 2.5-3.5 mm. in diameter, solid or nearly so; Panhandle southeast to Knox and Fisher counties 2. *A. gracilis*.
18. Pod larger, 9-17 mm. long, 4.5-6 mm. in diameter, a little inflated; Trans-Pecos Texas 1. *A. pictiformis*.
- 19(17). Plants of Trans-Pecos Texas; pod globose, ovoid or half-ovoid, bladderly-inflated, the papery-diaphanous valves strigulose (20)
19. Plants of east Texas; pod narrowly lunate-ellipsoid or half-obovoid, the firmly papery or leathery valves glabrous (21)
- 20(19). Pod subsymmetrically ovoid or globose, both sutures about equally convex; very common in Trans-Pecos Texas 17. *A. Wootonii*.
20. Pod strongly asymmetric, half-ovoid or -ellipsoid, the ventral suture nearly straight, the dorsal one strongly convex; just entering Texas in El Paso County 16. *A. allochrous*.
- 21(19). Calyx 3-5.5 mm. long, the teeth not over 2 mm. long; petals (in Texas) purplish; keel 5.5-9.3 mm. long 18. *A. distortus*.
21. Calyx 6.3-8.9 mm. long, the teeth 2.5-4 mm. long; petals cream-colored or greenish-white; keel 9.4-10.2 mm. long 19. *A. Soxmaniorum*.
- 22(6). Pod papery, bladderly-inflated, unilocular; Trans-Pecos Texas (return to couplet no. 20)
22. Pod variable but never much-inflated, bilocular except in *A. Soxmaniorum* of east Texas (23)
- 23(22). Petals uniformly cream-colored or greenish-white; keel 9.4-10.2 mm. long; pod unilocular; potentially perennial but flowering the first season 19. *A. Soxmaniorum*.
23. Petals purple, lilac or at least lilac-tipped, if appearing whitish when dried then the keel shorter; pod bilocular; oblique annuals (*A. Emoryanus* exceptionally biennial) (24)
- 24(23). Plant thinly hirsute with widely spreading hairs 1-1.3 mm. long; petals irregularly graduated, the white wings much shorter than the violet banner and keel; keel blades lunately lanceolate, gradually tapering into a narrow beaklike apex; pod sessile, abruptly deflexed, triangular-ovate in dorsal view, 5.5-9 mm. long ... 25. *A. reflexus*.
24. Plant variously pubescent but if hirsute then densely so and the pod otherwise; petals regularly graduated, even if only slightly so, the banner longest and keel shortest (25)
- 25(24). Pod densely pilose-hirsute, narrowly oblong, straight, 7-13 mm. long, 2.5-3.5 mm. in diameter; racemes capitate 3- to 7-flowered, the flowers and pods erect or nearly so on stiff erect peduncles 27. *A. Wrightii*.
25. Pod glabrous, strigulose or thinly hirsutulous but if pubescent either narrower or spreading or incurved (26)
- 26(25). Racemes 7- to 25-flowered; pod deflexed, elevated on and readily deciduous from a stipelike gynophore 1.5-2.5 mm. long, the body peltate, subcircular or broader than long in dorsiventral view; ovules 4 26. *A. brazoensis*.
26. Racemes mostly fewer-flowered but if over 7-flowered the ovules at least 8; pod sessile or truly stipitate (the stipe continuous with the body), linear to oblong in outline, grooved dorsally (27)

- 27(26). Flowers both large and few (2 to 6), the banner (12-) 13-18.5 mm. long; keel 9.5-13 mm. long, its broad blades 7-9.5 mm. long; pod stipitate, the stipe 1-2.5 (-3) mm. long and the narrowly oblong body 3.5-6 mm. thick; style minutely barbellulate below the stigma24. *A. Lindheimeri*.
27. Flowers smaller, the banner not over 12 mm.; keel mostly less than 8 mm. long, its blades 2.3-5 mm. long (but if the keel up to 9.3 mm. or its blades up to 7 mm. long then the flowers 9 or more to the raceme); style glabrous; pod sessile or nearly so, the stipe less than 1 mm. long and the body 1.8-3.5 mm. in diameter (28)
- 28(27). Pod (sessile, uniformly glabrous) readily deciduous from the receptacle and dehiscent at both ends on the ground; keel tip broadly rounded, blunt; leaflets of all leaves truncate-emarginate or retuse21. *A. Emoryanus*.
28. Pod (sessile or substipitate, glabrous or pubescent) firmly attached to the receptacle and dehiscent (unless broken off accidentally or in pressing) apically on the raceme; if all leaflets truncate-emarginate or retuse and the keel tip obtuse the pod cuneately contracted at base into a short stipe (29)
- 29(28). Herbage more densely pubescent with longer hairs or if the hairs no longer than the leaflets pubescent above, or the ovary and pod pubescent, or the leaflets elliptic and acute in at least some upper leaves, or the keel-tip broadly rounded
.....22. *A. Nuttallianus*.
29. Herbage full, deep-green, the margins and lower midrib of the leaflets sparsely strigulose with appressed hairs 0.3-0.65 mm. long; leaflets of all leaves retuse; calyx sparsely strigulose with hairs 0.25-0.5 mm. long; keel-tip sharply deltoid or triangular-acute (30)
- 30(29). Banner mostly 8-12 mm. long; keel mostly 6-7.8 mm. long; pod 20-35 mm. long, straight or very gently and evenly incurved its whole length
.....23. *A. leptocarpus*.
30. Banner 5-7.5 mm. long; keel 4.5-5.8 mm. long; pod 12-26 mm. long, usually incurved near the base and straight or nearly so thereafter ...22. *A. Nuttallianus*.

1. *Astragalus pictiformis* Barneby. Perennial, low and slender, with an initial taproot and deeply buried root crown; herbage densely strigulose-villosulous with subappressed and ascending sinuous hairs, greenish-cinereous or canescent; stipules 1.5-5 (-6.5) mm. long, those at the buried nodes connate around the stem, the upper ones connate through about one third to one half their length; leaves (10-) 15-55 mm. long, shortly petioled; leaflets 9 to 17, mostly crowded, oblong-obovate to -oblanceolate or (especially in some lower leaves) suborbicular, obtuse or commonly retuse, flat or marginally involute, 2-8 (-10) mm. long; calyx 4-6.3 mm. long; petals flesh-pink tinged with lilac, the banner purple-striate, the keel tipped with dull-purple; banner (8.5-) 9-11 mm. long; keel 7-8.9 mm. long; pod deflexed, sessile, oblong or plumply oblong-elliptic in outline, 9-17 mm. long, 4-6 mm. in diameter, straight or commonly a trifle decurved, abruptly contracted at base into an obscure stipelike neck no longer than wide and at apex into a short deltoid-acuminate slightly declined beak, elsewhere obscurely and obtusely triquetrous, keeled ventrally by the prominent thick convexly arched suture, shallowly and openly grooved dorsally, the lateral angles obtuse, the thinly fleshy green or purplish ultimately stiffly papery and brownish valves strigulose, finely coarse-reticulate. Rare in desert grassland, calcareous soil, Hueco Mts., Hudspeth Co., and Davis Mts., Jeff Davis Co., in the Trans-Pecos, Apr.-June and later; also N.M.

2. *Astragalus gracilis* Nutt. Perennial, slender, sparsely leafy, strigulose nearly throughout with fine straight appressed or a few narrowly ascending hairs 0.3-0.5 mm. long; stems 15-40 cm. long; stipules amplexicaul and connate, progressively less united upward, the uppermost free or united by a stipular line; leaves 25-70 mm. long, all shortly petioled or the uppermost sessile; leaflets 9 to 17, linear, linear-oblong, narrowly oblong, oblanceolate or cuneate-oblong, commonly retuse but when narrow-truncate to obtuse, flat or involute, (3-) 5-20 (-25) mm. long; calyx 2.1-3.3 mm. long; petals pale-lilac or purplish; banner often purple-veined, 5.3-8.4 mm. long; keel 3.7-6.1 mm. long; pod declined or deflexed, or from decumbent branches horizontally spreading, sessile, obliquely suborbicular to plumply ovate or ovate-elliptic in dorsal view, (4-) 4.3-8 (-9) mm. long, 2.2-3.6 mm. thick, obtuse at base, abruptly cuspidate at apex, obcompressed,

the dorsal face either flattened or openly and shallowly sulcate, the ventral face convex, carinate by the prominent thickened suture, the somewhat fleshy densely strigulose or minutely villosulous valves becoming brown or stramineous, stiffly leathery and rigid, transversely rugulose-reticulate. *A. microphacos* Cory. Scattered in calcareous soils, higher parts of the Plains Country, Apr.-June; Sask., S.D. and Mont. s. to Tex.

3. *Astragalus puniceus* Osterh. Perennial; herbage canescent with basifixed often curly hairs 0.4-0.9 (-1.2) mm. long; stems several, 1-3 (-5) dm. long; stipules 2-6 mm. long, the lowest small and connate, in the upper nodes becoming nearly free; leaves (2-) 3-11 cm. long; leaflets (7 to) 13 to 27, (3-) 5-16 mm. long; racemes with 5 to 19 (to 27) flowers; pedicels at anthesis 1-1.8 mm. long, in fruit arcuate-recurved, somewhat thickened; calyx 6-10.5 mm. long, the tube 4.9-8 mm. long; petals pink-purple or pallid; banner 13.4-21 mm. long; wings 13.5-18 mm. long; keel 10.4-14 mm. long; pod horizontally spreading or declined, sessile, oblong or ovoid-ellipsoid, 15-24 mm. long, 5-9.5 mm. thick, turgid or somewhat inflated except in the cuspidate beak; ovules 25 to 36. Rare, reported recently in higher parts of Plains Country in Deaf Smith Co. (we have not seen the specimens), spring (?); Panhandle of Okla., s.e. Colo., n.e. N.M. and Tex.

4. *Astragalus humistratus* Gray. Perennial, prostrate to diffuse or weakly assurgent, sometimes matted, the several or many stems radiating from the root crown or caudex, slender and wiry or rather coarse, (4-) 17-60 (-30) cm. long, dolabriform-pubescent; stipules all fully amplexicaul and connate, the smaller lowest ones into a subtruncate or bidentate sheath, the upper progressively longer ones with narrowly triangular or lance-acuminate free blades as long as or longer than the sheathing base; leaves 10-60 (-75) mm. long, all subsessile or the lowest shortly petioled; leaflets (5 to) 9 to 17 (or 19), elliptic to oblong-elliptic or oblanceolate, acute to obtuse and mucronulate or (in some lower leaves) obovate and obtuse, flat, loosely folded or involute, crowded or well-spaced, (2-) 3-17 (-19) mm. long; racemes 7- to 30-flowered; pedicels ascending or a trifle arched outward; calyx 3.2-7.6 (-8.8) mm. long; petals varying from greenish- or pinkish-white to ochroleucous and to lurid or magenta-purple; banner 5.9-11.8 mm. long; wings 5.8-10.7 mm. long; keel 5.1-10 mm. long; pod ascending, spreading, rarely a little declined, commonly humistrate, varying from plumply half-ovoid to narrowly oblong-ellipsoid, 6-20 mm. long, contracted distally into a deltoid or triangular-acuminate laterally compressed beak. Rare in Davis Mts., elev. 6,500-7,000 ft., in the Trans-Pecos, May-Sept.; Colo., Ut., Nev., N.M., Ariz., Tex., Son. and Chih. Our plants belong to the typical variety which occurs only in Tex., Chih., N.M., Ariz. and Colo.

5. *Astragalus racemosus* Pursh. Perennial, coarse leafy herb of stout or moderate stature, with a woody taproot and knotty multicipital root crown at or just below soil-level, thinly to quite densely strigulose with filiform or flattened appressed hairs; stipules scarious or nearly becoming so, 3-12 mm. long, the lowest amplexicaul and connate into a short subtruncate or bidentate often early-ruptured sheath, the median ones progressively less united upward along the stem, the uppermost free or nearly so; leaves (4-) 5-15 cm. long, the lowest shortly petioled, the rest subsessile; leaflets (9 or) 11 to 29 (or 31), lance-elliptic to ovate, mostly obtuse and mucronulate, sometimes (in upper leaves, rarely all) linear-lanceolate or elliptic and acute or acuminate, flat or loosely folded, (5-) 10-35 mm. long; petals white or ochroleucous or whitish with keel tip, wings or base and tip of banner blade tinged or veined with pale-lilac or pink-purple; banner 14-20.5 mm. long; wings 12.5-19 mm. long; keel 10.8-15.2 mm. long; pod pendulous, stipitate, the slender straight stipe, 3.5-7 mm. long, the linear-oblong to lance-oblong or oblong-ellipsoid body 1-3 cm. long and 3-8 mm. in diameter, triquetrously compressed with acute ventral and narrow but blunt lateral angles. Local in Plains Country, Mar.-June; Sask., N.D. to Tex. and w. to Wyo., Ut., Colo. and N.M.

6. *Astragalus praelongus* Sheld. Ill-scented perennial, coarse and ordinarily tall, either nearly glabrous or the upper stems, lower surface of the leaflets and the inflorescence thinly strigulose with straight appressed hairs 0.3-0.65 (-1) mm. long; stipules all free, thinly herbaceous, becoming papery-scarious, 2.5-7 (-9) mm. long; leaves 4-18 (-22) cm. long, all petioled or the uppermost subsessile; leaflets (7 to) 11 to 27 (to 33), obovate or oblong-obovate to lanceolate or oblanceolate, obtuse or retuse, or in some upper (all) leaves elliptic and acute, (3-) 8-35 (-50) mm. long; racemes 10- to 25- (to 33)-flowered; pedicels in fruit ascending, straight; calyx 5.8-13 (-14) mm. long, glabrous

or thinly strigulose with black or white hairs; petals orchroleucous with faintly maculate keel tip, exceptionally pink-tinged; banner 15-23.5 mm. long; wings 15-22 mm. long, the claws 5.3-8.4 mm.; pod subunilocular, erect or horizontally spreading, sessile, the turgid or decidedly inflated body varying from narrowly ellipsoid to broadly ovoid or obovoid to subglobose, 18-38 (-42) mm. long, 5-15 mm. thick. *Jonesiella Ellistiae* Rydb. Rare in Plains Country, spring; Nev., Ut., Colo., Ariz., N.M. and Tex.

7. *Astragalus canadensis* L. Usually robust, more rarely quite slender caulescent perennial; stems arising singly and few together from oblique or horizontally spreading at length woody rhizomes, more or less densely strigulose with straight or largely straight appressed and subappressed dolabriform hair; stipules deltoid-acuminate or lanceolate, 3-18 mm. long, membranous, at least the lowest ones connate into a bidentate sheath; leaves (3-) 5-35 cm. long, shortly petioled or the upper ones subsessile; leaflets (7 to) 13 to 35, broadly lanceolate or lance-oblong to ovate-oblong or elliptic, rarely obcordate, obtuse and mucronulate to obtuse or shallowly emarginate, flat, (0.5-) 1-4.5 (-5) mm. long; pedicels ascending or a little arched outward; calyx (4.6-) 5.5-10.5 (-11) mm. long; petals greenish-white, cream-color, dull-straw-yellow or greenish tinged with dull- or lurid-purple; banner (11.3-) 13.2-17 (-17.5) mm. long; pod erect, sessile on the slightly elevated receptacle, oblong-cylindroid or -ellipsoid, (9-) 10-20 mm. long, 2.9-5.2 mm. thick. Scattered in n. part of n.-cen. Tex. and parts of e. and s.e. Tex., May-June; much of temp. N.A.

Without much doubt merely a variety of the Old World *A. uliginosus* L.

8. *Astragalus Waterfallii* Barneby. Perennial, low, tufted, subcaulescent or shortly caulescent, with a thick woody taproot, strigulose nearly throughout with straight or nearly straight appressed and often a few narrowly ascending hairs; stipules ovate-triangular or triangular-lanceolate, 2.5-8 mm. long; leaves appearing subradical, 30-100 (-125) mm. long, with slender petiole; leaflets 9 to 25, elliptic or oval-elliptic to ovate-oblong or oblanceolate, obtuse or subacute, loosely folded or finally flat, 3-16 mm. long; petals purple with paler claws, the banner with a large pallid lozenge in the fold; banner 18.5-23 mm. long; wings 17.2-22.7 mm. long; keel 14.5-19 mm. long; pod ascending (humistrate), narrowly oblong-ellipsoid or somewhat clavately ellipsoid, a trifle incurved, (17-) 20-38 mm. long, 5-8 mm. in diameter, cuneate or cuneately tapering at base, abruptly acute and cuspidate at apex, obtusely trigonous and at the same time a little compressed, carinate ventrally by the suture, the lateral angles rounded, the dorsal face shallowly sulcate, the fleshy purple-mottled strigulose valves becoming stiffly papery or leathery, in age brownish, finely reticulate and also wrinkled lengthwise, inflexed below the beak as a complete or subcomplete septum 2.3-4.3 mm. wide. Limestone areas in the Trans-Pecos, scattered, with one locality in Reagan Co., Mar.; N.M., Tex., Chih. and probably Coah.

9. *Astragalus amphioxys* Gray. Low, tufted or loosely matted, subcaulescent or shortly caulescent, winter annual or perennial of short duration, densely strigose-strigulose throughout with stiff straight appressed usually subcontiguous dolabriform hairs, the herbage silvery-white; stipules ovate or deltoid to triangular or triangular-acuminate or -caudate, semi- (the lowest sometimes fully) amplexicaul; leaves 2-10 (-13) cm. long, all petioled; leaflets (7 to) 11 to 21, elliptic or rhombic-elliptic to oblanceolate or obovate, sharply acute to obtuse and mucronulate, exceptionally emarginate, distant or crowded, flat or loosely folded, 3-13 (-20) mm. long; calyx 9.3-14.2 mm. long; petals bright-pink-purple; banner with a large striate lozenge in the fold, exceptionally pure-white, 16-25 mm. long, the wings a little shorter; keel 13-20 mm. long; pod ascending (humistrate), variable in length and curvature, (15-) 20-40 (-50) mm. long, 5-10 mm. thick, most commonly (1) crescentic in profile, gently and evenly arched through one fourth to a complete circle, laterally compressed and acute to long-acuminate at both ends, obcompressed at the middle; or (2) straight but otherwise as above; or (3) obcompressed throughout below the beak; or (4) when short then obtuse and dorsiventrally compressed at base, acuminate and laterally compressed distally; in all cases both sutures prominent their whole length, the dorsal one often sinuous, commonly depressed at the middle of the pod and lying in a double groove, the green or sometimes mottled more or less fleshy strigulose valves becoming stiffly leathery or subligneous, rarely a trifle spongy in age, reticulate and sometimes also wrinkled lengthwise, often rugulose on the obtuse trans-

versely dilated angles, either not inflexed or if so the septum present only near the middle of the pod and very narrow, not over 1.1 mm. wide; dehiscence apical, through the gaping beak and also basal through the dorsal or both sutures. Rare near El Paso, extreme w. Trans-Pecos, Mar.-June; Nev., Ut., Colo., Ariz., N.M., Tex. and Chih.

10. *Astragalus missouriensis* Nutt. Low, loosely tufted or prostrate, shortly caulescent or sometimes subcaulescent, with a taproot and at length loosely forking, with a scarcely suffruticulose caudex, densely strigulose or strigose throughout with straight parallel often contiguous lustrous dolabriform hairs 0.7-1.25 mm. long; herbage silvery-white to greenish-gray; stipules (2-) 3-9 mm. long, ovate or triangular-acuminate, fully or semi-amplexicaul-decurrent, free (or the lowest exceptionally shortly connate); leaves (2-) 4-14 cm. long, with a flaccid, deciduous or weakly persistent petiole; leaflets (5 to) 11 to 17 (to 21), elliptic to narrowly obovate, acute or mucronulate, sometimes mostly obovate and obtuse, flat, 3.5-13 (-17) mm. long; calyx 5-12 mm. long, strigulose, purple-tinged; petals (except in rare albinos) pink-purple, with a pale lozenge in the fold of the banner, drying dull-bluish; banner 9.5-22 (-24) mm. long, the wings nearly as long to considerably shorter; keel 8.9-17.3 (-18.5) mm. long; pod ascending (humistrate), sometimes through accidental twisting of the pedicel apparently spreading or declined, sessile and (commonly) persistent on the receptacle, subsymmetrically oblong or oblong-elliptic in outline, 14-27 (-30) mm. long, (4-) 5-9 (-10) mm. thick, obtuse or sometimes cuneate at base, abruptly contracted distally into a subulate, pungent or triangular-acuminate and laterally compressed beak, variably compressed, the green fleshy strigulose valves becoming stiffly leathery or subligneous, 0.3-0.5 mm. thick when dry, transversely reticulate and wrinkled lengthwise, brownish and ultimately black, either not inflexed or often so far as to form a distinct septum to 1.1 mm. wide. Rare in Plains Country and Trans-Pecos, in desert grama grasslands, Mar.-June; Alta., Sask. and Man. s. to Tex.

11. *Astragalus mollissimus* Torr. CRAZY WEED, TEXAS LOCO, WOOLLY LOCO, PURPLE LOCO WEED. Low, often relatively robust and leafy, densely or quite loosely tufted, perennial but of only a few years' duration, the taproot early becoming woody and the rootcrown in old plants sometimes developing into a shortly forking caudex, the stems and foliage villous-tomentose (pilose) throughout; leaves canescent, silvery or rarely greenish, the vestiture usually composed of two sorts of extremely fine hairs, one shorter, curly and entangled, the other longer, spreading-ascending or rarely retrorse or forwardly appressed, straight or sinuous, spirally twisted, both turning rufous or tawny when dry; stipules free; leaves (3-) 6-26 cm. long, all petioled; leaflets 11 to 35, suborbicular or ovate to obovate or rhombic-elliptic, often thick-textured, 3-45 mm. long, commonly diminishing upward along the rachis; pedicels 0.5-1.5 mm. long, in fruit thickened and 1-3 mm. long; calyx (7-) 8-14 mm. long; petals pink-purple to dull-pinkish-lavender or yellowish suffused with sordid-lilac, or creamy-white drying stramineous, often tending to persist about the forming pod; banner 12-24.5 mm. long, the wings as long or somewhat shorter; keel shorter than the wings; pod spreading or ascending, commonly humistrate, obliquely ovate or lance-elliptic to lunate or linear-oblong in outline, 9-25 mm. long, 4-13 mm. in diameter, solid or more or less turgid, sometimes decidedly inflated but never bladderly, rounded or (when broad) subtruncate or a trifle umbilicate at base, contracted distally into a short conical or laterally flattened deltoid beak, terete when narrow, obcompressed and shallowly sulcate along both sutures when broad, nearly straight to incurved through 90° or slightly more, the fleshy valves becoming stiffly papery, leathery or subligneous, rugulose-reticulate, glabrous, strigose or villous-tomentose, inflexed as a complete septum extending up to the base or into the apex of the beak.

According to some authorities, this was the first loco weed to be recognized. When eaten, it is especially fatal to horses.

Ranging from Nebr., Wyo. and Ut. s. and s.e. to Pue.; represented in w. Tex. by 5 varieties.

Var. *mollissimus*. Calyx tube 3.4-4.5 mm. in diameter; petals purple or marginally suffused with purple, the keel 14-18 mm. long; pod glabrous or with hairs much less than 1 mm. long. Plains Country, with one record from Culberson Co. in the Trans-Pecos; intergrading extensively with var. *Earlei*.

Var. *Earlei* (Rydb.) Tidestr. Like var. *mollissimus* but flowers smaller; calyx tube 0.8-3

mm. in diameter; keel 9-13 mm. long. Abundant in the Trans-Pecos, Mar.-June, etc.; Tex., Chih. and Coah.

Var. *Coryi* Tidestr. Petals cream-colored, immaculate; pod glabrous or distally with hairs less than 1 mm. long. *A. argillophilus* Cory. Abundant on w. part of Edwards Plateau from Crockett Co. n. to Martin Co., Mar.-May, etc.; endemic.

Var. *Bigelovii* (Gray) B. L. Turner. Calyx 10 mm. or more long; banner 16-25 mm. long; pod 10-15 mm. long, densely villous-tomentulose, the longest hairs 1-1.6 mm. long; ovules 20 to 30. Local in Trans-Pecos deserts (El Paso, Hudspeth and Presidio cos.), Feb.-June; N.M., Ariz. and Tex.

Var. *marcidus* (Rydb.) B. L. Turner. Calyx 7-9.5 mm. long; banner 12-16 mm. long; pod 6-10 mm. long, villous-hirsute with hairs more than 1 mm. long; ovules 12 to 16. Rare in Jeff Davis and Presidio cos. in the Trans-Pecos, Apr.-July; endemic.

12. *Astragalus giganteus* Wats. Robust, amply leafy, with a thick woody taproot, densely tomentulose and pilose throughout with shorter curly or sinuous and longer nearly straight spirally twisted loosely ascending hairs 1.3-2.5 mm. long; herbage silky-canescens or greenish in age, the vestiture tending to turn rufous or rusty when dry; stipules free; leaves (9-) 13-35 cm. long, with stout rather short petioles; leaflets 17 to 35, broadly to narrowly elliptic or ovate to oblong or rhombic-elliptic, acute or abruptly short-acuminate, often callous-mucronulate, flat, (7-) 10-55 mm. long, all carinate dorsally by the prominent pale densely pilose midrib; pedicels at first ascending, becoming arched outward or recurved and then again erect in fruit, at anthesis (1.2-) 1.5-4 mm. long, in fruit (3-) 4-9 mm. long; calyx (7.8-) 10-14.7 mm. long; petals pale-yellow; banner (14.4-) 15.5-21.5 mm. long; wings (12.4-) 14.3-19.5 mm. long; keel (11.5-) 12-15.1 mm. long; pod stiffly erect, sessile, plumply ovoid- or ellipsoid-acuminate, 15-25 mm. long, 8-13 mm. in diameter, slightly incurved, rounded or subtruncate at base, contracted distally into a short triangular-acuminate laterally compressed unilocular beak, otherwise turgid but a little dorsiventrally compressed, flattened or shallowly sulcate dorsally (but the sinuous suture prominent), more deeply open-sulcate ventrally toward the middle, the green fleshy glabrous valves becoming stiffly leathery, brownish-stramineous and ultimately blackish, faintly cross-reticulate and sometimes also wrinkled lengthwise, inflexed below the beak as a complete or subcomplete septum (1.5-) 2-5 mm. wide. Davis Mts. and Chinati Mts. in the Trans-Pecos, 6-7,000 ft. elev., June-Aug.; N.M., Tex. and Chih.

13. *Astragalus crassicaarpus* Nutt. GROUND PLUM. Perennial of medium or robust stature, with a woody taproot and several decumbent, ascending or sometimes suberect stems arising from a determinate root crown or (in one var.) from slender subterranean caudex branches; herbage variably pubescent, green or cinereous, the leaflets glabrous or medially glabrescent above; stipules free; leaves (20-) 35-150 mm. long, the upper ones shortly petioled or subsessile; leaflets (11 to) 15 to 33, broadly to narrowly elliptic, obtuse or acute, or (in some lower leaves) truncate-emarginate, mostly flat, 3-24 mm. long; pedicels ascending or a little arched outward, at anthesis slender and 1-2.7 mm. long, in fruit thickened (often clavate) and (2-) 2.7-7.5 mm. long; petals purple, lilac, cream-colored or greenish-white, the keel in any case purple- or pink-tipped; banner (16-) 16.5-25 (-27) mm. long, the wings shorter; keel (10.7-) 12-20.7 mm. long; pod spreading or ascending (humistrate except sometimes in var. *trichocalyx*), sessile, globose, broadly and plumply oblong-ellipsoid-ovoid or -obovoid, 15-40 mm. long, seven eighths to one and a half times as long as wide, abruptly obtuse or truncate at both ends, or a trifle retuse or umbilicate at apex and there abruptly contracted into a conic subulate cusplike beak 1-3 mm. long, the body a little obcompressed, shallowly sulcate or merely depressed along the sutures, the fleshy glabrous valves at first firm and succulent (and if dried at this stage collapsing inward and becoming irregularly and coarsely wrinkled, leaving the sutures salient), composed of 3 layers: a thin outer coat and a similar inner one of small cells, these becoming leathery, the outer one eventually brown or blackish and nearly smooth, and a much thicker intervening layer of large cells filled with a sweet juice, this ultimately drying out to a pale alveolate-spongy or pithy texture, the whole valve wall 1.2-5 mm. thick (at least near the sutures), the endocarp inflexed across the pulpy-filamentous cavity as a papery septum 8-15 mm. wide, this produced through the valve wall to unite with or at least to meet the immersed ventral suture; dehiscence very

tardy, either occurring on the ground by gradual weathering and decay over winter (the exocarp then sometimes separating as a papery shell, the beak splitting but not gaping to release the seeds) or the whole pod splitting through both sutures and the septum and separating into two false carpels. Alta., Sask. and Man. s. to Ariz., N.M., Tex. and Ark.; represented with us by 3 varieties as follows:

Var. *crassicaarpus*. Calyx pilose with mixed black and white or largely black hairs 0.5-1.5 mm. long; petals purple or purple-tinged; peduncles mostly 20-65 mm. long; stems arising together from the crown of the taproot or very shortly forming from the root at or just below the soil level. *A. caryocarpus* Ker. Locally frequent in prairies of n. Tex. s. to Limestone, Tom Green and Irion cos., and in the Trans-Pecos, Mar.-July; Alta., Sask. and Man. s. to N.M., Tex. and Ark.

Var. *Berlandieri* Barneby. Like var. *crassicaarpus* but the stems arising singly or few together from slender widely forking underground stem branches, forming loose mats. *A. mexicanus* DC. Cen. Tex., Williamson Co. s.w. to Uvalde Co., scattered s.e. to Victoria Co., in prairies, spring, etc.; endemic.

Var. *trichocalyx* (T.&G.) Gl. Calyx and pedicels densely villosulous (hairs 0.5-1 mm. long) with short entangled and some longer ascending cream-colored or brownish hairs; petals greenish-white or cream colored; peduncles mostly 6-15 cm. long. Open woodlands, e. Tex. and rare w. to n.-cen. Tex., Mar.-June; Ill., Mo., Okla., Ark. and Tex.

14. *Astragalus gypsodes* Barneby. GYP GROUND PLUM. Perennial, low, robust, commonly quite coarse, strigulose throughout (except the fruit) with fine sometimes flattened stiff straight appressed hairs 0.25-0.5 (-0.7) mm. long; herbage silvery or greenish-canescens, the leaflets pubescent on both sides, often a little more densely so above than beneath; stipules free; leaves (4-) 6-18 cm. long, with short stiff petiole; leaflets (11 to) 15 to 25 (to 29), elliptic to narrowly ovate-lanceolate or rhombic-elliptic and obtuse or subacute, or (in some leaves) oblong-obovate and retuse, flat, 5-20 mm. long; pedicels at anthesis ascending, 1.3-2.3 mm. long, in fruit a little thickened, usually arched outward, (1.6-) 2-3.4 mm. long; petals bright pink-purple above the pale claws, drying bluish, the keel tip deeply maculate; pod loosely ascending or spreading (nearly always humistrate), broadly and plumply oblong-cylindroid to oblong-ellipsoid or more narrowly cylindroid or clavate-ellipsoid, 25-45 (-50) mm. long, (8-) 10-21 mm. thick, straight or rarely a little incurved, subtruncately rounded to broadly turbinate at base, abruptly contracted at apex into a minute conic-subulate beak, terete or a trifle compressed either laterally, dorsiventrally or (especially when incurved) shallowly sulcate dorsally at maturity, the extremely thick succulent smooth and shining glabrous pale-green but brightly purple-checked valves becoming alveolate-spongy and 1.7-2.3 mm. thick when ripe, the exocarp becoming stramineous or more or less brownish-purple and finely reticulate-wrinkled, the endocarp inflexed as a complete septum nearly as wide as the pod's diameter; dehiscence tardy, after falling, primarily basal and upward through the ventral suture, the seeds apparently discharged basally. Rare and local in gypsum soils, n. Culberson and Reeves cos. in the Trans-Pecos, May; also N.M.

15. *Astragalus plattensis* T.&G. Perennial, low, diffuse or decumbent, with an often deeply buried woody taproot giving rise to slender branched and often widely creeping subterranean caudex branches, the whole plant including ovary and pod thinly to densely pilose with widely to narrowly ascending or spreading rarely subappressed straight or subsinuous lustrous hairs (0.9-) 1-1.5 (-1.9) mm. long; herbage green or grayish-green; stipules at the lowest leafless nodes connate into a bidentate or truncate sheath, the median and upper ones free or connate for a short space; leaves 25-115 mm. long, shortly petioled or the uppermost sessile, leaflets (11 to) 15 to 27, broadly to narrowly elliptic or ovate to oblong, obtuse or acute, or in some lower or rarely all leaves oblong-obovate and truncate-emarginate, flat or loosely folded, (2-) 4-13 (-17) mm. long; pedicels in fruit 2.4-3.8 mm. long; calyx 7.8-12.2 (-13.7) mm. long; petals pink- or lilac-purple, the color fugacious in drying, the banner sometimes largely pallid but keel and wings at least purple-tipped; banner (14.3-) 16.5-20 (-21.5) mm. long; wings (13-) 14.5-17 (-18.4) mm. long; keel (11.5-) 12-15.5 (-16) mm. long; pod ascending or spreading (humistrate), sessile, long-persisting on but finally disjointing from the receptacle (this sometimes produced as a thick glabrous stipelike neck to 1.3 mm. long), the body obliquely ovoid-oblong or subglobose, 10-17 mm. long, 10-13 mm. thick, truncate or

shallowly cordate at base, abruptly contracted distally into a narrowly conic-subulate rigid beak 1-3.5 mm. long, a trifle obcompressed, sulcate both dorsally and ventrally, the sutures both thick but embedded in the valves and not salient, the ventral suture nearly straight or at least much less strongly convex than the dorsal one, the thick fleshy valves strigulose or pilosulous with appressed or narrowly ascending hairs 0.5-0.8 mm. long, stiffly leathery, transversely rugulose and 0.9-1.3 mm. thick at maturity, inflexed as a complete septum 3.6-6 mm. wide. Common in Plains Country, Edwards Plateau and n.-cen. Tex., scattered s. to Victoria and Karnes cos., spring; N.D. and Wyo. s. to Tex.

16. *Astragalus allochrous* Gray. Low, commonly coarse biennial or short-lived perennial, usually flowering and often perishing the first summer, strigulose nearly throughout with straight or mostly straight appressed or subappressed hairs 0.45-0.7 mm. long; herbage green or when young cinereous; stipules ordinarily free, rarely very shortly and obscurely connate; leaves 4-10 mm. long, the uppermost either shortly petioled or subsessile; leaflets (9 or) 11 to 21, oblong-obovate to oblanceolate and obtuse or retuse, or (especially in some upper leaves) elliptic or narrowly oblong-elliptic and either obtuse and mucronulate or acute, flat or loosely folded, (4-) 6-21 mm. long; pedicels in fruit arched outward, a trifle thickened, 2-4 mm. long, persistent; calyx (3.6-) 4.1-5.7 mm. long; petals pink- or reddish-purple, drying violet; banner 7.2-9.4 mm. long; wings 6.6-8.3 mm. long; keel 6.2-7.5 mm. long; pod loosely spreading or declined, those of some outer stems often humistrate and ascending, sessile on the slightly elevated receptacle and readily deciduous, very obliquely ellipsoid or half-ellipsoid, bladderly-inflated, (20-) 25-40 (-45) mm. long, 10-17 (or when pressed apparently to 20) mm. thick, obconic at base, contracted about 3-6 mm. below the apex into a deltoid compressed slightly incurved beak, the ventral suture straight or nearly so, the dorsal one strongly convex, the thin pale-green or purple-cheeked finely strigulose valves becoming papery-diaphanous, stramineous, lustrous, delicately cross-reticulate, not inflexed, the funicular flange 0.4-0.8 mm. wide; dehiscence apical, after falling. Rare in deserts, El Paso Co., extreme w. Trans-Pecos, Apr.; Ariz., N.M. and Tex.

17. *Astragalus Wootonii* Sheld. **GARBANCILLO.** Low but often coarse and leafy, winter annual or biennial, thinly or when young rather densely strigulose, villosulous or pilosulous with hairs 0.4-0.8 mm. long; herbage pale-green, yellowish-green or greenish-cinereous; stipules free, rarely very shortly and obscurely connate; leaves (2-) 4-10 (-12) cm. long, all shortly petioled or the uppermost subsessile; leaflets (7 to) 11 to 23, narrowly oblanceolate to linear-oblong or oblong-obovate, retuse-truncate or obtuse, often callous-mucronulate, folded or rarely flat, 5-20 mm. long; pedicels in fruit arched, a trifle thickened, 1.5-3.5 mm. long, persistent, calyx 4.3-6.4 mm. long; petals whitish, sometimes tinged with pink or lavender, or pale to vivid reddish-lilac; banner 4.6-7.5 mm. long, the wings a trifle shorter or rarely a trifle longer; keel (4.1-) 4.4-6.4 mm. long; pod loosely spreading or declined, commonly humistrate (and then often apparently ascending), sessile on the conical receptacle and readily disjointing, broadly and subsymmetrically or sometimes somewhat obliquely ovoid or ovoid-ellipsoid to ellipsoid or subglobose, bladderly-inflated, (10-) 15-37 (-43) mm. long, (8-) 12-20 (or when pressed apparently to 24) mm. thick, broadly cuneate or rounded at base, contracted just below the apex into a short and obscurely differentiated deltoid laterally flattened beak, otherwise subterete or openly and shallowly sulcate along one or both sutures, the sutures filiform, subequally convex or the dorsal one more strongly so, the thin green or purplish-tinged very rarely lightly mottled thinly strigulose to subvillosulous or glabrate valves becoming papery, stramineous, lustrous, delicately reticulate, not inflexed, the funicular flange none or to 0.7 (-1) mm. broad; dehiscence apical, after falling. *A. Tracyi* (Rydb.) Cory. Frequent in the Trans-Pecos, reported also to be rare near the Canadian River in the Panhandle, spring; Calif., Ariz. and N.M. s.e. to Michoac., Mex. and Pue.

This is considered to be one of the most poisonous of all loco weeds. Although especially poisonous to horses it is also known to have some effect on cattle and sheep.

18. *Astragalus distortus* T.&G. Short-lived perennial, low, diffuse, with a taproot and knotty root crown or shortly forking caudex, sparsely strigulose with fine straight appressed or subappressed hairs 0.2-0.45 mm. long; herbage green; stipules free; leaves of the principal stems (20-) 40-100 (-135) mm. long (those of the subbasal branchlets often smaller and with smaller leaflets), with slender but sometimes short petiole; leaflets

(9 to) 13 to 25 (to 27), oval or obovate to elliptic-oblancheolate or suborbicular, truncate or retuse, flat, (2-) 3-11 mm. long; pedicels in fruit somewhat thickened, 1.5-2.4 mm. long; calyx 3.1-6.3 mm. long, the triangular-subulate or subulate teeth one third to one half as long as the campanulate tube; petals pink-purple with pale wing tips and pale striate eye in the banner, all lilac-tinged or all whitish with lavender keel tip, rarely all white; banner 8.2-15.3 mm. long, the wings shorter; keel 5.5-9.3 mm. long; pod normally ascending and humistrate, rarely declined of its own weight from ascending peduncles, sessile on an incipient or short gynophore 0.4-1.4 mm. long, varying in profile from narrowly lunate-elliptic to obliquely oblong-, ovate-, or obovate-elliptic, 13-25 mm. long, 3.5-7 mm. in diameter, shallowly sulcate only dorsally or more deeply sulcate along both sutures, the green thinly fleshy glabrous valves becoming leathery, brownish and ultimately almost black, not inflexed or inflexed as an incipient septum to 1 mm. wide; dehiscence apparently apical, very tardy, after falling and weathering on the ground. Ia. and Ill., s. to Tex., La. and Miss.; W.Va. and Va.; represented with us by 2 varieties as follows:

Var. *distortus*. Pod deeply sulcate on both ventral and dorsal surfaces, didymous in cross section; ovules mostly 28 to 37; banner 11-15.5 mm. long; keel 7.5-9.5 mm. long. Not collected as yet in Tex., but known just north of the border in Okla.

Var. *Engelmannii* (Sheld.) M. E. Jones. Pod shallowly sulcate dorsally but not or obscurely so ventrally, obcordate to nearly round in cross section; ovules 15 to 28; banner mostly 6.5-11.5 mm. long; keel 5.5-7 mm. long. Abundant in n.-cen., e. and s.e. Tex. s.w. to Wilson and Goliad cos., spring; also La.

19. *Astragalus Soxmaniorum* Lundell. Perennial but probably of short duration, diffuse, thinly strigulose-hirsutulous with fine mostly straight loosely ascending and subappressed hairs 0.5-0.7 mm. long; herbage green; stipules free; leaves (25-) 35-90 (-115) mm. long, shortly petioled; leaflets (9 to) 13 to 19 (or 21), obovate to obovate-cuneate or oblong-obovate, deeply notched, flat, (2-) 4-15 mm. long; pedicels in fruit straight and ascending or divaricate, or strongly arched outward, a little thickened, 1.2-2.6 mm. long, persistent; calyx 6.1-9 mm. long, the lanceolate or lance-caudate teeth (2-) 2.4-4 mm. long; petals greenish-white or cream-colored, immaculate; banner 11.4-17.4 mm. long; wings 9.8-13 mm. long; keel 8.6-12.7 mm. long; pod ascending (humistrate) or (when pressed) apparently spreading or declined, sessile on a stout gynophore 0.6-1.6 mm. long, the body half-obovate or lunately oblanceolate in profile, with straight or gently concave ventral and strongly convex dorsal sutures, 15-21 mm. long, 5-8 mm. thick, broadest above the middle and tapering downward into the cuneate base, abruptly contracted distally into a rigid cusp 1.5-2.5 mm. long, the whole a trifle compressed laterally and obscurely trigonous, with rounded lateral and flattened or shallowly grooved dorsal faces, the green somewhat fleshy glabrous valves becoming leathery, reticulate, stramineous or blackish-brown, inflexed (especially toward the base) as a very narrow and incomplete septum 0.4-1.3 mm. wide; dehiscence apical, basal, and ultimately through the ventral suture, the dorsal suture also splitting to reveal the septum's outer walls. Rare and local, forests of e. Tex. and s. to Hardin Co., spring; endemic.

20. *Astragalus lotiflorus* Hook. Short-lived perennial, low, with a taproot, at first very slender becoming stouter, woody and ultimately producing a shortly forking caudex; herbage pubescent, usually densely so, with fine dolabriform hairs; stipules free; leaves 25-110 (-140) mm. long, with slender petiole; leaflets (3 to) 7 to 17, cinereous or canescent, narrowly to broadly elliptic or oblanceolate to oval or obovate-cuneate, flat or loosely folded, 4-20 (-26) mm. long, the terminal one commonly longer than the last pair; inflorescence dimorphic, (a) chasmogamous and (b) cleistogamous, these found commonly on different plants or if on the same plant at different seasons of the year, most often in discrete colonies of like plants but sometimes separately on different individuals in a colony, in seedling plants cleistogamous only; (a) *chasmogamous racemes* borne on slender peduncles (3-) 4-12 cm. long, these ascending at anthesis, procumbent in fruit, either longer or shorter than the leaf; pedicels in fruit thickened, sometimes arched outward, 1.2-2.4 mm. long, persistent; calyx 5-9.7 mm. long; petals greenish-white to ochroleucous or tinged or veined with lavender, sometimes brightly tipped or margined with purple or bluish-purple; banner 8.5-14 mm. long; wings 7.8-11.8 mm. long; keel 6.6-9.8 mm. long; *cleistogamous flowers* with calyx at anthesis commonly shorter but accrescent and as large in fruit; petals whitish (drying yellowish);

banner 4.3-7.2 mm. long; wings 4.2-6.5 mm. long; keel 4.2-6 mm. long; pod (alike on both types of inflorescence) ascending or loosely spreading (humistrate), ovoid-acuminate, ovoid-, lance- or narrowly oblong-ellipsoid, 12-37 mm. long, 5-8 mm. in diameter, straight, lunately incurved or rarely a little decurved, rounded or narrowly to broadly cuneate at base, either abruptly contracted or gradually tapering distally into a triangular- or lance-acuminate somewhat compressed beak, dorsally flattened or openly depressed-sulcate (when obscurely trigonous) in the lower one-third to two-thirds, carinate ventrally by the prominent thick suture, the dorsal suture also prominent but thinner and commonly undulate, the green somewhat fleshy strigulose or villosulous valves becoming stramineous or purplish-brown, leathery or stiffly papery, cross-reticulate and often wrinkled lengthwise, not inflexed. Incl. var. *nebraskensis* Bates, *A. Reverchonii* Gray. Local, n.-cen. Tex. w. to Plains Country with an isolated station in n. Brewster Co. in the Trans-Pecos, spring; Alta., Sask. and Man. s. to N.M., Tex. and Coah.

21. *Astragalus Emoryanus* (Rydb.) Cory. Annual or winter annual, exceptionally persisting into a second year, diffuse or prostrate, densely to quite thinly strigulose, hirsutulous or subvillosulous with appressed incurved-ascending or more rarely rather stiffly spreading hairs; herbage silvery-cinereous or sometimes greenish; stipules free; leaves 10-45 (-80) mm. long, all shortly petioled or the uppermost sessile; leaflets (7 to) 11 to 19 (or 21), often rather crowded, oval-obovate or obcordate to broadly cuneate-oblancheolate or sometimes mostly elliptic-oblancheolate, obtuse or retuse, loosely folded or flat, 2-10 (-14) mm. long; calyx 3.6-6 mm. long; petals pink-purple, the banner with a large pallid striate eye in the fold; banner (6-) 7.3-11.2 mm. long; wings (5.1-) 6.2-8.8 (-10) mm. long; keel (4.5-) 4.8-6.6 mm. long; pod spreading, declined or (when humistrate) ascending, linear-oblong or narrowly lance-oblong in profile, incurved gently and evenly through a one fourth to one half circle or (when short) lunately incurved to almost straight, 8-22 mm. long, (2-) 2.2-4.3 mm. in diameter, obtuse at base, shortly cuspidate at apex, triquetrously compressed with low-convex lateral and openly sulcate dorsal faces, the green or purple-tinged glabrous valves becoming papery, pale-brown or stramineous, delicately reticulate, inflexed as a complete or nearly complete septum 1.2-2 mm. wide. A species with 2 varieties as follows:

Var. *Emoryanus*. Pod linear-oblong, very gently to strongly but then evenly incurved, 12-22 mm. long, (2-) 2.2-3.3 mm. in diameter, five to six and one half times as long as its diameter. Frequent in the Trans-Pecos and near the Rio Grande in Rio Grande Plains, with isolated stations in s.-cen. Tex., spring; Ariz., N.M., Tex., Chih. and N.L.

Var. *terlinguensis* (Cory) Barneby. Pod more broadly and plumply lance-oblong, nearly straight or very slightly incurved, 8-14 mm. long, (2.5-) 3-3.7 mm. thick, three to four and one third times as long as thick. Known in Tex. only from Brewster, Presidio, Culberson and Hudspeth cos. in the Trans-Pecos, spring; also Coah.

22. *Astragalus Nuttallianus* A. DC. Annual and winter annual, mostly of 3 or 4 months duration, nearly always quite slender, sometimes diminutive and fugitive, varying from nearly glabrous below the thinly strigulose inflorescence to densely strigulose, villosulous or pilose with appressed incurved or partly (rarely all) spreading often lustrous hairs 0.4-1.35 mm. long; herbage green, cinereous or canescent; stipules free; leaves 10-65 (-90) mm. long, all slender-petioled or the upper ones often sessile; leaflets (5 or) 7 to 19 (to 23), varying from linear-elliptic and acute to obcordate, 2-14 (-17) mm. long, nearly always flat, all of the same type throughout the plant or dimorphic, those of the lower leaves broader; pedicels in fruit 0.5-1.6 mm. long; calyx 2.5-5.7 mm. long; petals whitish, pinkish-lilac, pinkish- or amethystine-purple, when brightly colored the banner with a large pale eye, the color turning bluish or violet on drying; banner 3.7-10 (-13) mm. long; wings 3.7-8.6 (-10.7) mm. long; keel 3.7-6.8 (-9.3) mm. long; pod ascending, spreading or declined, sessile or contracted at base into a short stipe or obscure stipelike neck 0.5-0.9 mm. long, linear or linear-oblancheolate in profile, nearly straight, incurved near the base and straight or nearly so thereafter, or less often evenly and gently incurved its whole length through about a one third or even one half circle, when first formed triquetrously and a trifle laterally compressed, with nearly plane lateral and narrower shallowly sulcate dorsal faces, the faces becoming flat or slightly convex as the ovules swell, subequally 3-sided or somewhat tetragonal when ripe, the thin green or purple-tinged glabrous, strigulose or villous valves becoming papery, stramineous or brownish and ultimately black or nearly so, delicately cross-reticulate, inflexed as a

complete septum to about 2 mm. wide or the septum sometimes incomplete or sub-obsolete; dehiscence apical and downward through the ventral and part way through the dorsal suture. A species with at least 9 "varieties" occurring from Calif., Nev., Ut., Colo. and Okla. s. to Dgo. and Pue.; represented with us by 6 varieties separable by the following key:

1. Leaflets of all leaves retuse or truncate-emarginate (2)
 1. Leaflets not all retuse or truncate-emarginate, elliptic or ovate and obtuse to subacute in at least some upper (often all) leaves (4)
 - 2(1). Ovary and pod pubescent; pod loosely strigulose and the herbage hirsutulous; flowers very small, the banner about 5-6 mm. long .. var. *zapatanus*.
 2. Ovary and pod glabrous or if pubescent only minutely strigulose; flowers variable in size but if very small with banner less than 6.5 mm. long, then the herbage minutely strigulose or subglabrous (3)
 - 3(2). Flowers small, the banner 4.3-7.3 (-7.6) mm. long, the keel tip deltoid-acute or sharply deltoid; raceme axis not elongating or scarcely so, not more than 8 (or 10) mm. long in fruit var. *Nuttallianus*.
 3. Flowers larger, the banner 8.5-13 mm. long, the keel tip obtusely rounded; raceme axis mostly elongating and 10-30 mm. long in fruit .. var. *macilentus*.
 - 4(1). Keel obtusely rounded at tip; racemes elongating, the axis mostly 5-30 mm. long in fruit; pod commonly glabrous var. *macilentus*.
 4. Keel deltoid or narrowly so at tip, acute or subacute, commonly porrect; racemes not or scarcely elongating, to 8 (rarely to 12) mm. long in fruit; pod glabrous, strigulose or villosulous (5)
 - 5(4). Flowers relatively large, the banner mostly 7-9 mm. long; racemes mostly 4- to 10-flowered; pod consistently glabrous var. *pleianthus*.
 5. Flowers small, the banner mostly 5-7 mm. long; racemes mostly 1- to 5- (or 6-) flowered (6)
 - 6(5). Pod hirsutulous, the hairs 0.5-1 mm. long; leaflets commonly 11 to 13 var. *trichocarpus*.
 6. Pod glabrous or strigulose, if pubescent the shorter hairs appressed and 0.5 mm. long or less; leaflets commonly 7 to 11 var. *austrinus*.

Var. *Nuttallianus*. N.-cen. Tex. and e. part of Plains Country, s. to Edwards Plateau and Rio Grande Plains, spring; also Okla.

Var. *macilentus* (Small) B. L. Turner. Edwards Plateau and Trans-Pecos, spring; endemic.

Var. *pleianthus* (Shinners) Barneby. *A. austrinus* var. *pleianthus* Shinners. Cen. Tex., w. to Sutton Co., s. to Refugio Co., n. nearly to Red River, spring; endemic.

Var. *trichocarpus* T. & G. Almost same range as preceding; passing into var. *austrinus* to the w.

Var. *austrinus* (Small) Shreve & Wiggins. *Hamosa Davisiana* Rydb. W. two-thirds of Tex., e. to n.-cen. Tex. and Rio Grande Plains, spring; Ariz., N.M. and Okla. s. to Son., Dgo., Coah. and N.L.

Var. *zapatanus* Barneby. Webb, Zapata and Jim Hogg cos. of Rio Grande Plains, Feb.-Mar.; also Tam.

23. *Astragalus leptocarpus* T.&G. Precocious annual with slender taproot, variable in stature but commonly low and delicate, the stems, leaf rachises and peduncles thinly (or when young somewhat densely) strigulose with straight appressed or subappressed hairs; stipules free; leaves 15-70 mm. long, the lowest shortly petioled, the rest sessile; leaflets (7 to) 11 to 17 (or 19), oblong-, obovate- or oblanceolate-cuneate, retuse or emarginate or in some lower leaves broadly cuneate-obcordate, flat, rather thick-textured, green, glabrous, 2-10 (-12) mm. long; pedicels in fruit 0.8-1.7 mm. long, persistent; calyx (3-) 3.6-4.5 (-5.3) mm. long; petals magenta- or amethystine-purple, drying violet, the banner with a large white striate eye, the wings often white-spotted distally near the inner margin; banner (5.2-) 8.3-12 (-13.2) mm. long; wings (5-) 7.2-9.8 (-11.3) mm. long; keel (4.5-) 6-7.8 (-9) mm. long; pod horizontally spreading or ascending at a wide angle, sessile but cuneately tapering at base into a thick sometimes stipelike neck to 0.5 mm.

long, narrowly linear or linear-oblongate in profile, straight or rarely slightly and evenly incurved, narrowly cuneate and shortly cuspidate at apex, 17-37 mm. long, 2.2-3.1 (-3.5) mm. in diameter, triquetrously compressed with at first nearly flat but ultimately convex lateral and narrowly sulcate dorsal faces, carinate ventrally by the rather thick prominent suture, the very slightly fleshy green or purplish glabrous valves becoming papery, at first brownish but ultimately almost black, delicately cross-reticulate, inflexed as a complete septum 1.5-1.8 mm. wide; dehiscence apical and downward through the ventral suture, the septum also splitting in age and the valves somewhat coiled distally. Abundant in e., s.e. and n.-cen. Tex. and near the coast s. to Cameron Co., spring; endemic.

24. *Astragalus Lindheimeri* Gray. Annual, resembling forms of *A. Nuttallianus* but often coarser, with a slender taproot, thinly strigulose with straight appressed or sub-appressed hairs 0.35-0.5 mm. long; herbage green, the leaflets glabrous above; stipules free; leaves (10-) 20-65 mm. long, petioled but the uppermost quite shortly so; leaflets (11 or) 13 to 21, broadly to narrowly cuneate to cuneate-oblong or -oblongate, truncate-emarginate to deeply retuse, flat or loosely folded, of rather thick texture and 2-14 mm. long; pedicels in fruit 1.8-3 mm. long; calyx (4-) 5-8 mm. long; petals bicolored, the banner purple-margined around the prominent white but purple-veined eye, the wings white, the keel tip purple-maculate, the purple turning violet on drying; banner (12-) 13-18.5 mm. long; wings 11.2-17 mm. long; keel 9.5-12.9 mm. long; pod stipitate, the stout stipe (0.8-) 1-2.6 (-3) mm. long, ascending at a wide angle, horizontal or a little declined in line with the pedicel, the linear-oblong or -oblongate body gently and lunately or more abruptly and sub-basally incurved through about a right angle (the distal half then narrowly ascending and becoming perpendicular in a plane parallel to the raceme axis), 17-27 mm. long, 3.5-6 (-6.5) mm. in diameter, broadly cuneate or acuminate tapering at base, cuspidate at apex, compressed-triquetrous with flat or low-convex lateral faces and narrower narrowly sulcate dorsal face, carinate ventrally by the prominent thick suture, the thinly fleshy green glabrous valves becoming thinly leathery or stiffly papery, brownish or when ripe nearly black, inflexed as a complete septum 2.2-3.3 mm. wide. Incl. var. *bellus* Shinnars. Plains Country, frequent, infrequent s. to Edwards Plateau and e. to n.-cen. Tex., spring; also Okla.

25. *Astragalus reflexus* T.&G. Precocious winter annual, variable in stature according to site and season, commonly slender, thinly hirsute-hirsutulous (especially upward) with rather stiff straight horizontal or widely ascending hairs, the herbage green; stipules free; leaves 2-8 cm. long, the lowest shortly petioled, the rest commonly sessile; leaflets (9 or) 11 to 15 (to 19), oblong-ovate to -obovate or obovate-cuneate, sharply retuse, flat, thin-textured, (3-) 5-15 mm. long; pedicels 0.7-1.4 mm. long in fruit, persistent; petals bicolored, the banner and keel bluish- or reddish-violet, the wings pallid or white-tipped or -margined; banner 4.2-5.2 mm. long; wings 3.1-4 mm. long; keel 4.3-5 mm. long; pod reflexed, sessile on and disjuncting from an obscure gynophore 0.1-0.5 mm. long, the body narrowly to broadly ovate or triangular-ovate in dorsiventral view, 5.5-9 mm. long, 2.5-5.5 mm. in diameter, truncate or shallowly retuse at base, abruptly contracted distally into a subulate cusp about 0.5 mm. long, triquetrously compressed, carinate ventrally by the prominent straight or slightly incurved suture, deeply and openly sulcate dorsally, the pale-green or commonly purple-speckled glabrous valves becoming brownish, stiffly papery, prominently cross-reticulate and somewhat rugulose on the obtuse lateral angles, inflexed as a complete but narrow septum 0.4-1 mm. wide. Infrequent, Dallas to Travis cos., rarely s.e. to Gonzales and Walker cos., Apr.; endemic.

26. *Astragalus brazoensis* Buckl. Annual or winter annual, variable in stature according to site and season, dwarf and slender or quite coarse and robust, thinly strigulose with appressed or narrowly ascending straight hairs; stipules free; leaves (20-) 25-75 mm. long, the lowest petioled, the rest sessile; leaflets (11 or) 13 to 19, narrowly to broadly obovate-cuneate or orbiculate, retuse, flat, 3-10 (-13) mm. long; pedicels slender, at anthesis ascending and 0.5-0.8 mm. long, in fruit arched outward (a trifle thickened) and 0.7-1.5 mm. long, persistent; calyx (2.7-) 3-4.1 mm. long, often purplish; petals whitish, distally suffused with lilac or bicolored, the banner then broadly purple-margined, the wing tips white, the keel tip always purple; banner (5.4-) 6.7-8 mm. long; wings (5-) 5.5-7.2 mm. long; keel 4.5-5.9 mm. long; pod reflexed, sessile but elevated out of the calyx on a slender often decurved stipelike gynophore 1.5-2.3 mm. long, the body very strongly obcompressed, peltiform, subcircular in dorsiventral view or often a little wider

than long, 3.5-7 mm. long, 4.5-7.5 (-9) mm. in diameter, truncate or shallowly retuse at either or both ends, contracted at apex into a conic-subulate cusplike more or less incurved beak 0.7-1 mm. long, straight or the whole gently incurved (the ventral face then depressed in the middle and shallowly bowl-shaped), the rather firm green or purple-tinged glabrous valves becoming stiffly papery, brownish or stramineous, somewhat lustrous, prominently cross-reticulate and often rugulose on the narrow but obtuse lateral angles, inflexed as a narrow but complete septum 0.5-0.8 mm. wide; dehiscence tardy, after falling the pod separating into two halves along both sutures and through the septum; ovules 4. Local in Rio Grande Plains, Feb.-Apr.; also Tam.

27. *Astragalus Wrightii* Gray. Slender but ultimately stiff or rigid annual with a filiform taproot, silky-pilose throughout with fine mostly straight narrowly or loosely ascending basally thickened hairs; herbage silvery-cinereous or -canescent, in youth becoming greenish; stipules free; leaves 15-55 (-75) mm. long, the lower and median petioled, the upper subsessile; leaflets 7 to 13, broadly to narrowly elliptic or oblanceolate, acute or (in some early leaves) obovate and obtuse, flat or loosely folded, (2-) 4-17 (-20) mm. long; peduncles erect and stiffly ascending, 7-70 mm. long, the first usually and sometimes all longer than the leaf, the uppermost often (rarely all) shorter; racemes capitately 3- to 7-flowered; pedicels at anthesis subobsolete, in fruit thickened and 0.6-1 mm. long; calyx 5.2-6.2 mm. long; petals reddish-violet, lilac, or whitish faintly lilac-tinged, the color evanescent in drying; banner 5.2-6.2 mm. long; wings 4.7-5.5 mm. long; keel 4.7-5.5 mm. long; pod erect, sessile on and firmly attached to the receptacle, oblong or lance-oblong in profile, 7-13 mm. long, 2.5-3.5 mm. in diameter, straight or nearly so, truncate or broadly rounded at base, abruptly contracted at apex into a short subulate decurved beak, bluntly compressed-triquetrous, the ventral angle broad and obtuse, the lateral faces low-convex, the dorsal face narrowly sulcate, the green scarcely fleshy valves becoming brown or ultimately blackish, stiffly papery, transversely reticulate, loosely and densely pilose-hirsute, inflexed as a complete septum 1.2-2.2 mm. wide; dehiscence apical and downward through the ventral suture, the beak gaping to release the seeds, the dorsal suture finally splitting to expose the separating walls of the septum. Edwards Plateau from Brown, Lampasas and Bell cos. s. to Bandera, Kerr and Comal cos., spring; endemic.

44. OXYTROPIS DC.⁹³

CRAZY-WEED. PURPLE LOCO

A genus of about 150 to 300 species of north-temperate regions, reaching its southern limits in our state.

1. *Oxytropis Lambertii* Pursh var. *articulata* (Greene) Barneby. Perennial herb, often forming colonies by short rhizomes; stems several from the crown, very short; herbage all pubescent with hairs attached in the middle and with 2 free ends; petioles short; stipules broad, persistent, 7-24 mm. long; leaves basal, alternate, once-imparipinnately-compound, lower leaves shorter than the upper ones, 4-21 cm. long; leaflets (7 or) 9 to 19, narrowly linear to linear-oblong, 10-35 mm. long, 1-3.5 (-5.5) mm. broad, thick, firm, basally asymmetric; racemes 2-4 cm. thick at full anthesis, terminal on nearly leafless scapes 5-25 cm. long and commonly surpassing the foliage; flowers usually 10 to 25 per raceme, 15-26 mm. long; calyx with a tube and 5 lobes, silky-pilose, the tube 6-8 mm. long, the deltoid-subulate teeth 1.2-3 (rarely to 4) mm. long; corolla papilionaceous, pink-purple to almost white or various shades of rose or lavender; banner 18-25 mm. long; wings 15-26 mm. long, commonly much-dilated upward; keel 14-19 mm. long, the keel petals apically extending into a sharp erect point; stamens 10, diadelphous, 9 filaments coalescent, the tenth (uppermost) free; pod sessile, stiffly woody, the body ovoid to oblong-ovoid, commonly 7-10 mm. long and exserted, the beak 3-5 mm. long; seeds several. *Astragalus Lambertii* (Pursh) Spreng. var. *abbreviatus* (Greene) Shinnars. Scattered in the higher parts of the Plains Country and n.-cen. Tex. s. to Tarrant and Dallas cos., very rarely s. to Comanche and Travis cos., Apr.-June; Sask. and Man. s. and s.w. to Ariz., N.M. and Tex. (species as a whole); the var. in Okla. and Tex.

⁹³ Adapted from Rupert C. Barneby in Proc. Calif. Acad. Sci. ser. 4, 27:177-312. 1952.

One of the most dangerous of the loco weeds because it is readily eaten by grazing animals, often with fatal effects. Because of its abundance and wide distribution it is probably the most destructive of all the known loco weeds.

45. GLYCYRRHIZA L.

A genus of about 15 species in the temperate and subtropical parts of the world. Licorice of commerce is obtained from the roots of the European *G. glabra* L.

1. *Glycyrrhiza lepidota* Pursh. LICORICE. Perennial herb with tall (6-9 dm.) erect stems arising from stout sweet roots, the herbage all glandular-viscid; leaves alternate, once-imparipinnately-compound; stipules minute, slender; petioles short; leaflets 15 to 19, oblong-lanceolate, mucronate-pointed, sprinkled with little scales when young and with corresponding dots when old; flowers in spiciform axillary racemes; calyx somewhat 2-lipped, the upper lip nearly entire (that is, the 2 upper lobes nearly completely coalescent), the 3 lower lobes not coalescent so high; corolla whitish, very much as in *Astragalus*; stamens diadelphous, 9 filaments coalescent, the tenth (uppermost) free, the anthers alternating large and small (shorter ones smaller); fruit dry and indehiscent or scarcely dehiscent, laterally compressed, few-seeded, oblong, beset with hooked prickles suggesting the projections of cockleburs. Infrequent in alluvial and sandy soils, often in stream beds or damp roadside ditches, in the Trans-Pecos, higher parts of the Plains Country, e. locally to Wichita Co. along the Red River, Apr.-June; widespread in U.S. except the s.e. portion.

A good soil-binder but potentially a noxious weed.

46. ALHAGI GAGNEBIN

A genus with perhaps 3 species of the deserts of central and western Asia, of which 1 has been introduced in the deserts of North America.

1. *Alhagi camelorum* Fisch. CAMEL-THORN. Much-branched thorny glabrous shrubs, spreading by rhizomes, to about 1 m. high; leaves alternate, small, unifoliolate, the blade linear or linear-oblancoate to obovate; flowers numerous in short racemes; calyx with a campanuloid tube and 5 teeth or lobes; corolla papilionaceous, purplish-pink; fruit a flattened pod with 1 to several joints but these joints not separating from each other at maturity, indehiscent. Established along drainage ditches and streams, often in gypseous soils, in Culberson and El Paso cos. in the Trans-Pecos, June-July; introd. into Tex., Ariz., etc. from Asia.

A potentially pernicious weed.

47. AESCHYNOMENE L.⁹⁴ JOINT VETCH

Perennial herbs with erect, prostrate or sprawling stems, unarmed; leaves alternate, once-imparipinnately-compound, 1-10 cm. long; stipules peltate, appendiculate below the point of attachment or attached at base and not appendiculate; petioles short; leaflets 5 to 63; flowers 5-10 mm. long, in axillary or terminal racemes, the racemes usually not dense; calyx with a campanuloid tube and 5 teeth; corolla papilionaceous, yellowish; stamens 10, monadelphous, the filaments united into a sheath which is open at the lower side; fruit a loment, of 2 to 12 1-seeded joints which are severally indehiscent but separate from each other at maturity.

A genus of about 100 species of the warmer parts of the world.

1. Leaflets 5 to 11; stems prostrate or spreading 1. *A. viscidula*.
2. Leaflets 19 to 63; stems erect 2. *A. indica*.

1. *Aeschynomene viscidula* Michx. STICKY JOINT VETCH. Stems sprawling, 2-10 dm. long; herbage viscidulous-pubescent with glandular hairs; leaves 10-25 mm. long; leaflets 5 to 11; flowers 5-7 mm. long; fruit with 2 or 3 (to 5) joints. Locally abundant in grass-

⁹⁴ Adapted from Velva E. Rudd in Contr. U.S. Nat. Herb. 32:1-172. 1955.

lands on sandy soil, coastal s. Tex. from Calhoun to Willacy cos., inland to Brooks Co., Apr.-Sept.; s.e. U.S. s. to Braz.

2. *Aeschynomene indica* L. Stems erect, 5-25 dm. tall, glabrous to hispidulous; leaves 5-10 cm. long; leaflets 19 to 63; flowers 8-10 mm. long; fruit with 5 to 14 joints. Local in wet coastal areas, Kleberg Co. to Jefferson Co., Aug.-Sept.; N.C. to Tex., s. to Braz. and Arg.

Our plants have fruits only 2.5-3.5 mm. broad, which would place them technically in the taxon *A. evenia* Wright, which replaces *A. indica* in much of tropical America but seems not to be specifically separable from it.

48. HEDYSARUM L.

Hedysarum is said to comprise about 80 species of north-temperate Eurasia and North America; six occur in the United States.

1. *Hedysarum boreale* Nutt. Perennial herb 2-5 dm. tall; stems ascending; leaves once-compound, odd-pinnate, with 11 or 13 leaflets; leaflets entire, narrowly elliptic to linear-oblong, 1-2 cm. long; stipels absent from the leaflets; flowers in terminal spikelike racemes; calyx equally or subequally 5-cleft, the lobes narrow and nearly equal, a little longer than half the total calyx length; corolla pink-purple to red-purple, about twice as long as the calyx; keel nearly straight, obliquely truncate, not appendaged, longer than the wings; stamens diadelphous, 9 united, 1 free; legume flattened, dehiscent into several nearly bilaterally symmetrical reticulate roundish articles (each severally indehiscent). *H. cinerascens* Rydb. Rare in higher parts of Plains Country (Canadian River breaks n. of Phillips), May; Sask. to Ariz., N.M. and Tex.

49. NISSOLIA JACQ.⁹⁵

A genus of 12 species of warm, dry areas of North and South America.

1. *Nissolia platycalyx* Wats. Perennial climbing often twining vine, less often sprawling over herbaceous vegetation, the stems annual and 3-10 dm. long; leaves 4-7 cm. long, alternate, once-imparipinnately-compound; stipules lanceolate to deltoid-ovate; leaflets 5 (rarely 7), elliptic, 5-25 mm. long, 4-15 mm. broad, glabrous, obtuse; flowers 14-20 mm. long, solitary or 2 to 4 in axillary racemes shorter than the foliage; calyx with a campanuloid tube and 5 subequal teeth or lobes; corolla papilionaceous, yellow; stamens 10, monadelphous, the filaments coalescent into a sheath which splits eventually on the upper side; fruit a loment 3-4 cm. long, splitting into 2 to 4 joints, subglabrous at maturity, the terminal joint sterile, flat and winglike, conspicuously larger than the other joints. Rare at elev. of 5,000-6,000 ft. in the Chisos Mts. in the Trans-Pecos, May-Sept.; also Coah. and N.L.

50. STYLOSANTHES Sw.⁹⁶

PENCIL-FLOWER

Perennial herbs (sometimes bushy-branched above) with erect, ascending or sprawling-procumbent stems 1-6 dm. long; leaves alternate, pinnately trifoliolate (the rachis below the terminal leaflet only 1 mm. long); petioles 5-20 mm. long; stipules only slightly shorter than the petioles, adnate nearly the full length to the petiole, often conspicuously veiny; leaflets firm, elliptic, 1-2 (-3) cm. long, conspicuously veiny; stipels absent; flowers 5-10 mm. long, inconspicuous, short-pedicellate, solitary in the axils of distal leaves or in crude racemes by crowding of distal floriferous nodes; calyx with a long tube and 5 lobes; corolla papilionaceous, orangish-yellow; stamens 10, monadelphous, the filaments coalescent into a tube which splits on the upper side after anthesis; 5 anthers versatile alternating with 5 sub-basifixed ones; fruit a loment of 2 flattened achenelike joints which separate from each other at maturity, the distal joint fertile and beaked, the proximal one persistent and sterile, much-reduced.

⁹⁵ Adapted from Velva E. Rudd in Contr. U.S. Nat. Herb. 32:173-206. 1956.

⁹⁶ Adapted largely from Robert H. Mohlenbrock in Ann. Missouri Bot. Gard. 44:299-355. 1957.

A genus of 25 species occurring in Asia, Africa, South and North America.

- 1. Flowers in terminal bracted racemes 1-3 cm. long (somewhat less at early anthesis); branches glandular-pubescent; plants of southern Texas 1. *S. viscosa*.
- 1. Flowers in short terminal heads or racemes 1 cm. long or less; branches not at all glandular-pubescent (may be densely hispid); plants mostly of eastern Texas 2. *S. biflora*.

1. *Stylosanthes viscosa* Sw. Depressed usually prostrate herbs with stems 1-2 dm. long, the herbage densely viscid-glandular-pubescent; loment to 2.5 mm. broad, the upper (fertile) joint 2-4 mm. long, shortly hairy; beak short, less than half as long as the upper-joint body, usually about a third to a fourth as long, strongly uncinata, often coiled. Coastal s. Tex. from Aransas Co. to Cameron Co. in sandy prairies, May-Sept.; Tex., Mex., C.A., S.A. and Gr. Ant.

2. *Stylosanthes biflora* (L.) B.S.P. Usually erect or ascending and somewhat bushy-branched, (1-) 2-6 dm. tall; herbage pubescent or glabrous, never viscid or glandular; loment 2.5-3 mm. broad, the upper fertile joint 2.5-5 mm. long and puberulent; beak 0.5-1 mm. long, coiled to nearly straight. Incl. var. *hispidissima* (Michx.) Pollard & Ball, *S. riparia* Kearn. Frequent in e., s.e. and n.-cen. Tex., Apr.-Nov.; most of e. U.S.

51. ZORNIA J. F. GMEL.⁹⁷

Herbs; leaves alternate, with 2 or 4 leaflets palmately arranged; petioles as long as the leaflets; stipules elliptic-obovate, attached near but not at their base; stipels absent; inflorescence spicate, several-flowered; each flower subtended by 2 large bracts similar to the stipules of the leaves; flower calyx with a campanuloid tube and 5 lobes or teeth; corolla papilionaceous, yellow, 7-14 mm. long; stamens 10, the filaments united into a tube which abscises about half its length at maturity; 5 anthers versatile and alternate with 5 sub-basifixed ones; fruit a loment with 2 to 7 flattened indehiscent joints.

A genus of about 80 species of the warmer parts of the world.

- 1. Leaflets 4 1. *Z. bracteata*.
- 1. Leaflets 2 (2)
- 2(1). Mature spikes so elongate that the bracts overlap little if at all; joints of loment often not reticulate; mature loment elongate so the last 3 joints at least visible beyond the end of the bract 2. *Z. gemella*.
- 2. Mature spikes with bracts overlapping; joints of loment reticulate; mature loment either not as long as the bract or else only the last 1 or 2 joints protruding 3. *Z. reticulata*.

1. *Zornia bracteata* J. F. Gmel. VIPERINA. As in the key; frequent in sandy gravelly soils, Rio Grande Plains, n.-cen. and s.e. Tex., less frequent w. to the Llano area of Edwards Plateau and to e. Tex., June-Sept.; Coastal States, Va. to Tex.

2. *Zornia gemella* (Willd.) Vog. As in the key; including plants which have usually been referred to the Asian *Z. diphylla* (L.) Pers. Infrequent in sandy soils, Rio Grande Plains, rare in s.e. and e. Tex., spring-fall; Arg. and Parag., n.w. to Cuba and Tex. (See comments below.)

3. *Zornia reticulata* Sm. As in the key; infrequent or rare in sandy soils, Rio Grande Plains and s.e. Tex., spring-fall; Parag. n.w. to Ariz., Tex. and Cuba.

This is weakly differentiated from *Z. gemella*. Specimens which are not definitely determinate as one or the other are the rule rather than the exception.

52. DESMODIUM DESV.⁹⁸ TICK-TREFOIL. TICK-CLOVER. BEGGAR'S-TICKS

Annual or perennial, prostrate to erect or ascending herbs or subshrubs, variously pubescent with hooked trichomes often present (at least on the fruits, occasionally on the stems); leaves alternate (whorled in no. 2 and sometimes appearing opposite),

⁹⁷ Adapted largely from Robert H. Mohlenbrock in *Webbia* 16:1-141. 1961.
⁹⁸ Contributed by Bernice G. Schubert.

pinnately trifoliolate or (in no. 26) unifoliolate (or rarely quinquefoliate), petiole (or with petioles much-reduced as in no. 9); petiole sulcate, extending to become the leaf rachis, stipulate; stipules usually attenuate, rarely connate (as in no. 4), persistent or caducous; leaflets petiolulate; petiolules rather uniform throughout, rugose, dark, stout, densely pilose, 1.5-5 mm. long, stipellate (each lateral leaflet subtended by 1 stipel, the terminal by two); stipels usually subulate and persistent, often caducous or lacking in species 1 to 3; inflorescence composed of axillary or terminal stiff to lax often paniculately compound racemes; flowers appearing to be borne in pairs or threes (which are actually reduced secondary racemes), each pair subtended by a primary bract, each pedicel further subtended by a smaller secondary bract; pedicels to 2 cm. or more long; calyx bilabiate, the upper lobe bifid, the lower tridentate with a usually long-acuminate central tooth exceeding the two laterals; corolla white or pink to purplish (or greenish), *never yellow*; standard orbicular to ovate and often retuse, the short-unguiculate wings slightly adherent to the more or less falcate and mostly apically truncate long-unguiculate coherent keel petals; stamens monadelphous (in 3 of our species) or diadelphous, 9 and 1 (at least above); fruit a (1-) 2-multiarticulate stipitate loment with its lower suture usually more deeply indented than the upper, generally separating into 1-seeded mostly uncinulate-pubescent indehiscent (in our area) articles, sometimes glabrous on the sutures, rarely glabrous on the surfaces (as in no. 7).

A genus of more than 200 species in temperate to tropical areas excepting the western United States (Pacific slope), Europe and New Zealand. Our species coming south from the eastern and central states and north from Mexico. There is some taxonomic difficulty in a few species complexes but the basis for it is not completely clear, little cytological work having been done on the group. In general, the species do not seem to hybridize readily and their characters are relatively stable. Leaflets and stipules, bracts, pedicels and loment articles seem to offer the best diagnostic characters, size, shape and attachment of the loment articles being a good basis for recognizing groups of rather closely related species.

1. Stamens monadelphous; stipe of loment 3 times as long as calyx or more, usually equaling or exceeding the length of the pedicel; calyx scarcely lobed (2)
1. Stamens diadelphous; stipe of loment to 2.5 times as long as calyx or scarcely exceeding it, in our species rarely equaling pedicel in length; calyx 2-lobed, the upper lobe bifid, the lower lobe with the central tooth exceeding the laterals in length (4)
- 2(1). Inflorescences axillary and terminal; flowers white; pedicels slender; stipe of loment 5-9 mm. long 3. *D. pauciflorum*.
2. Inflorescence not axillary; flowers rose to purple (rarely white) (3)
- 3(2). Flowering stem leafless, arising from the base; stipules deciduous; pedicels slender; stipe of loment (5-) 10-22 mm. long 1. *D. nudiflorum*.
3. Flowering stem arising from a whorl of leaves; stipules persistent; pedicels stout; stipe of loment shorter, 4-10 mm. long 2. *D. glutinosum*.
- 4(1). Leaves unifoliolate 26. *D. psilophyllum*.
4. Leaves trifoliolate (5)
- 5(4). Primary bracts broadly lanceolate to ovate, gradually to abruptly long-acuminate, rather broad at base, leaving a prominent horizontal scar, finely striate, regularly subtending only 2 pedicels, each of these often further subtended (laterally) by a somewhat reduced or depauperate secondary bract (6)
5. Primary bracts lanceolate to lance-ovate, long-acuminate, prominently striate; secondary bracts similar but smaller, each subtending a single pedicel; pedicels 2 to 7 (commonly 3 to 5) in a fascicle (25)
- 6(5). Stipules ovate-attenuate, cordate to hemicordate at base or abaxially connate, splitting only at maturity (7)
6. Stipules linear to lance- or ovate-attenuate (11)
- 7(6). Stipules deciduous; articles of the loment glabrous on surfaces, uncinulate-pubescent on sutures only 7. *D. Lindheimeri*.
7. Stipules persistent; articles of the loment uncinulate-pubescent throughout (8)

- 8(7). Plants prostrate and trailing, the leaflets almost orbicular and the stipules obliquely cordate at base and reflexed at maturity, or if only partially prostrate and later becoming erect and more or less shrubby only basal leaflets orbicular and the stipules fused and splitting at maturity (9)
8. Plants erect; leaflets ovate to rhombic (10)
- 9(8). Stipules obliquely cordate at base and reflexed at maturity; loments with sub-rhombic to elliptic articles 5. *D. rotundifolium*.
9. Stipules connate, splitting at maturity; loments with articles semielliptic (essentially straight on the upper suture) 4. *D. canum*.
- 10(8). Stem and rachis of inflorescence patent-pilose with long tapering trichomes; leaflets not strongly reticulate 6. *D. canescens*.
10. Stem and rachis of inflorescence pilose with a preponderance of multicellular trichomes; leaflets strongly reticulate, usually with white blotches along midrib 8. *D. Tweedyi*.
- 11(6). Loments 1-3 (-4) -articulate, at least the lower suture curved; plants with small bracts (to 3 mm. long) and small flowers (to 6 mm. long) (12)
11. Loments multiarticulate (i.e., usually with 4 or more large articles) (17)
- 12(11). Plants erect with linear to linear-oblong or -lanceolate leaflets (13)
12. Plants prostrate to ascending or erect with ovate to ovate-oblong or almost orbicular leaflets (14)
- 13(12). Leaves sessile to very short-petiolate; petioles (when present) not more than 9 mm. long; leaflets linear-oblong, 7-15 mm. broad; pedicels stout, 1.4-4.5 mm. long 9. *D. sessilifolium*.
13. Leaves petiolate; petioles 4-18 mm. long; leaflets linear to linear-lanceolate, to 7 mm. broad; pedicels slender, 6-13 mm. long 10. *D. strictum*.
- 14(12). Leaflets elliptic to lance-ovate, large (terminal leaflet 50-67 mm. long), thick; stipules and bracts very early-deciduous; inflorescence lax; pedicels 6-17 mm. long 11. *D. obtusum*.
14. Leaflets chiefly ovate to rounded-ovate or oblong to orbicular, much smaller (terminal leaflet 9-30 mm. long); stipules mostly persistent (15)
- 15(14). Plants prostrate, trailing, glabrous to puberulent throughout; leaflets thickish; inflorescence lax 14. *D. lineatum*.
15. Plants erect; leaflets rather thin; inflorescence stout (16)
- 16(15). Leaves nearly sessile; petioles to 15 mm. long; stems and petioles mostly pilose; pedicels 4-9 mm. long 12. *D. ciliare*.
16. Leaves mostly petiolate; petioles 12-27 mm. long; plants essentially glabrous; pedicels (6-) 8-19 mm. long 13. *D. marilandicum*.
- 17(11). Plants with long stipules, large showy primary bracts (to 12 mm. long) and short-stipitate to sessile loments (18)
17. Plants with shorter stipules, smaller primary bracts and flowers and longer-stipitate loments (19)
- 18(17). Leaves short-petiolate (petioles 8-25 mm. long); petiolules to 3 mm. long; leaflets thickish, oblong to ovate-lanceolate, obtuse or acutish and with conspicuous venation; stipules 4.5-9.5 mm. long; stipels 2-4 mm. long; both sutures of loment articles curved or the lower obtusely angled 15. *D. canadense*.
18. Leaves longer-petiolate (petioles 40-97 mm. long); petiolules 3-5 mm. long; leaflets thin, ovate-acuminate, glaucous beneath; stipules 11-20 mm. long; stipels 5-9 mm. long; both sutures of loment articles regularly angled 16. *D. cuspidatum*.
- 19(17). Pedicels mostly short (3-12 mm. long) and stout (20)
19. Pedicels longer, 9-20 mm. long (24)

- 20(19). Plants with thin leaflets inconspicuously reticulate and rather inconspicuously to densely pilose; terminal leaflet mostly lanceolate and twice to many times longer than broad; stems sparsely if at all pilose, usually only uncinulate-puberulent 21. *D. paniculatum*.
20. Plants with coriaceous leaflets glabrous or densely pubescent or (if not coriaceous) at least with conspicuously reticulate venation (21)
- 21(20). Leaflets moderately to densely tomentose beneath, soft-velvety to touch, the upper surface moderately soft-pilose, not prominently reticulate (22)
21. Leaflets glabrescent to moderately pilose beneath and rather strongly reticulate (23)
- 22(21). Terminal leaflet usually rhombic to deltoid, acute to cuneate or truncate at base, width generally at least two thirds the length; leaflets thick; articles chiefly rhombic or with the upper suture somewhat angled . . 17. *D. viridiflorum*.
22. Terminal leaflet (except of the uppermost leaves) elliptic-ovate, mostly rounded at base, width about one half the length; leaflets thinner; articles rounded above (i.e., the upper suture curved rather than angled) . . 18. *D. Nuttallii*.
- 23(21). Leaflets uncinulate-pubescent along midrib and veins, otherwise essentially glabrous beneath; terminal leaflet obtuse to acute at apex; stipules early-deciduous 19. *D. Fernaldii*.
23. Leaflets mostly appressed-pilose on both surfaces (with uncinulate pubescence also above); stipules usually persistent through flowering; terminal leaflet obtuse and emarginate 20. *D. glabellum*.
- 24(19). Leaflets glabrous to puberulent, glaucous beneath . 22. *D. laevigatum*.
24. Leaflets appressed soft-pilose beneath, venation strongly reticulate 25. *D. Grahamii*.
- 25(5). Leaflets broad (terminal leaflet to 3 cm. wide), with prominent reticulation; bracts early-deciduous 23. *D. tortuosum*.
25. Leaflets narrower (terminal leaflet to 1.5 cm. wide), the venation not prominent; bracts persistent 24. *D. neomexicanum*.

1. *Desmodium nudiflorum* (L.) DC. Ascending to erect perennial herb with a simple sterile stem to about 2.5 dm. high bearing a whorl of leaves at its apex, and slightly to 3 times exceeded by the usually leafless and simple flowering scapes arising from the base; sterile stem glabrate or sparsely pilose; stipules awl-shaped, caducous; leaves trifoliate, 4 to 7, usually whorled, sometimes scattered along the stem; petioles more or less pilose with bent but not hooked trichomes, 4.5-12.5 cm. long; rachis of terminal leaflet similar to petioles, slightly more slender, 1.3-2 cm. long; terminal leaflet rhombic-obovate or broadly elliptic, abruptly acuminate, more or less cuneate at base, finely puberulent and sparsely pilose above, glaucous and moderately pilose below, 4.5-12 cm. long, 3.5-8 cm. wide; lateral leaflets oblique, the broader half semiovate, pubescence similar to that of the terminal leaflet, 3.8-10 cm. long, 3-5.5 cm. wide; inflorescence leafless except in occasional forms, racemose or racemose-paniculate, the rachis grooved, moderately pilose below with long curved white trichomes, becoming less so above where abundantly uncinulate-puberulent; bracts early-deciduous, the primary linear-lanceolate to narrowly ovate-acuminate, striate, more or less pilose on outer surface and minutely puberulent, long-ciliate, about 5 mm. long and 0.5 mm. wide; secondary bracts similar, much smaller, 0.5-0.8 mm. long; pedicels slender, uncinulate-puberulent, 10-23 mm. long; calyx minutely puberulent and with some scattered long stiff white trichomes, teeth of both lobes somewhat ciliate, 2.5-3.5 mm. long (including the tube and lobes); corolla rose to purple (rarely white), 6-9 mm. long, the petals subequal in length; the puberulent loment stipe equaling or exceeding the pedicel; loment 1- to 4-articulate; articles obpyramidal in outline with the sinuses between them broadly inverted-U-shaped, sutures glabrous throughout, the upper straight or slightly invaginated, surfaces densely uncinulate-puberulent, 7-12 mm. long, 4-5 mm. wide. Rare, in rich woods, e. Tex., Sept.; e. and cen. U.S., s. to n. Fla., s. Miss. and cen. La.

This and the two species which follow are closely related and have their nearest relatives in eastern Asia.

2. *Desmodium glutinosum* (Willd.) Wood. Erect simple-stemmed perennial herb to 1 m. tall, from a slender branching root about 3.5 dm. long; stem more or less terete, striate, patent-pilose and uncinulate-puberulent; leaves regularly trifoliolate, usually whorled at the base of the terminal inflorescence; stipules rather long-persistent, linear-lanceolate, striate, puberulent and spreading-pilose, ciliate, 8-12 mm. long, 0.4-0.5 mm. wide; petiole striate, uncinulate-puberulent and patent-pilose with long white tapering trichomes, 6-14.5 cm. long; leaf rachis similar, 2-4.3 cm. long; leaflets with moderate uncinulate-puberulence and scattered stiff white tapering gland-based trichomes on the upper surface, both types of pubescence denser on the lower surface (especially along midrib), the margins ciliate; terminal leaflet broadly ovate-acuminate with cuneate to truncate base, 7-13 cm. long, 6-12.3 cm. wide; lateral leaflets narrower, slightly oblique, 8-11.8 cm. long, 4-7 cm. wide; inflorescence simply racemose to rather much-branched, terminating the stem (except in rare forms), i.e., arising from the whorl of leaves; rachis densely uncinulate-puberulent and with long stout curved (but not hooked) trichomes interspersed; primary bracts early-deciduous, each subtending 2 or 3 (to several) pedicels (2 of which usually mature together, the remainder often not becoming mature), linear-lanceolate, attenuate, striate, uncinulate-puberulent and ciliate, 5-9 mm. long, 0.2-0.3 mm. wide; secondary bracts each subtending a single pedicel, more or less elliptic, puberulent, ciliate, caducous, 0.4-0.5 mm. long, 0.2 mm. wide; pedicels stoutish, puberulent to glabrescent, 3-8 mm. long, equaled or slightly exceeded by the remotely puberulent to glabrous stipe of the loment, 4-9.5 mm. long; calyx shallowly 2-lobed, puberulent, short-ciliate, with stout straight white trichomes on central tooth of lower lobe, 3-3.5 mm. long including lobes and tube; corolla purple, drying bluish or rarely white; the stipitate loment 1- to 4-articulate; articles subquadrate or obpyramidal, separated by inverted narrowly U-shaped sinuses, 8-11 mm. long, 4.5-6 mm. wide, the sutures essentially glabrous, the surfaces uncinulate-puberulent. Dry rocky woods, n.e. and n.-cen. Tex., June-Aug.; e. and cen. U.S.; N.L., S.L.P., Pue.

3. *Desmodium pauciflorum* (Nutt.) DC. Perennial herb from a slender to thick branched root system often with roundish or elliptical swellings at more or less regular intervals; erect or sprawling plants with slender leafy often much-branched stems bearing rather short terminal and axillary inflorescences; stems terete to angulate, striate, rather sparsely pilose with long tapering trichomes; stipules linear-lanceolate to narrowly ovate-attenuate, striate, uncinulate-puberulent, pilose and ciliate, caducous (few seen), 1.5-7 mm. long, about 0.5 mm. wide; stipels 0.5-1.5 mm. long, also caducous; petioles striate, moderately long-pilose, 55-66 mm. long; leaf rachis similar, 7-13 mm. long; leaves trifoliolate, the terminal and lateral leaflets nearly equal in size, the lateral slightly smaller and a little asymmetric, all moderately glandular-pilose and minutely puberulent on both surfaces, more abundantly pilose on midrib below, the margins ciliate; terminal leaflet rhomboidal, acute or abruptly acuminate at apex, cuneate at base, 5-9 cm. long, 4-6.2 cm. wide; lateral leaflets obliquely ovate, acute at apex, more or less rounded at base, 35-56 mm. long, 55-66 mm. wide; inflorescence mostly racemose or slightly branched, the terminal ones often more elongate than the axillary; rachis angulate, minutely and abundantly uncinulate-puberulent and scattered-pilose; primary bracts linear-lanceolate, puberulent, ciliate, 1-4 mm. long, 0.5-1 mm. wide, not usually long-persistent; secondary bracts similar, 0.5-1 mm. long, 0.5 mm. wide; pedicels uncinulate-puberulent, 4.5-14 mm. long; calyx minutely puberulent throughout and rather abundantly appressed-pilose, the teeth ciliate, 1.5-2 mm. long including the tube and lobes; corolla white, 4-5 mm. long; stipe of loment mostly puberulent, 5-9 mm. long; loment 1- to 3-articulate; articles more or less triangular in outline with the upper suture slightly invaginated at the mid-point of each article, densely uncinulate-puberulent on surfaces and scattered-pilose on upper suture, 8.5-13 mm. long, 6-8 mm. wide, sinus between the articles inverted V-shaped. Rich woods and wooded banks, apparently rare, e. Tex., July; e. and cen. U.S. southw.

4. *Desmodium canum* (Gmel.) Schinz & Thell. Perennial, herbaceous or becoming shrubby; stem prostrate to erect, to almost 3 m. tall, terete to subangulate, uncinulate-puberulent to -pubescent and somewhat pilose; stipules obliquely ovate-acuminate, striate, puberulent and pilose on the outer surface, ciliate, at least partially connate abaxially, long-persistent, 6-10 mm. long, 1-2 mm. wide; stipels subulate, puberulent, more or less

ciliate, 2-5.5 mm. long; petioles uncinulate-puberulent and long spreading-pilose, 13-35 mm. long; leaf rachis similar, shorter, to 15 mm. long; leaflets variable, mostly somewhat elliptic, acute at apex, rounded at base, rather lustrous, darker and uncinulate-puberulent above and with pilosity along midrib, rather densely pilose on the paler lower surface; terminal leaflet 4-9 cm. long, 25-45 mm. wide; lateral leaflets 3.3-6 cm. long, 18-27 mm. wide; racemes with angulate rachis ridged and grooved, densely uncinulate-puberulent; pedicels usually solitary, each subtended by 1 primary bract and 2 lateral bracts, all more or less persistent; primary bracts lance-acuminate, puberulent on the outer surface, ciliate, 2.2-4.5 mm. long, 0.5-0.7 mm. wide; secondary bracts similar, 1-1.8 mm. long, 0.2-0.5 mm. wide; pedicels uncinulate-puberulent, 5-10 mm. long; calyx with central tooth of lower lobe 2.5-3.5 mm. long and lateral teeth 2-3.5 mm. long, upper bifid lobe 2.5-3.5 mm. long; corolla with petals 3.5-6 mm. long; loment stipitate, to 8-articulate, the stipe 1.5-2 mm. long; articles essentially straight above, invaginated about two-thirds their width at the isthmi, uncinulate-pubescent throughout, 3.5-4 mm. long, 2.5-3 mm. wide; seed obtusely oblong, 1 mm. long, 0.5 mm. wide. DeWitt Co. in s. Tex., Oct.

Known by many synonyms in various parts of the world, the most common in our manuals being *D. incanum*, *D. supinum*, and *Meibomia cana*, *M. incana*, and *M. supina*. A nearly ubiquitous weed of warmer areas, common on grazed land in the American tropics and becoming so in Africa. Shape of leaflets very variable; characters of stipules and fruit constant.

5. *Desmodium rotundifolium* DC. Prostrate perennial herb with subangulate finely canaliculate stem usually with soft white dense pilosity and occasionally also with uncinulate puberulence; stipules ovate-acuminate, obliquely cordate and amplexicaul, strongly palmately veined, ciliate, usually pilose on outer surface, 5-11 mm. long; stipels linear or linear-lanceolate to elliptic-acuminate, striate, ciliate, 1-3.5 mm. long; petioles lineate and only a little less densely pilose than the stem, 2-4.6 cm. long; leaf rachis similar, 7.5-20 mm. long; leaflets orbicular to ovate, ciliate, abundantly appressed-pilose above, more densely so and somewhat spreading-pilose below; terminal leaflet chiefly cuneate at base, 35-53 mm. long, 31-49 mm. wide; lateral leaflets truncate to subcordate, 2.7-4 cm. long, 18-46 mm. wide; inflorescence axillary, racemose to racemose-paniculate, pilose as is the stem; primary bracts ovate-acuminate, occasionally bifid or trifid at apex, striate, ciliate, glabrous to somewhat puberulent on outer surface, 3-7 mm. long; secondary bracts slender, lingulate to slenderly oval, striate and long-ciliate, 1-3 mm. long; flowers usually borne in pairs or occasionally with a third central one which may or may not mature; pedicels stout, uncinulate-puberulent, 6-13 mm. long; calyx puberulent, the teeth of the lobes often pilose and ciliate, central tooth of lower lobe 3-5 mm. long and lateral teeth 3.5-4.5 mm. long, upper bifid lobe 3-5 mm. long; corolla at least twice as long as the calyx, 6-10.2 mm. long; loment stipitate, (3-) or 4- to 6-articulate; stipe uncinulate-puberulent, 3-6 mm. long; articles subrhomboidal to elliptic, usually the upper suture curved, the lower angled, uncinulate-puberulent throughout, 5-7.5 mm. long, 4-5 mm. wide; isthmi connecting the articles essentially central, 1-2 mm. wide. *D. Michauxii* (Vail) Daniels. Uncommon, dry woods, s.e. Tex., June-Sept.; Fla. to Tex. northw. to Mass., s. Vt., N.Y., s. Ont. and Mich.

6. *Desmodium canescens* (L.) DC. Perennial herb, often with many stems (to 8) from a long (1-4 dm.) brown taproot; stem much-branched and with various types of pubescence, long-tapering trichomes predominating; stipules deltoid to ovate-acuminate or -attenuate, truncate at base and obliquely lobed, striate, ciliate, puberulent on the outer surfaces (often with scattered pilosity until about the time of anthesis), glabrous within, becoming reflexed, 5-13 mm. long, 4.5-7 mm. wide; stipels linear- to lance-subulate, puberulent and ciliate, 1.3-6 mm. long; petioles terete and lineate to canaliculate, with pubescence similar to that of stem, 1.9-11 cm. long; leaf rachis similar, 7-35 mm. long; leaves usually trifoliolate; leaflets mostly thick and scabrous, moderately uncinulate-pubescent and with long tapering trichomes intermixed along midrib above, venation prominent and pubescence similar but denser below; terminal leaflet narrowly to broadly ovate with truncate to rhombic or rounded base and acute to gradually acuminate apex, 5-13 cm. long, 3-10 cm. wide; lateral leaflets slightly narrower in proportion to their length, somewhat oblique at base, 33-125 mm. long, 2-6.2 cm. wide; inflorescence racemose-paniculate, rather lax and becoming diffuse; rachises terete, lineate to canaliculate, with pubescence similar to that of stem; primary bracts ovate-attenuate, with pubescence similar to that of

stipules, not long-persistent, 3.5-7 mm. long; secondary bracts linear-attenuate, puberulent and ciliate, early-deciduous, 1.5-3 mm. long; pedicels with pubescence similar to that of petioles but with fewer long tapering trichomes, 8-14 mm. long; calyx minutely puberulent and pilose with long tapering trichomes along chief veins or scattered on teeth and lobes, the teeth (acute to) acuminate, long-attenuate, finely ciliate; upper bifid lobe 3-5 mm. long, central tooth of lower lobe 4.5-7 mm. long and lateral teeth 3.5-5 mm. long; corolla pinkish soon becoming green, approximately twice as long as calyx; loment 1- to 6-articulate, stipitate; stipe 2.5-6 mm. long, pubescent as the loment; articles uncinulate-pubescent with multicellular hairs intermixed and especially dense on isthmi and sutures, 7-9 mm. long, 5 mm. wide; loment sometimes with articles acutish below and with narrow isthmi or obtuse and with broad isthmi (the variation not having correlation with other characters). Dry sandy woods, e. and n.-cen. Tex., Sept.; e. half of U.S.

7. *Desmodium Lindheimeri* Vail. Erect branching perennial herb to 6 dm. tall; stem angulate, grooved, uncinulate-puberulent and -pubescent and sparsely scattered-pilose with slender white trichomes; stipules ovate, long-attenuate, densely pilose on the outer surface with long white trichomes, reflexed at maturity, not long-persistent, 6.5-8 mm. long, 1.5-2 mm. wide; stipels slenderly lance-attenuate, 1.5-4 mm. long; petioles densely uncinulate-puberulent and -pubescent and somewhat long spreading-pilose, 14-25 mm. long; leaf rachis similar, 6-14 mm. long; leaflets acute at apex, cuneate to obtuse at base, uncinulate-puberulent and more or less soft white-pilose above, densely long and soft white-pilose or tomentose below with prominent venation; terminal leaflet ovate to mostly rhombic in outline, 7-9 cm. long, 3-5.8 cm. wide; lateral leaflets more nearly ovate or elliptic, somewhat asymmetrical, 4.3-6 cm. long, 2-4 cm. wide; inflorescence paniculate, the rachis ridged and grooved, uncinulate-puberulent and -pubescent; primary bracts ovate-attenuate, striate, long appressed pilose on outer surface, ciliate, glabrous within, not long-persistent, 4.5-7 mm. long, 2-4.5 mm. wide; secondary bracts essentially glabrous but ciliate, 0.8-3 mm. long, 0.8-1 mm. wide; pedicels rather finely pilose with multicellular trichomes which are glandular at base; flowers blue-green or purple; calyx finely puberulent, somewhat ciliate, the long white trichomes along central tooth of lower lobe reaching 3 mm. in length; corolla to 7 mm. long; loment stipitate, to 5-articulate; stipe 2-3.5 mm. long; articles subrhombic to semiovalate in outline, the isthmi slightly excentric, the articles appearing somewhat contorted because of the infolding of their margins, surfaces glabrous, reticulate at maturity, the sutures densely uncinulate-pubescent, 7-11 mm. long, 5-8 mm. wide; seeds small, seeming never to fill article, to about 3 mm. long. *Meibomia Lindheimeri* Vail. Rare, known in Tex. only from the collections of Lindheimer, from near New Braunfels, Comal Co., made in Nov. 1850; also from scattered collections in n.e. Mex. as far s. as S.L.P.

The relationship of this species is with *D. canescens* and its relatives, especially *D. ochroleucum* M. A. Curtis of southeastern United States, which it resembles particularly in the characters of the loment.

8. *Desmodium Tweedyi* Britt. Perennial herb with rather slender (8 mm. thick) long root and 1 to several usually unbranched ridged and grooved stems; stems densely uncinulate-puberulent with minute hooked trichomes and abundantly pubescent with a mixture of stout long hooked trichomes and fewer multicellular somewhat glutinous ones; stipules obliquely ovate-attenuate, striate, long-ciliate, chiefly minutely puberulent on outer surface, puberulent to glabrous on the inner surface, 7.5-14.5 mm. long, 2.5-4 mm. wide; stipels linear-lanceolate, striate, puberulent and ciliate, 1-4.5 mm. long; petioles abundantly uncinulate-puberulent and -pubescent with long white tapering trichomes interspersed, 4-9 cm. long; leaf rachis similar, 1-2.6 cm. long; leaflets thick, reticulate, ovate-obtuse, with pale mottling along midrib, more or less obtuse and mucronulate at apex, rounded to truncate at base, long-ciliate with stout tapering trichomes, scattered uncinulate-pubescent above, densely so beneath with straight tapering trichomes along midrib of both surfaces; terminal leaflet 4-12 cm. long, 2-6.6 cm. wide; lateral leaflets slightly oblique and smaller (3-11 cm. long and 16-45 mm. wide); inflorescence racemose to slightly paniculate, the rachis finely ridged and grooved, densely pubescent with rather glutinous hooked and multicellular trichomes; primary bracts (each subtending 2 or 3 pedicels, the third flower not often developing fully) ovate-attenuate, striate, puberulent, ciliate, essentially glabrous within, not long-persistent, 5-8 mm. long, 2-4 mm. wide;

secondary bracts similar to the primary, lance- to ovate-attenuate, soon deciduous, 1-2.5 mm. long, 0.5 mm. wide; pedicels with pubescence dense and similar to that of the rachis, rather heavily glutinous, 1-2.2 cm. long; calyx minutely puberulent throughout and more or less glutinous, teeth of both lobes ciliate, central tooth (3-4 mm. long) of lower lobe with long stout tapering trichomes along its midrib and lateral teeth 2-3 mm. long, the upper bifid lobe, 2-3 mm. long; corolla white (when noted), about twice the length of calyx; loment stipitate, (2- to) 4- to 6-articulate; stipe 2-4 mm. long; articles subrhombic, somewhat acutely angled on the upper suture and obtusely so on the lower, reticulate on the surfaces, rather abundantly uncinete-pubescent throughout and often somewhat glutinous, 6-8 mm. long, 4.5-5 mm. wide, the isthmi 0.5 mm. wide. Scattered in calcareous sandy loam near creeks and rivers, n.-cen. Tex., Edwards Plateau and e. part of Plains Country, June-July; also Okla.

Desmodium Tweedyi seems to bridge the gap between *D. canescens* and *D. illinoense* Gray, and is doubtfully distinct from the latter species.

9. *Desmodium sessilifolium* (Torr.) T.&G. Erect perennial herb from a somewhat branched and thickened rootstock, the 1 to several stems sometimes branched at base (rarely so above), terete to angulate, densely uncinete-pubescent and -puberulent throughout; stipules lance- (to ovate-) attenuate, striate, puberulent and patent-pilose on outer surface, glabrous on the inner surface, ciliate, moderately persistent, 4-9.5 mm. long; stipels mostly linear-lanceolate, uncinulate-puberulent and more or less ciliate, 1.5-3 mm. long; petioles (if present) to 9 mm. long; leaf rachis lineate, uncinulate-puberulent, spreading-pilose with straight tapering trichomes along margins of the adaxial groove, 3-8 mm. long; leaves trifoliolate (occasional unifoliolate ones observed); leaflets linear-lanceolate to narrowly elliptic, gradually acuminate to almost obtuse at base and apex, mucronate, ciliate, rather prominently reticulate, moderately uncinulate-puberulent and pilose above, paler beneath, minutely puberulent and abundantly long-pilose; terminal leaflet 37-85 mm. long, 7-15 mm. wide; lateral leaflets 3-6.5 cm. long, 6-12 mm. wide; inflorescence racemose-paniculate, its branches more or less virgate and densely flowered; rachises terete to subangulate, often ridged and grooved, rather densely uncinete-pubescent; primary bracts subtending 2 or 3 pedicels, ovate-attenuate, striate, puberulent on outer surface and somewhat long-pilose, ciliate, 2.5-3.5 mm. long; secondary bracts similar, linear to lanceolate or ovate, 0.6-1.5 mm. long; pedicels with pubescence similar to that of rachis, 1.5-4.5 mm. long; calyx puberulent and somewhat long-pilose throughout, teeth of both lobes ciliate, central tooth of lower lobe 2.5-3.5 mm. long and lateral teeth 2-2.8 mm. long, upper scarcely bifid lobe to 2.5 mm. long; corolla pinkish or lavender to white, to about 6 mm. long; loment stipitate, 1- to 4-articulate; stipe 1.5-3 mm. long; articles curved on upper suture, rounded to subangulate on the lower, with uncinete and multicellular trichomes intermixed and dense on surfaces and sutures, 4-6 mm. long, 3-4.5 mm. wide. Dry sandy soils, frequent in e. and n.-cen. Tex., infrequent in s.e. Tex., rare in Plains Country, June-Sept.; local in e. U.S.

10. *Desmodium strictum* (Pursh) DC. Perennial herb from a long slender (to 5 mm. thick) somewhat branched root, with erect mostly simple stems; stem terete to angulate, lineate, rather densely uncinulate-puberulent above, less so below or glabrescent; stipules obliquely lance- to ovate-attenuate, striate, puberulent on the outer surface, somewhat ciliate, more or less persistent, 2-5 mm. long; stipels subulate to lanceolate, puberulent, usually ciliate at least at apex, 1.6-2 mm. long; petioles sparsely pilose on margins of groove or throughout and somewhat uncinulate-puberulent, 6.5-18 mm. long; leaf rachis similar, 4-7 mm. long; leaves trifoliolate; leaflets linear to linear-lanceolate or narrowly elliptic, obtuse to acute and mucronate, scattered puberulent and pilose above and below, moderately ciliate, venation finely reticulate and rather prominent, lower surface paler; terminal leaflet 3.8-6 cm. long, 4-7 mm. wide; lateral leaflets 2-4 cm. long, 2-6 mm. wide; inflorescence simply to diffusely racemose-paniculate; rachises terete to angulate, moderately to abundantly uncinulate-puberulent and -pubescent; primary bracts subtending 2 or 3 (or more) pedicels, ovate-acuminate, striate, puberulent and pilose over outer surface, glabrous on the inner surface, ciliate, 1.4-2 mm. long, about 0.5 mm. wide; secondary bracts similar, smaller; pedicels slender, rather stiff, densely uncinulate-pubescent, 6-13 mm. long; calyx puberulent throughout and rather abundantly pilose especially on lobes of both teeth, central tooth of lower lobe 2-2.5 mm. long and lateral teeth 1.5-2 mm. long, upper bifid lobe 1.5-2 mm. long; corolla almost twice the length of

calyx (color not noted); loment stipitate, 1- or 2-articulate; stipe 1.5 mm. long; articles slightly invaginated at center of upper suture and at isthmi above, rounded or obtusely angled below and deeply indented at isthmi, sparsely to densely uncinulate-puberulent and -pubescent and with straight multicellular trichomes often intermixed on surfaces and sutures, 4-6 mm. long, 3-4 mm. wide, the isthmi about 1 mm. wide. Reported from Texas but no material has been seen. The species occurs chiefly in sandy pine barrens from La. to Fla., n. to N.J. and is not common anywhere in its range; it should be sought in east Texas.

11. *Desmodium obtusum* (Willd.) DC. Erect perennial herb from a rather stout branched root system; stems usually several from the base, slender, simple, terete to subangulate, usually pale and lineate with prominent green to purple lines extending to branches of inflorescence, rather densely uncinulate-puberulent to -pubescent, with tapering (not hooked) trichomes only near nodes; stipules obliquely ovate-attenuate, striate, puberulent and abundantly pilose on outer surface, ciliate, deciduous (few seen), (3-) 4-6.5 mm. long, 2 mm. wide; stipels lance-attenuate (often bifid), puberulent, ciliate, persistent, 1.5-3 mm. long; petioles mostly densely uncinulate-puberulent and -pubescent with straight tapering trichomes chiefly along adaxial groove, 2-20 mm. long; leaf rachis similar (occasionally longer than petiole on upper portion of stem), 5-10 mm. long; leaves trifoliolate; leaflets narrowly ovate to ovate or elliptic, acute to obtuse and mucronate at apex, rounded at base, rather thick, usually conspicuously reticulate, uncinulate-puberulent and somewhat pilose above, more abundantly pilose beneath (especially along midrib), ciliate; terminal leaflet 5-6.7 cm. long, 2-3.3 cm. wide; lateral leaflets 3-4.2 cm. long, 15-27 mm. wide; inflorescence racemose-paniculate, diffuse with the branches often lax; rachis uncinulate-puberulent and -pubescent with straight often gland-tipped trichomes often intermixed; primary bracts ovate-attenuate, striate, puberulent and pilose over outer surface, ciliate, mostly subtending 3 to 5 pedicels, 2.5-3.5 mm. long, not persistent; secondary bracts linear to lanceolate or lance-ovate, ciliate, deciduous, 0.5-1.4 mm. long; pedicels spreading-ascending with pubescence similar to that of rachis of inflorescence, 6-17 mm. long; calyx puberulent and more or less long-pilose throughout, teeth of both lobes somewhat ciliate, central tooth of lower lobe attenuate and 2-3 mm. long, the broader lateral teeth 1.5-2.5 mm. long, upper bifid lobe 1.5-2 mm. long; corolla white or pale-pink to lavender-blue, about twice as long as calyx (5-6 mm.); loment stipitate, 1- to 3-articulate; stipe 1.5-2 mm. long; articles with upper suture curved (convex), lower suture rounded-obtuse, surfaces and sutures uncinulate-puberulent with some straight multicellular trichomes intermixed, 4-4.5 mm. long, 2.5-4 mm. wide. *D. rigidum* of Gray's Man. ed. 8. Rare and scattered in sandy open woodlands, e. and n.-cen. Tex., Oct.; scattered in e. U.S. s. to s.e. S.C., Fla. and Tex.

12. *Desmodium ciliare* (Willd.) DC. Perennial herb with slender ascending to erect stems often branched from base and arising from a somewhat stout often branched root (sometimes reaching 2 dm. in length); stems subangulate, strongly lineate, usually abundantly spreading-pilose with long slender tapering trichomes and often with short uncinulate-puberulence intermixed or with only the latter; stipules slenderly lance-attenuate, striate, minutely puberulent on outer surface and more or less pilose, ciliate, fairly long-persistent, 2.5-5 mm. long; stipels subulate, puberulent and ciliate, 0.7-2 mm. long; petiole long-pilose chiefly on the margins of the groove, 1-15 mm. long; leaf rachis similar, 2-9 mm. long; leaflets elliptic to slenderly ovate or almost rhombic, obtuse, mucronate, more or less prominently reticulate above and usually long-pilose and somewhat puberulent, similarly but not so densely pubescent below, ciliate; terminal leaflet 9-30 mm. long, 5-17 mm. wide; lateral leaflets only slightly (if at all) smaller; inflorescence racemose-paniculate; rachis angulate, uncinulate-puberulent, often scattered-pilose; primary bracts ovate-acuminate, striate, puberulent on outer surface, ciliate, soon deciduous, subtending 2 to several pedicels, 1.5-3 mm. long; secondary bracts subulate to slenderly ovate, puberulent and ciliate, each subtending 1 pedicel, 0.6-0.9 mm. long; pedicels densely uncinulate-puberulent, 4-9 mm. long; calyx minutely puberulent throughout, the teeth of both lobes finely ciliate, pilose with scattered long trichomes, central tooth of lower lobe 2-3 mm. long and lateral teeth 1.5-2.5 mm. long, upper bifid lobe 1.5-2.1 mm. long; corolla about twice as long as calyx, usually pink; loment stipitate, 1- to 3-articulate; stipe 1-1.5 mm. long; articles broadly elliptic, the upper suture of each article forming an arc, not deeply indented at isthmi, moderately uncinulate-puberulent

on sutures and surfaces and with some multicellular trichomes intermixed, 4-5.5 mm. long, 2.7-4 mm. wide. Dry sandy woods and clearings, e. and s.e. Tex., rare w. to n.-cen. Tex., Aug.-Oct.; s. Can., e. U.S.; recorded from Mex. and C.A.; W.I.

13. *Desmodium marilandicum* (L.) DC. Ascending to erect slender perennial herb with simple stems or branching from the base or several from the subligneous simple or branched slender often elongate root; stem terete to subangulate, lineate, essentially glabrous or sparsely to moderately uncinulate-puberulent, to 10 dm. or more tall (including terminal inflorescence); stipules narrowly ovate- to lance-attenuate, striate, puberulent on the outer surface, ciliate, moderately persistent, 2-4.5 mm. long; stipels subulate to lanceolate, puberulent, 1-2 mm. long; petiole subangulate to angulate, lineate, sparsely and minutely uncinulate-puberulent, not deeply sulcate, 12-27 mm. long; leaf rachis similar or slightly pilose, 5-10 mm. long, leaflets essentially glabrous above with reticulate venation rather prominent, paler beneath and with scattered pilosity especially along midrib, chief lateral veins and margins; terminal leaflet ovate to ovate-rhombic or sub-orbicular, obtuse and mucronulate, 19-24 mm. long, 1-1.7 cm. wide; lateral leaflets similar but mostly elliptic- to deltoid-ovate, 15-25 mm. long, 11-16 mm. wide; inflorescence chiefly terminal, racemose-paniculate and rather diffuse; rachis terete and strongly lineate, moderately uncinulate-puberulent; primary bracts ovate, acuminate, striate on the outer surface, puberulent, ciliate, not long-persistent, each subtending 2 to several pedicels, about 2 mm. long; secondary bracts lance-attenuate to linear, puberulent and ciliate, 0.7-1.3 mm. long; pedicels densely and minutely uncinulate-puberulent, (6-) 8-19 mm. long; calyx minutely puberulent throughout, scattered-pilose, teeth of both lobes finely ciliate, central tooth of lower lobe 2-3.5 mm. long and lateral teeth 1.5-2.5 mm. long, upper bifid lobe 1.5-2.2 mm. long; corolla reddish, drying bluish-green or darker, almost twice as long as calyx; loment stipitate, 1- to 4-articulate; stipe 1-2 mm. long; articles gently curved above, obtusely angled below, uncinulate-puberulent and -pubescent and with fine multicellular trichomes interspersed on surfaces and sutures, 4-5.5 mm. long, 3-4 mm. wide. Dry open woods, scattered and rare in e. and s.e. Tex., Aug.-Oct.; e. half of U.S.; Mex.

There seem to be some transitional plants which bridge the gap between the extreme forms of this and the preceding species.

14. *Desmodium lineatum* DC. Stems slender, simple to branched, trailing to prostrate, often forming mats, from a stout reddish-brown root to 3 dm. long and 1 cm. thick; stems terete, lineate, uncinulate-puberulent and -pubescent with long straight tapering trichomes often scattered about the nodes; stipules lance-attenuate to obliquely ovate-attenuate, striate, minutely puberulent on outer surface (occasionally also pilose), ciliate, moderately persistent, 2-5 mm. long; stipels lance-subulate, puberulent and ciliate, 0.5-2 mm. long; petioles lineate, more or less puberulent throughout, usually pilose in and about groove, 5-21 mm. long; leaf rachis similar, 3-8 mm. long; leaflets ovate or rhombic to obovate or orbicular, obtuse, moderately uncinulate-puberulent and scattered-pilose above, pilose below mostly on midrib, veins and veinlets, puberulent; terminal leaflet 1-2.6 cm. long, 13-29 mm. wide; lateral leaflets 8-22 mm. long and wide; inflorescence racemose to racemose-paniculate, axillary and terminal, lax; rachis subangulate, striate, densely uncinulate-puberulent; primary bracts ovate-acuminate, striate, puberulent on outer surface and more or less pilose, ciliate, 2-3 mm. long; secondary bracts linear to lanceolate, pubescent as the primary bracts, 0.6-1.4 mm. long; pedicels uncinulate-puberulent with some multicellular trichomes intermixed, 8-16 mm. long; calyx minutely puberulent throughout and somewhat pilose, teeth of both lobes rather finely ciliate, central tooth of lower lobe 2-3 mm. long and lateral teeth 1.5-2.2 mm. long, upper bifid lobe 1.5-2.5 mm. long; corolla twice as long as calyx; loment stipitate, 1- to 4-articulate; stipe 1-2 mm. long; articles ovate-orbicular or obovate, upper suture slightly curved, lower suture rather deeply indented, the isthmi narrow, uncinulate-pubescent with multicellular trichomes intermixed on surfaces and sutures, 3.5-5 mm. long, 2.5-3.5 mm. wide. *D. arenicola* (Vail) Herm., *Meibomia arenicola* Vail. Rare in sandy forested areas, e. Tex., May-Aug.; Fla. n. to s.e. Md. on the Coastal Plain; N.L.

15. *Desmodium canadense* (L.) DC. Erect perennial herb with 1 to several stems from a simple to branched brown root; stem terete and smooth below, becoming lineate, moderately to abundantly uncinulate-puberulent and -pubescent and usually densely

long patent-pilose above; stipules linear-lanceolate to lance-attenuate, striate, puberulent and usually pilose on the abaxial surface, ciliate, more or less persistent, 4.5-9.5 mm. long; stipels lanceolate to linear-lanceolate, puberulent and ciliate, 2-4 mm. long; petioles lineate, sparsely to abundantly pilose throughout, 8-25 mm. long; leaf rachis similar, 9-15 mm. long; leaflets elliptic to rhombic or almost orbicular in lower portion of plant, becoming ovate to lance-ovate above, short-acute to obtuse at apex, cuneate at base, uncinulate-puberulent and moderately appressed-pilose on upper surface, much paler and abundantly pilose on the lower surface, margins ciliate; terminal leaflet 48-105 mm. long, 20-38 mm. wide; lateral leaflets similar, slenderer, 45-82 mm. long, 19-28 mm. wide; inflorescence racemose-paniculate; rachis prominently ridged and grooved, pubescent as the stem and with some scattered multicellular trichomes; primary bracts lance- to ovate-attenuate, striate, puberulent and somewhat pilose on outer surface, ciliate, 4-10 mm. long; secondary bracts linear to liguliform or spatulate, puberulent on outer surface, more or less pilose, long-ciliate, 2.5-4 mm. long; pedicels densely uncinulate-puberulent, with scattered multicellular and stout long tapering trichomes often intermixed, 5-6 (-9.5) mm. long; calyx rather abundantly long-pilose throughout especially on lobes, teeth of both lobes finely ciliate, central tooth of lower lobe 5-7 mm. long and lateral teeth 4.5-5.5 mm. long, upper bifid lobe 4.5-5 mm. long; corolla somewhat more than twice as long as calyx; loment stipitate, 1- to 5-articulate; stipe 2-2.5 mm. long; articles curved above, obtusely angled below, densely uncinulate-pubescent throughout and with multicellular and straight tapering trichomes occasionally intermixed, 5-7 mm. long, 4-5 mm. wide. Reported from Wheeler Co. in the Panhandle but no Texan material has been seen; the description applies to the species as it occurs in open woods from N.S. to s. Sask., s. to N.E., Md., w. Va., W.Va., O., Ind., Ill., Mo. and Okla.

16. *Desmodium cuspidatum* (Willd.) Loud. Erect perennial herb to 1 m. tall or more; stems simple or branched from a stout root to 15 cm. long, angulate and grooved, mostly glabrous (only occasionally uncinulate-puberulent); stipules slenderly and obliquely ovate-attenuate, striate, minutely puberulent to glabrous, rarely somewhat ciliate, 1.1-2 cm. long; stipels linear-attenuate or subulate, striate, glabrous to puberulent, ciliate, 5-9 mm. long; petioles essentially glabrous, 4-9.7 cm. long; leaf rachis similar, 18-35 mm. long; leaflets ovate-acuminate, rounded to cuneate at base, essentially glabrous on both surfaces except for pilosity along midrib and veins, paler and glaucous below; terminal leaflet 8-14 cm. long, 42-67 mm. wide; lateral leaflets similar, somewhat oblique, 69-117 mm. long, 28-52 mm. wide; inflorescence racemose-paniculate; rachis angulate, lineate, rather abundantly uncinulate-pubescent; primary bracts (subtending 2 pedicels and usually an abortive third one) ovate-attenuate, striate, essentially glabrous, inconspicuously ciliate, deciduous, 6-12 mm. long, 4-5 mm. wide; secondary bracts linear, ligulate or ovate, glabrous to puberulent and ciliate, 1.5-3.5 mm. long; pedicels puberulent to pilosulous with (often glutinous-tipped) multicellular trichomes or uncinulate-pubescent, or glabrescent, 3.5-7 mm. long; calyx finely puberulent with ciliate teeth and some pilosity along central tooth of lower lobe which is 4.5-6 mm. long, the lateral teeth 4-5 mm. long, upper bifid lobe 4-4.5 mm. long; corolla rose-lavender, to 8 mm. long; loment stipitate, 1- to 7-articulate; stipe about 2.5 mm. long; articles triangular to rhombic or 5- or 6-angular, the isthmi usually broad, sutures densely uncinulate-puberulent, the surfaces less so, 7-10 mm. long, 4-5 mm. wide. *D. bracteosum* (Michx.) DC. Not common, but known from rich woods in 4 counties in n.e. Tex., Aug.-Sept.; e. and cen. U.S.

17. *Desmodium viridiflorum* (L.) DC. Erect suffrutescent perennial to 3 dm. high, with mostly simple terete somewhat ridged and grooved or lineate stems, moderately to sparsely pilose (with long tapering trichomes) and abundantly uncinulate-puberulent and -pubescent; stipules ovate- to lance-acuminate (usually long-attenuate), striate, appressed-pilose on outer surface, long-ciliate, 3-7 mm. long; stipels linear to lance-attenuate, puberulent and more or less pilose, ciliate, 0.5-4 mm. long; petioles ridged and grooved, uncinulate-puberulent and long patent-pilose, 5-65 mm. long; leaf rachis similar, 11-28 mm. long; leaflets mostly rhombic (or the terminal sometimes deltoid with truncate base), acute to acuminate or obtuse, about two thirds as wide as long, rather moderately spreading-pilose with short straight or uncinulate trichomes (or both), rather dark-green above, densely tomentose with long soft spreading white tapering trichomes

beneath; terminal leaflet 52-118 mm. long, 36-88 mm. wide; lateral leaflets slightly oblique, 4-10.2 cm. long, 2-6.5 cm. wide; inflorescence racemose-paniculate; rachis prominently furrowed, uncinulate-pubescent and sparsely patent-pilose; primary bracts ovate-acuminate, striate, long and soft pilose on the outer surface, ciliate, 2-4 mm. long, about half as wide; secondary bracts lance-attenuate to linear, puberulent and pilose, ciliate, 0.5-1.5 mm. long; pedicels uncinulate-puberulent and somewhat pilose, 3-8 mm. long; calyx soft spreading-pilose throughout, central tooth of lower lobe 2.5-4.5 mm. long and lateral teeth 2-4 mm. long, upper bifid lobe 2-3 mm. long; corolla lavender-blue to pink, said to turn green after anthesis, to about 9 mm. long; loment stipitate, (2- to) 4- or 5- (or 6-) articulate; stipe 3-6 mm. long; articles more or less rhombic, moderately to densely uncinulate-pubescent on surfaces and sutures, 5-9 mm. long, 3.5-5 mm. wide. Dry woods, e. Tex., infrequent, Sept.-Oct.; s.e. U.S. n. to Del. and inland only to Ark. and Tenn.

18. *Desmodium Nuttallii* (Schindl.) Schub. Perennial, herbaceous to suffrutescent, ascending to erect, to about 15 dm. tall; stem simple or branched from the base, densely to moderately uncinulate-pubescent and somewhat patent-pilose; stipules lance- to ovate-acuminate, striate, rather densely appressed-pilose on abaxial surface, ciliate, 2.5-5.5 (-6.5) mm. long, 1.5-2 mm. wide; stipels subulate, puberulent and usually densely white-pilose on abaxial surface, ciliate, 1.5-3.5 (-4) mm. long; petioles striate, rather densely uncinulate-pubescent and sparsely to densely patent-pilose with long straight trichomes, 5-25 (-33) mm. long; leaf rachis sometimes exceeding petioles in length, 4-16 (-23) mm. long; leaves occasionally unifoliolate at base, chiefly trifoliolate; leaflets ovate to rhombic in upper portions of plant, mostly elliptic-ovate below, acute to obtuse at apex, rounded at base, moderately appressed-pilose above and somewhat uncinulate-pubescent near base, densely soft tomentulose beneath; terminal leaflet 5.2-10 cm. long, 28-56 mm. wide; lateral leaflets elliptic to ovate, 3.4-8 (-10) cm. long, 21-51 mm. wide; inflorescence chiefly terminal, racemose-paniculate; rachis uncinulate-pubescent and occasionally more or less spreading-pilose; primary bracts ovate-acute, striate, pilose over outer surface, ciliate, 2-4 mm. long; secondary bracts lance-ovate, pilose and ciliate, 0.5-1.5 mm. long; pedicels chiefly uncinulate-puberulent and -pubescent, (2.5-) 3.5-6.5 mm. long; calyx puberulent throughout and at least somewhat long-pilose, the teeth of both lobes ciliate, central tooth of lower lobe 2-3.5 mm. long and lateral teeth 1.5-2.5 mm. long, upper bifid lobe 1.5-2 mm. long; corolla pink, 6-7 mm. long; loment stipitate, 1- to 4-articulate; stipe 2.5-4 mm. long; articles mostly rounded above and cuneate below, uncinulate-pubescent throughout, 4-7 mm. long, 3-4.5 mm. wide. Dry sandy open woods, e. and n.-cen. Tex., rare, June-Sept.; N.Y. to Ind., s. to n. Fla., Ala. and Tex.

19. *Desmodium Fernaldii* Schub. Stout perennial herb from a slender branching root to about 4 dm. long; stem terete to slightly angulate, finely puberulent and slightly to densely uncinulate-pubescent, to about 13 dm. tall; stipules lance-attenuate, striate, more or less pilose and puberulent on both surfaces, soon deciduous, 2-4 mm. long, about 0.8 mm. wide; stipels subulate or ovate-acuminate, puberulent, ciliate, 1-3 mm. long; leaflets rhombic to ovate, obtuse to acute at apex, cuneate to rounded at base, often acute at apex and truncate at base, dark-green above, moderately uncinulate-pubescent and somewhat short and straight pilose, paler beneath, uncinulate-pubescent and pilose along midrib and veins; terminal leaflet (4.5-) 6-8 (-9.3) cm. long, 2.5-5 cm. wide; lateral leaflets mostly elliptic to elliptic-ovate, 4-6 cm. long, 18-35 mm. wide; inflorescence racemose-paniculate, often densely flowered; rachis striate, angulate, uncinulate-puberulent and -pubescent; primary bracts ovate-acuminate, puberulent, pilose and ciliate, 1.5-2.5 mm. long, 1-1.5 mm. wide; secondary bracts similar, 1-1.5 mm. long, about 0.5 mm. wide; pedicels mostly uncinulate-puberulent, 5-8 mm. long; calyx puberulent and stiff-pilose throughout, central tooth of lower lobe 3-3.5 mm. long and lateral teeth 2-3 mm. long, upper bifid lobe 1.5-2.5 mm. long; corolla about twice as long as calyx; loment stipitate, 1- to 5-articulate; stipe 2.5-4 mm. long; articles more or less deltoid to rhombic, uncinulate-pubescent throughout, the upper suture slightly angled, the lower obtusely so, 5.5-8 mm. long, 3.3-5 mm. wide. Rare in sandy woods, e. Tex. (Newton, Smith and Polk cos.); s.e. Va. to S.C., La. and e. Tex.

20. *Desmodium glabellum* (Michx.) DC. Spreading to erect perennial herb from a rather thick long (to 4 dm.) branched root; stem simple to branched, terete to angulate,

lineate, uncinulate-puberulent and more or less spreading-pilose (at least near nodes), to about 1 m. tall; stipules obliquely ovate- to lance-attenuate, remotely striate, pilose on abaxial surface with long trichomes at base and shorter ones above, ciliate, 2-4 mm. long, 1-1.5 mm. wide; stipels subulate to linear-attenuate, minutely puberulent, ciliate, 1-2 mm. long; petioles lineate, sulcate, finely uncinulate-puberulent and sparsely to moderately ascending-pilose, 4-38 mm. long; leaf rachis similar, 2-16 mm. long; leaflets narrowly to broadly ovate to elliptic or rhombic, mostly obtuse and emarginate and mucronulate at apex, with rather prominent reticulate venation, somewhat uncinulate-puberulent and moderately to abundantly appressed-pilose above, similarly pilose on the paler lower surface; terminal leaflet 3-8 cm. long, 18-55 mm. wide; lateral leaflets chiefly elliptic-obtuse, 2-6 cm. long, 1-3.5 cm. wide; inflorescences racemose-paniculate, rather lax and diffuse; rachis angulate, densely uncinulate-puberulent and sparsely to moderately spreading-pilose; primary bracts ovate-acuminate, striate, puberulent and more or less pilose, ciliate, 1.2-3 mm. long, about 1 mm. wide; secondary bracts elliptic to lanceolate, puberulent and long-ciliate, 0.6-1.2 mm. long; pedicels densely uncinulate-puberulent and with occasional pilosity, 3.5-12 mm. long; calyx puberulent throughout, pilose especially on teeth of both lobes with short pointed trichomes and ciliate, central tooth of lower lobe 2.5-5.5 mm. long and lateral teeth 2.2-3.5 mm. long, upper bifid lobe 1.5-3.5 mm. long; corolla bright- to deep-rose, to 9.5 mm. long; loment stipitate, 1- to 5-articulate; stipe 3-5 (-7) mm. long; articles triangular to rhombic, uncinulate-pubescent throughout, with some multicellular trichomes intermixed, 6-8 mm. long, 3-5 mm. wide. *D. Dilleni* Darl. in part. Dry sandy woods, e. Tex. as far s. as Fort Bend Co., May-Sept.; s.e. Mass. to Mich. and Ill., s. to S.C., Ala., La. and Tex.

21. *Desmodium paniculatum* (L.) DC. var. *paniculatum*. Erect herbaceous perennial with several stems usually arising from an elongate branching root; stem slender, sub-angulate, lineate, glabrous to puberulent and scattered-pilose, often branched above, to 9 dm. high; stipules linear- to lance-attenuate, striate, puberulent, often pilose on abaxial surface, ciliate, 3-6 mm. long; stipels lance-attenuate, 1-3 mm. long; petioles angulate, more or less pilose along margins of the groove, otherwise glabrous to uncinulate-puberulent, 1-5.3 cm. long; leaf rachis similar, 5-17 mm. long; leaflets linear-lanceolate to linear-elliptic or lance-ovate, acute to acuminate at apex, rounded at base, mostly minutely puberulent and moderately to abundantly pilose on both surfaces, margins slightly revolute and ciliate; terminal leaflet 4.3-10 cm. long, 1-2.3 cm. wide; lateral leaflets similar, slightly smaller, 4-9.6 cm. long and 6.5-20 mm. wide; inflorescence racemose-paniculate, often very diffuse; rachis angulate, lineate, often ridged and grooved, minutely puberulent to uncinulate-pubescent with some pilosity of straight pointed trichomes interspersed; primary bracts lance- to ovate-attenuate, striate on outer surface, puberulent, somewhat pilose mostly at base, ciliate, deciduous, 1-3.5 mm. long; secondary bracts linear to slenderly ovate-attenuate, puberulent and ciliate, 0.5-1 mm. long; pedicels ascending, uncinulate-puberulent, 4-18 mm. long; calyx puberulent throughout and pilose with stout stiff straight pointed trichomes chiefly on lobes but also scattered on tube, teeth of both lobes ciliate, central tooth of lower lobe 3-5 mm. long and lateral teeth 2.5-4 mm. long, upper (scarcely) bifid lobe 2-3.5 mm. long; corolla not quite twice the length of calyx; loment stipitate, 1- to 5-articulate; stipe 3-4 mm. long; articles triangular to subrhombic, 5.5-7 mm. long, 3.5-4.5 mm. wide. *D. dichromum* Shinn. Scattered in clearings and borders of dry woods throughout the e. half of Tex., May-Sept.; N.H. to Ont., Ia. and Neb., s. to Fla., Ala., Miss., La. and Tex.; N.L.

21a. *Desmodium paniculatum* var. *epetiolatum* Schub. This variety differs from var. *paniculatum* in its sessile or very short petiolate leaves and the rounded articles of the loment. It is known in Texas only from Colorado County in the southeastern part of the state; Tex., N.C. and Va.

22. *Desmodium laevigatum* (Nutt.) DC. Ascending to erect perennial herb from a long woody root; stem stout, erect, somewhat branched, terete, lineate, glabrous to uncinulate-puberulent, 15 dm. tall; stipules apparently very early deciduous, only scars seen; stipels linear-lanceolate, puberulent on both surfaces, 1-3 mm. long; petioles angular, glabrous to uncinulate-puberulent, 18-66 mm. long; leaf rachis similar, 11-28 mm. long; leaflets dark and glabrous to sparsely puberulent above with distinct paler venation, glabrous to sparsely puberulent and/or short pilose beneath and glaucous, the

margins becoming revolute, more or less ciliate at base; terminal leaflet ovate-acute to more or less acuminate, mucronulate, rounded to acute at base, 43-84 mm. long, 28-52 mm. wide; lateral leaflets elliptic-oblong to ovate, obtuse at apex, truncate to rounded at base, 32-74 mm. long, 25-40 mm. wide; inflorescence chiefly racemose-paniculate, axillary and terminal; rachis terete to angulate, finely lineate, uncinulate-puberulent; primary bracts ovate-acuminate, striate, puberulent on both surfaces, more or less ciliate, 3-3.5 mm. long; secondary bracts slenderly ovate-acuminate, puberulent, ciliate, 1-2 mm. long; pedicels slender, lax, uncinulate-puberulent, 1-2 cm. long; calyx puberulent and somewhat short-appressed-pilose throughout, teeth of both lobes ciliate, central tooth of lower lobe 3.5-4.5 mm. long and lateral teeth 2.5-3.5 mm. long, upper bifid lobe 2.5-3.5 mm. long; corolla pink to deep-rose, about twice as long as calyx; loment stipitate, 2- to 5-articulate; stipe 6-6.5 mm. long; articles more or less rhombic, prominently reticulate, uncinulate-puberulent, 5-7 mm. long, 3.5-4 mm. wide. Dry sandy woods and clearings, e. Tex., May-Sept.; N.Y. to Ind. and Mo., s. to n. Fla., Tenn., La. and Tex.

23. *Desmodium tortuosum* (Sw.) DC. Erect perennial herb to 1 m. tall; stems simple or branched from base, terete, striate, uncinulate-pubescent and somewhat spreading-pilose with long tapering trichomes; stipules obliquely ovate-attenuate, striate, ciliate, puberulent on abaxial surface but becoming glabrous, often reflexed, long-persistent, 3-12.5 mm. long, 3-7 mm. wide; stipels lance-attenuate, striate, ciliate, more or less puberulent, 1-7 mm. long; petioles finely ridged and grooved, pubescent as is stem, 7.5-50 mm. long; leaf rachis similar, 4.5-20 mm. long; leaflets elliptic to ovate, mostly obtuse at apex, cuneate at base, venation prominently reticulate, sparsely to moderately uncinulate-puberulent to pilose on both surfaces, ciliate; terminal leaflets 2.4-8 cm. long, 1-3 cm. wide; lateral leaflets 2-5 cm. long, 1-2.4 cm. wide; inflorescence axillary and terminal, racemose to racemose-paniculate; rachis striate, uncinulate-puberulent and moderately to densely finely glandular-pilose; primary bracts narrowly ovate-attenuate, striate, long-ciliate, minutely puberulent on abaxial surface, not long-persistent, 5-6.5 mm. long, 0.5-1.5 mm. wide; secondary bracts similar but smaller, about 2 mm. long, 0.4-0.5 mm. wide; pedicels rather stiff, ascending to spreading at maturity, with pubescence similar to that of rachis, 1-1.6 cm. long; calyx minutely puberulent and rather abundantly pilose throughout, teeth of both lobes more or less ciliate, central tooth of lower lobe 3-4 mm. long and lateral teeth 2-3 mm. long, upper bifid lobe 2-3 mm. long; corolla 3-4 mm. long; loment stipitate, 5- to 7-articulate; stipe 0.5-1 mm. long; articles mostly orbicular, sometimes with margins alternately revolute and appearing rhomboidal, uncinulate-pubescent throughout, 3-3.5 mm. long, 2.6-3.5 mm. wide. *D. purpureum* (Mill.) Fawc. & Rendle. Cult. as a green manure in the s.e. U.S. and other parts of the world; found as an escape from cult. and becoming weedy in most trop. and warm areas; known from Newton and Tyler cos., Aug.-Sept.

24. *Desmodium neomexicanum* Gray. Annual herb from a slender taproot, much-branched from base, the branches slender, angulate and grooved, uncinulate-puberulent to -pubescent; leaves trifoliolate (or the lowermost often unifoliolate); leaflets linear-lanceolate to lance-ovate, gradually acuminate to an obtuse mucronulate apex, rounded to cuneate at base, bright-green and moderately uncinulate-puberulent to -pubescent above and with scattered stout tapering trichomes intermixed, paler below with similar pubescence, the straight tapering trichomes more abundant on midrib and chief lateral veins, the margins slightly revolute, ciliate; terminal leaflet 1.2-6 cm. long, 3-15 mm. broad; lateral leaflets slightly smaller; stipules obliquely ovate-acuminate, usually long-attenuate, striate, somewhat appressed-pilose, ciliate, (1.4-) 2.5-7 mm. long, 1-2 mm. wide; stipels subulate to linear-lanceolate, ciliate, 0.5-2.5 mm. long; petiole finely grooved, uncinulate-puberulent, 5-55 mm. long; leaf rachis similar, 8-12 mm. long; inflorescence racemose-paniculate, lax; rachis slender, rather sharply angulate, densely puberulent with both uncinulate and straight trichomes; primary bracts lance- to elliptic-attenuate, striate, puberulent and scattered-pilose, ciliate, becoming reflexed, 2.5-5.5 mm. long, 0.5-1 mm. wide; secondary bracts similar but very slender, 3-4 mm. long; pedicels slender, uncinulate-puberulent with some straight multicellular trichomes intermixed, 7-14 (-23) mm. long; calyx puberulent and scattered-pilose with stout trichomes, to 2 mm. long; corolla pink, about 4 mm. long; loment sessile to stipitate, to 5-articulate; stipe to 2 mm. long; articles (except the terminal) rhombic in outline, the margins more or less sinuate, surfaces reticulate, uncinulate-puberulent to -pubescent and with scattered long

tapering white trichomes (subterminal article glabrescent to glabrous), 3-4 mm. long, 2-3 mm. wide; terminal article usually more or less orbicular and glabrous, 3.5 mm. long and wide. *D. Bigelovii* Gray. Local in the mts. of Jeff Davis, Presidio and Brewster cos. in the Trans-Pecos, Aug.; Tex. to Ariz., southw. to Pue.; S.A., Peru, Bol. and Arg.

25. *Desmodium Grahamii* Gray. Prostrate or decumbent perennial herb, much-branched from the base, the thickish root also branched and spreading; stem slender, angulate, lineate, uncinulate-puberulent; stipules obliquely lance-attenuate, striate, ciliate, somewhat short-pilose on the outer surface, glabrous within, usually soon reflexed, 3-5.5 mm. long, 1-1.5 mm. wide; stipels lance-attenuate, puberulent, ciliate, 1.5-2.5 mm. long; petiole angulate, lineate, moderately to abundantly uncinulate-puberulent and scattered long-pilose, 1.2-2 cm. long; leaf rachis similar, 9-17 mm. long; leaflets with prominent reticulation, appressed-pilose with long slender tapering trichomes (usually bulbous at base) on the upper and the paler lower surface, ciliate, mucronulate; terminal leaflet almost orbicular on lower portions of plant to obtusely ovate above, truncate to obtuse at base, 25-37 mm. long, 17-25 mm. wide; lateral leaflets elliptic to ovate, obtuse at base and apex, 18-25 mm. long, 12-15 mm. wide; inflorescence racemose, terminal, the rachis not usually branched; rachis angulate, grooved, uncinulate-puberulent and occasionally scattered-pilose with straight tapering trichomes; primary bracts ovate or elliptic-attenuate, striate, puberulent and pilose on the outer surface, ciliate, 4.5-6.5 mm. long, 1.5-2 mm. wide; secondary bracts minute, elliptic to ovate, puberulent, ciliate (chiefly at apex), deciduous, 0.5-1 mm. long, 0.4 mm. wide; pedicels finely uncinulate-puberulent, 10-15 mm. long; calyx minutely puberulent throughout, pilose on teeth of both lobes, central tooth of lower lobe 4-5 mm. long and lateral teeth 3-4 mm. long, upper (scarcely bifid) lobe 3-4 mm. long; corolla purple, about twice as long as calyx; loment stipitate, 2- to 5-articulate; stipe 3-3.5 mm. long; articles elliptic to suborbicular, more deeply curved below than above, reticulate, finely uncinulate-puberulent throughout, 4.5-7 mm. long, 2.5-5 mm. wide. Higher parts of Davis and Chisos mts. in the Trans-Pecos, infrequent, July-Sept.; Tex. to Ariz., s. to the states of Mex. and Michoac. where it is rather frequent along roadsides.

26. *Desmodium psilophyllum* Schlecht. Erect perennial herb, much-branched from the base, to 9 dm. tall from a thickish (4 mm.) rather long (2 dm.) root; stem terete, finely ridged and grooved, minutely uncinulate-puberulent; stipules obliquely ovate-attenuate, striate, puberulent, more or less persistent, 1.5-3.5 mm. long, 0.5 mm. wide; stipels subulate, puberulent, ciliate, 0.5 mm. long; petioles angulate, somewhat puberulent, 6-9 mm. long; leaves unifoliolate; leaflets lance-ovate to ovate-obtuse, truncate to rounded at base, mucronulate at apex, moderately to abundantly uncinulate-puberulent throughout and with scattered pilosity of stout straight tapering trichomes especially along midrib and veins of both surfaces, occasionally with paler patches along midrib, the margins ciliate, 35-55 mm. long, 10-20 mm. wide; inflorescence terminal, racemose; rachis densely puberulent with uncinulate and more or less glutinous multicellular trichomes; primary bracts ovate, long-attenuate, striate, puberulent and somewhat spreading-pilose with short slender pointed trichomes, ciliate, 1-2 mm. long, 0.4-0.7 mm. wide; secondary bracts lance-attenuate, striate, puberulent and somewhat pilose, ciliate, 0.5-1 mm. long, 0.25 mm. wide; pedicels with pubescence like that of rachis, 4-10 mm. long; calyx puberulent throughout, pilose with multicellular and short straight pointed trichomes, central tooth of lower lobe 2-3 mm. long and lateral teeth 2-2.5 mm. long, upper bifid lobe 1.5-2.5 mm. long; corolla pink, twice as long as calyx or slightly longer; loment stipitate, 2- to 5-articulate; stipe 1.5-2.5 mm. long; articles elliptic to obovate, upper suture slightly curved, lower suture obtuse, uncinulate-pubescent on surfaces, somewhat so on sutures or almost glabrous, 4-4.5 mm. long, 3-3.5 mm. wide. *D. Wrightii* Gray. Canyons, s. margin of Edwards Plateau (e. to Travis Co.) and the Trans-Pecos, spring-autumn; Tex., Ariz. and Mex.

53. LESPEDEZA MICHX.⁹⁹

BUSH CLOVER

Unarmed annual or perennial herbs; leaves alternate, trifoliolate; stipules persistent; leaflets entire; stipels absent; flowers borne in pairs on loose or contracted racemes, often

⁹⁹ Contributed by Andre F. Clewell.

cleistogamous; calyx tube shorter than or equaling the lobes, the 5 subequal lobes persistent in fruit, often the calyx of cleistogamous flowers shorter than those of chasmogamous flowers; corolla papilionaceous (white to purple with purple throats) or absent (actually vestigial) in cleistogamous flowers; banner oblong to obovate or suborbicular, clawed, free or slightly adherent to the incurved obovate keel petals; stamens 10, diadelphous, the uppermost filament free; fruit a solitary flattened 1-seeded ovate or rounded indehiscent pod, often reticulated; style persistent (though easily broken in dried material), elongate on chasmogamous pods or very short and tightly recurved on cleistogamous pods.

A genus of about 90 species of Asia, Australia and North America. Several Asian species have been introduced for erosion control, forage and for use in wildlife management, especially for quail. A few hybrids often occur wherever two or more perennial species exist in moderate numbers, making identification somewhat difficult.

1. Stipules ovate to ovate-lanceolate; lateral veins of leaflets conspicuously parallel and extending to the margins, unbranched or uncommonly once-forked; annuals with stems mostly less than 4 dm. long (2)
1. Stipules narrow, subulate to setaceous; lateral veins of leaflets usually much-branched and anastomosing before reaching the margins; perennials with stems mostly more than 4 dm. long (3)
- 2(1). Stems upwardly appressed-pubescent; leaflets of the younger or upper leaves conspicuously ciliate marginally; petioles of the principal leaves mostly 4-10 mm. long 10. *L. stipulacea*.
2. Stems downwardly appressed-pubescent; leaflets not conspicuously ciliate; petioles of the principal leaves usually less than 3 mm. long . 11. *L. striata*.
- 3(1). Leaflets cuneate; flowers white or cream-colored with purple throats, mostly 2 to 4 per raceme; pods mostly 2.5-3 mm. long 9. *L. cuneata*.
3. Leaflets linear to ovate but not cuneate; flowers white to purple, if white or cream-colored then mostly 10 or more per raceme; pods 3-7 mm. long (4)
- 4(3). Stems erect or strongly ascending (5)
4. Stems procumbent or weakly ascending (9)
- 5(4). Rachis of the terminal leaflet notably longer than its petiole on the larger leaves 7. *L. capitata*.
5. Rachis of the terminal leaflets equaling or shorter than its petiole on the larger leaves (6)
- 6(5). Leaflets linear to linear-oblong, more than 3 times as long as wide 6. *L. virginica*.
6. Leaflets oblong, elliptic or ovate, less than 3 times as long as wide (7)
- 7(6). Corolla white or cream-colored; calyx about equaling or exceeding the pod; usually 16 or more flowers per raceme; larger leaflets generally ovate, at least half as wide as long 8. *L. hirta*.
7. Corolla purple; calyx about one half as long as pod; racemes with 4 to 14 flowers; leaflets generally oblong or elliptic, mostly less than half as wide as long (8)
- 8(7). Stem and upper surface of leaflets glabrous or glabrate; keel protruding beyond wing petals 4. *L. violacea*.
8. Stem and leaflets copiously short-appressed-pubescent or pilose; keel included within the wing petals 5. *L. Stuevei*.
- 9(4). Stems procumbent; stipules mostly under 4 mm. long; keel included within wings; leaflets to 25 mm. long (10)
9. Stems ascending, at least at the base; usually some stipules over 4 mm. long; keel either included or protruding beyond wings; leaflets sometimes more than 25 mm. long (11)
- 10(9). Stems appressed-pubescent 2. *L. repens*.
10. Stems pilose 1. *L. procumbens*.

- 11(9). Keel included within wings; leaflets rather coriaceous and reticulate, often nearly white below; longer stems ascending to 15 cm., then trailing for the rest of their length 3. *L. texana*.
11. Keel protruding beyond wings; leaflets membranous, green or gray-green below; stems not trailing 4. *L. violacea*.

1. *Lespedeza procumbens* Michx. TRAILING BUSH CLOVER. Perennial herb; stems procumbent, 3-18 dm. long, pilose throughout; stipules mostly 2-4 mm. long; leaflets soft-pubescent, ovate or elliptic, 12-25 mm. long; racemes bearing up to 8 to 12 flowers, often surpassing the foliage; calyx extending to about half the length of the pod; pods 4-5 mm. long. Roadsides and open sandy woodlands, e. and n.-cen. Tex., July-Sept.; most of e. and cen. U.S.

2. *Lespedeza repens* (L.) Bart. CREEPING BUSH CLOVER. Perennial herb; stems procumbent, 3-13 dm. long, sparsely appressed-pubescent; stipules subulate, 1.5-4 mm. long; leaflets membranous, elliptic or ovate, to 25 mm. long, green beneath, glabrous or glabrate above; racemes delicate, usually bearing up to 4 to 8 flowers, often surpassing the foliage; calyx at least a fourth to about half the length of the pod; corolla purple; keel about equaling the wings; pods 3-7 mm. long. Frequently in sandy or gravelly soils of roadsides and open woodlands, e. Tex., infrequent w. to n.-cen. Tex., Apr.-Sept.; e. and cen. U.S.

3. *Lespedeza texana* Britt. TEXAS BUSH CLOVER. Perennial herb; stems appressed-pubescent or rarely pilose, 2-15 dm. long, ascending only briefly at the base then sprawling, altogether the plant usually not more than 2 dm. tall; longer stipules 4-8 mm. long; leaflets firm-textured, mostly elliptic to 35 mm. long, gray-green beneath, usually glabrous or glabrate above; racemes delicate, mostly bearing 4 to 8 flowers, often surpassing the foliage; calyx extending about half the length of the pod; corolla violet; wings about equaling the keel; pods 4-7 mm. long. Usually in rocky calcareous soils, shaded cliffs and stream banks and canyons, Edwards Plateau, rare e. into limy cuestas in the Coastal Plain, June-Oct.; Tex. and Coah.

The firm, grayish leaflets and sprawling habit escape notice in pressed specimens. This has led some authors to consider it identifiable with *L. repens*.

4. *Lespedeza violacea* (L.) Pers. PRAIRIE CLOVER. Perennial herb; stems weakly ascending to nearly erect, 2-7 dm. long, sparsely appressed-pubescent; longer stipules filiform, 2.5-6 mm. long; leaflets membranous, light-green beneath, elliptic to broadly oblong, sometimes the leaves of successive nodes of notably contrasting sizes, mostly 2-5 cm. long; racemes delicate, mostly bearing 4 to 6 flowers, sometimes exceeding the foliage; calyx extending no more than a fourth the length of the cleistogamous pods and about half the length of the chasmogamous pods; corolla purplish, the keel extending beyond the wings; pods 4-7.5 mm. long. *L. prairea* Britt. Rare in n.-cen. Tex., July-Aug.; most of the n.e. and cen. U.S.

5. *Lespedeza Stuevei* Nutt. TALL BUSH CLOVER. Perennial herb; stems strongly ascending or erect, densely appressed-pubescent or pilose, 3-18 dm. tall, very leafy; leaflets elliptic or oblong, mostly 10-25 mm. long; terminal leaflets 2 or 3 times as long as broad, appressed-pubescent to pilose above; racemes included within or slightly extending beyond the foliage, each with 4 to 14 flowers; calyx extending up to half the length of the pod; corolla purple; pods sericeous-canescenscent, 5-6 mm. long. Frequent in sandy or gravelly soils on roadsides and in open woodlands, e. and n.-cen. Tex., w. to West Cross Timbers and rare in Llano region on Edwards Plateau, May-Oct.; most of e. U.S.

Lespedeza intermedia (Wats.) Britt., a species of eastern United States, including the Ozark Plateau, has been collected once in Texas (dry woods, Tarrant Co., in 1910). It is similar to *L. Stuevei*, but has stems appressed-pubescent, leaflets glabrous above and pods glabrate.

6. *Lespedeza virginica* (L.) Britt. SLENDER BUSH CLOVER. Perennial herb; stems strongly ascending or erect, appressed-pubescent or pilose, 3-16 dm. tall, very leafy; stipules mostly less than 4 mm. long; leaflets linear or linear-oblong, 3 to 10 times as long as broad, sparsely appressed-pubescent above (often only along the midrib), 15-40 mm. long; racemes included within or only slightly exceeding the foliage, usually bearing 4 to 8 flowers; calyx up to half the length of the pod; corolla purple, the keel about equaling

the wings; pods 4-7 mm. long. Frequent along roadsides and in sandy open woodlands, e. and n.-cen. Tex., rare w. to Llano region on Edwards Plateau, Aug.-Oct.; s. Can., e. U.S.; also mts. of N.L.

7. *Lespedeza capitata* Michx. ROUND-HEAD BUSH CLOVER. Perennial herb; stems erect, to about 2 m. tall; rachis of the larger terminal leaflets notably longer than its petiole; leaflets less than half as broad as long, quite variable in shape and indument, in our range generally oblong with closely appressed sericeous pubescence; racemes compact and subglobose, bearing 10 to 30 flowers, the peduncles about equaling or protruding slightly beyond the foliage; calyx exceeding the mature pod, 7-13 mm. long; corolla white with a purple throat. Very rare in sandy prairies and open woodlands, Grayson, Hemphill, Hardin and Lamar cos., July-Aug.; e. and cen. U.S.

8. *Lespedeza hirta* (L.) Hornem. HAIRY BUSH CLOVER. Perennial herb; stems erect, to 18 dm. tall, densely short-pubescent; leaflets elliptic or (ob-) ovate, the longer ones to 4 dm. long and at least half as broad as long; glabrous or appressed-pubescent above; racemes extending considerably beyond the foliage and bearing 16 to 44 flowers; calyx 6-12 mm. long, equaling or exceeding the pod; corolla cream-colored or white with a purple throat. Incl. var. *calycina* Schindl. Frequent in sandy soils, e. and s.e. Tex., rare w. to n.-cen. Tex., June-Sept.; s. Can., e. U.S.

9. *Lespedeza cuneata* (Dumont) G. Don. SERICIA, CHINESE BUSH CLOVER. Perennial herb; stems often erect with ascending branches, 4-15 dm. tall; leaves short-petiolate, crowded; leaflets narrowly cuneate, mostly 1-2 cm. long, apices retuse or truncate; racemes mostly shorter than the foliage, bearing 2 to 4 flowers; corolla cream-colored or white with a purple throat; pod 2.5-3 mm. long. *L. sericea* (Thunb.) Benth. Scattered or rare on sandy roadsides, e. and n.-cen. Tex., summer-fall; nat. of e. Asia and Austral., now widely introd. on roadsides and fields, especially in s.e. U.S.

10. *Lespedeza stipulacea* Maxim. KOREAN BUSH CLOVER. Bushy-branched tap-rooted annual with stems under 4 dm. long, antrorsely appressed-pubescent; stipules ovate to ovate-lanceolate, mostly 5-8 mm. long on the mainstem; stalk of terminal leaflet not much longer than the petiolules of the laterals (thus leaf subpalmate); petioles of the principal leaves mostly 4-10 mm. long; leaflets spatulate to obovate, mostly 1-2 cm. long, the upper or younger (i.e., bracteal) leaves conspicuously ciliate on the margins; flowers and fruits in short leafy racemes; corolla pink; pods about 3 mm. long. Scattered on sandy roadsides, e. Tex., June-Sept.; nat. of e. Asia, now widely introd. in N.A.

11. *Lespedeza striata* (Thunb.) H.&A. JAPANESE BUSH CLOVER. Bushy-branched taprooted annual with stems mostly under 4 dm. long, retrorsely appressed-pubescent; stipules ovate to ovate-lanceolate, 3-5 mm. long; stalk of the terminal leaflet not much longer than the petiolules of the laterals (thus subpalmate); petioles usually less than 3 mm. long; leaflets obovate to narrowly oblong, not conspicuously ciliate on the margin; flowers and fruits in short leafy racemes; corolla pink; pod 3-4 mm. long. Abundant in sandy open areas, e. Tex., infrequent w. to n.-cen. Tex., June-Sept.; nat. of e. Asia, now widely introd. in N.A.

54. VICIA L.¹⁰⁰

VETCH

Annuals, winter annuals, biennial or short-lived perennial trailing or climbing herbaceous unarmed vines; leaves alternate, once-paripinnately-compound; stipules herbaceous, persistent; leaflets 2 to 18, usually linear to elliptic-oblong and several times longer than broad; rachis of leaf terminating in simple or branched tendrils; flowers in pedunculate axillary usually loose few-flowered spikelike racemes; calyx with a tube and 5 usually unequal teeth or lobes; corolla papilionaceous, usually 3-10 mm. long, white, blue, violet or yellow (rarely even reddish), the wings coalescent with the keel; fruit a dry slightly flattened linear to narrowly elliptic 2-valved legume with 2 to many seeds.

A genus of perhaps 150 species in temperate regions of the earth. Some species are important silage, pasture and green-manure legumes, and several have been introduced for these purposes.

¹⁰⁰ Adapted largely from F. J. Hermann in U.S. Dept. Agric. Handbook No. 168, 84 pp. 1960.

1. Peduncle (if present) much shorter than the leaves; flowers few (often solitary or paired), sessile or subsessile in the upper leaf axils (2)
1. Peduncle well-developed, nearly equaling to much-exceeding the leaves; flowers 1 to many (3)
- 2(1). Pod pale-brown at maturity; flowers 18-30 mm. long; leaflets chiefly oblong to obovate; nectaries on calyx teeth conspicuous, yellowish-brown 1. *V. sativa*.
2. Pod almost black at maturity; flowers 10-18 mm. long; leaflets chiefly linear (except in var. *segetalis*); nectaries on calyx teeth usually inconspicuous, pale-stramineous 2. *V. angustifolia*.
- 3(1). Corolla 2-9 mm. long; racemes 2- to 8- (to 13-) flowered or flowers solitary (4)
3. Corolla more than 9 mm. long or else racemes (3- to) 10- to 40-flowered (8)
- 4(3). Peduncles 1- or 2-flowered; calyx lobes equal or subequal, shorter than or equaling the tube (5)
4. Peduncles (1- to) 3- to 12-flowered; calyx lobes unequal or subequal, lance-subulate, the longer equaling or exceeding the tube (6)
- 5(4). Calyx lobes deltoid, 0.5-1 mm. long, much shorter than the tube; plant slender; peduncles in fruit 2 cm. long; stipules moderately unequal 3. *V. minutiflora*.
5. Calyx lobes lanceolate, 2 mm. long, equaling the tube; plant much more robust and more pubescent (especially calyx and pod); peduncles in fruit 3 cm. long; stipules strikingly unequal 4. *V. Reverchonii*.
- 6(4). Peduncles (2- to) 5- to 12-flowered, at anthesis more than half the length of the leaves; calyx lobes markedly unequal, only the lower as long as the tube; flowers broad and showy 5. *V. ludoviciana*.
6. Peduncles 1- to 4- (to 5-) flowered, at anthesis half the length of the leaves or less; flowers narrow, rather inconspicuous (7)
- 7(6). Corolla 4.5-7 mm. long; upper calyx teeth not appreciably shorter or broader at the base than the lower; peduncles (1- or) 2- to 5-flowered 6. *V. Leavenworthii*.
7. Corolla 6-9 mm. long; upper calyx teeth much shorter and broader at the base than the lower; peduncles 1- or 2-flowered 7. *V. exigua*.
- 8(3). Mature inflorescence shorter than the subtending leaves, 2- to 12-flowered; flowers (12-) 15-20 mm. long 11. *V. americana*.
8. Mature inflorescences equaling or exceeding the subtending leaves, many-flowered; flowers 8-15 mm. long (9)
- 9(8). Flowers 8-12 mm. long, scattered in loose racemes; calyx teeth deltoid, subequal; corolla white, the keel blue-tipped 8. *V. caroliniana*.
9. Flowers 10-15 mm. long, overlapping in dense racemes; at least the lower calyx teeth lance-attenuate to subulate; corolla blue, violet or violet and white (banner often somewhat rosy) (10)
- 10(9). Raceme spreading-pubescent; lowest calyx lobe long-villous, 2-5 mm. long 9. *V. villosa*.
10. Raceme appressed-pubescent; lowest calyx lobe short-pubescent to glabrescent, 1-2 (-2.5) mm. long 10. *V. dasycarpa*.

1. *Vicia sativa* L. COMMON VETCH, SPRING VETCH. Glabrescent annual; stems to 1 m. long, erect-ascending or climbing; leaves with 8 to 16 leaflets terminating in a branched tendril; leaflets oblong to elliptic or obovate, 15-35 mm. long, 5-15 mm. broad, truncate to emarginate and mucronate at apex; stipules semisagittate, usually sharply serrate, the lower surface bearing a purplish nectary; flowers mostly paired in the upper axils, subsessile, 18-30 mm. long, violet-purple or rarely white; calyx 10-15 mm. long, the campanulate tube 5-7 mm. long, the subequal teeth linear-subulate and 3-9 mm. long, the 3 lower teeth bearing a conspicuous yellowish-brown nectary on the outer face; pod

nearly cylindrical to somewhat compressed, torulose, 25-70 mm. long, 5-8 mm. broad, brown, 4- to 12-seeded. Infrequent along roadsides in extreme n.e. Tex., May-June; nat. of Eur., now widely introd.

2. *Vicia angustifolia* L. NARROW-LEAVED VETCH. Glabrous or glabrate annual; stems decumbent, ascending, 1-6 dm. long, usually branched only at base; leaves with usually 4 to 10 (or 12) leaflets, those of the lower leaves oblong and truncate, of the upper linear to narrowly elliptic or lance-attenuate [in var. *segetalis* (Thuill.) Koch leaflets of the upper leaves oblong to oblong-obovate, 2-9 mm. broad, the apex truncate or emarginate and mucronate], 15-30 mm. long, 1-4 mm. broad; stipules semisagittate, serrate or the upper entire, often lacking a nectary; flowers commonly paired in the upper axils, 10-18 mm. long, blue or violet varying to white; calyx 7-11 mm. long, the campanulate tube 4-6 mm. long, the linear-lanceolate teeth about equal and 3-6 mm. long, the 3 lower teeth bearing a usually inconspicuous pale-stramineous nectary on the outer face; pod very dark-brown to almost black at maturity, terete. Occasionally escaped in e. Tex., May-June; Eur., now widely introd.

3. *Vicia minutiflora* Dietr. PYCMTY-FLOWERED VETCH. Glabrate or minutely pubescent winter annual; stems slender, branched, reclining or climbing, 3-8 dm. long; leaves relatively few and distant, 2-6 cm. long; bearing 4 to 6 leaflets and terminated by a simple or branched tendril; leaflets linear-elongate to narrowly oblong, 10-35 mm. long (those of the lower leaves sometimes obovate and 5-12 mm. long), the apex acute to rounded and mucronulate; stipules semisagittate, the upper lanceolate, subequal or 1 of the pair up to twice as broad as the other; peduncles shorter than the leaves, 5-20 mm. long, 1- (2-) flowered (the flower terminal when solitary), usually rigid and ascending-divaricate; flowers pale-blue or purplish-white, 5-6 (-8) mm. long; calyx sparsely villous, the tube 1.5-2 mm. long, the deltoid teeth 1-1.5 mm. long (much shorter than the tube) and subequal, the upper teeth usually somewhat shorter and broader; pods flat, glabrous, narrowly oblong-falcate, 2-3 cm. long, 4-4.5 mm. broad, with (4 to) 6 to 8 (to 12) seeds. Frequent, e., s.e. and n.-cen. Tex., spring; Fla. to Tex., n. to Tenn. and Mo.

4. *Vicia Reverchonii* Wats. Hairy-pod VETCH. Low spreading-pubescent stoutish winter annual; stems branched at base, the branches ascending to decumbent or reclining, 2-4 dm. long; leaves numerous, 15-50 mm. long, subsessile to short-petioled, bearing (4 to) 6 to 10 leaflets, terminating in a simple or branched tendril; leaflets elliptic to broadly oblong-cuneate or obovate, 5-17 mm. long, 3-7 mm. broad, more or less villous on both surfaces, at apex rounded to truncate-emarginate; stipules very unequal, 1 of the pair broadly semisagittate and often 4 times as broad as the other which is lanceolate or very narrowly semisagittate; peduncles stout, equaling or shorter than the leaves, 5-35 mm. long, 1-flowered; flowers blue or bluish, 5-7 mm. long; calyx villous, the tube 2 mm. long, the lanceolate teeth equal and 2 mm. long (equaling the tube); pods flat, appressed-villous, oblong-falcate, 25-30 mm. long, 4.5-5 mm. broad, 4- to 6-seeded, *V. minutiflora* f. *Reverchonii* (Wats.) Shinn. Rare and local in vicinity of Dallas, n.-cen. Tex., spring; also Okla.

5. *Vicia ludoviciana* Nutt. DEER PEA VETCH. Glabrous or pubescent winter annual; stems decumbent or climbing, 2-10 dm. long; leaves 3-9 cm. long, the rachis terminating in a usually forked tendril; leaflets 6 to 12, linear-oblong or elliptic to broadly elliptic, 6-25 mm. long, rounded or emarginate at apex; stipules semisagittate, usually more or less unequal; peduncles shorter than to exceeding the leaves, 2-4 cm. long; flowers solitary or 2 to 13 in a lax or dense raceme; corolla lavender-blue, 5-8 mm. long, the folded banner 1.5-4 mm. high; calyx somewhat pilose, the tube 1-2 mm. long, the teeth unequal, the lower teeth subulate and equaling the tube, the upper teeth shorter and broader; pods flat, glabrous, oblong, oblique at both ends, 2-3 cm. long, 4- to 8-seeded. Widespread in e. half of Tex.; represented with us by 3 varieties.

Var. *ludoviciana*. Perfectly glabrous; folded standard 2.5-4 mm. high; racemes with 2 to 12 flowers, fairly compact. E. half of Tex., w. sparingly to Edwards Plateau, spring; Mo., Fla., Miss., La., Okla., Tex. and N.M.

Var. *texana* (T. & G.) Shinn. Sparingly pubescent to nearly glabrous; peduncles very slender; racemes generally compact but with only 1 to 6 flowers; flowers 5-6.5 mm. long, the folded banner 1.8-2.5 mm. high. Coastal Plains of s.e. Tex. w. to n. part of Rio Grande Plains, spring; Miss. to Tex.

One author (Turner) thinks this race best treated as a few-flowered narrow-leaved extreme of *V. Leavenworthii* var. *Leavenworthii*; the two species and this form in particular are perplexing taxonomically and deserve much further study.

Var. *laxiflora* Shinn. Sparingly to rather densely grayish-pubescent; racemes loose, 3- to 13-flowered; flowers rather widely spaced, 5.5-8 mm. long; folded banner 1.5-2.5 mm. high, narrower and paler than in the other forms. Calcareous soils of Edwards Plateau and infrequent e. to n.-cen. Tex., spring; endemic.

6. *Vicia Leavenworthii* T. & G. Glabrescent to sparsely pilose or puberulent winter annual; stems usually much-branched and spreading at base, reclining or climbing, 3-6 dm. long; leaves 3-6 cm. long, terminating in a forked tendril; leaflets (8 or) 10 to 14, narrowly elliptic-lanceolate to oblong or elliptic to oblanceolate, 5-12 mm. long, acute or rounded and mucronulate or shallowly emarginate at apex; stipules mostly lanceolate, occasionally narrowly semisagittate; peduncles from shorter than to exceeding the subtending leaves, (1- or) 2- to 5-flowered; flowers bluish-lavender, 4.5-7 mm. long; calyx pubescent, the turbinate tube 1-1.5 mm. long, the subequal teeth lance-subulate and about equal to or longer than the tube; pods flattish, glabrous, oblong, oblique at both ends, 20-25 mm. long, 5-7 mm. broad, 4- to 6-seeded. Frequent in a variety of soils, e. half of Tex. rarely w. to Wichita, Taylor, Edwards and Kinney cos., intergrading with the *V. exigua* on a broad scale, spring; Mo., Okla., Ark. and Tex.

7. *Vicia exigua* T.&G. Glabrous or sparsely strigose, very slender winter annual; stems decumbent, ascending or erect, usually branching at base, 2-7 dm. long; leaves rather distant, 2-6 cm. long, terminating in a usually branched tendril; leaflets 4 to 12, narrowly linear to oblong, 5-25 mm. long, from rounded to acute or rarely emarginate and mucronate at apex, glabrous or occasionally sparsely strigose; stipules narrow, semisagittate, entire or incisely serrate; peduncles slender, 2-4 cm. long, shorter than the leaves, 1- or 2-flowered, aristate; flowers yellowish-white to purplish, (5-) 6-8 (-9) mm. long; calyx sparingly hirsute-strigose, the lanceolate teeth broad at base and from somewhat shorter than to equaling the tube, the upper teeth shorter than the lower and broader-based; pods oblong, oblique at apex, 2-3 cm. long, 4-6 mm. broad, glabrous, 4- to 7-seeded. *V. Thurberi* Wats., *V. producta* Rydb., *V. Leavenworthii* var. *occidentalis* Shinn. Frequent in w. Tex., e. less frequently to Rio Grande Plains and Coastal Bend area, rare in Plains Country, spring; Ore., Nev., Ut., Colo. and Tex. to n. Mex.

8. *Vicia caroliniana* Walt. PALE VETCH, WOOD VETCH. Slender perennial; stems trailing or climbing, to 1 m. long; leaflets 10 to 24, elliptic to oblong or oblong-lanceolate, obtuse, mucronulate, usually with 5 to 7 lateral veins on each side; stipules lanceolate or semisagittate, entire; peduncles elongate; racemes (including the peduncle) 6-10 cm. long, bearing 7 to 20 loosely disposed pedicelled flowers 8-12 mm. long; calyx nearly regular, the tube 2-2.7 mm. long, the subequal lobes broadly deltoid and about as broad as long (less than 1 mm.); corolla white, the keel blue-tipped; pod stipitate, narrowly oblong, obliquely long-beaked, 15-30 mm. long. Rare in wooded areas, e. Tex. and e. edge of Edwards Plateau, Apr.-June; e. U.S.

9. *Vicia villosa* Roth. HAIRY VETCH. Annual or biennial; stems spreading-villous, to 1 m. long; leaflets usually 10 to 20, narrowly oblong to linear-lanceolate, obtuse and mucronate to acute, 10-25 mm. long; peduncles elongate; racemes dense, 10- to 40-flowered, secund, plumose in bud; flowers 12-20 mm. long; calyx irregular, villous, the tube 2.3-4 mm. long and gibbous at base on the upper side, the pedicel apparently inserted ventrally, the lower linear-aciculate teeth long-villous and 2-5 mm. long, the upper teeth linear-deltoid and 0.8-1.5 mm. long; corolla violet and white to rose-colored or white, slender, the blades of the glabrous banner less than half as long as the claw; pod oblong, 2-3 cm. long, 7-10 mm. broad, obliquely beaked. Rare along roadsides in e. and n.-cen. Tex., Apr.-Aug.; nat. of Eur., now widely introd.

10. *Vicia dasycarpa* Ten. WINTER VETCH, WOOLLY-POD VETCH. Annual, rarely perennial; very similar to *V. villosa* but differing in its appressed-pubescent or glabrate stem and foliage, in its fewer- (usually only 5- to 15-) flowered racemes not plumose in bud, and in its shorter (1-2 mm. long) glabrescent lower calyx teeth. *V. villosa* var. *glabrescens* Koch. Infrequent on roadsides, e. and n.-cen. Tex., Apr.-Aug.; Eur., now widely introd.

11. *Vicia americana* Muhl. AMERICAN VETCH. Perennial; stems glabrous to sparsely pilose, trailing or climbing to 1 m. long; leaflets 8 to 18, linear to elliptic, mostly 15-35

mm. long, 1-14 mm. broad, the lateral veins prominent beneath in drying, at apex rounded to truncate or emarginate; stipules mostly sharply serrate; racemes shorter than the subtending leaves, loose, 3- to 9-flowered; flowers bluish-purple, 15-28 mm. long; calyx tube oblique, 3.5-5.5 mm. long, the variable teeth variously unequal with the lower usually lance-attenuate and 1.2-4 mm. long, the upper teeth short and broad; pod 25-35 mm. long. Widely distributed in the U.S. (except the s.e. states), and represented with us by 2 varieties:

Var. *americana*. Leaflets thin, broad, ovate to broadly elliptic or oblong, 4-14 mm. broad, obtuse to broadly rounded at apex, mucronate, the conspicuously branching lateral veins numerous and forming a 45° angle with the midrib. Rare in the higher parts of Guadalupe Mts. in the Trans-Pecos, spring-June; much of w. and n. U.S.

Var. *minor* Hook. Leaflets thick, narrow (1-4 mm. broad), linear to linear-oblong, at apex rounded or truncate, entire, the few lateral veins scarcely branched and forming a very narrow angle with the midrib. Rare in the higher parts of the Plains Country, May-June; much of w. U.S.

55. LATHYRUS L.¹⁰¹

PEA-VINE

Unarmed annual or perennial herbs or usually trailing or climbing vines; leaves alternate, once-paripinnately-compound, the rachis terminating in a simple or branched tendril; stipules present, persistent, usually semisagittate; leaflets 2 to 14, often linear or oblong but very variable, entire; flowers solitary to several in axillary racemes; calyx with a campanulate tube and 5 teeth or lobes, the lower lobes longer than the upper; corolla papilionaceous, white, pink, red or purplish, the wings free from the keel or nearly so but wings and keel closely fitted together in a common groove; stamens 10, diadelphous, nine filaments coalescent, the uppermost one free; style flattened, barbate on the ventral (upper) surface for about half its length, persistent; fruit a linear to oblong 2-valved several-seeded thin-walled promptly dehiscent legume, usually somewhat flattened.

A genus of about 120 species of the temperate regions of the world (except Australia).

1. Leaflets 2 (2)

1. Leaflets 4 to 14 (4)

2(1). Perennial; flowers 15 mm. long or more; pods 6-10 cm. long
.....3. *L. latifolius*.

2. Annuals; flowers 15 mm. long or less; pods 2-4 cm. long (3)

3(2). Pods and ovary pubescent, 5-8 mm. broad; introduced (cultivated) species
.....1. *L. hirsutus*.

3. Pods and ovary glabrous, 2-4 mm. broad; native species .2. *L. pusillus*.

4(1). Tendrils bristlelike, simple, not at all prehensile ..5. *L. polymorphus* subsp.
incanus.

4. Tendrils well-developed, prehensile, forked (5)

5(4). Leaflets 4 to 10, 10 times as long as wide; plants of Trans-Pecos Texas
.....6. *L. graminifolius*.

5. Leaflets (8 or) 10 to 14, 2 to 5 times as long as wide; plants of east and north-central Texas4. *L. venosus*.

1. *Lathyrus hirsutus* L. SINGLETARY PEA. Annual, sparingly hirsute (especially the stipules and calyxes); stems 2-10 dm. long, usually clambering, narrowly to broadly winged; stipules linear-lanceolate, usually entire, the upper lobe the larger, scarcely a fourth as long as the 2-linear-lanceolate to elliptic 3-8 cm. long leaflets; tendrils well-developed, branched; flowers 9-12 mm. long, red to bluish, 1 or 2 (to 4) per peduncle; peduncles usually exceeding leaves, often projecting past base of uppermost pedicel as a small brittle; calyx 5-7 mm. long, the teeth lanceolate or narrowly ovate-lanceolate and about equal to or slightly longer than the tube; banner broadly obcordate, the blade twice as long as the claw; wings and keel with claw somewhat shorter than blade; pod 25-40

¹⁰¹ Adapted largely from C. Leo Hitchcock in Univ. Wash. Publ., Biol. 15:1-104. 1952.

mm. long, 5-8 mm. broad, conspicuously hirsute with pustulose-based hairs, 4- to 10-seeded. Rare on roadsides, e. and n.-cen. Tex., spring; Eur., now widely escaped from introd.

2. *Lathyrus pusillus* Ell. Sparsely pubescent annual; stems prostrate to clambering or erect, 3-6 dm. long, narrowly to broadly winged; stipules lanceolate to lance-ovate, the upper lobe 2 to 3 times as long as the lower, the whole a third to three fourths the length of the 2 linear-lanceolate to elliptic 3-7 cm. long leaflets; tendrils well-developed, usually branched; flowers usually 2, about 1 cm. long, bluish; calyx 5-8 mm. long, the linear-lanceolate teeth about twice as long as tube; banner narrowly obcordate, scarcely delimited into blade and claw, reflexed but slightly; wings and keel narrow with claw somewhat shorter than blade; pods 3-4 cm. long, 2-4 mm. broad, 10- to 20-seeded. Infrequent, e., s.e., and n.-cen. Tex., spring; Gulf States n. to s. Kan. and Mo.; also reportedly in n. Mex.

3. *Lathyrus latifolius* L. PERENNIAL SWEETPEA, EVERLASTING PEA. Perennial from rootstocks, glabrous; stems 8-20 dm. long, very broadly winged, climbing; stipules broadly lanceolate to ovate, 3-5 cm. long, usually entire, the upper lobe 2 to 3 times as long as lower, leaflets 2, lanceolate-elliptic to obovate-lanceolate, as much as 15 cm. long and 5 cm. broad; tendrils well-developed; racemes 5- to 15-flowered, the peduncles often considerably exceeding leaves; flowers 15-20 mm. long, pinkish-red (white, red or striped); calyx 8-12 mm. long, the linear-lanceolate teeth subequal to tube; banner well-reflexed, nearly as broad as long, short-clawed like the wings and keel; pods 6-10 cm. long, 7-10 mm. broad, 10- to 25-seeded. Rarely escaped or persisting at old home-sites, spring; nat. of Old World, widely introd.

The seeds are poisonous.

4. *Lathyrus venosus* Willd. var. *intonsus* Butt. & St. John. Perennial from rootstocks, pubescent; stems 4-10 dm. long, erect or scandent; stipules linear-lanceolate to lanceolate, a sixth to half as long as leaflets, often constricted into 2 lobes, the margins entire to shallowly dentate; leaflets (8 or) 10 or 12 (or 14), paired or more frequently scattered, 3-6 cm. long, 1-3 cm. broad, narrowly to broadly elliptic or ovate-elliptic, thin to subcoriaceous, usually paler on lower surface, glabrous to densely short-pubescent; tendrils well-developed; racemes usually closely 5- to 25-flowered; peduncles from about half as long as to nearly equal the leaves; flowers 12-20 mm. long, bluish or purplish; calyx glabrous to hairy, 8-14 mm. long, the deltoid upper teeth scarcely as long as the lower lateral ones that are lanceolate to linear-lanceolate, these slightly shorter than but usually broader than the lowest tooth; fruits 4-6 cm. long, 5-8 mm. broad. Occasionally in open woods in n.e. Tex., Apr.-May; s. Can. through n.-cen. U.S., s. to Ga., Ala., Ark., Okla. and Tex.

5. *Lathyrus polymorphus* Nutt. subsp. *incanus* (Sm. & Rydb.) C. L. Hitchc. Perennial, simple or branched, 1-2 (-4) dm. long, villous or hirsute throughout; stems not winged; leaves 2-5 cm. long; stipules from less than half as long to nearly as long as leaflets, upper lobe narrowly lanceolate, lower lobe much shorter, a tooth often present at their juncture; leaflets 4 to 12 (commonly about 8), usually paired but often scattered, mostly 2-3 cm. long, linear or linear-elliptic to linear-oblong-elliptic or the shorter ones oblong-elliptic, 1.5-6 (usually 2-3) mm. broad, rather prominently veined; rachis rather broad but not winged, prolonged as a straight or curved nonprehensile bristle; racemes 2- to 5- (to 8-) flowered, the peduncles usually slightly surpassing leaves, to 6-7 cm. long; pedicels usually ascending and straight or nearly so; flowers 2-3 cm. long; calyx (7-) 8-10 (-11) mm. long, the teeth somewhat shorter than tube and all rather narrowly lanceolate, the upper 2 teeth not much shorter than the lower 3; corolla ochroleucous to magenta or deep-violet; pods coriaceous, 2-6 cm. long, 5-10 mm. broad, 2- to 10-seeded. The correct name for the species may be *L. decaphyllus* Pursh. Very rare in the Plains Country, known from one collection from Childress Co., Mar.; the species as a whole from S.D., Wyo., Neb., Colo., Kan., Okla. and Tex.

6. *Lathyrus graminifolius* (Wats.) White. Perennial from rootstocks, glabrous or sparsely hairy; stems 2-6 dm. long, erect or clambering, not winged; stipules linear-lanceolate; leaflets mostly 6 or 8 (4 to 10), usually scattered, linear, 4-13 cm. long, 1.5-4 (-15) mm. broad, usually at least 10 times as long as broad; tendrils well-developed; racemes (2- to) 4- to 20-flowered, often greatly exceeding leaves; flowers 12-16 mm.

long; calyx glabrous except for cilia or a few coarse hairs at base of tube, 6-8 mm. long, the linear-lanceolate teeth subequal or the upper 2 much shorter with all shorter than the tube; banner from pale-pink to rather deep bluish-orchid; wings white to pale-orchid; keel white or tip slightly colored; pods 3-5 cm. long, 4-7 mm. broad, 8- to 15-seeded. Higher parts of the Trans-Pecos mts., spring; Ariz., N.M., Son., Chih. and Tex.

56. CLITORIA L. PIGEON-WINGS. BUTTERFLY PEA

A genus of about 35 species mostly in warmer parts of the world. One species, *C. ternata* L., with 5 to 7 leaflets, is cultivated sometimes in Texas, but is not known as a wild plant.

1. *Clitoria mariana* L. Perennial herb; stems slender, 2-10 dm. long, suberect to trailing or scandent (never twining); leaves alternate, pinnately trifoliolate, 5-13 cm. long; stipules subulate, 3-10 mm. long; petioles well-developed, usually (2-) 3-7 cm. long; leaflets usually lance-ovate, (15-) 20-80 mm. long, acute, entire, much paler below than above; stipels present, setaceous, persistent; flowers 4-6 cm. long, solitary or in twos or threes on axillary peduncles that are usually a little shorter than the petioles; calyx with a slightly flaring tube 1-2 cm. long and 5 deltoid-acuminate teeth (the lower usually slightly longer than the upper); corolla papilionaceous, very large, bluish or lavender (the banner with a pale lozenge in the center); stamens diadelphous, 9 of the filaments coalescent, the tenth (uppermost) free; fruit a stipitate beaked 4- to 10-seeded flattened 2-valved promptly dehiscent legume 4-8 cm. long; seeds glutinous-sticky. Frequent in e. half of state w. to Eastland and Llano cos. and s. to Travis and Bastrop cos., May-Sept.; mostly e. U.S.; also reportedly in Ariz.

57. CENTROSEMA (DC.) BENTH. BUTTERFLY PEA

A genus of about 30 species of the warmer parts of the Americas.

1. *Centrosema virginianum* (L.) Benth. Perennial herbaceous vine; stems 2-16 dm. long, trailing or usually vigorously twining; leaves alternate, pinnately trifoliolate, 3-10 cm. long; petioles well-developed, often nearly as long as the leaflets; stipules setaceous, 2-5 mm. long, often deciduous; leaflets linear to ovate (quite variable), (1-) 2-6 (-8) cm. long, entire; stipels present, setaceous, fairly persistent, minute; flowers solitary (or in twos), pedicellate at the ends of axillary peduncles usually shorter than the foliage, each pedicel with 2 membranous bracts 3-5 mm. broad; flowers 2-3 cm. long; calyx deeply 5-lobed, the acute lobes longer than the cuplike tube; corolla papilionaceous, purplish or lavender to nearly white; banner with a small spur near the median base; stamens 10, diadelphous, 9 filaments coalescent, the tenth (uppermost) free; fruit a stipitate long-beaked linear 2-valved 4- to 10-seeded pod 4-12 cm. long. Frequent, e. half of Tex. w. to Erath, San Saba, Llano and Brooks cos., Mar.-Nov.; s.e. U.S.; e. Mex.

58. AMPHICARPAEA NUTT.¹⁰² HOG PEANUT

A genus of 3 species, 1 Asian, 1 African and 1 North American, all closely related to each other. The generic name is sometimes spelled *Amphicarpa*.

1. *Amphicarpaea bracteata* (L.) Fern. Taprooted annual; stems 2-20 dm. long, twining, glabrous or pubescent; leaves alternate, pinnately trifoliolate; petioles 2-10 cm. long; stipules persistent, membranous, 3-8 mm. long, broadly lanceolate to ovate; leaflets ovate to nearly deltoid, acute at apex, 1.2 to 2 times as long as broad, 2-10 cm. long, 18-70 mm. broad; rachis stalk of terminal leaflets 5-40 mm. long; flowers of two sorts; *chasmogamous flowers* in axillary racemes 15-90 (-150) mm. long; peduncle 1-4 (-6) cm. long; pedicels 2-4 (-5) mm. long, each subtended by 2 bracts; bracts 2-4 (-5) mm. long, ovate to fan-shaped, broadest above the middle, broadly obtuse to nearly truncate at apex; calyx of a tube which is more or less gibbous at base and 4-5 (-6) mm. long and 4 broadly lanceolate to deltoid lobes 0.5-2 mm. long; corolla papilionaceous, lilac-colored or nearly white; *cleistogamous flowers* either aerial or subterranean, usually produced on creeping

¹⁰² Adapted from B. L. Turner and O. S. Fearing in Southw. Nat. 9:207-218. 1964.

branches near the ground and commonly lacking well-developed petals and often with the ovary stipe reflexed to position the stigma next to the reduced androecium; stamens 10, diadelphous, 9 filaments coalescent, the tenth (uppermost) free; fruit a flattened thin-walled legume, often decidedly falcate. Infrequent in woods, e. and s.e. Tex., rare w. to n.-cen. Tex., May-Sept.; s.e. Can. and e. U.S.; also rare near Orizaba, Ver.

59. COLOGANIA KUNTH¹⁰³

Perennial herbs; stems procumbent (or erect), often twining, 1-15 dm. long, appressed-pubescent; leaves pinnately trifoliolate; petioles to 10 cm. long; stipules linear to ovate, 6- to 12-nerved, persistent; stipels linear to lanceolate; leaflets linear to ovate or obovate to oblong, at base varying from obliquely acute to rounded or rarely cordate, at apex acute to obtuse or rounded; flowers axillary, solitary or in pairs or rarely in axillary clusters, sometimes in racemes of reduced umbel-like aggregations; calyx gibbous at base, with a tube two thirds the total length and 4 lobes (the upper lobe representing 2 coalescent lobes); corolla papilionaceous, purple, sometimes magenta, reddish or reddish-purple to generally deep-royal-purple, rarely becoming bluish with white margins in age; banner 17-32 mm. long, 10-18 mm. broad, clawed; wings 15-22 mm. long, 2-6 mm. broad, auriculate at upper base, clawed; stamens 10, diadelphous, 9 filaments coalescent, the tenth (uppermost) free; fruit a linear to falcate legume, nearly terete at maturity, usually producing 6 to 12 seeds; cleistogamous flowers also commonly occur, these being reduced in size and commonly with parts (especially petals) lacking and with the style reflexed and juxtaposed to the reduced androecium.

A genus of about 10 species of mountainous areas of southwestern United States, Mexico, Central America and South America, difficult taxonomically because of cleistogamic reproduction and possibly hybridization. Plants rather closely related to *Cologania* and *Amphicarpaea* are soybean [*Glycine Max* (L.) Merr.] varieties found at edges of fields in e. Tex.; soybeans have distinctly 5-lobed calyxes instead of 4-lobed as in *Cologania*.

- 1. Leaflets ovate to lanceolate, 1 to 5 times as long as wide 1. *C. pallida*.
- 1. Leaflets linear, 5 to 20 times longer than wide 2. *C. angustifolia*.

1. *Cologania pallida* Rose. Stems 15-45 cm. long; petioles 1-3 cm. long; stipules 3-4 mm. long; leaflets ovate to elliptic, at base somewhat rounded to acute, at apex acute, sericeous and pale-green on both surfaces, mucronate; rachis stalk of terminal leaflet 6-10 mm. long; pedicels 12-14 mm. long; corolla purple; fruit 4-6 cm. long, 4-5 mm. broad. Davis and Guadalupe mts. in the Trans-Pecos, at elev. above 4,000 ft., July-Oct.; N.M., Ariz., Tex. and Coah.

Occasional populations exhibit evidence of past hybridization of this species and the next.

2. *Cologania angustifolia* H.B.K. Stems 15-50 cm. long; petioles 1-6 (-8) cm. long; stipules 2-4 mm. long; leaflets linear, 5 to 20 times as long as broad, 25-80 (-100) mm. long, 2-10 mm. broad; rachis stalk of terminal leaflets 3-8 mm. long; pedicels 5-8 mm. long; corolla purple to reddish-purple. *C. longifolia* Gray, *C. confusa* Rose. Davis and Chisos mts. in the Trans-Pecos, at elev. of 4,500 to 6,500 ft., July-Oct.; Ariz., N.M. and Tex., s.e. to Oax.

60. APIOS BOEHM. POTATO BEAN. GROUNDNUT

A genus of about 8 species of temperate eastern Asia and North America.

1. *Apios americana* Medic. AMERICAN POTATO BEAN. Perennial from tuberous rhizomes; stems annual, 1-3 m. long; twining and high-climbing; leaves alternate, once-pinnately 5- or 7-foliolate; petioles 15-70 mm. long; stipules setaceous, soon deciduous, 4-6 mm.

¹⁰³ Adapted with permission from the work of Olin S. Fearing, "A cytotaxonomic study of the genus *Cologania* and its relationship to *Amphicarpaea* (Leguminosae-Papilionoideae)," a doctoral dissertation done and filed at the University of Texas (1959).

long; rachis stalk of terminal leaflet and rachis internodes 1-3 cm. long; leaflets mostly ovate to lance-ovate, acuminate, rounded at base, (15-) 20-70 (-100) mm. long, pubescent usually; stipels 1-2 mm. long, deciduous; flowers in rather dense axillary racemes usually shorter than the foliage; peduncles (2-) 3-5 cm. long; pedicels only 2-6 mm. long, each with 2 minute promptly deciduous bractlets; calyx 5-11 mm. high, nearly truncate or the 5 sepals distinguishable only as slight undulations at the rim of the tube; corolla papilionaceous, about 1 cm. long; banner whitish dorsally, brown-red ventrally; keel sickle-shaped, very slender, brownish-red; wings down-curved, brown-purple; stamens 10, diadelphous, 9 filaments coalescent, the tenth (uppermost) free; fruit a linear slightly flattened legume 5-10 (-12) cm. long, 4-6 (-7) mm. broad, with coriaceous valves. Incl. var. *turrigera* Fern. Infrequent in e., s.e. and n.-cen. Tex., rare in Edwards Plateau (Tom Green Co.), usually in woods near streams, reported from Hemphill Co. in the Panhandle, May-Sept.; s.e. Can. and e. U.S.

61. ERYTHRINA L.

CORAL BEAN. COLORÍN

A genus of about 40 species of the warmer parts of the world. In addition to our native species, a South American species is cultivated in Texas, *E. crista-galli* L. It is a brilliantly red-flowered vine or tree, the flowers about 4 cm. long and 25 mm. broad.

1. *Erythrina herbacea* L. Thorny shrub or subshrub (at this latitude the branches tend to die back nearly to the ground each winter) with rather rigidly ascending stems 5-20 dm. tall, often growing up through other shrubby vegetation; leaves remote, alternate, once-pinnately 3-foliolate; terminal leaflet hastately 3-lobed to broadly hastately deltoid, 2-13 cm. long, 2-11 cm. broad, at apex long-acuminate, at base truncate or broadly cuneate; rachis 20-75 mm. long; petioles and rachises of leaves sometimes spiny; stipules and stipels present; flowers in a terminal raceme; peduncle very long and erect, 20-75 cm. long; pedicels 3-9 mm. long; calyx nearly tubular, gibbous or spurred basally, 5.5-11.5 mm. long on the lower side, 5-10 mm. long on the upper side, denticulate or entire at rim; corolla red, papilionaceous but this obscure because the entire structure is narrow and elongate (30-53 mm. long) and appears tubular on cursory examination; keel petals connate; stamens 10, monadelphous or diadelphous; fruit a torulose tardily dehiscent 2-valved subligneous several-seeded beaked blackish legume 75-210 mm. long; seeds scarlet, 5-13 mm. long, 4-8 mm. broad. Sandy woods on the Coastal Plain inland to Cass, Walker, Washington, Bastrop and Gonzales cos., cult. elsewhere, Apr.-June; Coastal States, N.C. to Ver., inland to S.L.P.

62. GALACTIA P. BR.

MILKPEA

Perennials with (rarely erect or) prostrate or trailing or usually twining and climbing herbaceous stems 3-30 dm. long; leaves alternate, once-pinnately 3- to 7-foliolate or in one species simple by reduction; stipules present, usually small and more or less early-deciduous; leaflets entire, variously shaped, usually firm-textured; stipels usually developed, minute and setaceous; flowers 1 or few to numerous in axillary racemes; peduncles short to long; calyx with a short nearly symmetrically campanulate tube and 4 longer acute lobes (the upper one representing the coalescence of 2 lobes); corolla (rarely absent, as in the cleistogamous flowers of *G. canescens*) papilionaceous, white to pink or lavender or purple (never yellow), 6-15 mm. long; stamens 10, diadelphous, 9 of the filaments coalescent, the tenth (uppermost) free; fruit a linear legume several cm. long, with several seeds (except the subterranean fruits of *G. canescens* which are 1-seeded and indehiscent).

A genus of about 50 species in the warmer parts of the world.

1. Leaves simple 10. *G. marginalis*.

1. Leaves compound, 3- to 5-foliolate (2)

2(1). Leaves nearly sessile, the petioles 1-3 mm. long 6. *G. longifolia*.

2. Leaves with well-developed petioles, these 6 mm. long or more (3)

3(2). At least some of the leaves 5-foliolate 8. *G. heterophylla*.

3. Leaflets 3, never 5 (4)

- 4(3). Stems short, erect, 3 dm. tall or less, not at all trailing or twining; flowers white
..... 9. *G. erecta*.
4. Stems elongate, trailing or twining; flowers lavender to pink (5)
- 5(4). Pods both subterranean and aerial; stems trailing but not twining; racemes 2 to 7
at the nodes; leaflets thick, leathery, the veins conspicuous and reticulate beneath
..... 7. *G. canescens*.
5. Pods never developing below soil surface; stems usually conspicuously twining (at
least at the tips); racemes 1 or 2 at the nodes, seldom more; leaflets thin, not
leathery or conspicuously reticulate beneath except in *G. texana* (6)
- 6(5). Peduncle plus raceme slender, elongate, the well-developed ones 1 dm. long or
more 3. *G. Macreei*.
6. Peduncle plus raceme short, mostly 1 dm. long or less (7)
- 7(6). Leaflets elliptic-linear to linear-oblong, 2 to 5 times longer than wide; flowers
10-14 mm. long; plants of Trans-Pecos Texas 5. *G. Wrightii*.
7. Leaflets commonly ovate to oval, rarely elliptical-linear, mostly 1 to 2 (sometimes 4)
times as long as wide; flowers 6-12 mm. long; plants of central and east Texas (8)
- 8(7). Legume distinctly falcate; leaves thick and leathery, conspicuously reticulate-
veined beneath; plants of rocky limestone soils in south-central Texas
..... 4. *G. texana*.
8. Legume straight or nearly so, the base or tip sometimes curved, but the whole legume
scarcely falcate; leaves thin, not conspicuously reticulate-veined beneath; plants of
sandy or gravelly soils in eastern Texas, rarely occurring on adjacent calcareous
soils (9)
- 9(8). Stems depressed, rarely twining except at tips, minutely puberulent; leaflets short-
strigose to glabrous on lower surface; calyx strigillose to glabrous, 6-9 mm. long;
keel petals 10-14 mm. long 1. *G. regularis*.
9. Stems and branches intricately twining, divergently or retrorsely pilose; leaflets pilose
beneath; calyx spreading-pilose, 4-5.5 mm. long; keel petals 6-10 mm. long
..... 2. *G. volubilis*.

1. *Galactia regularis* (L.) B.S.P. Stem prostrate or depressed, twining (if at all) only at tip, minutely puberulent; leaflets 3, elliptic to ovate-oblong, firm, short-strigose to glabrous beneath; peduncles and rachises of racemes stiff, minutely puberulent, 2-11 cm. long; fully developed but unexpanded calyces strigillose to glabrous, straight or nearly so, 6-9 mm. long, their basal bracts ovate; corolla violet-purple; keel petals 10-14 mm. long; legume canescent-strigose, 2-5 cm. long. Dry sandy soil in s.e. Tex., June-Aug.; Fla. to Tex., n. to N.Y., Pa. and Tenn.

2. *Galactia volubilis* (L.) Britt. DOWNY MILKPEA. Stems twining, 5-15 dm. long, sparsely to densely puberulent with spreading hairs; leaflets 3, mostly narrow to broadly oblong, oblong-ovate or elliptic with an obtuse to broadly rounded or even cordate base, glabrous or nearly so above, (1-) 2-4 (-6) cm. long, 10-25 (-35) mm. broad, thin or membranous and not conspicuously reticulate-veined beneath; peduncle and raceme together usually less than 1 dm. long, only 1 or 2 at any one node; flowers 6-12 mm. long, in clusters of 1 to 3 about 5-20 mm. apart on spreading pedicels (1-) 2-3 (-4) mm. long; corolla 6-10 mm. long, pink to roseate; legume always aerial, 20-55 mm. long, straight or nearly so, densely pubescent with spreading hairs. *G. mississippiensis* (Vail) Rydb. Frequent in woodlands, e. half of Tex. s. and w. to Palo Pinto, Burnet and Cameron cos., June-Aug.; most of e. U.S.

3. *Galactia Macreei* M.A.Curtis. Stems twining, 5-15 dm. long, with a minute retrorsely appressed pubescence; leaflets 3, mostly oblong to oblong-linear to oblong-ovate and sometimes oblong-lanceolate or elliptic, with a usually broadly rounded or obtuse but occasionally somewhat cordate base, (1-) 2-4 (-5) cm. long, 5-20 mm. broad, usually (1.5 to) 2 to 4 times as long as broad, thin or membranous and not conspicuously reticulate-veined beneath; peduncle and raceme together usually 1-3 dm. long (1) or even longer, slender to filiform, only 1 or 2 racemes at any node; flowers 11-15 mm. long, solitary or in twos or threes on retrorsely-appressed-puberulent spreading pedicels about 1-3 mm. long; corolla 10-14 mm. long, purple or pink with purple center; legume always

aerial, 3-7 cm. long, straight or nearly so, appressed-pubescent. Infrequent or rare in woodlands on sandy soil, n.e. Tex., July-Sept.; Coastal States, Va. to Tex. Seeming to intergrade somewhat with *G. volubilis*.

4. *Galactia texana* (Scheele) Gray. TEXAS MILKPEA. Stems twining, 3-15 dm. long; leaflets 3, ovate to elliptic, mostly 1 to 2 (to 4) times as long as broad, 1-6 cm. long, thickish and subcoriaceous, conspicuously reticulate-veined beneath; peduncle and raceme together less than 1 dm. long, raceme only 1 or 2 at any node; flowers 8-14 mm. long, all aerial, solitary or in twos or threes on short spreading pedicels at each node of the raceme; corolla lavender to lavender-pink; legumes all aerial, distinctly falcate, otherwise like those of *G. volubilis*. Rare in rocky calcareous canyons and stream-bottoms, Rio Grande Plains and s. part of Edwards Plateau (Kerr, Val Verde and Zavala cos.), summer; endemic.

5. *Galactia Wrightii* Gray. Stems twining, 3-15 dm. long; leaflets 3, elliptic-linear to linear-oblong, 2 to 5 times as long as broad, grayish, thickish or firm; peduncle and raceme together usually but not always less than 1 dm. long, only one raceme at any node; flowers solitary or in twos or threes on short spreading pedicels at each raceme node, 10-14 mm. long; corolla lavender or lavender-pink; legume always aerial, 2-6 cm. long, straight or nearly so. Frequent in Trans-Pecos mts., elev. 4,500-6,000 ft., May-Sept.; Ariz., N.M., Tex., Chih. and Son. Closely related to *G. volubilis* and separable mainly on geographic basis.

6. *Galactia longifolia* Hoehne. Stems twining, 6-20 dm. long; leaflets 3, mostly oblong to linear-oblong; petioles (0-) 1-3 mm. long; corolla pink or lavender; fruit always aerial, nearly straight, several cm. long. Very local in coastal Tex. (Aransas, Calhoun and Jackson cos.) where it was probably introd. from S.A., July-Sept.; Tex., Braz., Parag. and Arg.

7. *Galactia canescens* Benth. HOARY MILKPEA. Stems (5-) 10-30 dm. long, prostrate or less commonly trailing, *never* twining; leaflets 3, about like those of *G. texana*, firm and conspicuously reticulate beneath, often grayish or canescent; racemes often several per node, of 2 sorts: (1) short, aerial ones with (presumably chasmogamous) pinkish flowers and nearly straight legumes several cm. long, and (2) very short (usually 1-flowered) subterranean racemes with ecorollate cleistogamous flowers and small peanut-like 1-seeded indehiscent pods. Loose exposed sand, frequent in the sandy eolian plain of the Rio Grande Plains, infrequent or rare n. to Medina, Comal, Travis and Bastrop cos., with an outlying station in Somervell Co., Apr.-July; endemic.

8. *Galactia heterophylla* Gray. Stems 5-60 cm. long, prostrate or trailing, numerous; leaflets mostly oblanceolate, 1-3 cm. long, on most leaves 5 (on a few leaves 3), the 2 lower pairs attached at the same place, the terminal leaflet on a rachis stalk 1-4 mm. long; racemes very short, few-flowered; corolla mostly lavender (the banner often white dorsally); legume several cm. long, always aerial. *G. Grayi* Vail, a superfluous illegit. name. Sandy loam of Rio Grande Plains, infrequent also in Llano region on the Edwards Plateau, Apr.-Sept.; endemic.

9. *Galactia erecta* (Walt.) Vail. Stems 1-3 dm. long, stiffly erect, solitary, often zigzag or geniculate; leaflets 3, mostly linear-oblong, 15-50 mm. long, 7-18 mm. broad; racemes very short, axillary, few-flowered; corolla about 7-8 mm. long, essentially pure-white; legumes 2-4 cm. long, 5-8 mm. broad. Rare in deep pine-duff and podsol, long-leaf pine forests of Polk and Tyler cos., e. Tex., May-June; Coastal States, N.C. to Tex.

10. *Galactia marginalis* Benth. Stems ascending, 1-3 dm. long; leaves few, seemingly simple (by reduction), firm, lustrous, entire, broadly oblanceolate, at apex usually rounded, long-tapered to base; racemes so reduced that flowers usually appear solitary and sessile in axils; corolla 11-15 mm. long, purple. *G. heterophylla* (H. & A.) Vail, an illegit. name. Rare in sandy prairies or caliche areas, coastal Tex. from Kleberg to Matagorda Co. and inland to Travis, Karnes and Jim Wells cos., Mar.-Sept.; also Mex., C.A. and S.A.

The enlarged root is edible and formerly was used extensively. The species tends to disappear in grazed ranges and is now quite rare.

63. DIOCLEA H.B.K.

An American tropical genus of about 25 species, only one species reaching the United States.

1. *Dioclea multiflora* (T.&G.) Mohr. Said to be "semiwoody or woody" but ours appearing merely perennial; high-climbing or trailing twining vines; leaves alternate, once-pinnately-trifoliolate; petioles of well-developed leaves often 1-2 dm. long; stipules minute and quickly deciduous; rachis stalk of terminal leaflet (3-) 4-6 cm. long; leaflets usually orbicular, varying from very broadly ovate to subreniform, 5-15 cm. across, entire, apiculate; petiolules 3-6 mm. long, darkly pigmented; stipels minute or obsolescent; peduncles 7-11 cm. long, solitary, axillary, ascending, racemes 2-5 cm. long; calyx about 7 mm. long, with a tube about half the total length and 4 lobes (the upper representing 2 coalescent lobes); corolla 15-20 mm. long, papilionaceous, partly roseate (drying lavender), partly white; stamens 10, monadelphous, the uppermost filament free at the very base and for most of the distal half, coalescent with the rest only briefly; fruit a dry flattened oblong elastically dehiscent legume about 5-6 cm. long, often coriaceous. Rare, known only from woods along Mills Creek, 11 miles west of Kirbyville, Jasper Co. and just below Town Bluff Lake in Tyler Co., e. Tex., May; Ga., Fla., w. to Ark. and Tex.

64. PUERARIA DC.

An Asiatic genus of about 10 or 15 species, of which at least one is widely introduced.

1. *Pueraria lobata* (Willd.) Ohwi. KUDZU. Perennial; stems more or less villous and woody, twining and very high-climbing (up to 20 m., rarely to 30 m.); leaves alternate, once-pinnately-trifoliolate; petioles very elongate, often as long as the rest of the leaf; stipules ovate-lanceolate, the lower portion more or less adnate to the stem, mostly 8-12 mm. long; leaflets ovate-rhombic or ovate to more or less rotund, entire or often deeply 2- or 3-lobed, abruptly tapering to an acuminate tip, pubescent beneath, 5-12 (-20) cm. long; petiolules 3-10 mm. long; stipels setaceous, 5-9 mm. long; flowers in axillary racemes (5-) 10-20 (-30) cm. long; pedicels 2-8 mm. long; peduncle, rachis and pedicels densely appressed-silky-pubescent; calyx about 9-10 mm. long, with a tube a little less than half the total length and 4 lobes (the uppermost representing 2 coalescent lobes); corolla papilionaceous, 15-25 mm. long, violet-purple to reddish-purple; stamens 10, monadelphous, the uppermost filament coalescent to the rest only briefly, free at both ends; fruit a flattened elongate linear-oblong several-seeded thin-valved dehiscent legume 4-5 cm. long, tawny to red-brown-villous throughout. *P. Thunbergiana* (Sieb. & Zucc.) Benth. Frequent along road shoulders, e. and s.e. Tex., spring-fall; nat. to China and perhaps elsewhere, now widely introd. in warm-temperate moist regions.

Used as a ground cover and green manure, and by misguided highway landscapers to protect embankments from erosion, etc. It should be considered as a noxious weed since it has the capability of choking out all native vegetation. According to some authorities, the combined aggressiveness of this species and the Japanese honeysuckle (*Lonicera japonica*) may eventually have a telling influence upon forest reproduction in some parts of southeastern United States.

65. CANAVALIA DC.¹⁰⁴

JACKBEAN. SWORDBEAN

A genus of 51 species of the tropical and subtropical parts of the world. In addition to the species below, the horse bean, *C. ensiformis* (L.) DC., with ovate-elliptic leaflets, has been cultivated in Texas.

1. *Canavalia maritima* (Aubl.) Thou. Stems trailing or often twining, 5-30 dm. long or more; root presumably perennial; leaves alternate, once-pinnately-trifoliolate; stipules caducous; leaflets 3, subcoriaceous, oblong to nearly orbicular, 6-12 cm. long, obtuse to emarginate, often apiculate; petiolules developed; stipels subulate; flowers in axillary racemes with 2 or 3 pedicels at each node of the raceme, commonly resupinate; pedicels 3 mm. long; calyx 12 mm. long, bilabiate, the tube almost half the total length, the upper lip representing 2 coalescent lobes, the lower lip composed of 3 very short lobes, all pubescent; corolla papilionaceous, about 3 cm. long, pale-violet or lavender; stamens 10, monadelphous, the uppermost filament coalescent only briefly to the rest, free at both ends; fruit a coriaceous dehiscent legume about 15 cm. long and 25 mm.

¹⁰⁴ Adapted from Jonathan Sauer in *Brittonia* 16:106-181. 1964.

broad, moderately compressed, the 2 valves separating into a thick outer layer and thin inner layer; seeds $18 \times 13 \times 10$ mm., brown with darker marbling. Infrequent or rare, perhaps not persistent, in loose sand near the Gulf beaches, Padre Island, s. Tex., all year; on warm seabeaches throughout the world.

66. RHYNCHOSIA LOUR.¹⁰⁵

SNOUTBEAN

Climbing, trailing or erect perennials; stems 1 to several; leaves alternate, 1- or 3-foliolate; stipules present; blades entire, resinous-dotted, papilionaceous hairs present on upper and lower surface; stipels usually present; flowers peduncled or in axillary or terminal racemes; calyx bilabiate, with a short campanulate tube and 5 longer lanceolate lobes; corolla papilionaceous, yellow, sometimes tinged with red, purple or brown (especially on the standard); stamens 10, diadelphous, with 9 filaments fused, the upper one free; fruit a legume, flattened, oblong to orbicular or scimitar-shaped, mostly 1- or 2-seeded. *Dolicholus* Medic.

A genus of about 150 species in tropical and subtropical regions of both hemispheres.

1. Calyx not foliaceous; corolla exceeding the calyx (2)
1. Calyx foliaceous; corolla equal to or shorter than the calyx (4)
- 2(1). Flowers axillary 2. *R. texana*.
2. Flowers in racemes (3)
- 3(2). Longest terminal leaflets 15-37 mm. 1. *R. minima* var. *minima*.
3. Longest terminal leaflets 4.5-15 mm. 1. *R. minima* var. *diminifolia*.
- 4(1). Plants trailing or twining (5)
4. Plants erect (7)
- 5(4). Leaves unifoliolate, reniform 5. *R. americana*.
5. Leaves trifoliolate; leaflets ovate or ovate-rhombic (6)
- 6(5). Racemes very short-peduncled or sessile, less than 3.5 cm. long 3. *R. difformis*.
6. Racemes peduncled, 3-30 cm. long 4. *R. latifolia*.
- 7(4). Plants 15-90 cm. tall; leaves mostly trifoliolate; leaflets oval to elliptic 6. *R. tomentosa* var. *tomentosa*.
7. Plants 5-25 cm. tall; leaves mostly unifoliolate (at least toward the base), reniform to oval 7. *R. reniformis* var. *reniformis*.

1. *Rhynchosia minima* (L.) DC. var. *minima*. Stems trailing or twining, papilionaceous hairs descending to spreading (0.1-0.2 mm. long); leaves trifoliolate; longest rachis 17-62 mm.; longest leaflets 15-37 mm., rhombic to rhombic-orbicular, resin-dotted, sparingly pubescent; stipules lanceolate, 1.5-4.5 mm. long; flowers in axillary racemes 45-165 mm. long; calyx lobes narrowly lanceolate, 1.5-3 mm. long; corolla yellow (occasionally brown-tinged), 4-7 mm. long; legumes 12-20 mm. long, scimitar-shaped. *Dolicholus minimus* (L.) Medic. Frequent in the Coastal Plain inland to Newton, Houston, Travis, Bexar and Hidalgo cos., usually in clay soil, Apr.-Dec.; coastal Tex., La., Fla. and Ga.

Var. *diminifolia* Walraven. Stems trailing or twining, papilionaceous hairs descending to spreading (0.1-0.2 mm. long); leaves trifoliolate; longest rachis 8-28 mm.; longest leaflets 4-15 mm., rhombic to rhombic-orbicular, resin-dotted, sparingly pubescent; stipules lanceolate, 1.5-4.5 mm. long; flowers in axillary racemes 3-15 cm. long; calyx lobes narrowly lanceolate, 2-3.5 mm. long; corolla yellow (occasionally brown-tinged), 4.5-6.5 mm. long; legumes 9-17.5 mm. long, scimitar-shaped. Rare in Nueces and Cameron cos.; also coastal Fla. and Fla. Keys.

¹⁰⁵ Contributed by Wesley C. Walraven.

2. *Rhynchosia texana* T. & G. Stems trailing or twining, papilionaceous hairs ascending to descending (0.1-0.6 mm. long); leaves trifoliolate; longest rachis 8.5-12 mm., resin-dotted; stipules lanceolate, 1.3-4.5 mm. long; flowers 1 to 3, axillary; lower calyx lobe lanceolate, acuminate, 1.5-5 mm. long, the upper lobes shorter; corolla yellow, often tinged with red or brown, 3.5-7 mm. long; legumes scimitar-shaped, longest 11-19 mm. Incl. var. *angustifolia* Engelm., *Dolicholus texensis* (T. & G.) Vail. Frequent in calcareous and other soils, Trans-Pecos, Edwards Plateau, Rio Grande Plains and s. part of n.-cen. Tex., n. and e. to Mitchell, Palo Pinto, Dallas, McLennan, Brazos, Austin and Calhoun cos., Apr.-Oct.; Tex. to Ariz. and n. Mex.; Parag., Arg.

3. *Rhynchosia difformis* (Ell.) DC. Stems trailing or twining, papilionaceous hairs descending (0.2-1.5 mm. long); leaves mostly trifoliolate; longest rachis 18-56 mm.; longest leaflets 24-52 mm., ovate, pubescent, resin-dotted; flowers in short congested axillary racemes or glomerules to 35 mm. long; calyx lobes lanceolate to linear, 6-13 mm. long; corolla yellow, 5.5-11 mm. long; legumes 14-21 mm. long, 6-8 mm. broad, pubescent. *R. tomentosa* var. *volubilis* (Michx.) T. & G., *R. volubilis* (Michx.) Wood, *R. tomentosa sensu* Small. Very rare in e. Tex., known only from Smith and Montgomery cos., summer; Va. to Tex. and s. to n. Fla.

4. *Rhynchosia latifolia* (Nutt.) T. & G. Stems trailing or twining, papilionaceous hairs descending to spreading (0.5-1.1 mm. long); leaves trifoliolate; longest rachis 16-83 mm.; longest leaflets 30-77 mm., rotundly ovate to rotundly rhombic, resin-dotted; stipule 2.5-7.5 mm. long; flowers in elongate racemes 3-30 cm. long; calyx 8-15 mm. long; corolla yellow, 8.5-13 mm. long. *R. reticulata* var. *latifolia* (Nutt.) O. Ktze., *R. Torreyi* Vail, *Dolicholus latifolius* (Nutt.) Vail, *D. Torreyi* (Vail) Vail. Abundant in woodlands in sandy soil, e., s.e. and n.-cen. Tex., May-Aug.; Mo., s.w. to La. and Tex.

5. *Rhynchosia americana* (Mill.) C. Metz. Stems prostrate, trailing or twining, papilionaceous hairs spreading to descending (0.2-1 mm. long); leaves unifoliolate; longest petioles 14-47 mm.; longest blades 18-48 mm., reniform, resin-dotted; stipules 2.5-6.5 mm. long; longest raceme 2-20 mm., few-flowered; calyx 7-13 mm. long; corolla yellow, 6-10 mm. long; legumes 12-18 mm. long, 5-7 mm. broad. *R. menispermoidea* DC., *Dolicholus americanus* (Mill.) Vail. Frequent in sandy prairies and open woodlands on sandy or gravelly soil, Rio Grande Plains and n. to Comal, Bastrop, Fayette, Colorado and Harris cos., Mar.-Oct.; Tex., Tam. and Ver.

6. *Rhynchosia tomentosa* (L.) H. & A. var. *tomentosa*. Stems erect, never twining, 15-85 cm. tall, papilionaceous hairs ascending to descending (0.1-1.4 mm. long); leaves mostly trifoliolate; longest rachis 17-78 mm.; longest leaflets 28-61 mm., oval to elliptic, resin-dotted, often densely and softly pubescent; flowers several; axillary racemes compact and less than 3 cm. long; calyx 4-9 mm. long, the lobes lanceolate; corolla yellow, 4.5-8.5 mm. long; legume 13-19 mm. long, 5-7 mm. broad. *R. erecta* (Walt.) DC., *Dolicholus Drummondii* Vail, *D. erectus* (Walt.) Vail. Very rare in woodlands, e. Tex., summer; n. to D.C., Va., Ky. and Tenn.

7. *Rhynchosia reniformis* DC. var. *reniformis*. DOLLAR-LEAF. Stems erect, never twining, 4-22 cm. tall, papilionaceous hairs ascending to descending (0.2-1 mm. long); leaves unifoliolate; longest petioles 18-65 mm.; longest leaflets 25-54 mm., reniform or orbicular, often slightly cordate at base, resin-dotted; stipules 3-11 mm. long; racemes very reduced, often nearly sessile, 4-30 mm. long; calyx 4.5-10 mm. long, upper lobes ovate, lower lobes lanceolate; corolla yellow, 6-9.5 mm. long; legumes elliptic with lateral beaks, 11-19 mm. long, 4.5-7 mm. broad. *R. simplicifolia* (Walt.) Wood, *Dolicholus simplicifolius* (Walt.) Vail. Infrequent in pine woods, e. Tex., June-Sept.; Coastal States, N.C. to Tex. The author of the name is sometimes given incorrectly as "(Pursh) DC."

76. STROPHOSTYLES ELL.

FUZZY BEAN

Annual or perennial vinelike herbs; stems 1 or usually several, the early shoots erect but distally becoming trailing and often twining, (2-) 3-20 dm. long; stipules persistent; leaves alternate, petiolate, once-pinnately-trifoliolate; stipels present; racemes axillary, ascending, long-pedunculate (peduncles 5-30 cm. long), the raceme rachis very short so the flowers are few and racemes subcapitate; calyx with a short tube, more or less bilabiate, the upper 2 lobes almost completely coalescent; corolla papilionaceous, pink to purplish or cream-colored, 5-15 mm. long; keel very narrow and strongly curved

or sickle-shaped, the tip pointing back into the flower (but keel remaining in one plane, not contorted except slightly in *S. leiosperma* or spiral; cf. *Phaseolus*); stamens 10, diadelphous, 9 of the filaments coalescent, the tenth (uppermost) free; fruit a sessile linear slightly flattened short-beaked several-seeded promptly dehiscent legume; seeds usually pubescent (not in *S. leiosperma*).

A genus of 4 species of North America, very weakly distinguished from *Phaseolus* on the technical basis that the keel remains in a single vertical plane. Some authors, probably correctly, regard it as no more than a section of *Phaseolus*.

1. Flowers 5-8 mm. long; stalk of inflorescence (peduncle) slender, rarely exceeding 10 cm. in length; seeds 2-3 (-4) mm. long 3. *S. leiosperma*.

1. Flowers 9-15 mm. long; stalk of inflorescence stout, mostly 15 cm. or more in length; seeds 3-10 mm. long (2)

2(1). Bracts at base of individual flowers blunt, half as long as the calyx tube or less; leaflets without conspicuous lobes at base, 3 to 8 times as long as wide 2. *S. umbellata*.

2. Bracts at base of individual flowers acute, as long as the calyx tube or longer; leaflets lobed at base or (if not lobed) the leaflets 1 to 3 times as long as wide 1. *S. helvola*.

1. *Strophostyles helvola* (L.) Ell. AMBERIQUE BEAN. Annual (apparently); leaflets ovate or rhombic-ovate to ovate-oblong, or commonly 3-lobed and pandurate, with a mucronate broadly rounded to acute apex and broadly rounded to broadly cuneate base; peduncle stout, (9-) 15-30 cm. long; bracts at base of individual flower acutish, as long as calyx tube or longer; flowers 9-15 mm. long, mostly purplish; seeds 6-10 mm. long. *Phaseolus helvolus* L. Frequent in grasslands and open woodlands, usually on sandy soil, e., s.e. and n.-cen. Tex. rarely w. and s. to Eastland, Mason and Karnes cos., reported from Hemphill Co. in the Panhandle, June-Sept.; s. Can., e. U.S.

2. *Strophostyles umbellata* (Willd.) Britt. Perennial; leaflets narrowly (rarely broadly) ovate to lanceolate or narrowly oblong to rarely elliptic, 3 to 8 times as long as broad, never lobed, broadly rounded to acute at apex, broadly rounded (to cuneate) at base; peduncle stout, (9-) 12-30 cm. long; bracts at base of individual flowers blunt, half as long as the calyx tube or shorter; flowers 9-15 mm. long, mostly pale-purplish; seeds 3-6 mm. long. *Phaseolus umbellatus* (Willd.) Nutt. Frequent in e. and s.e. Tex., in sandy soils of pine woodlands, June-Sept.; e. U.S.

3. *Strophostyles leiosperma* (T.&G.) Piper. SLICK-SEED BEAN. Annual (apparently); leaflets nearly linear to lanceolate or lance-oblong to -elliptic, at apex acute to rounded, at base rounded; peduncle 3-10 (-11) cm. long, about 0.5 mm. thick; bracts at base of individual flower longer than calyx tube; flowers 5-8 mm. long, mostly lavender or pink; pods 15-35 mm. long; seeds 3-4 mm. long. *Phaseolus leiospermus* T. & G. Local in various soils, usually sandy loam, Plains Country, n.-cen., e. end s.e. Tex., the Llano region and n. part of Rio Grande Plains, May-Sept.; Miss. to Tex., n. to Ind., Minn., Neb. and Colo.

The slight contortion of the keel in this species indicates transition to *Phaseolus*.

68. PHASEOLUS L. BEAN. FRIJOLE

Annual or perennial often vinelike herbs; stems 1 or usually several, the early shoots erect but later distal stems usually twining, (2-) 3-30 dm. long; stipules persistent; leaves alternate, petiolate, once-pinnately-trifoliolate; stipels present; racemes axillary, ascending, long-pedunculate (peduncles 5-30 cm. long), the raceme rachis very short to elongate; calyx with a campanulate to narrowly campanulate tube and 5 lobes which are either longer than or shorter than the tube, equal or unequal, the 2 upper lobes usually coalescent farther than the others; corolla papilionaceous, white to purplish or lavender to brick-reddish; wings at anthesis in some species very elongate; keel usually narrow and always contorted or in one species usually giving one or slightly more spiral turns; stamens 10, diadelphous, 9 of the filaments coalescent, the uppermost free; fruit a usually linear slightly laterally compressed usually thin-walled legume with several seeds.

A genus of about 200 species in the warmer parts of the world, very important eco-

nomically, including *P. vulgaris* L., frijole or kidney bean; *P. limensis* Macf., lima bean; *P. aconitifolius* Jacq., moth or mat bean.

Also to be sought here is the very rare *Oxyrhynchus volubilis* Brandeg. (incl. *O. alienus* Piper), which, in 1921, was known to occur near Austin, Travis Co. This is a twining vine with greenish-yellow to purplish flowers (the keel not contorted); the seeds are 10-15 mm. long and 10-14 mm. in diameter, with conspicuous linear hilum extending over half the circumference of the seed. The species was probably introduced in Austin; it occurs naturally in Nuevo León, Tamaulipas, San Luis Potosí and the West Indies.

1. Plant annual; inflorescence 2- to 4-flowered 7. *P. acutifolius*.
1. Plants perennial; inflorescence 5- to many-flowered (2)
- 2(1). Leaflets linear to triangular-elongate, 5 to 20 times as long as wide 4. *P. angustissimus*.
2. Leaflets of a broader type, less than 5 times as long as wide (3)
- 3(2). Pods narrow, less than 5 mm. wide; stems and leaves conspicuously pubescent (4)
3. Pods broad, 5 mm. wide or more; stems and leaves glabrous to minutely pubescent (5)
- 4(3). Legumes short, curved, 2-3 cm. long; calyx (including lobes) 3-5 mm. long; flowers brick-red 1. *P. heterophyllus*.
4. Legumes linear, nearly straight, 4-8 cm. long; calyx 5-8 mm. long; flowers dark-purple 2. *P. atropurpureus*.
- 5(3). Leaflets triangular with conspicuous lobes at the base; legume 35 mm. long or shorter 5. *P. Wrightii*.
5. Leaflets triangular-ovate to oval, without conspicuous lobes at the base; legume 35-80 mm. long (6)
- 6(5). Stipules subulate, 3 mm. long or less; leaflets mostly acute at tip; calyx glabrous or essentially so; plants or central and east Texas ... 3. *P. polystachios*.
6. Stipules ovate, 4-8 mm. long; leaflets mostly obtuse or retuse, shortly apiculate at tip; calyx conspicuously short-pubescent; plants of igneous soils of Trans-Pecos Texas 6. *P. Metcalfei*.

1. *Phaseolus heterophyllus* Willd. Perennial; leaflets usually rhombic-ovate to rhombic-obovate, sometimes with a brief lobe near the middle on 1 or both sides, 15-40 mm. long, once or twice as long as broad; peduncles 10-25 cm. long; raceme rachis 2-8 cm. long; flowers remote on the raceme, not crowded, only 5-8 mm. long; calyx 3-5 mm. long, equally 5-lobed, the lobes as long as the tube; corolla at least partially brick-red; wings at anthesis elongated; pods short, curved, 2-3 cm. long, less than 5 mm. broad. *P. rotundifolius* Gray. Local in Jeff Davis Co., foothills of Davis Mts., at elev. of 4,000-6,000 ft., Aug.; Guat. n.w. to N.M. and Ariz.

2. *Phaseolus atropurpureus* DC. PURPLE BEAN. Perennial, often conspicuously pubescent; leaflets usually ovate to rhombic-ovate or sometimes narrowly rhombic-ovate or nearly lance-ovate, often with a brief lobe on one or both sides in the lower half, 2-5 cm. long, 1.2 to 3 (rarely more) times as long as broad, often canescent with grayish-pubescent at least beneath; peduncles (8-) 15-30 cm. long; raceme axis (3-) 4-8 cm. long; flowers usually crowded at anthesis but not in fruit, 15-20 mm. long, the internodes elongating after anthesis; calyx 5-8 mm. long, rather equally 5-lobed, the lobes much shorter than the tube; corolla at least distally a beautiful very dark red-purple or maroon, drying atropurpureous; wings at anthesis much-elongated; pods linear, nearly straight, 4-8 cm. long, less than 5 mm. broad. Rare and local in deep sands near the coast, Cameron, Kleberg and Kenedy cos. in extreme s. Tex., also exceedingly rare in Sierra Vieja and Chinati Mts. in Presidio Co., spring-Sept.; Salv., Guat., Mex. and Tex.

3. *Phaseolus polystachios* (L.) B.S.P. Perennial; leaflets ovate, usually acuminate or acute, entire, (3-) 4-10 (-13) cm. long, 1.2 to 1.6 times as long as broad, nearly glabrous above, usually pubescent beneath; peduncles 1-4 cm. long; raceme rachis 3-15 cm. long; flowers not crowded, only about 1 cm. long at anthesis; calyx nearly glabrous, 2.5-4 mm. long, rather equally 5-lobed, the lobes much shorter than the tube; corolla mostly lavender or pale-purple to nearly cream-colored; wings at anthesis much-elongated; pods 35-60 (-80) mm. long, 7-9 mm. broad. Very rare in Tex., known from Harrison Co. in n.e. Tex.

and also encountered in a canyon of the Edwards Plateau, where perhaps introd., summer; e. U.S.

Our Frio Canyon collection shows lobed leaflets and other characteristics which cast doubt on its referral here; it may be *P. Wrightii*.

4. *Phaseolus angustissimus* Gray. Perennial; leaflets linear to narrowly lanceolate or sometimes with a lanceolate main lobe and basally on each side with an angled corner or narrow short lobe, (2-) 3-10 cm. long, (1-) 2-10 mm. broad, 5 to 25 times as long as broad, mostly glabrous; peduncles usually 2-3 cm. long; raceme axis (1-) 2-15 cm. long (the internodes much-elongating after anthesis); flowers not crowded, 8-11 mm. long at anthesis; calyx nearly glabrous, about 3 mm. long, subequally 5-lobed, the lobes only slightly shorter than the tube; corolla pale-purple; wings at anthesis much-elongated; pods 2-3 cm. long, somewhat falcate, about 6-7 mm. broad at the widest point (in distal half), with a subulate beak 2-4 mm. long; seeds rugose. Dry canyons, Brewster and Presidio cos., s. Trans-Pecos, summer; Tex., N.M., Ariz. and Chih.

5. *Phaseolus Wrightii* Gray. Perennial; leaflets ovate in general outline but usually with an oblong main portion and in the lower half on 1 or both sides an oblong lobe shorter than the main portion, at apex rounded to acute, 2-7 cm. long, 1 or 2 times longer than broad, mostly glabrous; peduncles 2-10 cm. long; raceme axis 2-10 cm. long, apparently both peduncles and axes elongating after anthesis; calyx nearly glabrous, 2-3 mm. long, the lobes much shorter than the tube; corolla pale-purple; pods 25-35 mm. long, somewhat falcate, about 6 mm. broad, with a minute beak 1-2 mm. long; seeds rugose. Trans-Pecos mts. at 3,000-7,300 ft. elev., Aug.-Nov.; Tex., N.M., Ariz., Son., Chih. and Coah.

6. *Phaseolus Metcalfei* Woot. & Standl. Perennial from deep woody roots, often a rampant vine; leaflets broadly ovate to obovate or almost orbicular, about as long as broad, rarely lobed, at base rounded or narrowed, at apex very short-apiculate, 3-5 (-8) cm. long; stipules ovate, 4-8 mm. long; peduncles 1-2 dm. long; raceme axis 4-15 cm. long; flowers not crowded, 12-15 mm. long at anthesis; calyx short-pubescent, about 5 mm. long, subequally 5-lobed, the lobes much shorter than the tube; corolla pale-purplish; pods 35-80 mm. long, more than 5 mm. broad. Mts., among boulders, 4,000-7,300 ft. elev. in the Trans-Pecos, July-Sept.; Tex., N.M., Ariz., Son., Chih., S.L.P., Aguasc., Hgo., Zac., Pue. and Oax.

7. *Phaseolus acutifolius* Gray. TEPARY BEAN. Annual from slender taproots; leaflets linear to lanceolate (to narrowly rhombic-ovate), sharply acute, (2.5 to) 3 to 8 times as long as broad, rarely or perhaps never lobed; peduncles 5-40 mm. long; raceme axis (0-) 5-30 mm. long; flowers (1 or) 2 to 4 per inflorescence, 8-10 mm. long at anthesis; calyx pubescent, about 4 mm. long, subequally 5-lobed, the lobes much shorter than the tube; corolla creamy-blue to lavender; pods curvilinear, 4-7 cm. long. Rare in canyons, Trans-Pecos mts., 4,000-6,000 ft. elev., July-Sept.; Tex., N.M. and Ariz., s. to Jal.

A broad-leaved form is cultivated in southern United States and Mexico.

69. VIGNA SAVI

Annual or perennial herbs, with vinelike or trailing annual stems to 3 m. long, twining at the ends; stipules present; petioles well-developed; leaves once-pinnately-trifoliolate; stipels present; racemes axillary, usually long-peduncled and few-flowered; calyx campanulate, somewhat bilabiate, the upper 2 lobes (upper lip) somewhat coalescent; corolla papilionaceous, yellow or purple; wings with obovate blades that are auriculate near the base on the upper side; stamens 10, diadelphous, 9 of the filaments coalescent, the uppermost free; fruit a linear little if at all laterally compressed several-seeded thin-walled promptly dehiscent legume.

A genus of about 60 species in the tropical and subtropical parts of the world; 1 of our species is of great economic value.

- 1. Stipules small, inconspicuous, 2-5 mm. long; pods 3-7 cm. long; native species 1. *V. luteola*.
- 1. Stipules conspicuous, 7-15 mm. long; pods 10 cm. long or more; cultivated species 2. *V. unguiculata*.

1. *Vigna luteola* (Jacq.) Benth. Perennial; leaflets ovate to lanceolate or linear-lanceolate, obtuse to broadly cuneate at base, acute, 2-8 cm. long; peduncles usually several times longer than the foliage; flowers closely clustered at anthesis (internodes elongating, separating the fruits), 15-18 mm. long; calyx with tube 2-2.5 mm. long, the lobes 1.5-2.5 mm. long; corolla yellow; pods 3-7 cm. long. *V. repens* (L.) O. Ktze., not of Baker. Local in wet places, coastal tier of counties and inland to Hidalgo Co., Mar.-Nov.; trop. Am. n. to Gulf States, rarely to N.C.

2. *Vigna unguiculata* (L.) Walp. COWPEA, BLACK-EYED PEA, CREAM-PEA. Annual; leaflets 4-15 cm. long, ovate to ovate-hastate; corolla purple; pods 1 dm. or more long. Rarely volunteering at the edges of fields in the e. half of the state, where it is cult., summer; nat. of Old World (Asia?), now very widely introd. and cult.

When the peas are gathered very young they are called cream-peas; later they are black-eyed peas because of the increased pigmentation near the micropyle.

FAM. 92. KRAMERIACEAE DUM.¹⁰⁸

RATANY FAMILY

Low shrubs or perennial herbs from woody stocks, in the shrubby ones the stems often intricately branched and somewhat thornlike; herbage often densely grayish-pubescent; leaves alternate, usually linear or nearly so, simple, entire, acute; petioles short or absent; stipules absent; flowers perfect, bilaterally symmetrical, solitary in the axils of the distal leaves (sometimes clustered due to shortness of distal internodes); pedicels usually with 2 opposite foliaceous bracts; sepals 4 or 5, unequal; petals 5, very unequal, the upper 3 long-clawed, distinct or partly united and usually purplish or reddish in color, the 2 others much smaller, broad, thick, sessile, greenish (usually) and glandlike; stamens 4, free or adnate to the claw of the upper petal; each of the 2 thecae dehiscent by a pore; ovary 1-celled; ovules 2, collateral, pendulous, anatropous; fruit a nearly globose 1-seeded indehiscent pod, armed with straight sharp prickles; cotyledons thick; endosperm apparently absent.

An American family of a single genus of about 25 species from Chile to southern United States. It has been treated as a part of the Leguminosae but is more than adequately distinct and deserving of familial rank.

I. KRAMERIA L.

RATANY

Characters of the family.

- 1. Stems decumbent, completely herbaceous above ground; widespread in Texas 1. *K. lanceolata*.
- 1. Plants shrubby; in the Trans-Pecos and the southern half of Texas (2)
- 2(1). Pedicels densely glandular, very rarely not glandular but (if so) then the prickles of the fruit with scattered barbs near the apex as opposed to barbless prickles or whorled barbs at the apex of the prickles in the species below 2. *K. glandulosa*.
- 2. Pedicels without glands (3)
- 3(2). Leaves 2-6 mm. long; prickles of the fruit 2 mm. long or less at maturity, without barbs; petals 6-8 mm. long 3. *K. ramosissima*.
- 3. Leaves 5-25 mm. long, at least some of them 10 mm. long; prickles of the fruit 2-6 mm. long at maturity, with a whorl of barbs at apex; petals 8-12 mm. long 4. *K. Grayi*.

1. *Krameria lanceolata* Torr. CRAMERIA. Perennial herb from woody stocks; stems 1-18 dm. long, prostrate on ground or trailing over herbaceous vegetation, slender, silky-pubescent; leaves linear or nearly so or the larger ones oblong, 8-20 mm. long; fruit globose, the body woolly, 6-7 mm. thick, the subulate barbless spines 2-4 mm. long. The name *K. secundiflora* has been used incorrectly for this species in a number of books.

¹⁰⁸ Many of the characters are from B. L. Turner, "The Legumes of Texas." 1959.

Widespread over the state (missing only from the wettest, densest pine forests of e. Tex.), spring-fall; Kan. to Ariz. and s. to Chih., Coah. and Tex.

2. *Krameria glandulosa* Rose & Painter. RANGE RATANY. Intricately branched shrub 3-7 dm. tall, the herbage grayish-pubescent; leaves linear, 4-12 mm. long; pedicels densely glandular-pubescent or rarely the glands nearly absent; fruit globular, the body 6-7 mm. thick, the prickles of the fruit with scattered barbs near the apex. Frequent in desertic scrub in the Trans-Pecos, e. to Loving and Brewster cos., summer; Calif. and Son. e. to Tex.

3. *Krameria ramosissima* (Gray) Wats. CALDERONA. Intricately branched shrub 3-10 dm. tall, the herbage grayish-pubescent; leaves linear to linear-lanceolate, 2-6 mm. long, often fascicled in the axils; pedicels not glandular-pubescent; petals 6-8 mm. long; prickles of the fruit 2 mm. long or less at maturity, barbless. Locally abundant in dry scrubby vegetation in the Trans-Pecos and Rio Grande Valley, from Brewster Co. to Hidalgo Co., spring-fall; s. to Coah., N.L., and Tam.

4. *Krameria Grayi* Rose & Painter. WHITE RATANY. Intricately branched shrub 3-6 dm. tall, the herbage grayish-pubescent; leaves linear, 5-25 mm. long, at least some of them on each plant 10 mm. long or more; pedicels not glandular-pubescent; petals 8-12 mm. long; prickles of the fruit 2-6 mm. long at maturity, each with a whorl of barbs at apex. Frequent in desertic scrub in the Trans-Pecos, e. to Ward and Val Verde cos., summer; Baja Calif. and Calif., e. and s.e. to Tex. and Coah.

FAM. 93. GERANIACEAE JUSS.

GERANIUM FAMILY

Winter annual, biennial or perennial herbs; leaves alternate or basal, lobed or divided, stipulate; inflorescence cymose or a solitary flower; flowers perfect, regular or nearly so, 5-merous, hypogynous; sepals imbricated in the bud, persistent; glands of the disk 5, alternate with the petals; stamens (counting the sterile filaments) as many as or commonly twice as many as the sepals, when as many then opposite the sepals; ovary at base with 5 equal lateral lobes; carpels 2-ovuled, 1-seeded, when mature separating elastically with their long styles from the elongated axis.

A family of about 5 genera and some 750 species of temperate and subtropical regions.

1. Fertile stamens usually 10; ripe carpels plump, widely dehiscent on the inner suture to allow the seed to fall free; each separated stylar portion merely recurved upward, at most softly pubescent on the inner surface; seeds noticeably reticulate1. *Geranium*, p. 890.
1. Fertile stamens 5; ripe carpels fusiform, sharp-pointed at base, though dehiscent remaining tightly inrolled to enclose the seed; each separated stylar portion twisting spirally below the middle, bristly long-bearded on the inner surface; seeds smooth2. *Erodium*, p. 892.

1. GERANIUM L.¹⁰⁷

CRANESBILL

Annual or perennial herbs with much-branched stems and pinnate or palmately lobed petiolate leaves; flowers usually in pairs on a slender peduncle and slender pedicels that are subtended by narrow bracts; stamens 10 or rarely 5, all with perfect anthers, the 5 longer ones with glands at their base and alternate with the petals; stylar portions usually remaining attached by their apex to the summit of the torus.

Consisting of about 400 species mainly in temperate regions; many are used as ornamentals.

1. Plants perennial, with a stout simple or branched rootstock; petals always exceeding the sepals; stylar branches 2 mm. long or more; in mountains of west Texas (2)
1. Plants annual or biennial, without a thick rootstock, the taproot slender; petals not or scarcely surpassing the sepals; stylar branches rarely more than 1 mm. long; mostly east of the Pecos River (4)

¹⁰⁷ Adapted partly from G. N. Jones and F. F. Jones in *Rhodora* 45:5-53. 1943.

- 2(1). Petals 10-20 mm. long or (if slightly shorter) not white; stylar branches 5-8 mm. long1. *G. caespitosum*.
2. Petals 7-10 mm. long, white or pinkish; stylar branches 5 mm. long or less (3)
- 3(2). Stems, petioles and pedicels copiously glandular-villosulous; style column 20 mm. long or more, glandular-pubescent; stylar branches 4-5 mm. long2. *G. lentum*
3. Stems and petioles sparsely pilose, not glandular; style column to 18 mm. long, puberulent; stylar branches 2-3 mm. long3. *G. Wislizenii*.
- 4(1). Sepals orbicular-ovate, about 4 mm. long; style column with short ascending or subappressed hairs, not glandular; pubescence on stems, peduncle and pedicels directed downward6. *G. texanum*.
4. Sepals ovate-lanceolate to elliptic-lanceolate, 6-8 mm. long; style column with long spreading hairs, often glandular; pubescence spreading, usually a noticeable mixture of long and short hairs (5)
- 5(4). Stylar branches purplish, about 0.5 mm. long, terminating a very slenderly constricted neck; style column conspicuously and densely glandular-hirsute4. *G. dissectum*.
5. Stylar branches yellowish, 1 mm. long or more, terminating a short tapering neck; style column hirtellous, sometimes with scattered glandular hairs5. *G. carolinianum*.

1. *Geranium caespitosum* James. Perennial; stems tufted from a woody branched rootstock, procumbent to ascending or erect, to 7 dm. or more long, strigillose to pilosulous; leaf blades to 5 cm. wide, finely appressed-pubescent, orbicular to pentagonal in outline, divided into 5 rhombic lobes that are again 3-parted; sepals ovate-elliptic, mucronate, 3-veined, to 12 mm. long; petals obovate, usually deep rose-purple, to 18 mm. long; style column to 3 cm. long; stylar branches 5-8 mm. long; carpel bodies 4-5 mm. long, sparsely short-strigose; seeds reticulate, 3-4 mm. long. *G. atropurpureum* Heller. In canyons and open woods in w. Tex., May-July; from w. Tex. to Col., Ut., Ariz. and Mex.

2. *Geranium lentum* Woot. & Standl. Perennial; stems ascending or spreading from a stout rootstock, to 5 dm. long, glandular-pilose; leaf blades to 5 cm. wide, densely hispidulous-strigose or glandular-villosulous, orbicular in outline, divided into 5 rhombic to obovate obtuse lobes; sepals ovate-elliptic, mucronate, 7-8 mm. long; petals white, entire or emarginate, 8-10 mm. long; style column to 25 mm. long, glandular-pubescent; stylar branches 4-5 mm. long; carpel bodies about 4 mm. long, puberulent and sparsely hispid; seeds finely reticulate, 2.5-3 mm. long. Mts. of w. Tex., July-Aug.; from Tex. to Ariz. and Mex.

3. *Geranium Wislizenii* Wats. Perennial; stems tufted and erect from a simple rootstock, to 4 dm. long, retrorsely villosulous, not glandular; leaf blades to 8 cm. wide, sparsely strigose, pentagonal in outline, divided into 5 rhombic lobes that are again several times incised into obtuse or rounded segments; sepals ovate-elliptic to elliptic-lanceolate, mucronate, to 7 mm. long; petals entire, white, to 1 cm. long; style column to 18 mm. long, puberulent and more or less glandular; stylar branches 2-3 mm. long; carpel bodies 2-2.5 mm. long. Mts. of w. Tex., May-July; from Tex., Ariz. and n. Mex.

4. *Geranium dissectum* L. Annual or biennial, usually much-branched and straggly; stems to 6 dm. long, ascending, spreading-hirsute; leaves angulate-rotund in outline, to 7 cm. wide, deeply 5-parted, with the lobes of segments of upper leaves linear and acute; sepals elliptic-lanceolate, aristate, 6-8 mm. long; petals pinkish or reddish-pink, obovate, emarginate, about 5 mm. long; style column about 12 mm. long, conspicuously glandular-hirsute; stylar branches purplish and a little more than 0.5 mm. long, terminating a slender neck that is 2-3 mm. long; carpel bodies about 2.5 mm. long, short-hispid with divergent sharp hairs; seeds subglobose, about 2 mm. in diameter, strongly reticulate or pitted with small thick-walled squares or rounded areolae. Fields, roadsides and waste places in n.e. Tex., Apr.-May; local from Mass., w. to Mich. and s. to N.C.; also Tex. and Pac. slope; adv. from Eur.

5. *Geranium carolinianum* L. Annual or biennial, densely retrorse-hirsute, usually much-branched, with the branches to 8 dm. long and ascending; leaves to about 7 cm.

wide, suborbicular to reniform in outline, with obtuse linear-oblong to obovate ultimate segments; sepals ovate-lanceolate, aristate, about 7 mm. long, short-pilose, with villous-ciliate nerves; petals about as long as sepals, pale-pink or whitish, oblanceolate; style column about 13 mm. long, hirtellous and sometimes glandular; styler branches 1 mm. long or more; carpel bodies hirsute, about 3 mm. long; seeds oblong, about 2 mm. long, with irregular rows of elongate finely reticulate areolae. *G. Langloisii* Greene. Dry rocky woods and fields, about boulders, on gravelly or clay flats, and wastelands generally, in most of Tex. but especially in the cen. part., Mar.-May; from N.E., s. to Fla. and Tex., w. to Mich., Ill., Mo., Kan., Wyo., Ida. and s. B.C.

6. *Geranium texanum* (Trel.) Heller. Annual with spreading or ascending branches to 4 dm. long, pubescent with short appressed white hairs that point downward; leaf blades orbicular in outline, with rounded sinuses, to 4 cm. in diameter, 3-parted with these divisions again 3-lobed; sepals suborbicular to orbicular-ovate, shortly aristate, about 4 mm. long, essentially glabrous except on the 3 nerves; petals white and purple-tinged, oblong to oblong-obovate, entire, slightly exceeding the sepals; style column 1-1.2 cm. long, with short ascending or subappressed hairs; styler branches about 0.5 mm. long; carpel bodies about 3 mm. long, with long scattered hairs; seeds subglobose, 2 mm. in diameter, finely and closely pitted. *G. carolinianum* var. *texanum* Trel. In clayey or sandy soils, mostly in cen. and s. Tex. where it is apparently endemic, Mar.-Apr.

2. ERODIUM L'HER. STORK'S-BILL

Annual or biennial herbs forming rosettes and with spreading to ascending leafy branches; leaves petiolate, entire and palmately lobed to pinnatifid or pinnate-pinnatifid; peduncles axillary, bearing several flowers in an umbel; upper petals sometimes slightly smaller than the others; antheriferous stamens 5, opposite the sepals; ripe carpels fusiform, aristate below, hispid, at most tardily dehiscent, the persistent style column or "beak" (when freed) spirally twisting below, bearded on the inner surface; seed smooth.

About 90 species widespread in both the Old World and New World, in temperate and subtropical regions.

- 1. Leaf blades simple, basally cordate and shallowly or deeply palmately lobed; pubescence of short appressed hairs; petals 10 mm. or more long, noticeably exceeding the sepals, purplish-red 1. *E. texanum*.
- 1. Leaf blades pinnatifid or pinnate-pinnatifid, oblong to narrowly triangular in outline, the divisions toothed or narrowly lobed (2)
- 2(1). Leaf blades pinnate-pinnatifid; leaves rarely more than 5 cm. long, the petiole usually less than one fourth the length of blade; style column 5 cm. long or less 2. *E. cicutarium*.
- 2. Leaf blades pinnatifid; leaves more than 5 cm. long, the petiole a third or more as long as blade; style column 7 cm. long or more 3. *E. Botrys*.

1. *Erodium texanum* Gray. Plant prostrate or ascending, branched from base, the branches to 5 dm. long; leaves ovate in outline, to 35 mm. long, the lobes rounded and crenate; sepals elliptic, apiculate, 6-12 mm. long; petals broadly obovate; style column to 75 mm. long; seed tan-color, ellipsoid-conic, 4-5 mm. long. Rocky or sandy soils on limestone, in prairies and open areas in cen., s. and w. Tex., Feb.-Apr.; from Tex. to s. Ut. and s.e. Calif.

2. *Erodium cicutarium* (L.) L'Her. ALFILERILLO. Plant prostrate or ascending, much-branched from base, the nonstrigose branches to 5 dm. long and arising from a rosette of over-wintering leaves; mature leaves pinnate-pinnatifid; sepals elliptic, 2-6 mm. long, the short awns bristle-tipped; petals elliptic-obovate; style column to 5 cm. long; seed dull-brown, ellipsoid, 2-3 mm. long. In rocky or sandy soil in various types of habitat, roadsides, fields, lawns, waste places, ravines in w. and cen. Tex., Feb.-June; Que., w. to Mich. and Ill., s. to Va., Tenn., Ark. and Tex.; also Mex.; nat. of Eur.

3. *Erodium Botrys* (Cav.) Bertol. Plant robust, superficially resembling *E. cicutarium*; mainstem and branches strigose; mature leaves more than 10 cm. long, with a long petiole, the blade pinnatifid with the broad segments decurrent to produce a winged rachis;

sepals oblong, 6-7 mm. long at anthesis, with a conspicuous mucro; fruit with 2 furrows below the pits; style column 7-11 cm. long. In disturbed soils, rare in s.-cen. Tex. (Bexar Co.), Mar.-May; nat. of Medit. region.

A recent introduction that will undoubtedly soon become an established element in our flora.

FAM. 94. OXALIDACEAE R. BR. WOOD-SORREL FAMILY

Annual or perennial herbs, shrubs or rarely trees (in tropics), typically with sour sap (oxalic acid), with strong rootstocks to scaly bulbs; acaulescent or with leafy stems; leaves usually palmately compound; flowers perfect, regular, 5-merous, borne at the apex of a scape or on axillary peduncles, either solitary or in cymose or umbelliform clusters; sepals usually imbricate and often unequal; petals without basal glands; stamens 10 in ours, all perfect; filaments united at base into a short tube; anthers dorsally attached; ovary 5-celled, mostly with numerous ovules; styles 5, distinct; fruits a loculicidal capsule or berry.

About 900 species in several genera of worldwide distribution, mostly tropical. A few ornamental species, especially in the genus *Oxalis*, and edible fruits of the tropical Carambola (*Averrhoa Carambola* L.) are of economic importance.

1. OXALIS L.¹⁰⁸ WOOD-SORREL. LADY'S-SORREL

Annuals or perennials; leaves basal or alternate, simple to pinnate or palmately compound; leaflets usually 3, obovate to obcordate or obreniform, entire except for the notched or 2-lobed apex, downwardly folded together at night or with inclement weather; stipules small or absent; flowers closing at night and with inclement weather, nodding before and after blooming, often dimorphous or even trimorphous in the relative length of the stamens and styles; sepals persistent; petals sometimes weakly united at base, withering after expansion; stamens 10; capsule oblate, prismatic, cylindrical or subulate, membranaceous.

About 800 cosmopolitan species but mainly in South America and South Africa. The commonly cultivated Brazilian *O. rubra* St.-Hil. occasionally spreads from abandoned homesteads and dumps in east Texas. It may be distinguished by its pubescent trifoliolate leaves and inflorescences of pink or rose-color to sometimes white flowers that arise on slender stalks from a woody crown with taproot and root tubers.

- 1. Plant stemless; scape and leaves all basal; petals purple to pinkish-purple or lavender-pink (2)
- 1. Plant leafy-stemmed; petals yellow, sometimes tinged or marked with red (5)
- 2(1). Scapes and petioles more or less villous; leaflets with a narrow deep apical sinus, more or less pubescent and adorned with small scattered reddish-brown callosities; distribution in extreme southeastern Texas1. *O. corymbosa*.
- 2. Herbage entirely glabrous; leaflets with a truncated apex or with a broad apical sinus, without callosities (3)
- 3(2). Leaflets typically crescentiform or lunate, with elongated spreading lobes; sepals with as many as 6 more or less confluent apical tubercles; distribution mostly on the Edwards Plateau and in south Texas2. *O. Drummondii*.
- 3. Leaflets typically broadly obreniform to flabellate or broadly V-shaped, with short rounded lobes; sepals with usually 2 short distinct or somewhat confluent apical tubercles (4)
- 4(3). Plants in eastern third of Texas; leaflets 25 mm. wide or less3. *O. violacea*.
- 4. Plants in the mountains of Trans-Pecos Texas; leaflets usually about 30 mm. wide or more4. *O. amplifolia*.

¹⁰⁸ Ref.: George Eiten in Am. Midl. Nat. 69:257-309. 1963; Lloyd H. Shinnars in Field & Lab. 24:39-40. 1956.

- 5(1). Leaf blades simple (1-foliolate); stipules free, bristlelike; stigmas introrse 5. *O. dichondraefolia*.
5. Leaf blades 3-foliolate; stipules (when present) appearing as mere dilations at the base of the petiole; stigmas terminal (6)
- 6(5). Leaflets pinnate; flower stalk jointed; capsule drooping; stigmas 2-cleft 6. *O. Berlandieri*.
6. Leaflets palmate; flower stalk not jointed; capsule erect; stigmas capitate (7)
- 7(6). Leaflets thick, bluish-green; sepals and petals mostly tinged with red or purple; capsule usually longer than the pedicel; confined to Trans-Pecos Texas 7. *O. albicans*.
7. Leaflets mostly thinnish, light- or dark-green; sepals and petals very rarely tinged or marked with red; distribution east of Trans-Pecos Texas (8)
- 8(7). Corolla golden-yellow, very showy; petals 12-18 mm. long; confined to woodlands of east Texas 8. *O. Priceae*.
8. Corolla usually pale-yellow; petals mostly 5-12 mm. long; widespread (9)
- 9(8). Septate hairs present on stems, petioles and pedicels; pedicels (in fruit) horizontal to erect; inflorescence often regularly cymose; stipules absent; in mature plants stems arising from a thin definitely underground rhizome, the stems appearing singly (rarely 2 or 3 together) from the ground; main root not thicker than stems 9. *O. stricta*.
9. Septate hairs totally absent on all stems, petioles and pedicels; pedicels (in fruit) strongly deflexed to erect; inflorescence never regularly cymose; stipules present or absent; in mature plants stems few to many from crown of taproot, the horizontal stems (if present) on top of ground or only slightly covered; main root usually thicker than stems (10)
- 10(9). Stems several from main root, creeping or decumbent; stem ends of current season horizontal or erect; nodes of horizontal stems with single leaves and peduncles, with fascicles of leaves or with erect stems; stem hairs none to abundant, upwards-appressed, ascending, patent or retrorse, or usually these variously intermixed; seeds brown 10. *O. corniculata*.
10. Stems single, erect or decumbent, or several from main root and cespitose; stem ends of current season erect; nodes of horizontal stems with fascicles of leaves or with erect stems; stem hairs sparse to abundant, appressed upwards, rarely a few ascending; seeds brown, with strong white lines along the transverse ridges 11. *O. Dillenii*.

1. *Oxalis corymbosa* DC. Plants 1-3 dm. tall; bulb scales 3-ribbed; leaves as tall as or shorter than the scapes; petioles more or less villous; leaflets 3, the blades suborbicular to orbicular-obovate, with a narrow deep apical sinus, typically adorned with minute reddish-brown callosities (especially submarginally), 2.5-5 cm. wide, deep-green and usually with scattered hairs above, paler-green and more or less pubescent beneath, the lobes rounded; scapes villous; cymes mostly compound, commonly many-flowered; pedicels 1-3 cm. long, sparingly appressed-pubescent; sepals oblong-elliptic to linear, 4.5-6 mm. long, glabrous or nearly so, each bearing 2 thick apical tubercles; petals violet or rose-purple, 12-15 mm. long; shorter filaments mostly glabrous; longer filaments pubescent, unappendaged; styles pubescent. *O. Martiana* Zucc., *Ionoxalis Martiana* (Zucc.) Small. Waste places, cult. ground and fields in s.e. Tex., Mar.-June; nat. of trop. Am., introd. in U.S. from Fla. to Tex., n. to S.C.

Oxalis rubra St.-Hil., a native of Brazil and quite similar in appearance to this species, is often cultivated. It is superficially distinguished from *O. corymbosa* by its thick, hard, rough root-crown and taproot.

2. *Oxalis Drummondii* Gray. Plants 1-3 dm. tall, glabrous; bulb scales 3-ribbed; leaflets 3, deeply V-shaped, crescentic to lunate, sometimes broadly so, 1.5-6 cm. wide, glabrous, bright-green above, pale-green beneath, the lobes ovate to oblong or lanceolate; scapes nearly twice as long as leaves; cymes 4- to 8-flowered; pedicels 1-4 cm. long; sepals

oblong to linear-oblong or oblong-lanceolate, 5-7 mm. long, each bearing as many as 6 more or less confluent apical tubercles; petals violet, 15-23 mm. long; shorter and larger filaments sometimes pubescent, unappendaged; styles mostly pubescent; capsules broadly oblong, 7-9 mm. long, somewhat pubescent. *Oxalis vespertilionis* T. & G., *Ionoxalis Drummondii* (Gray) Rose, *I. vespertilionis* (T. & G.) Small. In sandy-gravelly soils in open oak woodlands, limestone soils and disturbed areas, mostly on the Edwards Plateau and in the Rio Grande Plains and Valley, rare eastw. to Gonzales and Coryell cos.; apparently endemic.

3. *Oxalis violacea* L. VIOLET WOOD-SORREL. Plants 1-4 dm. tall, glabrous, rarely without leaves; bulb scales 3-ribbed; leaflets 3, obreniform to flabellate, the sinus broad and open to essentially obsolete, 1-2.5 cm. wide, glabrous, bright-green above, slightly paler-green beneath, the lobes rounded; scapes about twice as long as leaves; cymes simple, 4- to 19-flowered; pedicels 1-3 cm. long; sepals oblong-elliptic to ovate-oblong, 4-6 mm. long, glabrous, each bearing 2 short irregular confluent apical tubercles; petals violet, 14-20 mm. long; shorter and longer filaments pubescent or the shorter ones sometimes glabrous; styles short and glabrous, becoming elongated and hispid with age; capsules globose-ovoid, 4-5 mm. long. *Ionoxalis violacea* (L.) Small. In sandy soil of pinelands and dry gravelly soils of open oak woods and grassy-brushy slopes, sometimes on rock outcrops, in e. fourth of Tex., Mar.-May (with leaves) and Aug.-Oct. (without leaves); from Fla. to Tex. and N.M., n. to Mass., N.Y., O., Ind., Wisc., Minn., S.D. and Colo.

4. *Oxalis amplifolia* (Trel.) Knuth. Plants 15-35 cm. tall, glabrous or nearly so, the bulb scales several-ribbed; leaves shorter than the scape; leaflets 3, V-shaped or somewhat obreniform, 2.5-4 cm. wide, deep-green, scarcely paler beneath than above; scapes only occasionally with hairs; cymes 7- to 12-flowered; pedicels 1-3 cm. long; sepals lanceolate to oblong, 4-5 mm. long, each with 2 short apical tubercles; petals violet, 12-16 mm. long; shorter and longer filaments pubescent, the longer ones each usually with a prominent appendage on the back below the middle. *Oxalis latifolia* Trel., *Ionoxalis amplifolia* (Trel.) Rose, (?) *I. monticola* Small. About cliffs and on ledges in mts. of the Trans-Pecos, May-Sept.; from Tex. to Ariz.

5. *Oxalis dichondraefolia* Gray. AGRITO. Stems or branches tufted, from a perennial woody rootstock, 5-30 cm. tall, herbaceous, pubescent with short gray hairs; stipules brownish, setaceous; leaflet as long as the petioles or shorter; blades suborbicular to quadrate-orbicular, inclined to obovate or ovate, 1-3 cm. long, truncate or retuse and more or less apiculate at the apex, finely pubescent on both surfaces, mostly shallowly cordate at the base; inflorescence 1-flowered; bracts setaceous, to 1 cm. long; sepals 8-10 mm. long, the outer ones deltoid to triangular-lanceolate, copiously pubescent, acute or acuminate at the apex, cordate at the prominently auricled base, the 2 inner sepals narrowly linear; petals yellow, about twice as long as the sepals, erose-undulate at the apex; stamens glabrous; pistil and styles pubescent; capsules broadly oblong to ovoid-oblong, 8-10 mm. long; seeds 2-2.5 mm. long. *Monoxalis dichondraefolia* (Gray) Small. On gravelly hills and on clay dunes in brushland and chaparral, also on limestone slopes, in the Rio Grande Plains and Edwards Plateau, flowering the year around; also adj. Mex.

6. *Oxalis Berlandieri* Torr. Plants to 35 cm. high; stem and branches woody or herbaceous, closely pubescent with loosely spreading or crisped hairs that are often very densely set on the younger parts; leaves scattered on the stem and the branches, the petioles loosely pubescent; leaflets cuneate to obovate or oblong-obovate, mostly 1-2.5 cm. long, ciliate and more or less pubescent on both sides but more copiously so beneath, those of the terminal leaflets emarginate or notched, those of the lateral ones singly or doubly notched at the apex; primary peduncles mostly longer than the petioles, several flowered; pedicels loosely pubescent, 4-10 mm. long; sepals 4-5 mm. long, the outer ones oblong to lanceolate, ciliate, sparingly pubescent; petals yellow, about 15 mm. long; longer filaments appendaged below the middle, pubescent above; styles pubescent; capsules broadly oblong or ovoid-oblong, 7-8 mm. long, pubescent on the angles; seeds about 2 mm. long. *Lotoxalis Berlandieri* (Torr.) Small. In sandy soils in pastures and live oak copses in the Rio Grande Valley and s. Coastal Tex., Mar.-Oct.; also adj. Mex.

7. *Oxalis albicans* H.B.K. Stems erect or partially decumbent, suffrutescent, 1-4 dm. tall, short-hirsute (usually densely so at least on the lower part), the tuberous roots fusi-

form (often slenderly so); leaflets deeply notched, cuneate-obreniform, with the lobes often conduplicate, bluish-green, 4-15 mm. broad, thick, with scattered hairs on both surfaces; peduncles as long as the petioles or longer, strigillose, 1- to several-flowered; pedicels strigillose, about 15 mm. long, refracted in fruit; sepals oblong-elliptic to lanceolate, 4-5 mm. long at maturity, often purple-tinged or purple; petals light-yellow to purplish, 6-10 mm. long; longer filaments glabrous; capsules columnar, rather stout, 1.6-2 cm. long, mostly exceeding the pedicel, minutely close-pubescent, gradually narrowed at the apex. *O. Wrightii* Gray, *Xanthoxalis albicans* (H.B.K.) Small. On gravelly-grassy flats, in igneous soils in canyons in mts. of the Trans-Pecos, June-Sept.; from Tex. to Ariz. and n. Mex.

We not only have subsp. *albicans* with hairs on the stem and pedicels crisped or straight and appressed upward but we also have subsp. *pilosa* (Nutt.) Eiten with hairs on the stem and pedicels straight and spreading to retrorse or occasionally appressed upwards.

8. *Oxalis Priceae* Small. YELLOW WOOD-SORREL. Stems erect or decumbent, to 4 dm. high, the horizontal slender rootstocks elongate, densely strigillose or spreading-villous; leaflets bright-green, 5-15 mm. wide, strigillose; peduncles conspicuously elongate and much-overtopping the stem or its branches, appressed-pubescent, 2- to 7-flowered; pedicels strigillose, conspicuously elongate (to 2 cm. long); sepals 5.5-6.5 mm. long at maturity; petals golden-yellow, 12-18 mm. long; filaments glabrous, more or less dilated, the inner ones often conspicuously so; capsules 1-1.5 cm. long. (?) *O. recurva* Ell., *O. recurva* var. *texana* (Small) Wieg., *Xanthoxalis texana* Small. In sandy soil in cut-over woods, fields and in open pinelands in e. Tex., Mar.-May; from Fla. to Tex., n. to N.C. and Mo.

Our plant is referable to subsp. *texana* (Small) Eiten with hairs all appressed upwards or with some intermixed ascending hairs.

9. *Oxalis stricta* L. YELLOW WOOD-SORREL, CHANCHAQUILLA. Plant typically erect or at length decumbent, tall, large-leaved, the stems subglabrous to densely covered with patent septate hairs, usually also with some short appressed nonseptate hairs, or the latter present alone but thinly so; white filiform succulent rhizomes present, easily broken off in collecting; leaves often purplish, petioles mostly with septate hairs at the base as well as nonseptate ones; stipules none; inflorescence mostly many-flowered, usually cymose; pedicels 1-2.5 cm. long, glabrous to densely pubescent with septate or nonseptate hairs or both; fruit glabrous to patent septate-hairy; seeds brown, only rarely with white markings on the transverse ridges. *O. europaea* Jord., *O. cymosa* (Small) Small, *Xanthoxalis cymosa* Small. Nat. to and common in e. and cen. U.S.; introd. into Eur. and widespread there, and perhaps present also in Afr. and w. Asia as a weed.

10. *Oxalis corniculata* L. CREEPING LADY'S-SORREL, AGRITO, JOCOYOTE. Stems creeping from a thin taproot, subglabrous to pubescent with appressed or spreading nonseptate (very rarely some septate) hairs, usually rooting at most nodes and sending up leaves and inflorescences only or also short aerial shoots; white succulent rhizomes none; leaves often purplish, with broad often auriculate stipules; inflorescence 1- to several-flowered, umbellate; fruit hoary with appressed nonseptate hairs and often longer patent septate hairs; seeds brown, only very rarely with white markings on the transverse ridges. Pantrop., spread into temp. areas in lawns, gardens, and in and around greenhouses (where it often becomes a noxious pest); reported from s. Tex.

11. *Oxalis Dillenii* Jacq. Usually caespitose, branching at base; stems usually densely strigose with white nonseptate hairs; white succulent rhizomes none; leaves mostly green; petioles never with septate hairs; stipules broad or narrow, not auricular; inflorescence 1- to several-flowered, mostly umbellate; pedicels densely strigose with nonseptate hairs; fruit hoary with appressed nonseptate hairs and often longer patent septate hairs; seeds brown with definite white markings on the transverse ridges. Incl. var. *radicans* Shinnery, *O. stricta* of Tex. auth., *O. Langloisii* Small. In sandy, rocky or gravelly soils in thickets, woodlands, pastures, canyons, river bottoms and limestone banks throughout Tex. except in the Panhandle and Trans-Pecos, Feb.-May; nat. to the U.S., very common in the e. and cen. states; very rare in w. Eur., where introd.

Those plants with creeping and rooting stems whose capsules are typically hoary from a covering of short appressed whitish hairs have been segregated as var. *radicans* Shinnery.

FAM. 95. LINACEAE S. F. GRAY¹⁰⁹

FLAX FAMILY

Herbs or shrubs; leaves simple, alternate, opposite or whorled; stipular glands present or none; flowers bisexual, regular, cymose; calyx 4- or 5-merous, imbricate; corolla 4- or 5-merous, convolute, the petals distinct or rarely united basally, fugacious; stamens commonly as many as and alternate with the petals, united at the base, sometimes with diminutive intervening staminodia; pistil 1, ovary superior; carpels 2 to 5, the locules often twice as many by the intrusion of false septa; ovules 2 per carpel; styles as many as carpels, separate or united; stigma capitate or slender; fruit a capsule or rarely fleshy; seeds flat, oily.

About 200 species in ten genera, widespread in tropical and temperate regions. Represented in Texas by a single genus.

1. LINUM L. FLAX

Annual or perennial herbs, mostly with scorpioid cymes; flowers 5-merous throughout; fruit a more or less completely 10-celled capsule, dehiscent into 10 or (along the false septa) into 5 parts; otherwise with the characters of the family.

About 150 species, widely distributed in subtropical and temperate regions.

1. Flowers blue or rarely white (2)
1. Flowers yellow (4)
- 2(1). Inner sepals with ciliate margins; stigmas slender; fruiting pedicels erect or ascending1. *L. usitatissimum*.
2. Inner sepals entire; stigmas capitate; fruiting pedicels spreading or recurved (3)
- 3(2). Perennial; petals more than 10 mm. long; styles 4-9 mm. long; Trans-Pecos Texas only2. *L. Lewisii*.
3. Annual; petals less than 10 mm. long; styles 1-3 mm. long; mostly central and northern Texas3. *L. pratense*.
- 4(1). Styles separate or nearly so; fruit ultimately dehiscent into 10 one-seeded segments (5)
4. Styles united to above the middle; fruit dehiscent along the false septa into 5 two-seeded segments (10)
- 5(4). Outer sepals entire (6)
5. Sepals all with glandular teeth (8)
- 6(5). Fruit pyriform, longer than broad; pollen with about 15 germinal pores4. *L. floridanum*.
6. Fruit spheroidal, as broad as or broader than long; pollen with 3 germinal pores (7)
- 7(6). Margins of inner sepals with conspicuous stalked glands; mature fruit in dried specimens usually adhering to the plant; leaves narrowly lanceolate or oblanceolate5. *L. medium* var. *texanum*.
7. Margins of inner sepals glandless or with very inconspicuous glands; mature fruit in dried specimens usually soon shattering; leaves elliptic to oblanceolate or obovate6. *L. striatum*.
- 8(5). Annual; styles united at the base; pollen with about 12 germinal pores9. *L. sulcatum*.
8. Perennials; styles completely separate; pollen with 3 germinal pores (9)
- 9(8). Leaves lanceolate to oblanceolate or broader, some of the lower ones in whorls of four7. *L. Schiedeanum*.
9. Leaves linear, the lower ones alternate or opposite8. *L. rupestre*.
- 10(4). Sepals entire or fringed, not glandular-toothed; flowers few, mostly terminating leafy branches (11)
10. Sepals glandular-toothed; flowers racemose or paniculate (12)

¹⁰⁹ Contributed by C. Marvin Rogers.

- 11(10). Upper leaves and bracts sparsely but conspicuously ciliate-margined; cartilaginous portion of false septa conspicuously wider toward the base of carpel 10. *L. imbricatum*.
11. Upper leaves and bracts not ciliate-margined; cartilaginous portion of false septa uniformly narrow or absent throughout 11. *L. hudsonioides*.
- 12(10). Plants grayish-puberulent throughout 12. *L. puberulum*.
12. Plants glabrous or nearly so throughout (13)
- 13(12). Outer sepals ovate, the broad scarious margins irregularly crenate, each of the coarse teeth bearing a delicate gland 13. *L. alatum*.
13. Outer sepals lanceolate or narrower, the margins not scarious or narrowly so, regularly (though sometimes sparsely) serrate with gland-tipped teeth (14)
- 14(13). False septa incomplete, the inner margin terminating in a loose fringe; sepals persistent in fruit 14. *L. vernale*.
14. False septa complete; sepals usually deciduous in fruit (15)
- 15(14). Leaves small, the lower tending to be hidden among the branches; plant broomlike, bushy with long slender stiffly spreading-ascending few-flowered branches 15. *L. aristatum*.
15. Leaves quite evident; plants not broomlike, rather few-branched at the base or in the inflorescence (16)
- 16(15). Styles more than 6 mm. long; petals more than 10 mm. long (17)
16. Styles less than 6 mm. long; petals less than 10 mm. long (19)
- 17(16). Stigmas black; sepals grayish or purplish 16. *L. rigidum* var. *filifolium*.
17. Stigmas pale; sepals green (18)
- 18(17). Fruit thin-walled (dark seeds commonly evident through the wall), elliptic, the base rounded 16. *L. rigidum* var. *rigidum*.
18. Fruit thick-walled, opaque, broadly ovoid, tapering abruptly at the flattened base ..
..... 16. *L. rigidum* var. *Berlandieri*.
- 19(16). Stipular glands absent; north Texas only 16. *L. rigidum* var. *compactum*.
19. Stipular glands present at least near the base of the plant; Trans-Pecos Texas only (20)
- 20(19). Stipular glands present near the base of the plant only 17. *L. australe* var. *australe*.
20. Stipular glands present and prominent throughout 17. *L. australe* var. *glandulosum*.

1. *Linum usitatissimum* L. COMMON FLAX, LINAZA. Glabrous annual, commonly branched at the base, 3-9 dm. tall; leaves linear to narrowly lanceolate, 15-35 mm. long; stipular glands none; inflorescence paniculate, the fruit at maturity on erect or ascending pedicels; sepals 6-8 mm. long, the outer entire, the inner with delicately fringed margin; petals blue or sometimes white, 10-15 mm. long; styles separate, 3-5 mm. long; stigmas slender; fruit broadly ovoid, 6-8 mm. high, dehiscing tardily into 10 segments; false septa incomplete, ciliate; seeds about 5 mm. long. *L. humile* Mill. Sporadic escape from cult., mostly s. and n.e. part of the state, Mar.-July; nat. of the Old World, now widely cult.

2. *Linum Lewisii* Pursh. BLUE FLAX, PRAIRIE FLAX. Glabrous perennial, branched at the base, 2-8 dm. tall; leaves linear to linear-lanceolate, 1-3 cm. long, crowded below, mostly alternate above; stipular glands none; inflorescence paniculate, few-branched, the fruit at maturity on spreading or recurved pedicels; sepals 3.5-5 mm. long, entire; petals blue or rarely white, 10-15 mm. long; styles separate, 4-9 mm. long; stigmas capitate; fruit ovoid, 5-7 mm. high, dehiscing into 10 parts; false septa incomplete, ciliate; seeds 4-5 mm. long. Sandy and rocky slopes, w. Tex., Apr.-Oct.; Alas., s. to Calif., Tex. and n. Mex.

3. *Linum pratense* (Nort.) Small. MEADOW FLAX. Glabrous annual, commonly branched at the base, 5-40 cm. tall; leaves linear to linear-lanceolate, 1-2 cm. long, crowded near the base, scattered above; stipular glands none; inflorescence paniculate, the fruit at maturity on spreading or recurved pedicels; sepals 3.5-4.5 mm. long, entire; petals blue or rarely white, 5-10 mm. long; styles separate, 1-3 mm. long; stigmas capitate; fruit ovoid, 4-6 mm. high, dehiscent into 10 parts; false septa incomplete, ciliate; seeds 3.5-4.5 mm. long. Sandy open places, n. and w. Tex., Mar.-July; s. Can., s. to cen. Mex.

4. *Linum floridanum* (Planch.) Trel. Erect glabrous perennial, 2-10 dm. tall; leaves linear-oblongate, 1-2 cm. long, the lowermost opposite, otherwise alternate throughout; stipular glands none; inflorescence paniculate, few-branched; sepals 2.5-4.5 mm. long, the outer entire, the inner glandular-toothed; petals yellow, 6-9 mm. long; staminodia none; styles separate, 2-4 mm. long; fruit ovoid-pyriform, 2-3 mm. high, dehiscent into 10 parts; false septa nearly complete, eciliate; seeds about 2 mm. long. Open pine woods, e. Tex., May-Aug.; principally along Coastal Plain, Tex. to N.C.

5. *Linum medium* (Planch.) Britt. var. *texanum* (Planch.) Fern. SUCKER FLAX. Erect glabrous perennial, 2-8 dm. tall; leaves narrowly lanceolate, 1-2.5 cm. long, the lower few opposite, otherwise alternate; stipular glands none; inflorescence paniculate; sepals 2-3.5 mm. long, the outer entire, the inner glandular-toothed; petals yellow, 5-8 mm. long; staminodia none; styles separate, 1-3 mm. long; fruit depressed-globose or subspherical, about 2 mm. high, tardily separating into 10 segments; false septa nearly complete, ciliate; seeds about 1.5 mm. long. Open fields, meadows and swales, e. Tex., May-Aug.; Tex. to Fla. and Bah. I., n. to Ia. and Me.

6. *Linum striatum* Walt. Glabrous perennial; stems usually several from the base, 3-10 dm. tall; leaves elliptic to oblanceolate or obovate, 15-35 mm. long, the lower opposite, the upper alternate; stipular glands none; inflorescence paniculate with spreading branches; sepals 1.5-3 mm. long, entire or the inner with a few diminutive marginal glands; petals yellow, 2.5-4.5 mm. long; staminodia none; styles separate, 1.2-2 mm. long; fruit depressed-globose or subspherical, about 1.75 mm. high, splitting freely upon drying into 10 segments; false septa nearly complete, ciliate; seeds about 1.2 mm. long. Open or semishaded marshes, margins of streams and roadside ditches, e. Tex., May-Aug.; Tex. to n. Fla., n. to Mich. and Mass.

7. *Linum Schiedeianum* Schlecht. & Cham. Glabrous perennial, 2-6 dm. tall; leaves lanceolate to oblanceolate, 1-2 cm. long, the lower in whorls of 4, the upper alternate; stipular glands present; inflorescence paniculate, the flowers on pedicels 1 mm. long or less; sepals 2-3.5 mm. long, glandular-toothed; petals yellow, 3-6 mm. long; diminutive staminodia present; styles separate, 1.5-3 mm. long; fruit broadly ovoid, to 2.5 mm. high, readily dehiscent into 10 segments; false septa incomplete, the septa usually with a few marginal cilia; seeds about 1.2 mm. long. Calcareous soils in the mts. of the Trans-Pecos, June-Aug.; s.e. N.M., s. through e. Mex. to Guat.

8. *Linum rupestre* (Gray) Engelm. ROCK FLAX. Glabrous or sparsely hairy perennial, 2-7 dm. tall; leaves linear to linear-lanceolate, 1-2 cm. long, alternate throughout or the lowermost opposite; stipular glands present; inflorescence paniculate; sepals 2.5-5 mm. long, glandular-toothed; petals yellow, 6-10 mm. long; diminutive staminodia present; styles separate, 3-6 mm. long; fruit ovoid, 2-3 mm. high, dehiscent into 10 sharp-pointed segments; false septa partially developed, ciliate; seeds about 1.5 mm. long. Principally calcareous soils, cen. and w. Tex., Apr.-Aug.; Tex., s.e. N.M., s. through e. Mex. to Guat.

9. *Linum sulcatum* Ridd. Glabrous erect annual, 2-8 dm. tall; leaves linear to linear-lanceolate, entire, 1-3 cm. long, alternate or the lowermost opposite; stipular glands present; inflorescence paniculate; sepals lanceolate, acuminate, 3-7 mm. long, conspicuously glandular-toothed; petals pale-yellow, 5-10 mm. long; staminodia none; styles 2-4 mm. long, united at the base; fruit ovoid, 2.5-3.5 mm. high, dehiscent into 10 sharp-pointed segments; false septa partially developed, ciliate; seeds about 2 mm. long. Prairies and open sandy gravelly fields, e. half of state, May-Aug.; Tex. to Ga., n. to Man. and N.E.

10. *Linum imbricatum* (Raf.) Shinn. TUFTED FLAX. Annual; stems 5-30 cm. long, spreading to erect, glabrous below, hirsute above; leaves narrow, opposite below, alternate above, 5-10 mm. long, strongly imbricate, the upper with sparsely ciliate margins; stipular glands none; inflorescence few-flowered, the upper pedicels mostly hidden by the sub-

tending leaves; sepals persistent, 4.5-6 mm. long, with broad scarious margins, prominently toothed; petals yellow, each with or without brick-red base, 6.5-8 mm. long; styles 2-4 mm. long, united nearly to the summit; fruit broadly ovoid, 2.6-3 mm. high, dehiscent into 5 segments; false septa complete, mostly hyaline; seeds 2-2.6 mm. long. *L. multicaule* Hook. Sandy open places, e.-cen. Tex., Mar.-July; Tex. and s. Okla.

11. *Linum hudsonioides* Planch. Annual, 5-30 cm. tall; stems ascending to erect, hirsutulous on the angles above, otherwise glabrous; leaves narrow, opposite near the base, alternate above, 5-10 mm. long, imbricated throughout, eciliate; stipular glands none; inflorescence few-flowered, the pedicels usually all exerted beyond the subtending leaves; sepals persistent, 4.5-7 mm. long, the broad scarious margins toothed; petals yellow, each with or without a brick-red base, 8-12 mm. long; styles 3-6 mm. long, united nearly to the summit; fruit broadly ovoid, 2.7-3.5 mm. high, dehiscent into 5 segments; false septa almost entirely hyaline; seeds 2-2.7 mm. long. Sandy or gravelly soils in cen. Tex., Mar.-Sept.; Tex., N.M., Okla. and Kan.

12. *Linum puberulum* (Engelm.) Heller. PLAINS FLAX. Densely gray-puberulent annual, 5-25 cm. tall; leaves linear, 1-2 cm. long, alternate throughout or the lowermost opposite; stipular glands present; inflorescence paniculate; sepals 5-7 mm. long, glandular-toothed; petals yellowish-orange to salmon with reddish base, 7-14 mm. long; styles 3-7 mm. long, united nearly to the summit; stigmas dark; fruit ovoid, 3.5-4 mm. high, dehiscent into 5 segments; false septa complete, inner half scarious; seeds 2.5-3 mm. long. Sandy or gravelly open areas, w. Tex., Apr.-Sept.; Ut. to w. Neb., s. to n. Mex.

13. *Linum alatum* (Small) Winkl. Glabrous annual, 1-4 dm. tall; leaves linear to narrowly linear-lanceolate, 1-3 cm. long, alternate or the lowermost opposite; stipular glands present; inflorescence paniculate; sepals 5.5-8 mm. long, aristate, the outer with wide undulate or crenate margin and a sessile gland near the summit of each crenation, the inner regularly and closely glandular-toothed; petals yellow with reddish base, 10-18 mm. long; styles 5-9.5 mm. long, united nearly to the summit; stigma pale; fruit ovoid, 3.5-4.5 mm. high, dehiscent into 5 segments; false septa complete, the inner portion scarious; seeds 2.3-2.8 mm. long. Sandy soil in open areas, s.-cen. Tex., Mar.-July; also n.e. Tam.

14. *Linum vernale* (Woot.) Small. Glabrous annual, 1-5 dm. tall; leaves linear, 1-1.5 cm. long, alternate or the lower opposite; stipular glands present in most plants; inflorescence open, paniculate; sepals 4-7 mm. long, glandular-toothed, the outer sparsely so; petals yellow-orange to salmon with maroon base, 10-15 mm. long; styles 4-8 mm. long, united nearly to the summit; stigmas dark; fruit ovoid, 3-4 mm. high, dehiscent into 5 segments; false septa incomplete, the margin a loose fringe; seeds 2-2.8 mm. long. Stony, commonly calcareous soils, w. Tex., Mar.-Sept.; Tex., s.e. N.M. and n. Mex.

15. *Linum aristatum* Engelm. Glabrous annual, 1-4.5 dm. tall, much-branched throughout; leaves linear, 5-20 mm. long, alternate or the lowermost opposite; stipular glands nearly always present; inflorescence a diffuse panicle; sepals slender, 6-9 mm. long, glandular-toothed; petals yellow, 8-12 mm. long; styles 4.5-7 mm. long, united nearly to the summit; stigmas pale; fruit ellipsoid, clearly longer than broad, 3.5-4 mm. high, dehiscent into 5 segments; false septa complete, the larger inner portion scarious; seeds 2.5-3 mm. long. Very sandy soil, w. Tex., May-Sept.; Tex. and n. Mex. to Ut.

16. *Linum rigidum* Pursh var. *rigidum*. Glabrous annual, 2-5 dm. tall; leaves linear, 1-3 cm. long, alternate; stipular glands none; inflorescence open-paniculate; sepals 5.5-9 mm. long, glandular-toothed; petals yellow, 10-17 mm. long; styles 6-10 mm. long, united nearly to the summit; stigmas pale; fruit ellipsoid, 3.5-4.5 mm. long, dehiscent into 5 segments; false septa complete, inner half scarious; seeds 3-3.5 mm. long. Sandy, gravelly open areas, n. Tex., May-Sept.; Tex., n. to Alta. and Man.

Var. *filifolium* Shinnars. In many ways intermediate between var. *rigidum* and var. *Berlandieri*, but differing from both in having grayish sepals, black stigmas, and petals usually banded below the middle with purplish-red. Plants of southernmost part of the range, sometimes perennial, have been called *L. elongatum* (Small) Winkl. S. and w. Tex.; also n. Mex.

Var. *Berlandieri* (Hook.) T.&G. Differing from the typical var. in being somewhat shorter and more compact, having stipular glands in most individuals, petals brick-red at the base, and thick-walled triangular-ovate fruit. Throughout the state; Tex. to Colo. and Kan.

Var. *compactum* (A. Nels.) Rogers. Differs from the typical var. in its compact habit and from all vars. in its small floral parts. N. Tex. to Alta. and Sask.

17. *Linum australe* Heller var. *australe*. Glabrous annual. 1-5 dm. tall; leaves linear, 1-2 cm. long, alternate; stipular glands present near base of plants; inflorescence open-paniculate; sepals 4-6.5 mm. long, glandular-toothed; petals yellow, 5-9 mm. long; styles 2-4 mm. long, united nearly to the summit; stigmas pale; fruit ovoid, 3-4 mm. high, dehiscent into 5 segments; false septa complete, inner half scarious; seeds 2.5-3 mm. long. Semi-shaded hillsides, mts. of w. Tex., June-Aug.; Tex. to Ariz. and s. Nev. to Alta.

Var. *glandulosum* Rogers. Differs from the typical var. in having slightly larger floral parts, smaller fruits and stipular glands throughout. Mts. of w. Tex.; Tex. to Ariz. s. to Pue.

FAM. 96. ZYGOPHYLLACEAE R. BR.¹¹⁰

CALTROP FAMILY

Prostrate to ascending annual or perennial herbs from an herbaceous to woody root-stock, shrubs or rarely small trees; branches diffuse, crooked at nodes; stipules present; leaves opposite or rarely clustered in fascicles at nodes or alternate, even-pinnate and once-compound or rarely irregularly pinnatifid; leaflets usually opposite and paired, entire; flowers perfect, regular or nearly so, 5-merous, pseudaxillary; peduncles solitary or rarely clustered; sepals 4 or 5, free, sometimes unequal, imbricate or valvate in bud, persistent to deciduous; petals 4 or 5, free, equal, spreading, imbricate, valvate or convolute in bud; stamens 10 to (12 to 15), usually in 2 whorls; filaments free or outer whorl connate basally to petals, sometimes winged basally or with a basal appendage; disk usually conspicuous; gynoeceium of 2 to 5 united carpels; ovary superior, 2- to 5- or 10-lobed and -loculed; ovules 1 to many per locule, the placentation axile; style usually persisting to form a beak on fruit apex; fruit a lobed or winged variously dehiscent capsule, or separating at maturity into 5 or 10 indehiscent mericarps; seeds 1 to many per locule.

A relatively small family of about 27 genera and 250 species. Widely distributed, with a number of old, relict genera found mainly in the warmer, drier regions of the world.

1. Erect woody shrubs or small trees (2)

1. Prostrate to ascending annual or perennial herbs (3)

2(1). Petals bright-yellow; leaflets 2; fruit a 5-lobed white- to red-woolly capsule ...
.....1. *Larrea*, p. 901.

2. Petals blue or purple; leaflets 4 to 8 pairs; fruit a 2-lobed minutely puberulent capsule
.....2. *Porlieria*, p. 902.

3(1). Leaves alternate; fruit a glabrous irregularly loculicidal capsule
.....3. *Peganum*, p. 902.

3. Leaves opposite; fruit at maturity separating into 5 or 10 indehiscent mericarps (4)

4(3). Intrastaminal glands absent; mericarps 10, tubercled, 1-seeded; beak of fruit
persisting after mericarps fall4. *Kallstroemia*, p. 903.

4. Intrastaminal glands present; mericarps 5, spiny, 3- to 5-seeded; beak of fruit falling
with mericarps5. *Tribulus*, p. 905.

1. LARREA CAV.

A New World genus with 1 species in North America and 4 species in the deserts of South America.

1. *Larrea tridentata* (DC.) Cov. CREOSOTE BUSH, GOBERNADORA, HEDIONDILLA. Ever-green shrubs to 3 m. high, aromatic with odor of creosote (especially when moist); numerous flexuous slender stems radiating and ascending divaricately from near ground level, with no well-defined trunk; bark gray; nodes dark, conspicuous, resinous, giving

¹¹⁰ Contributed by Duncan M. Porter.

stems a jointed appearance; leaves opposite, subsessile to short-petiolate; leaflets 2, opposite, divaricate, inequilateral, falcate, connate basally, ovate to oblong or obovate to sometimes lanceolate, apex acute, coriaceous, glossy dark-green to yellowish-green, resinous, 5-10 mm. long; flowers solitary, to about 25 mm. in diameter; sepals 5, unequal, 5-8 mm. long, imbricate in bud, caducous; petals 5, bright-yellow, obovate, concave, short-clawed, twisted on edge, 7-10 mm. long, about 5 mm. wide; stamens 10; filaments winged, with basal scales half to as long as filaments; capsule globose, 5-lobed and -loculed, densely white- to red-woolly, about 6 mm. in diameter; carpels 1-seeded, indehiscent, at length separating from capsule. *L. mexicana* Moric., *L. glutinosa* Engelm. Probably the most abundant plant on the alluvial plains of the Trans-Pecos, less common in the mts. and e. across the w. part of the Edwards Plateau to Howard, Crockett and Terrell cos., thence s.e. along the Rio Grande to Starr Co., mainly Feb.-Aug.; throughout the warm deserts of N.A. from Calif., Nev., Ut., Ariz. and N.M. to Tex. and across Baja Calif., Son., Chih., Coah., N.L. and Tam. to Dgo., Zac., Ags., and S.L.P., with outlying localities in Qro. and Hgo.

Various decoctions of the plant, especially extractions of the leaves and twigs, are considered in folk medicine to be effective in treating a variety of conditions; by some it is reputed to be poisonous. Some authors consider this species to be conspecific with the South American *L. divaricata* Cav., a name that has priority over *L. tridentata*, and which must be used if the two are merged.

2. PORLIERIA R. & P.

A New World genus of about 4 species, 1 in North America and several in the South American deserts. This interesting bicentric distribution is also found in *Larrea* and in several other genera of the family. *Porlieria* is closely related to *Guaiacum*, a genus of the Caribbean region and western Mexico, which differs in having minute deciduous stipules, fewer and larger leaflets, no staminal appendages and more ovules in each ovary locule.

1. *Porlieria angustifolia* (Engelm.) Gray. GUAYACÁN, SOAP-BUSH. Evergreen shrubs or small trees, to 7 m. high; trunk well-defined, to 25 cm. in diameter; branches many, spreading or straggling, stout, crooked, knotty; bark gray, fissured; stipules subulate, somewhat spinescent, persistent; leaves opposite or crowded in fascicles at nodes, pinnate, 1-3 cm. long, folded at night and often also in heat of day; leaflets 4 to 8 pairs, sessile or nearly so, dark-green, coriaceous, reticulate, linear-oblong to linear-spatulate, apiculate, base oblique, 5-15 mm. long, 2-3 mm. wide; peduncles in axils of minute bracts, solitary or sometimes clustered; flowers 12-20 mm. in diameter, fragrant; sepals 5, unequal, suborbicular, obtuse, concave, 5 mm. long, imbricate in bud; petals 5, blue to purple, obovate to nearly elliptical, short-clawed, apex often notched, about 1 cm. long; stamens 10; filaments each with a small crenate basal scale; capsule 2 or (3 or 4) -lobed and -loculed, obcordate, flat, reticulate, coriaceous, puberulent, 1-2 cm. in diameter, margin somewhat winged, apex abruptly attenuate-apiculate, septicidally dehiscent; seeds 1 per locule, yellowish-brown, reniform, enclosed in a thick fleshy scarlet aril. Frequent in brush, across the Rio Grande Plains from Cameron to Comal cos. and scattered through canyons along the valley of the Rio Grande to Brewster and Pecos cos. in the Trans-Pecos, Mar.-Sept.; s. into Chih., Coah., N.L. and Tam.

The bark of the root is used as a source of soap, and root extracts are used in folk medicine to treat various diseases.

3. PEGANUM L.

Densely foliaged, dichotomously and corymbosely branched, prostrate to ascending and globose herbs less than 1 m. high; stems herbaceous, pubescent to glabrous, from a perennial woody rootstock; stipules setaceous, 1-2 mm. long; leaves alternate, fleshy, irregularly pinnatifid; lobes linear, acute to apiculate, pubescent to glabrous, 2-6 cm. long; flowers solitary; sepals 4 or 5, foliaceous, conspicuous, irregularly pinnatifid to entire, the segments linear, acute to apiculate, valvate in bud, persistent; petals 4 or 5,

white to yellow, subequal, imbricate in bud; stamens 12 to 15, 1 whorl alternate with petals, other in pairs opposite petals; filaments linear, the bases dilated; ovary globose, (2 or) 3 (or 4) -lobed and -loculed; ovules many per locule; capsule subglobose, (2 or) 3 (or 4) -lobed and -loculed, chartaceous, irregularly loculicidally dehiscent; style persisting to form a beak as long as or longer than fruit body; seeds triangular, dark, curved, many per locule.

A genus of 3 species. One native to the Chihuahuan Desert of North America, one found across the Great Palaeartic Desert from Morocco to Manchuria, and the third occurring in and around the Gobi Desert in Asia.

1. Peduncle shorter than petals in flower, in fruit recurved and shorter than capsule 1. *P. mexicanum*.
1. Peduncle about twice as long as petals in flower, erect and longer than capsule in fruit 2. *P. Harmala*.

1. *Peganum mexicanum* Gray. GARBANCILLO, LIMONCILLO. Stems prostrate to decumbent, pubescent, becoming glabrate, often glaucescent, to 3 dm. long; leaves pubescent to glabrate; peduncles shorter than petals; sepals to twice as long as petals; petals pale-yellow, narrowly oblong, less than 1 cm. long, a third as wide; filaments scarcely dilated basally; disk annular; peduncles recurved in fruit, shorter than capsules; capsules less than 1 cm. in diameter, shorter than sepals. Infrequent, scattered in alluvial often gypsum-bearing soils; in the U.S. only in Hudspeth Co. in the Trans-Pecos, May-Oct.; s. through Son., Chih., Coah., N.L. and Tam. to Zac. and S.L.P.

The herbage is reputed to be poisonous to cattle and sheep.

2. *Peganum Harmala* L. Stems prostrate to ascending and globose, pubescent to glabrous, to 9 dm. long and 3 dm. high; leaves glabrous to slightly pubescent; peduncles about twice as long as petals; sepals usually longer than petals; petals white to yellow, oblong-elliptic, to 15 mm. long, one half as wide to as wide as long; filaments dilated basally; disk cupuliform; peduncles longer than capsules in fruit, erect; capsules to 15 mm. in diameter, much shorter than sepals. Scattered across the Trans-Pecos in Hudspeth, Reeves, Presidio and Pecos cos., in Edwards Co. on the Edwards Plateau, and in Garza Co. in the Plains Country, Apr.-Nov.; an introd. weed from the Great Palaeartic Desert, spreading from an introd. in Luna Co., N.M., in the 1930's; also known from Ariz. and Nev.

The seeds are the source of the dye "Turkey-red." Also reputed to be poisonous to stock.

4. KALLSTROEMIA Scop.

Prostrate or decumbent to ascending diffusely branching annual or perennial herbs; stems pubescent to glabrate, spreading radially from a central taproot; leaves opposite, even-pinnate, obovate to elliptical, 1 of each pair alternately smaller or sometimes abortive; leaflets 3 to 8 pairs, oblong or obovate to elliptical, inequilateral, somewhat unequal; flowers solitary, the peduncles emerging from axils of the alternately smaller leaves; sepals 5, lanceolate or subulate to ovate, pubescent, imbricate in bud, persistent or rarely deciduous; petals 5, orange or yellow (rarely white), obovate, apex rounded to slightly notched, convolute in bud, marcescent; stamens 10, in 2 whorls of 5 each, outer whorl opposite petals and adnate to them basally, usually slightly longer than inner whorl; ovary globose or ovoid, 10-lobed and -loculed, pubescent to glabrous; ovules 1 per locule; style forming a persistent beak on fruit apex; fruit body ovoid, 10-lobed, pubescent to glabrous, at maturity separating into 10 indehiscent 1-seeded unarmed mericarps.

The largest and most difficult New World genus of the family, with 17 species in the warm arid and dry tropical areas of the Americas. The species usually are to be encountered in disturbed, sandy, alluvial soils.

1. Flowers 25 mm. in diameter or larger (2)
1. Flowers less than 25 mm. in diameter (3)

- 2(1). Herbaceous annual; peduncles longer than subtending leaves; stamens as long as style1. *K. grandiflora*.
 2. Subwoody-based perennial; peduncles shorter than subtending leaves; stamens about two thirds as long as style2. *K. perennans*.
 3(1). Fruits glabrous3. *K. maxima*.
 3. Fruits pubescent (4)
 4(3). Petals orange; beak of fruit longer than fruit body .4. *K. parviflora*.
 4. Petals yellow; beak of fruit shorter than fruit body (5)
 5(4). Sepals persistent; base of broadly conical beak surrounded by conspicuous ring of hirsute trichomes5. *K. hirsutissima*.
 5. Sepals usually deciduous; base of cylindrical beak glabrous to pubescent but ring of hirsute trichomes absent6. *K. californica*.

1. *Kallstroemia grandiflora* Gray. DESERT POPPY, MEXICAN POPPY. Decumbent to ascending annual; stems densely sericeous and hispid, to 1 m. long; leaves elliptical, 1.5-7 cm. long; leaflets 4 to 8 pairs, elliptical to slightly obovate, appressed-hirsute, becoming glabrate, 8-25 mm. long, 2-5 mm. wide; peduncles longer than subtending leaves; sepals lanceolate, 6-16 mm. long, 1.5-2.5 mm. wide, persistent; petals orange or rarely white, broadly obovate, 1-2 cm. long, 7-15 mm. wide; fruit body ovoid, strigose, 4-5 mm. in diameter; beak cylindrical, 6-18 mm. long; mericarps about 3.5 mm. high and 1 mm. wide, tubercles rounded. Across the Trans-Pecos from El Paso Co. e. to Loving Co. and s. to Brewster Co., often in limestone soils, May-Nov.; from extreme s.e. Calif. through s. Ariz. and N.M. to Tex., through Son. and Chih. to Coah. and s. along the w. coast of Mex. through Sin., Dgo., Nay., Jal., Colima and Michoac. to Gro.

A common plant of the warm deserts of North America; in favorable years sometimes forming large populations many yards across.

2. *Kallstroemia perennans* B. L. Turner. Prostrate to ascending perennial, 1-2 dm. high; stems densely hispid and strigose, 1 to several from a thick subwoody rootstock; leaves elliptical, 20-55 mm. long; leaflets 4 to 5 pairs, oblong to ovate, densely appressed-hirsute, 13-18 mm. long, 6-10 mm. wide; peduncles shorter than subtending leaves; sepals lanceolate, 13-15 mm. long, 1.5-2.5 mm. wide, persistent; petals orange, obovate, 19-26 mm. long, about 10 mm. wide; fruit body broadly ovoid, hispid and strigose, 5-6 mm. high, 8-10 mm. wide; beak cylindrical, 6-10 mm. long; mericarps cross-ridged and more or less keeled, about 4 mm. high and 2.5 mm. wide. *K. hirsuta* L. O. Wms. This rare endemic of limestone soils is known from the w. Edwards Plateau in the vic. of Langtry, Val Verde Co., and from s.w. Brewster Co. and adj. Presidio Co. in the Trans-Pecos, May-Aug.; to be expected on the Mex. side of the Rio Grande.

3. *Kallstroemia maxima* (L.) H. & A. Prostrate to decumbent annual; stems sericeous and sparingly hirsute, becoming glabrate, to 1 m. long; leaves obovate, 1-6 cm. long; leaflets 3 or 4 pairs, broadly oblong to elliptical, 5-29 mm. long, 3-14 mm. wide; peduncles in fruit as long as or longer than subtending leaves; sepals ovate, 3-8 mm. long, 2-3 mm. wide, persistent; petals yellow, obovate, 7-8 mm. long, to 6 mm. wide; fruit body ovoid, glabrous, 5-6 mm. in diameter; beak widely conical basally, about as long as body; mericarps tuberculate, cross-ridged and slightly keeled, 3-4 mm. high, about 1 mm. wide. This widespread weedy Carib. and trop. Mex. species has been collected twice in Washington Co., s.-cen. Tex., in the 1930's, to be expected elsewhere in Tex., July-Oct.; in the U.S. known also from coastal Fla., Ga. and S.C.

4. *Kallstroemia parviflora* Nort. Prostrate to decumbent annual; stems hirsute and sericeous, becoming glabrate, to 1 m. long; leaves elliptical, 1-6 cm. long; leaflets 3 to 5 pairs, elliptical to oblong or oval, appressed-hirsute, 8-19 mm. long, 3.5-9 mm. wide; peduncles usually longer than subtending leaves; sepals lanceolate, 4-7 mm. long, 1-2 mm. wide, persistent; petals orange, narrowly obovate, 5-11 mm. long, 3.5-6 mm. wide; fruit body ovoid, strigose, 3-4 mm. high, 4-6 mm. wide; beak cylindrical, longer than body, 4-9 mm. long; mericarps rugose to tubercled, 3-4 mm. high, about 1 mm. wide. *K. intermedia* Rydb. The most common representative of the genus in Tex., occurring everywhere but in e. and s.e. Tex., the High Plains and the southernmost Rio Grande Plains, Apr.-Nov.; w. through N.M., Colo., Ariz. and s. Nev. to s.e. Calif., n. through

Okla., Kan. and Mo. to Ill. and Miss., from Son. through Chih., Coah., N.L., Dgo., Zac., Ags. and S.L.P. to Gto., Qro., and Hgo.

5. *Kallstroemia hirsutissima* Vail. CARPETWEED. Prostrate annual, forming a dense carpetlike mat; stems copiously gray-sericeous and hirsute, 15-70 cm. long; leaves obovate, 1-4 cm. long; leaflets 3 or 4 pairs, broadly elliptical to oblong-ovate or broadly ovate, densely hirsute and conspicuously ciliate, 12-19 mm. long, 5-11 mm. wide; peduncles shorter than subtending leaves; sepals subulate, 2.5-4 mm. long, about 1 mm. wide, persistent; petals yellow, obovate, 2-4 mm. long, about 1.5 mm. wide; fruit body broadly ovoid, strigillose, 4-5 mm. high, 6-8 mm. wide; beak broadly conical and white-hirsute basally, shorter than body, 1-4 mm. long; mericarps prominently tubercled, about 4 mm. high and 1 mm. wide. Found sparingly across the Rio Grande Plains from Cameron Co. to Kinney and Bexar cos. in Kerr Co. on the Edwards Plateau and in the Trans-Pecos in Jeff Davis, Pecos and Brewster cos., June-Nov.; from s.e. Ariz. and s. N.M. to Tex. and through Chih., Coah., N.L. and Tam. to S.L.P.

Reported to be poisonous to livestock.

6. *Kallstroemia californica* (Wats.) Vail. Prostrate to decumbent annual; stems hirsute and strigose, becoming glabrate, 10-65 cm. long; leaves elliptical, 1.5-6 cm. long; leaflets 3 to 6 pairs, elliptical to oval, appressed-hirsute, becoming glabrate, 4-17 mm. long, 1.5-9 mm. wide; peduncles shorter than subtending leaves; sepals lanceolate, 2-4 mm. long, 1-1.5 mm. wide, usually deciduous; petals yellow, obovate, 4-6 mm. long, 2.5-3 mm. wide; fruit body ovoid, strigillose, 3-5 mm. wide, to 4 mm. high; beak cylindrical, the base conical, shorter than body, 2-4 mm. long; mericarps about 3 mm. high and 1 mm. wide, with blunt oblong tubercles to 1.5 mm. long. Incl. var. *brachystylis* (Vail) Kearns & Peeb. *K. brachystylis* Vail. Found sparingly in the Trans-Pecos along the valley of the Rio Grande in El Paso, Hudspeth, Presidio and Brewster cos., common throughout the Rio Grande Plains and spreading n. to Kerr Co. on the Edwards Plateau and e. to Lavaca Co. in s.-cen. Tex., Mar.-Nov.; Calif., Ariz. and N.M. to Tex., from Baja Calif. through Son., Chih., Coah., Tam., Sin., Dgo., and S.L.P. to Nay.

5. TRIBULUS L. CALTROP

Prostrate to ascending diffusely branching annual or perennial herbs; stems appressed-sericeous and hirsute, spreading radially from a central taproot, to 3 m. long; leaves opposite, even-pinnate, elliptical, one of each pair alternately smaller or sometimes abortive; leaflets 3 to 7 pairs, oblong to ovate or elliptical, inequilateral; flowers solitary, the peduncles emerging from axils of the alternately smaller leaves; sepals 5, ovate to lanceolate, pubescent, imbricate in bud, deciduous; petals 5, bright-yellow or rarely white, obovate, apex rounded to lobed; stamens 10, in 2 whorls of 5 each, outer whorl opposite petals and adnate to them basally, usually slightly longer than inner whorl; intrastaminal glands present; ovary ovoid, 5-lobed and -loculed, densely hirsute-pilose; ovules 3 to 5 per locule; fruit at maturity separating into 5 indehiscent mericarps, each with 2 to 4 stout dorsal spines and occasional smaller spines and aristate tubercles; each mericarp divided internally by oblique transverse septa into 3 to 5 1-seeded compartments; beak falling with mericarps.

A genus of the Old World deserts, with perhaps several dozen species. Three species occur as introduced weeds in the Americas.

1. Prostrate annual; flowers 5-10 mm. in diameter; peduncles usually shorter than subtending leaves; intrastaminal glands free 1. *T. terrestris*.

1. Prostrate to ascending perennial; flowers 20-40 mm. in diameter; peduncles usually longer than subtending leaves; intrastaminal glands connate, forming a 5-lobed ring around ovary base 2. *T. cistoides*.

1. *Tribulus terrestris* L. CALTROP, GOAT HEAD, PUNCTURE WEED, AROJO DE FLOR AMARILLA, CADILLO. Prostrate annual; leaves 10-45 mm. long; leaflets 3 to 6 pairs, oblong to ovate, 4-11 mm. long, 1-4 mm. wide; flowers 5-10 mm. in diameter, the peduncles usually shorter than subtending leaves; sepals ovate, 2-3 mm. long, 1.5-2 mm. wide; petals 3-5 mm. long, 2-3 mm. wide; intrastaminal glands free; fruits to about 1 cm. in diameter (excluding spines), larger spines 4-7 mm. long. Abundant usually in sandy or gravelly

disturbed soils throughout the state except on the Gulf Coast and the extreme e. portion, Apr.-Nov.; nat. to Medit. region, now widely distributed as a weed throughout the warm-temp. areas of the world.

The spiny mericarps are a nuisance to both man and beast, injurious to bare feet and automobile tires, and occasionally fatal to stock if eaten. The plants are extremely difficult to eradicate once established in an area, as the seeds will remain viable in the soil for at least 8 years.

2. *Tribulus cistoides* L. BURR NUT. Prostrate to ascending perennial; leaves 15-75 mm. long; leaflets 5 to 7 pairs, oblong to elliptical, 10-19 mm. long, 4-8 mm. wide; flowers 2-4 cm. in diameter, the peduncles usually longer than subtending leaves; sepals lanceolate, 6-9 mm. long, 2-3 mm. wide; petals 8-22 mm. long, 5-16 mm. wide; intrastaminal glands connate into a 5-lobed ring around ovary base; fruits to about 15 mm. in diameter (excluding spines), larger spines 5-8 mm. long. Reported to occur in Tex., but no specimens from the state have been seen; in the U.S. known from coastal Fla., Ga. and La., to be expected along the Tex. Gulf Coast; nat. to the Old World, a pantrop. weed, especially common in the Carib. region and trop. Mex., usually found in maritime habitats.

FAM. 97. RUTACEAE JUSS.

CITRUS FAMILY

Armed or unarmed shrubs or perennial herbs, rarely small trees; leaves alternate or opposite, often pinnately or palmately compound or by reduction simple, usually firm and thickish and aromatic, furnished at least on the underside of the leaves (and usually throughout the epidermis) with aromatic oil glands (these obscure in *Ptelea*); petioles and/or rachises often wing-margined; stipules absent; flowers perfect or polygamous or dioecious, in various types of inflorescences; calyx usually 5- (or 4-) parted, sometimes gamosepalous, sometimes caducous, or rarely absent; corolla of 3 to 5 or rarely more usually imbricate petals, or rarely absent; stamens 1 to 3 times as many as the petals, usually twice as many, and free or variously connate near the base, when 2 whorls present the outer whorl opposite the petals; a "disk" usually present just above the level of the androecium and below the ovary; ovary and fruit superior, very diverse in the family, but usually of several carpels oriented around a central columella, sometimes the carpels only lightly coalescent, and sometimes reduced to one; ovules anatropous; endosperm usually copious.

More than 900 species in about 150 genera, mainly in the tropics and temperate regions, especially South Africa and Australia.

- 1. Leaves opposite or some of them subopposite (2)
- 1. Leaves alternate (4)
- 2(1). Leaves trifoliolate6. *Helietta*, p. 908.
- 2. Leaflets more than 3 on most leaves (3)
- 3(2). Leaves palmately compound8. *Choisya*, p. 909.
- 3. Leaves pinnately compound3. *Amyris (madrensis)*, p. 907.
- 4(1). Herbs or subshrubs (5)
- 4. Shrubs or small trees (6)
- 5(4). Leaves simple; fruit 2-celled5. *Thamnosma*, p. 908.
- 5. Leaves much-divided; fruit 4- or 5-celled4. *Ruta*, p. 907.
- 6(4). Fruit with a leathery bitter oily rind and several wedge-shaped acidulous juicy endocarps each with several seeds; stamens usually at least 151. *Citrus*, p. 907.
- 6. Fruit not a hesperidium; stamens fewer than 15 (7)
- 7(6). Fruit a berry or drupe (8)
- 7. Fruit samaralike or else a capsule or folliclelike (9)
- 8(7). Calyx 3- (rarely 4-) lobed; plants armed2. *Triphasia*, p. 907.
- 8. Calyx otherwise; plants unarmed3. *Amyris (texana)*, p. 907.
- 9(7). Fruit samaralike7. *Ptelea*, p. 909.
- 9. Fruit a capsule or folliclelike (10)

- 10(9). Fruit a 4- or 5-celled woody capsule 9. *Esenbeckia*, p. 910.
 10. Each pistillate flower bearing 1 to 5 bivalved folliclelike carpids
10. *Zanthoxylum*, p. 910

1. CITRUS L. CITRUS

An Asiatic genus of about a dozen species, of which several are cultivated in Texas and one is said to have escaped. The cultivated citrus fruit plants such as orange (*C. Aurantium* L.), grapefruit [*C. maxima* (Burm.) Merr. var. *uvacarpa* Merr. & Lee], lemon (*C. Limonia* Osbeck) and lime [*C. aurantifolia* (Christm.) Swingle] all have unifoliate leaves.

1. *Citrus trifoliata* L. TRIFOLIATE ORANGE, BITTER ORANGE. Shrub or small tree; branches usually armed with stout straight thorns; leaves deciduous, trifoliolate; leaflets elliptic or obovate, 17-40 mm. long, entire-margined; flowers solitary, perfect; calyx cup-shaped, 3- to 5-toothed; petals usually 4 or 5, whitish, fragrant; stamens at least 15; fruit globose or subglobose, about 4 cm. thick. *Poncirus trifoliata* (L.) Raf. Infrequent near old home-sites and in fencerows in the e. half of the state where it is cult. and occasionally occurs as an escape; nat. of Asia (probably originally Japan).

2. TRIPHASIA LOUR.

A monotypic genus of southeast Asia.

1. *Triphasia trifolia* (Burm. F.) P. Wils. LIMEBERRY. Spiny evergreen shrub 1-2 m. tall; spines paired at the nodes (or in the axils), 5-17 mm. long, straight; leaves alternate, trifoliolate; leaflets crenate, ovate to broadly elliptic, 1-4 cm. long; flowers solitary; calyx cup-shaped, 3- or 4-lobed; petals white, fragrant, 3 or 4, 12-16 mm. long, imbricate in bud; stamens 6 (or 8); fruit a berry, 1- to 3-seeded, globose, or slightly prolate, red, 10-16 mm. long, insipid, punctate with aromatic oil glands. Cult. in s. Tex. and said to have escaped; nat. of Asia, now widely introd. in warm regions.

3. AMYRIS P. BR.

Unarmed shrubs; leaves pinnately compound, alternate or opposite; flowers in terminal arrangements, inconspicuous, perfect; pedicels bibracteate; sepals 4 or 5; petals 4 or 5, whitish, 2.5-3 mm. long; stamens 8 or 10; ovary 1-celled; ovules 2, pendulous; fruits a small blackish globose juicy drupe, 4-12 mm. thick.

An American genus of perhaps 2 or 3 dozen species, ranging from Peru and Venezuela north to the West Indies and the warmer parts of Mexico, 2 species venturing even as far north as south Texas, and another as far north as Florida.

1. Leaves alternate, trifoliolate, glabrous 1. *A. texana*.
 1. Leaves opposite or subopposite, 5- to 11-foliolate, pubescent
 2. *A. madrensis*.

1. *Amyris texana* (Buckl.) P. Wils. LANTRISCO, CHAPOTILLO. Rounded shrubs often only 1 m. tall, less commonly to 2 m.; leaves alternate, trifoliolate, glabrous and shiny; leaflets 1-3 cm. long, 5-15 mm. broad; drupes 4-5 mm. thick. *A. parvifolia* Gray. Locally abundant in brush in s. Tex., n. along the coast to Jackson Co., spring-fall; Tex., N.L., Tam. and extreme n. Ver.

2. *Amyris madrensis* Wats. Shrubs 1-3 m. tall; leaves opposite or subopposite, 5- to 11-foliolate, dull and pubescent; leaflets ovate or rhombic-ovate, 15-30 mm. long, 7-20 mm. broad; drupes mostly 8-12 mm. thick. Infrequent or rare in brush in extreme s. Tex. (Cameron, Hidalgo and Willacy cos.), spring-fall; Tex., Coah, N.L. and Tam.

4. RUTA L. RUE

Glaucous unarmed perennial herbs 3-8 dm. tall, often woody at base; herbage with a strong disagreeable odor when bruised; leaves alternate, gland-dotted, twice or thrice

pinnately or ternately divided; flowers perfect, in terminal corymbose or paniced cymes; sepals 4 or 5, 3-4 mm. long, persistent; petals 4 or 5, 5-9 mm. long, cymbiform, yellow or greenish, imbricate in bud; disk thick, 8- to 10-lobed; stamens 8 or 10, lying in pairs; ovary 4- or 5-celled, more or less 4- or 5-lobed; ovules several in each cell; fruit a 4- or 5-celled capsule.

A Mediterranean and Asian genus of perhaps 50 species, of which at least 2 are widely introduced and weedy.

1. Petals entire or toothed; lobes of the capsule rounded . . . 1. *R. graveolens*.

1. Petals fringed; lobes of the capsule pointed 2. *R. chalapensis*.

1. *Ruta graveolens* L. RUE, RUDA. Characters as in the key. Infrequent along roadsides in s. and w. Tex., spring-fall; Eur., now widely introd.

Reputed to be a narcotic and stimulant. Rue is the symbol of grace.

2. *Ruta chalapensis* L. RUE. Characters as in the key. Infrequent or rare in Edwards Plateau and probably elsewhere in w. Tex.; nat. of N. Afr., now widely introd. in warm regions.

5. THAMNOSMA TORR. & FRÉM. DUTCHMAN'S BREECHES

A curiously distributed genus of 4 or 5 species, mostly in the warmer, drier parts of North America, but with 1 species in Socotra (Gulf of Aden or Arabian Sea), and 1 in South Africa.

1. *Thamnosma texana* (Gray) Torr. RUDA DEL MONTE. Unarmed perennial herb or subshrub usually less than 3 dm. tall; leaves alternate, simple, essentially linear and entire, very strongly gland-dotted, 5-15 mm. long, somewhat fleshy, disagreeably aromatic when bruised; flowers perfect, in racemes or racemose cymes; sepals 4; petals 4, imbricate in bud, at anthesis erect and somewhat incurved, together somewhat urceolate though not coalescent; disk well-developed; stamens 8; ovary 2-celled, 2-lobed, stipitate; ovules several in each cell; fruit a leathery 2-celled and 2-lobed capsule 3-7 mm. long, in the shape of inflated "dutchman's breeches" with the legs projecting upward. Frequent but inconspicuous, Rio Grande Plains, s. and w. parts of Edwards Plateau, the Trans-Pecos and s. parts of Plains Country, early spring (and again in fall); Tex., N.M. and Ariz. and n. Mex.

The plants east of the 100th meridian have mostly clear canary-yellow flowers. To the west the flowers are mostly purplish with only a slight yellow center, or even this becoming obscured in the extreme west; these more western populations are the f. *purpurea* (Woot. & Standl.) Lundell (*Rutosma purpurea* Woot. & Standl., *Thamnosma Aldrichii* Tharp).

6. HELIETTA TUL.

A genus of about 7 species of Paraguay, Argentina, Uruguay, Brazil, Venezuela, Cuba, Mexico and Texas, mostly inhabiting low, subhumid forests or xeric scrub.

1. *Helietta parvifolia* (Gray) Benth. BARRETA. Unarmed spindly shrubs (1-) 2-4 m. tall; leaves opposite, trifoliolate, 35-50 mm. long, mostly glabrate; leaflets sessile or nearly so, usually oblong-obovate, apically rounded; flowers in terminal panicles, perfect, small; calyx 3- or 4-parted, about 2 mm. broad; petals 3 or 4, imbricate in bud, ovate to broadly elliptic, 2.5-3 mm. long; stamens 3 or 4; ovary 3- or 4-celled, 3- or 4-lobed; fruit of 3 or 4 indehiscent samaralike carpels, separating from each other at maturity, each winged on the upper dorsum, 10-15 mm. long; ovules 2 in each cavity but seeds solitary by abortion, about 6 mm. long. Confined to gravel and rocky hills a few miles east of Rio Grande City, Starr Co., extreme s. Tex., where it was originally locally abundant, spring, occasionally later; Hgo., S.L.P., Tam., N.L. and Tex.

This species, as well as several other associated unique species, is threatened with extermination in Texas due to the massive bulldoze-clearing of the hills on which they grow in order that a pittance of forage might be obtained. The Texas Parks Department or Highway Roadside Parks Division should salvage some of this unique floral region before it is too late to do so.

7. PTELEA L.¹¹¹

Unarmed aromatic polygamo-dioecious deciduous shrubs with pallid or even whitish epidermis and bark; leaves alternate, trifoliolate, rather variable in pubescence; leaflets variable in shape, usually 2-6 cm. long; flowers in terminal panicles, greenish-white; sepals 4 or 5 (or 6), 1-2 mm. long, soon deciduous; petals 4 or 5 (or 6), imbricated in bud, commonly 4-5 (-6) mm. long, broadly elliptic to ovate or linear-oblong; stamens 4 or 5 (or 6), alternate to petals (reduced to vestiges in pistillate flowers); disk lobed, acting as a gynophore; ovaries compressed, 2- (or 3-) locular; ovules 2 in each locule but the lower one in each locule aborting; fruit an indehiscent samara in a single plane, with a thin wing all around.

A North American genus of 3 species of which we have only one.

1. *Ptelea trifoliata* L. SKUNK-BUSH, WAFER-ASH, COLA DE ZORRILLO. Nearly throughout the state but absent from extreme s. part, and in w. Tex. found only in protected canyons. We have several weakly distinguished and completely intergrading infraspecific taxa as follows:

1. Leaves with relatively small glands that are mostly less than 0.1 mm. across; fruits mostly 2-carpellate, the seed-bearing bodies usually less than 1 mm. thick and commonly near center or above middle of wings (2)
1. Leaves with glands 0.15-0.25 (-0.3) mm. across; fruits often 3-carpellate, the seed-bearing bodies often 2(-3) mm. thick and sometimes below the middle of the wings (3)
- 2(1). Herbage glabrate (forests of extreme e. Tex.)subsp. *trifoliata* var. *trifoliata*.
2. Herbage pubescent (Aransas Bay n.w. to s. margin of Edwards Plateau and n.e. to e., s.e. and n.-cen. Tex.subsp. *trifoliata* var. *mollis* T.&G.
- 3(1). Lateral leaflets commonly strongly inequilateral, the angles between the lower margins and the midvein as much as 90°; leaf blades firmly herbaceous to subcoriaceous, usually dull-dark-green above, paler to glaucous beneath; the glands often very large and numerous, the margins crenate to entire (canyons of the High Plains Country)subsp. *polyadenia* (Greene) Bailey.
3. Lateral leaflets nearly equilateral, the angles between the lower midveins usually not more than 50° (rarely to 60°); leaf blades flexible-herbaceous, bright-green and somewhat glossy above, margins serrulate to irregularly serrate-dentate (4)
- 4(3). Leaf blades paler beneath, usually with prominent whitish veins; leaflets attenuate to acuminate at tips, at least the terminal ones attenuate to petiolelike bases, often villous beneath (infrequent in Trans-Pecos mts.) . .subsp. *angustifolia* (Benth.) Bailey var. *angustifolia*.
4. Leaf blades pale and somewhat lustrous on both sides, the veins inconspicuous; leaflets acute to obtuse at tip, cuneate to sessile at base, glabrate (Edwards Plateau and n.-cen. Tex.)subsp. *angustifolia* var. *persicifolia* (Greene) Bailey.

8. CHOISYA H.B.K.

A small genus of mountainous areas of western North America.

1. *Choisya dumosa* (Torr.) Gray. MEXICAN ORANGE, ZORRILLO. Rounded unarmed shrub usually only 1-2 m. tall; leaves opposite or subopposite, palmately compound; leaflets 5 to 10 (rarely only 3), linear, 1-5 cm. long, 1-3 mm. broad, coriaceous, crenulate with distant gland-tipped teeth; flowers perfect, in axillary corymbiform clusters; sepals 4 or 5, 4-5 mm. long, deciduous, membranous; petals 4 or 5, spreading, white, obovate,

¹¹¹ Adapted partly from Virginia Long Bailey in Brittonia 14:1-45. 1962.

about 1 cm. long; fruits of 4 or 5 (or by abortion 3) coriaceous 2-valved carpels separating from each other at maturity; seeds mostly solitary, 3-4 mm. long, black. Infrequent in Trans-Pecos mts., summer-fall; Tex., N.M., Chih. and Coah.

9. ESENBECKIA H.B.K.

An American tropical genus of perhaps 2 dozen species, of which perhaps one still occurs in Texas.

1. *Esenbeckia Berlandieri* Baill. ЖОРОУ. Small tree 3-6 m. tall, with whitish bark on the smaller limbs; leaves alternate, digitately 3-foliolate; leaflets elliptic, glossy, dark-green, 3-15 cm. long, 1-5 cm. broad, rounded at apex, narrowed to base; flowers in terminal clusters, perfect; sepals 4 or 5, orbicular to elliptic, 1.5-2 mm. long, deciduous; petals 4 or 5, imbricate in bud, spreading, elliptic to obovate, 2.7-3 mm. long; stamens 4 or 5; ovules 2 in each of the 4 or 5 cells; fruit a thick-walled tough or even woody 4- or 5-celled loculicidal capsule 3-6 cm. long, rather deeply (4- or) 5-lobed on top and often (4- or) 5-ridged laterally. *E. Runyonii* Morton. Exceedingly rare, formerly known from 4 trees at Los Fresnos, Cameron Co. in extreme s. Tex., at a locality which has since been cleared of most vegetation, presumably no longer a member of our flora although cult. at several residences in Cameron Co., summer-fall; Tam., N.L., S.L.P., Ver., Gro. and probably elsewhere.

10. ZANTHOXYLUM L.

Shrubs or trees, dioecious or polygamous, the branchlets and often the foliage and even sometimes the trunk armed with usually curved prickles; leaves alternate, pinnately once-compound, usually deciduous; leaflets often glandular-crenate or serrate; flowers in terminal or axillary clusters, small, yellow-green; calyx of 4 or 5 sepals that are commonly more or less united or (in some species) apparently absent; petals 4 or 5; stamens 4 or 5, alternate with the petals, rudimentary in the pistillate flowers; carpels 2 to 5, essentially separate or sometimes slightly united basally, rudimentary in the staminate flowers; each carpel maturing into usually 1-seeded dry follicles; seeds usually glossy-black. *Fagara* L.

The name is sometimes incorrectly spelled "Xanthoxylum."

A genus of about 160 species in the warmer parts of the world. The leaves of some species are chewed as a counter-irritant in a primitive treatment for toothache.

- 1. Leaves 1-3 dm. long, those on flowering branches with 9 to 17 acute or acuminate leaflets 35-90 mm. long; inflorescence 6-15 cm. long .1. *Z. Clava-Herculis*.
- 1. Leaves averaging smaller, those on flowering branches with 5 to 11 blunt usually obtuse or rounded leaflets 8-35 mm. long; inflorescence usually smaller (2)
- 2(1). Sepals apparently absent; Trans-Pecos mts. 4. *Z. parvum*.
- 2. Sepals apparently present; east of the Pecos River (3)
- 3(2). Sepals, petals and stamens usually 4 each; flowers in short often lateral axillary inflorescences usually only 1-2 cm. long 3. *Z. Fagara*.
- 3. Sepals, petals and stamens usually 5 each; flowers in ample terminal panicles 2. *Z. hirsutum*.

1. *Zanthoxylum Clava-Herculis* L. PEPPERBARK, HERCULES-CLUB, PRICKLY ASH, TICKLE-TONGUE, TOOTHACHE TREE. Rounded shrub or tree; leaves relatively large, 1-3 dm. long; those on flowering branches with 9 to 17 acute or acuminate leaflets 35-90 mm. long; inflorescence terminal, ample, 6-15 cm. long; sepals, petals and stamens 5 each. Frequent in forested areas of e. and s.e. Tex., w. sparingly to n.-cen. Tex., spring; s.e. U.S .

2. *Zanthoxylum hirsutum* Buckl. TICKLE-TONGUE, TOOTHACHE TREE, PRICKLY ASH. Shrub or rarely small tree; leaves of flowering branches usually about 25-120 mm. long, with 5 to 11 obtuse leaflets 10-35 mm. long, the twigs and foliage usually more or less hirsutulous or pilosulous; flowers in terminal panicles 1-7 cm. long; sepals, petals and stamens 5 each. *Z. carolinianum* var. *fruticosum* Gray. Frequent shrubs in brushy areas of Edwards Plateau, lower parts of Plains Country and n.-cen. Tex., usually in calcareous soil but also frequent in sandy soils of Rio Grande Plains (where the pubescence is usually most dense), spring; Ark., Okla. and Tex.

Reports of *Z. insulare* Rose in Texas are based on misdetermined specimens of *Z. hirsutum*.

3. *Zanthoxylum Fagara* (L.) Sarg. COLIMA, UÑA DE GATO, CORREOSA. Shrub, rounded, very prickly; leaves usually 2-9 cm. long, with 5 to 9 (rarely to 13) usually broadly obovate or oval leaflets 7-15 (-20) mm. long; inflorescences lateral, inconspicuous, shorter than the foliage; sepals, petals and stamens 4 each. *Fagara Pterota* L. Frequent in brush of Rio Grande Plains and near the coast n. to Jackson and Matagorda cos., winter-spring; Ver., Qro., S.L.P., Tam., N.L., Coah., Tex., Fla., W.I. and C.A.

4. *Zanthoxylum parvum* Shinn. SHINNERS' TICKLE-TONGUE. Shrub to 15 dm. tall; leaflets 7 to 9, broadly elliptic- to ovate-lanceolate, obtuse, crenulate, pilosulous, 6-11 mm. long; inflorescence terminal on the branches, appearing in spring before the leaves expand; sepals apparently absent; petals 4; staminate flowers and fruit unknown. Known only from a few populations in the Davis Mts. in the Trans-Pecos at elev. of 4,000-5,000 ft., Apr.; endemic.

FAM. 98. SIMAROUBACEAE DC.

QUASSIA FAMILY

Trees or spiny shrubs with usually bitter bark, mostly dioecious, the young branches more or less pubescent; leaves alternate, simple to pinnate, lacking pellucid dots; flowers perfect or unisexual, borne in axillary clusters or racemes or in panicles or spikes; sepals and petals (sometimes absent) 3 to 8; stamens mostly as many as or twice as many as sepals, obdiplostemonous, distinct, borne on or at base of floral disk; fruit various, in ours schizocarpous, the mericarps becoming samaralike or drupelike.

About 120 species in 20 genera mostly in temperate or tropical regions in both hemispheres.

1. Slender trees; leaves odd-pinnate; fruit a samara1. *Ailanthus*, p. 911.
1. Spiny shrubs; leaves simple, sometimes scalelike; fruit a drupe (2)
- 2(1). Leaves well-developed; petals 4 or 5; stamens 8 to 102. *Castela*, p. 911.
2. Leaves reduced to ephemeral scales; petals 5 to 8; stamens usually 12 or more3. *Holacantha*, p. 912.

1. AILANTHUS DESF.

About 10 species in Australasia.

1. *Ailanthus altissima* (Mill.) Swingle. COPAL TREE, TREE-OF-HEAVEN. Graceful tree of rapid growth, polygamo-dioecious, propagated by seeds and basal suckers, to 20 m. tall, the smooth trunk and branches containing a large pith, the open crown broadly globose; leaves to 6 dm. long, odd-pinnate, as much as 25-foliolate; leaflets elliptic-oblong to lanceolate, acuminate, falcate, to 15 cm. long and 45 mm. wide; flowers greenish or yellowish, in large terminal panicles, the staminate somewhat malodorous; calyx regular, the 5 lobes imbricated; petals 5, infolded-valvate; stamens 10 in staminate flowers, 2 or 3 in perfect flowers; disk lobed; ovary 2- to 5-parted into flat 1-celled divisions, in fruit becoming 1 to 5 oblong-elliptic membranaceous 1-seeded samaralike mericarps 3-5 cm. long. *A. glandulosa* Desf. Usually found in waste places such as alleyways, fencerows and similar places, rather weedy, mostly in e. third of Tex., Apr.-June; introd. from Asia and established from Mass. and s. Ont., s.w. to Tex.

2. CASTELA TURP.

GOAT-BUSH

Thirteen species, mostly in tropical America.

1. *Castela texana* (T. & G.) Rose. ALLTHORN, BISBIRINDA, CHAPARRO AMARGOSO. Low polygamo-dioecious shrub with spinescent branchlets and axillary spines, densely branched, to about 2 m. tall, the young branches with grayish-white intensely bitter bark; leaves sessile, coriaceous, linear-oblong to lanceolate or narrowly obovate, obtuse

to acute and mucronulate at apex, vernicose above, silvery- or grayish-canescens beneath, with the margins strongly revolute, to 25 mm. long and 7 mm. wide; flowers 3-4 mm. long, solitary or fascicled in the axils, with the pedicel 2-3 mm. long, red to salmon-pink or orange-color on outer surface, usually yellowish on inner surface; sepals and petals 4, subtended by 4 minute ovate bracts; petals narrowly obovate; stamens 8, inserted on a fleshy disk, the filaments basally hirsute; carpels 4, lightly coherent during development; fruit usually 4 distinct and widely spreading bright red drupelike mericarps 6-10 mm. long, subglobose, slightly compressed. *C. erecta* Turp. subsp. *texana* (T. & G.) Cronq., *C. tortuosa* Liebm., *C. Nicholsonii* β *texana* T. & G. On gravelly hills and bluffs in thickets and in mesquite prairies from Terrell Co. s. to Cameron Co. and e. to Travis Co., Mar.-May; also n.e. Mex.

3. HOLACANTHA GRAY

CRUCIFIXION THORN

Two species in southwestern United States and northern Mexico.

1. *Holacantha Stewartii* C. H. Mull. Sprawling or depressed dioecious shrub to 6 dm. high, with rigid spine-pointed intricately arranged branches, the younger gray-green stems with densely matted appressed silky hairs; branches and spines (6 cm. long or more) with a single axillary bud and no lateral or extra-axillary buds at the bases; leaves scalelike, ephemeral; flowers unisexual, produced in dense clusters; sepals 6, ovate, acute, pubescent, about 1 mm. long; petals 6, fleshy, dorsally pubescent, deeply concave, with narrow thin margins, about 4 mm. long and 1.7 mm. wide; stamens about 12; filaments 1.5-2 mm. long, strongly hirsute at the broadened base, glabrous at the subulate apex; fruit persistent for 1 or 2 years; carpels usually 6, lightly coherent during development, later distinct, lenticular-ovate, acute, the ventral margins obtusely ridged, 8-9 mm. long, 5-6 mm. broad, 3-4 mm. thick, glabrous, red or green, smooth, vernicose. On gravelly hills and cliffs of canyons in s. Trans-Pecos Tex. and n. Mex., spring.

FAM. 99. MELIACEAE JUSS.

MAHOGANY FAMILY

Trees or shrubs with hard scented wood and with alternate usually compound dotless leaves without stipules; inflorescences composed of panicles of perfect mostly 5- or 6-merous small regular flowers; sepals imbricate in bud; petals imbricate or valvate in bud; stamens mostly 8 or 10, monadelphous; anthers 2-celled, opening lengthwise, often sessile in tube formed by the united filaments; ovary superior, often 3- to 5-celled, the base surrounded by a ring or cuplike disk; styles and capitate stigma united; fruit a capsule or drupe.

More than 1,000 species in about 50 genera, mostly in tropical regions.

1. MELIA L.

Characters of the family. About 10 species native to Asia.

1. *Melia Azedarach* L. CHINABERRY-TREE, PRIDE-OF-INDIA, CANELÓN, PARAÍSO. Tree to 15 m. tall, with a broad spreading rounded crown; leaves bipinnate, 3 dm. long or more; leaflets numerous, ovate to elliptic-lanceolate, acuminate, to about 6 cm. long and 3 cm. wide, the margins crenate-dentate; flowers fragrant, with puberulent pedicels 3 mm. long; sepals small, elliptic, 1-2 mm. long, puberulent with simple or stellate hairs (like pedicels); petals narrowly oblanceolate or spatulate, white to pale-lavender, about 1 cm. long, widely spreading; stamen tube purplish, cylindrical, 8-10 mm. long, with numerous irregular teeth at orifice and 10 to 12 included anthers; drupes yellow, subglobose, thin-fleshy, about 15 mm. in diameter, bitter or bitter-sweet and astringent, a single seed in each cell of the bony putamen. In thickets, floodplain woods and borders of woods in e. half of Tex., Mar.-May; nat. of Asia but cult. and escaped as far n. as s.e. Va. in the U.S.

FAM. 100. MALPIGHACEAE JUSS.

MALPIGHIA FAMILY

Shrubs or trees, sometimes scandent, commonly invested with simple hairs that are medifixed; leaves opposite, stipulate, entire to dentate or rarely lobate, often with petiolar glands and jointed petioles; flowers usually perfect and showy, variously arranged, cleistogamous flowers often present; sepals 5, usually glanduliferous in the normal flowers; petals 5, conspicuously clawed; stamens 5 or 10, some often sterile, the anthers diverse; styles usually 3, distinct or united; fruit drupaceous, nutlike, capsular or of 1 to 3 samara-like mericarps.

About 850 species in perhaps 60 genera, mostly in the American tropics and subtropics.

1. Fruit a capsule or drupe, glabrous or puberulent at most; receptacle flat or depressed; stamens 10, all perfect (2)
1. Fruit of winged samaras or nutlike, long-strigose; receptacle usually pyramidal; stamens 5 or 6 (3)
- 2(1). Fruit a fleshy drupe, not separating; leaves glandless, typically ovate to elliptic-lanceolate; calyx with 6 to 10 noticeable glands ... 1. *Malpighia*, p. 913.
2. Fruit dry, separating into 3 carpels that dehisce; leaves with 2 petiolar glands, typically linear-lanceolate; calyx without glands ... 2. *Thryallis*, p. 913.
- 3(1). Fruit of 2 or 3 winged samaras; plant viny, the stems twining; stamens 6, all perfect or some without anthers 3. *Janusia*, p. 913.
3. Fruit a crested nutlet; plant shrubby, the stems straight; stamens 5, only 2 perfect 4. *Aspicarpa*, p. 914.

1. MALPIGHIA L.

About 35 species, mostly in tropical America.

1. *Malpighia glabra* L. BARBADOS CHERRY, MEXICAN MYRTLE, MANZANITA. Shrub to 25 dm. tall, diffusely branched; leaves opposite, short-petioled, entire, ovate to elliptic-lanceolate, acute to acuminate, to 7 cm. long and 4 cm. wide, glabrous or nearly so, bright-green; flowers with slender articulated bracteolate pedicels, in short axillary cymes, about 15 mm. broad; calyx with 6 to 10 glands; petals variously dentate, pink to reddish or somewhat purplish; fruit red, broadly ovoid, a stony 3-celled 3-lobed drupe, the carpels crested or winged on the back and indehiscent, about 8 mm. long, edible. In thickets, brushlands and palm groves in s. Tex., Mar.-Oct.; from s. Tex. to n. S.A. and the W.I.

2. THRYALLIS L.

About 12 species in southwestern United States and Mexico.

1. *Thryallis angustifolia* (Benth.) O. Ktze. Low slender essentially glabrous shrub to 4 dm. tall, the somewhat strigose stems herbaceous above; leaves opposite, sessile or petiolate, entire, usually somewhat glaucescent, linear to linear-lanceolate or rarely oval, obtuse-mucronate to acuminate, pale beneath, to 55 mm. long and 13 mm. wide; racemes laxly flowered, to about 15 cm. long; flowers usually yellow or orange-color, becoming reddish with age, with articulated bracteolate pedicels about 6 mm. long; calyx glandless or essentially so; sepals ovate-oblong to lanceolate, bearded at apex, 3-4 mm. long; petals entire or dentate, persistent, larger ones to 7 mm. long, the lamina triangular-ovate to ovate-oblong; capsules subglobose, 3-lobulate, 3-4 mm. long, the carpels separating and dehiscent. *Galphimia angustifolia* Benth. On rocky open or thinly wooded hills and in prairies from the Edwards Plateau southw. in Tex., Apr.-Oct.; also n. Mex.

3. JANUSIA Juss.

Twelve species in southwestern United States to Argentina.

1. *Janusia gracilis* Gray. Stems slender, wiry, somewhat scandent, pale-pubescent; leaves opposite, short-petiolate, entire, linear to narrowly lanceolate, acute at apex, to 35

mm. long and 7 mm. wide, silky-strigose (especially beneath), the margin with several toothlike glands near base; peduncle 2-flowered; bracts linear, about as long as the bibracteolate pedicels; flowers small, of two kinds, yellow to orange-yellow, becoming reddish-brown with age, solitary or in axillary clusters; sepals and petals 5 each, the petals undulate; *petaliferous* flowers with glandular calyx, a 3-angled style and 3 ovaries, the entire to denticulate petals 4-6 mm. long and with a rhombic-ovate lamina; *cleistogamous* flowers with a style and only 2 ovaries; fruit of 2 or 3 veiny samaras 9-12 mm. long. On open rocky hills, river terraces and sandstones in the Trans-Pecos, Apr.-Sept.; from w. Tex. to s. Ariz. and n. Mex.

4. ASPICARPA RICH.

ASP-HEAD

Slender branching shrubs with erect or reclining stems; leaves opposite, entire, sessile or short-petiolate; flowers of two kinds; *petaliferous* flowers in mostly terminal clusters, pedicellate, with glandular calyx and orbicular-obovate fimbriate rose-color petals, the glands about half the length of the sepals; *cleistogamous* flowers sessile or on long peduncles in the axils of the lower leaves, with a glandless calyx; fruit of 2 crested nutlets.

About a dozen species in southwestern United States to Argentina.

1. Cleistogamous flowers sessile in the leaf axils 1. *A. hyssopifolia*.
1. Cleistogamous flowers pedunculate, subtended by a pair of foliaceous bracts (2)
- 2(1). Peduncles of the pair of solitary flowers as long as or commonly longer than the leaves 2. *A. longipes*.
2. Peduncles of the umbellate (?) cleistogamous flowers much shorter than the leaves. 3. *A. humilis*.

1. *Aspicarpa hyssopifolia* Gray. Stems erect, numerous from a woody base, to 3 dm. tall; leaves sessile to somewhat clasping, linear to linear-lanceolate or sometimes oblong-elliptic, acute, with scattered appressed hairs on the margins and on the midrib beneath, to 25 mm. long and 6 mm. wide; petaliferous flowers with ovate sepals about 2.5 mm. long, the petals 5-7 mm. long; nutlet reticulate, 3-5 mm. long. On open or brushy limestone hills and slopes in the Edwards Plateau and southw. in Tex., June-Aug.; also n. Mex.

2. *Aspicarpa longipes* Gray. Stems numerous from a woody base, to 1 m. tall, usually much less, strigillose with appressed hairs, sometimes partly scandent; leaves ovate to ovate-oblong, rounded or abruptly pointed at apex, cordate to subcordate at base, strigose with appressed hairs, the primary veins conspicuous on the pale lower surface, to 45 mm. long and 15 mm. wide; *petaliferous* flowers with ovate sepals 3.5-4.5 mm. long, the petals 6-8 mm. long; peduncles of *cleistogamous* flowers usually surpassing the leaves, 2-flowered; nutlets 4-5 mm. long. On dry rocky slopes in the Trans-Pecos, July-Sept.; also n. Mex.

3. *Aspicarpa humilis* (Benth.) Juss. Low ascending shrub, the stems to about 4 dm. long, strigillose; leaves broadly ovate to oblong-lanceolate, obtuse to acute at apex, truncate to subcordate at base, to 25 mm. long, sparingly strigillose, paler beneath; *petaliferous* flowers in terminal clusters, with ovate sepals 2.5-3 mm. long, the petals 5-6.5 mm. long; peduncles of *cleistogamous* flowers usually much shorter than the leaves; nutlets 4.5-5 mm. long. On dry rocky hills in the Trans-Pecos, summer; also n. Mex.

Although some authors include Texas in the area of distribution for this plant, no specimen that might be placed here with surety has been seen from the state. It is quite possible that *A. humilis* and *A. longipes* represent only phases of the same species.

FAM. 101. POLYGALACEAE R. BR.

MILKWORT FAMILY

Represented in Texas only by the genus *Polygala* that differs from other genera in the family primarily by its 2-celled dehiscent capsular fruit that very rarely has one of the cells aborted.

About 800 species in 12 genera of world-wide distribution.

I. POLYGALA L.¹¹²

POLYGALA. MILKWORT

In our region herbaceous annuals or suffruticulose perennials with simple entire leaves; leaves alternate, opposite or whorled, sessile to shortly petiolate; flowers in terminal or axillary racemes, subsessile to distinctly pedicellate; sepals 5, the 3 outer herbaceous or the 2 lower very rarely petaloid, free or the 2 lower connate, persistent or deciduous; the 2 inner sepals (wings) usually petaloid, much larger than the others, deciduous; persistent; petals typically 3, united at base, the lower (keel) cymbiform, clawed, occasionally 3-lobed, unappendaged or usually with an apical beak or crest; the 2 upper petals ligulate to ovate, sometimes galeate, united to staminal tube or keel (or both) at least at base; 2 lateral petals rarely present, always minute; stamens 8 or rarely 6, the filaments united nearly to apex into a sheath split on the upper side, adnate to keel and upper petals at base; anthers usually confluent 1-celled, opening by an apical or introrse-apical pore; ovary 2-celled; ovules solitary, pendulous from the apex of the central placenta; style usually slender and often elongate, bent, more or less excavated at apex; stigma 2-lobed, often tufted; capsule equally or unequally 2-celled, winged to margined or marginless, compressed contrary to the partition, usually membranous-herbaceous, the cells usually dehiscent; seeds globose to fusiform or conic, usually pubescent and almost always arillate.

About 550 species of world-wide distribution.

1. Keel blunt, without crest or beak (2)
1. Keel with crest or beak (8)
 - 2(1). Capsule and leaves not obviously glandular (3)
 2. Capsule and leaves bearing large glands (7)
 - 3(2). Leaves nearly uniform, oval to ovate (4)
 3. Leaves more or less dimorphous, the lower ones oval to oblong, the upper ones longer and linear to oblong or elliptic to ovate (5)
 - 4(3). Plants erect, densely hirsute; wings 4-5 mm. long; capsule 8.5-13 mm. long ...
..... 1. *P. ovatifolia*.
 4. Plants prostrate or only slightly ascending, glabrous; wings about 4 mm. long; capsule about 2 mm. long 2. *P. rimulicola*.
 - 5(3). At least some leaves oblong-obovate and somewhat truncate-mucronate at apex, these widest above the middle; depth of the entire or merely denticulate-lobulate scarious margin of aril less than the height of the corneous umbo
..... 3. *P. Palmeri*.
 5. Leaves never oblong-obovate, obtuse to acuminate at apex; depth of the lobed or lobulate scarious margin or aril equaling or exceeding the height of the corneous umbo (6)
 - 6(5). Capsule merely ciliate at maturity; aril not veil-like
..... 4. *P. longa*.
 6. Capsule pubescent on sides at maturity or (if merely ciliate) the aril veil-like
..... 5. *P. obscura*.
 - 7(2). Leaves obovate 6. *P. glandulosa*.
 7. Leaves linear to oblong-lanceolate 7. *P. macradenia*.
 - 8(1). Keel with a conic or cylindrical beak, not crested (9)
 8. Keel with a fimbriate crest (12)
 - 9(8). Leaves squamiform, 4 mm. or less long (10)
 9. Leaves not squamiform, with a distinct lamina (11)
 - 10(9). Plants green, about 15 cm. tall; racemes 4- to 6-flowered, 2.8 cm. long or less; flowers white; capsule oblong, 2.8 mm. long 10. *P. minutifolia*.
 10. Plants glaucous, 15-40 cm. tall; racemes many-flowered, to 10 cm. long; flowers pink and rose-color; capsule cuneate to cuneate-obovate, 3-4 mm. long
..... 11. *P. maravillasensis*.

¹¹² Adapted from S. F. Blake in Contr. Gray Herb. 47:1-122. 1916; N. Am. Fl. 25:305-379. 1924.

- 11(9). Leaves essentially similar throughout, narrowly elliptic to oval or rarely sub-orbicular, the pubescence (like on the stem) densely spreading or sometimes spreading-incurved 8. *P. Lindheimeri*.
11. Leaves mostly linear to lanceolate but sometimes with the lower ones broader, the puberulence merely incurved like on the stem 9. *P. Tweedyi*.
- 12(8). Capsule unmarginated or narrowly and equally marginated on both cells (13)
12. Capsule winged or marginated on the upper cell, marginless on the lower (25)
- 13(12). Sepals not decurrent on the pedicels; pedicels not winged; flowers never truly yellow, the racemes never compounded into a cymose panicle (14)
13. Sepals decurrent on the winged pedicels; flowers yellow or orange, often turning green in drying or (if white) with the racemes compounded into a cymose panicle (24)
- 14(13). Cleistogamous flowers present, borne on short leafless basal branches; flowers bright rosy-purple, in loose racemes21. *P. polygama*.
14. Cleistogamous flowers absent; flowers white to purple (15)
- 15(14). Wings less than half as long as keel; stem glaucous; aril cellular, equitant, not obviously lobed20. *P. incarnata*.
15. Wings equaling or exceeding keel, rarely slightly shorter; stem not glaucous; aril 2-lobed, rarely obsolete (16)
- 16(15). Racemes cylindric or conic-cylindric or at least distinctly tapering above (17)
16. Racemes capitate to ovoid or cylindric, obtuse or merely apiculate (21)
- 17(16). Plants biennial or perennial, usually several-stemmed
.....15. *P. alba*.
17. Plants annual, single-stemmed (18)
- 18(17). Wings 3-3.3 mm. long18. *P. Hookeri*.
18. Wings 1.2-3 mm. long (19)
- 19(18). Leaves whorled at least to middle of stem14. *P. verticillata*.
19. Leaves alternate throughout or whorled only at base of stem (20)
- 20(19). Stem finely stipitate-glandular or puberulous12. *P. paniculata*.
20. Stem glabrous13. *P. leptocaulis*.
- 21(16). Wings broadly elliptic or oval, (2.8-) 4.5-6.3 mm. long, about twice as long as keel; aril more than half as long as seed16. *P. sanguinea*.
21. Wings equaling or but little longer than keel; aril usually less than half as long as seed (22)
- 22(21). Leaves all alternate17. *P. mariana*.
22. Leaves whorled at least below (23)
- 23(22). Wings ovate to ovate-oblong, merely acute and short-mucronate; racemes 6-12 mm. thick18. *P. Hookeri*.
23. Wings acuminate and strongly cuspidate from a deltoid base; racemes 10-17 mm. thick19. *P. cruciata*.
- 24(13). Racemes solitary at tips of stems and branches, capitate or thick-cylindric, 9-20 mm. thick; bracts mostly deciduous22. *P. nana*.
24. Racemes several or many, cymosely arranged at apex of stem and branches, 6-13 mm. thick; bracts persistent23. *P. ramosa*.
- 25(12). Stems glabrous or at most with scattered minute incurved puberulence; flowers 3-5 mm. long; upper cell of capsule noticeably longer than lower cell, the broad scarious wing erose24. *P. hemipterocarpa*.
25. Stems strigillose or puberulous; flowers usually smaller than above; upper cell of capsule only slightly longer than lower cell, very narrowly and evenly winged or keeled25. *P. scoparioides*.

1. *Polygala ovatifolia* Gray. Suffrutescent at base, branched, erect, 3 dm. tall or less, densely and softly spreading-pilose; leaves ovate or on the branches sometimes ovate-

oblong, 1.2-3 cm. long, 6-13 mm. wide, acute to obtuse at apex, rounded or cuneate at base, short-pilose on both sides with spreading hairs; petioles about 2 mm. long; racemes rather loose, 2-6.5 cm. long; sepals ovate-lanceolate, acute, 3 mm. long, deciduous; wings oblong to oval, 4-5 mm. long, abruptly short-pointed, pilose, soon deciduous; capsule ciliate, orbicular, 8.5-13 mm. long; seed 4 mm. long; aril with rather broad lobed and lobulate scarious margin. On rocky hills and slopes in w. Edwards Plateau and Rio Grande Plains, Apr.-July; Tex., N.M. and n. Mex.

2. *Polygala rimulicola* Steyerem. Delicate perennial from a woody base, glabrous throughout or minutely puberulent with incurved hairs; stems numerous, very slender, prostrate or slightly ascending, branching, 1-5 cm. long, green; leaves similar throughout, subsessile, elliptic-ovate, 1.5-4 mm. long, 1-2.5 mm. wide, acute to slightly cuspidate, slightly fleshy; flowers 1 or 2, terminal, rose-purplish and white, 5 mm. long; pedicels at maturity recurved and nodding, 2 mm. long; upper sepal persistent, ovate, 1.5-2 mm. long, 1 mm. wide, acute, glabrous; lower sepals free, deciduous, oblong-obovate, 2-3 mm. long, 1 mm. wide, acute, glabrous; wings deciduous, oblique, broadly obovate, 4 mm. long, 2.5 mm. wide, obtuse at apex, narrowed at base, veiny, glabrous; keel unbeaked, inflated, greenish-yellow, pouch-shaped, 3 mm. long, the outer upper and lower ends rounded, the inner upper ends terminating in 2 short parallel straight appendages extending toward the base of the flower, the upper third of the keel covered with numerous erect short fine hairs; upper petals united to the keel about three-eighths their length, white at the base, purplish-red at apex, linear-oblong, 4-5 mm. long, 1 mm. wide, subtruncate at apex, slightly puberulent within; stamens 7; capsule venose, broadly obovate-oval, 2 mm. long, 1.5-2 mm. wide, emarginate, sparingly covered with short incurved hairs, densely sericeous-pubescent in the sinus of the emarginate apex; seed oblong, 1-1.5 mm. long, densely sericeous-pubescent with long hairs; aril globose, 0.5 mm. high, with a large umbo at each side, corneous, glabrous. In crevices of boulders and cliffs, endemic to the Guadalupe Mts. in the Trans-Pecos, June-Oct.

The glabrous globose aril with no conspicuous lobes, the unbeaked keel, persistent upper sepal, prostrate habit, minute leaves and flowers, and essentially glabrous condition of stem, leaves, and fruit distinguish this species.

3. *Polygala Palmeri* Wats. Stems several, 12-18 cm. tall, densely and subcanescently pubescent with spreading-incurved hairs; leaves from oval below to oblong or commonly oblong-obovate above, the middle and upper leaves 15-16 mm. long and 4.5-7 mm. wide, obtuse to truncate and mucronate at apex, cuneate at base, thick, incurved-spreading-pubescent; racemes 35-45 mm. long, canescently pubescent, 6- to 11-flowered; flowers pale-greenish-yellow and purplish; wings obovate, 5.7-6 mm. long, 2.8 mm. wide, acutish, pubescent nearly all over with spreading-incurved hairs; keel equaling wings; capsule oval-ovate, somewhat narrowed above, rounded at base, ciliolate, 1 cm. long; seed 6 mm. long; aril 1.5 mm. deep, with spreading-pilose umbo and much narrower subentire scarious margin extended into short anterior and dorsal subhorizontal lobes. On open or brushy limestone slopes on s.w. Edwards Plateau, May-Aug.; also Coah.

4. *Polygala longa* Blake. Several-stemmed, suffruticulose below, 1.5-5 dm. tall, densely incurved-griseous-puberulous; lower leaves oblong to oblong-elliptic or linear and 8-17 mm. long, the middle and upper oblong-lanceolate to linear and 17-36 mm. long and 1.5-4 mm. wide, acute to acuminate or sometimes obtuse at apex, griseous-puberulous; racemes loose, 2-10.5 cm. long; flowers purplish; sepals lanceolate, pubescent, 2.2-3.5 mm. long; wings oval to suborbicular, 3.5-5.5 mm. long, 2.4-4 mm. wide, rounded at apex, rather sparsely pubescent; keel 4-5.7 mm. long; capsule oval, ciliolate, 7-8 mm. long; seed 4-4.5 mm. long; aril 1 mm. high, the dorsal margin 1.5 mm. long, the umbo 0.4 mm. high, pilose, the scarious margin strongly lobulate, with subdistinct or distinct dorsal and shorter lateral lobes. On rocky grassy slopes, among rubble on talus, in rocky washes and arroyos, and about caprock, mostly limestone, in w. part of Edwards Plateau and the Trans-Pecos, Apr.-Nov.; from Tex. to s. Ariz. and n. Mex.

This species, *P. racemosa* Blake and *P. reducta* Blake probably represent one highly variable species.

5. *Polygala obscura* Benth. Many-stemmed, suffruticulose below, 1.2-4 dm. tall, grayish-puberulous with incurved or rarely slightly spreading hairs; lower leaves oblong to oval-oblong and 12-28 mm. long and 4-7 mm. wide, the middle and upper oblong to

oval-ovate or lanceolate to linear and 18-42 mm. long and 1.5-12 mm. wide, obtuse to acuminate, puberulous; raceme loose, 3.3-9 cm. long; flowers purplish; sepals lanceolate, acute; wings oval-obovate to elliptic, 4.5-5.8 mm. long, 2-3.5 mm. wide, rounded, sparsely pubescent along middle and toward apex; keel nearly glabrous, 4.8-5 mm. long; capsule oval, when young usually densely puberulous, in age glabrate and ciliate or more or less puberulous on sides, 8-9 mm. long; seed 4-4.8 mm. high; aril 1.3-3 mm. long, veil-like, appressed, with broad irregularly lobulate scarious margin and pubescent umbo but without distinct lateral and dorsal lobes. *P. puberula* Gray. On open or brushy dry slopes, rare in Edwards Plateau and the Trans-Pecos, May-Aug.; from Tex. to Ariz. and s.-cen. Mex.

6. *Polygala glandulosa* H.B.K. Stems very numerous from a thick woody rootstock, suffruticose, diffuse, 1-2 dm. long, somewhat gray-pubescent with incurved hairs, densely leafy; leaves obovate to oval-obovate or rarely suborbicular-oval to cuneate-obovate, 4.5-10 mm. long, 1.5-6 mm. wide, rounded to subtruncate and mucronate at the apex, cuneate to rounded at base, thick, densely translucent-glandular-dotted, incurved-puberulous or short-pilosulous; flowers 1 or 2 on short axillary racemes, purple; sepals oblong-ovate, obtuse, 1.2-1.5 mm. long, ciliate and puberulous, the upper often subpersistent; wings spatulate-obovate, about 7.5 mm. long and 3.5 mm. wide, rounded at apex, long-cuneate at base, short-pilose and sparsely ciliate; keel 3-lobed, 4.5 mm. long; capsule elliptic, deeply emarginate, slightly pilose, dotted with whitish glands; seed oblong, appressed-hairy; aril galeiform, equitant, with very short lobes, about one fourth as long as seed. On gravelly hills in scrub and about boulders on crest of chalky hills in s. Rio Grande Valley, Apr.-Aug.; s. to cen. Mex.

7. *Polygala macradenia* Gray. Stems numerous, 3.5-21 cm. long, crowded, suberect to ascending, fruticulose below, from a thick woody rootstock, flexuous, densely leafy, canescently incurved- or incurved-spreading-puberulous; leaves linear-oblong to oblong-lanceolate, 2-6.3 mm. long, 0.6-1.3 mm. wide, obtuse, rounded at base, flattened above, thick, densely and canescently puberulous, thickly gland-dotted; racemes 1- or 2-flowered; flowers purple; sepals oblong-ovate, obtuse, pilosulous and gland-dotted, 1.7-2.1 mm. long; wings obovate, 5-5.5 mm. long, about 2.5 mm. wide, rounded at apex, cuneate at base, sparsely spreading-puberulous, ciliolate, purple; keel 4.5 mm. long; capsule oblong to oblong-ovate, canescently incurved-puberulous and gland-dotted, 5-5.5 mm. long; seed silky-pilose, comose at apex, 4 mm. long; aril 1.2-1.6 mm. high, with corneous vaulted sparsely pubescent umbo 0.9-1.1 mm. high and three short descending scarious-ended subappressed lobes. On dry rocky slopes, rock outcrops and plains, mostly limestone, in upper Rio Grande Plains, South Plains, w. Edwards Plateau and s. Trans-Pecos, Apr.-Oct.; from Tex. to s. Ariz. and n. Mex.

8. *Polygala Lindheimeri* Gray. Stems several from a fruticulose base, suberect to decumbent, densely pilose to pilosulous with wide-spreading or sometimes incurved-spreading hairs, about 18 cm. long; lower or all the leaves elliptic to oval or rarely orbicular, mucronate at the obtuse to rounded apex, rounded to cuneate at base, 5-13 mm. long, 3-12 mm. wide, coriaceous, spreading-pilosulous or incurved-spreading-puberulous, reticulate; middle and upper leaves usually oblong to oblong-lanceolate, acute at each end; racemes 2- to 8-flowered, geniculate, 1-3.5 cm. long; upper sepal ovate, acute, ciliate and pubescent or puberulous, persistent, 2.8-3.2 mm. long; lower sepals 2 mm. long; wings oblong-obovate, 4.5-6 mm. long, 2.3 mm. wide, barely retuse at the rounded apex, cuneate at base, pilosulous; keel 4.2-4.8 mm. long, the beak 0.6-1.1 mm. long; capsule oblong, striate, pilosulous, 4.8 mm. long, 2.4 mm. wide; seed silky-pilose, 3.3 mm. long; aril 1.8 mm. deep, entirely corneous, the umbo 0.4 mm. deep, with indistinct appressed dorsal and oblong entire lateral lobes 1.4 mm. long. On brushy limestone hills and bluffs in s.w. Tex., s. to Zapata Co. and w. to Presidio Co., Mar.-Oct.; also N.M. and n. Mex.

9. *Polygala Tweedyi* Britt. Suffruticose, several- to many-stemmed, spreading to erect, incurved-puberulous, usually densely leafy, 7-28 cm. tall; leaves more or less distinctly dimorphous or sometimes uniform, linear to lanceolate or elliptic to ovate-lanceolate, 4-26 mm. long, 1-6 mm. wide, the lowest broader than the others, sometimes orbicular, acute to acuminate or rarely subobtuse, coriaceous, more or less reticulate, incurved-puberulous; peduncles 1 cm. long or less, terminal and pseudo-oppositifolious,

sometimes arising near base of stems; racemes 3- to 22-flowered, geniculate, 4-46 mm. long; bracts elliptic, coriaceous, persistent, 1.2 mm. long; pedicels incurved-puberulous, 1-1.5 mm. long; flowers purple or lavender or rarely whitish, the keel partly yellow; upper sepal persistent, elliptic to ovate, ciliolate and puberulous, 2-2.8 mm. long; lower sepals 1.8-2.4 mm. long; wings obovate to oblong-obovate, 4-5.3 mm. long, 1.8-2.3 mm. wide, obtuse to rounded at apex, cuneate at base, glabrous or sparsely incurved-puberulous along midline; keel 3.5-5.3 mm. long, sometimes puberulous, the beak 0.5-1.4 mm. long; capsule oval to oblong, striate, puberulous or subglabrous, 4-4.5 mm. long, 2-2.8 mm. wide; seed silky, 2.8-3.5 mm. long; aril corneous, 1.2-2.2 mm. high, with 2 linear or linear-oblong appressed lateral lobes. *P. texensis* Robins. On rocky-gravelly hills, among boulders and on old lake-bed deposits from cen. Tex., w. to Presidio Co. in the Trans-Pecos, May-Aug.; from Okla. and Tex., w. to s. Ariz. and n. Mex.

10. *Polygala minutifolia* Rose. Stems very numerous, fruticulose, green, erect, about 15 cm. tall, sparsely strigillose or subglabrous; leaves squamiform, minute, linear-lanceolate, 1-4 mm. long, about 0.5 mm. wide, acuminate, sparsely incurved-puberulous; racemes straight, 4- to 6-flowered, 28 mm. long or less; flowers white; sepals ovate to elliptic, acute, 2.2-2.7 mm. long, the upper persistent; wings oval-obovate, 4 mm. long, 2.2 mm. wide, truncate-rounded at apex, glabrous; keel 3.5 mm. long, the blunt beak 0.7 mm. long; capsule oblong, nearly glabrous to sparsely pubescent toward apex, 2.8 mm. long; seed sericeous, 2.3 mm. long; aril 0.8 mm. long, with 2 oblong lateral lobes. On ledges in mts. of the Trans-Pecos, June-July; also n. Mex.

11. *Polygala maravillasensis* Correll. Plants broomlike, 2-4 dm. tall; stems from a woody base, erect or erect-ascending, rather stout and stiff, glabrous and usually glaucous-bluish; leaves squamiform, linear-subulate, mostly less than 1.5 mm. long, marginally incurved-puberulous, early-fugacious; racemes many-flowered, straight, simple or branched, to 1 dm. long; flowers pink and rose-color, with pedicels 1.5-2.5 mm. long; sepals 2-2.5 mm. long, elliptic, obtuse, the upper persistent; wings obovate, rounded at apex, about 4.5 mm. long and 2 mm. wide; the 2 upper ligulate petals deep-rose-color; keel 3.5-4 mm. long (including the beak); capsule cuneate to cuneate-obovate, glabrous, 3-4 mm. long; seeds sericeous, 2 mm. long; aril 1 mm. long, with 2 short lateral lobes. In crevices of cliffs on mts. in s. Trans-Pecos Tex., June-July; endemic.

12. *Polygala paniculata* L. Slender erect annual, to 4 dm. tall, densely pedicellate-glandular; leaves whorled at extreme base of stem, otherwise alternate, linear to linear-spatulate, rarely linear-obovate, mucronate, 8-18 mm. long, 1-4 mm. wide; racemes loose, cylindric, 5-6 mm. thick, the axis becoming 95 mm. long; pedicels 0.7-1 mm. long; flowers rosy or purplish, rarely white; sepals ovate to oblong-ovate, obtuse, 1.3 mm. long; wings obovate to spatulate-obovate, 2-2.5 mm. long, 0.7-1 mm. wide, rounded at apex, long-cuneate at base, 3-nerved; keel 2-2.5 mm. long, the crest of 3 or 4 lobes on each side; capsule elliptic, 1.7 mm. long; seed appressed-pubescent, 1.5 mm. long; aril 0.4-0.8 mm. long, the 2 lobes appressed. Tex. (*vide* Blake), Ver., the W.I. and S.A.

13. *Polygala leptocaulis* T.&G. Slender annual, to 5 dm. high, glabrous, branched above; leaves all scattered, linear to subfiliform, 8-25 mm. long, 1 mm. or less wide, acuminate, slightly revolute; racemes cylindric, loose or rather dense, 5-5.5 mm. thick, the axis to about 10 cm. long; pedicels 0.8-1 mm. long; flowers rosy, rarely white; sepals ovate, obtuse, 1 mm. long; wings obovate, about 2 mm. long and 0.9 mm. wide, rounded at apex, cuneate at base, 3-nerved; keel 2 mm. long, the crest of 2 or 3 lobes on each side; capsule oblong, often very slightly narrowed toward apex, with a row of glands on each side of septum, 1.6-1.8 mm. long; seed subcylindric, appressed-pubescent, 1.2 mm. long; aril minute, 2-lobed, about one tenth as long as seed. In savannahs and low open pine-lands in e. Tex., May-June; along Coastal Plains from Miss. to Tex., also Mex., C.A., Cuba and S.A.

14. *Polygala verticillata* L. Erect single-stemmed glabrous annual, 5-40 cm. tall, usually freely branched; leaves in whorls of 4 or 5 up to middle of stem or throughout, rarely with only 1 or 2 whorls below with the rest alternate, those of the branches scattered, linear to narrowly elliptic, 5-30 mm. long, 0.7-5.5 mm. wide, acute to acuminate at each end and cuspidate; peduncles to 9 cm. long; racemes conic to cylindric-conic, acute to acuminate, dense or loose, 2.2-4.5 mm. thick, the axis 35 mm. long or less; bracts subulate, glandular-denticulate, deciduous; pedicels 0.2-1 mm. long, rarely to 2 mm. long; flowers

whitish and greenish, rarely purplish-tinged; sepals ovate, ciliolate, 0.9-1.1 mm. long; wings obovate-oval, 1.6-2 mm. long, 1.1-2 mm. wide, broadly rounded at apex, short-clawed, about 3-nerved; keel 1.2-1.5 mm. long, the crest on each side of a lamella and 1 or 2 lobes; capsule oval, 1.8-2.1 mm. long; seed pilosulous, 1.5-1.8 mm. long; aril 0.7-1 mm. long, the 2 lobes linear-oblong or obovate. Incl. var. *isocycla* Fern. and var. *sphenostachya* Penn. In prairies, sandy post-oak and pine woodlands in the e. third of Tex., May-July; from Fla. to Tex., Okla., Colo. and Ut., n. to Mass. and s. Man.

Plants found in our area with most of the leaves alternate or with only 1 or 2 whorls below have been segregated as var. *ambigua* (Nutt.) Wood.

15. *Polygala alba* Nutt. Stems numerous from a perennial rootstock, often with a cluster of short leafy branches at base, erect or ascending, simple or sparsely branched, 2-3.5 dm. tall; leaves scattered except for 1 or 2 whorls at base, the lowest spatulate-obovate, 4-12 mm. long, 1.5-2.5 mm. wide, the others linear, acuminate, cuspidate, 8-25 mm. long, 1-1.5 mm. wide; racemes dense, conic-cylindric, 2-8.5 cm. long, 5-8 mm. thick; flowers white with a green center, the crest often purple; sepals ovate to oblong, obtuse, 1.3-1.5 mm. long; wings elliptic, about 3 mm. long and 1.5 mm. wide, rounded at apex, short-cuneate at base; keel 3 mm. long, the crest of 4 lobes on each side; capsule elliptic to oblong-elliptic, 2.5-3 mm. long, 1.3-1.6 mm. wide; seed pilose, 2.3-2.5 mm. long; aril 0.8-1.5 mm. high, the 2 lobes oblong, appressed. Sandy soil, rocky hills, mesquite plains, in cedar thickets, on rimrock and breaks and in dry washes in all but extreme e. Tex., Mar.-Oct.; from e.-cen. Tex., n. to Minn., w. to S.D., Wash. and Ariz., s. to s. Mex.

16. *Polygala sanguinea* L. Slender erect annual, 4 dm. tall or less, simple or branched; leaves all alternate, numerous, linear to elliptic-linear, 7-39 mm. long, 1-4.5 mm. wide, acute to acuminate and mucronulate, erect or ascending, papillose-serrulate on margin with subglandular teeth; peduncles 3-30 mm. long; racemes capitate to thick-cylindric, very obtuse and dense, 6-14 mm. thick, the axis 7-40 mm. long; bracts subulate, 1-1.5 mm. long, at length deciduous; pedicels 1.1-1.5 mm. long; flowers greenish and rosy or purplish, rarely white; sepals oval to elliptic-ovate, acute to subacute, glabrous, 1.3-1.8 mm. long; wings ovate-oval, 4.8-6.3 mm. long, 2.5-3.5 mm. wide, rounded at apex, short-clawed, 9-nerved; keel 2.5-2.7 mm. long, the crest on each side of a lamella and a cuneate lobe, or these connate; capsule cuneate-suborbicular, with short flattened sterile base, 2.5-3 mm. long, 2-2.5 mm. wide; seed subglobose-pyriform, pointed at base, rounded at apex, short-pilose, 1.5-1.7 mm. long; aril 1-1.3 mm. long, the 2 lobes linear or linear-oblong, scarious, appressed. *P. viridescens* L. In bogs and moist open flatwoods in n.e. Tex., May-July; from N.S. to s. Ont. and Minn., s. to Tenn., Okla., La. and n.e. Tex.

At anthesis the pedicels are 1.5 mm. long or less and the wing is more than 4.5 mm. long. These characteristics readily separate this species from *P. mariana*.

17. *Polygala mariana* Mill. Slender erect annual, 1.5-4 dm. tall, sparsely papillose-puberulent above; leaves all alternate, linear or the lower spatulate, 6-24 mm. long, 0.5-2.5 mm. wide, cuspidate, usually ascending; racemes capitate to short-cylindric, obtuse to apiculate, 6-11 mm. thick, the axis 5-35 mm. long; bracts subulate-ovate, erose, often ciliolate, deciduous; pedicels 1.8-2 mm. long or more; flowers pink or purple; sepals elliptic to ovate-lanceolate, obtuse to subacuminate, sometimes ciliolate, 0.8-1.8 mm. long; wings broadly elliptic to elliptic-obovate, 3-5 mm. long, 1.3-3 mm. wide, slightly apiculate at apex, cuneate at base, commonly 6-nerved; keel papillose below, 2.3-3.2 mm. long, the crest on each side of a lamella and a single lobe; capsule suborbicular to rhombic-suborbicular, with a broad stipelike sterile base, about 2.2 mm. long, 1-2 mm. wide; seed subglobose-pyriform, rostrate at base, rounded or apiculate at apex, short-pilose, 1.1 mm. long; aril 0.4 mm. long, the 2 oblong cellular lobes fastened to the point of seed, loosely descending and standing forward. *P. Harperi* Small. In low moist open pinelands and savannahs, and on seepage slopes in s.e. Tex., Apr.-Sept.; from Fla. to Tex., n. to N.J., Del., Md. and Ky.

At anthesis the pedicels are about 2 mm. long or occasionally longer and the wings are rarely more than 4.5 mm. long. These characteristics readily separate *P. mariana* from *P. sanguinea*.

18. *Polygala Hookeri* T. & G. Slender erect or procumbent annual, papillose-puberulent above, 1-2.5 dm. tall; leaves in remote whorls of 3 or 4 or the uppermost scattered, linear, 4-10 mm. long, 0.5-1 mm. wide, acutish, barely mucronulate, strongly revolute, glanduliform-puberulous; peduncles mostly 3-7 cm. long; racemes conic-cylindric, acuminate or

at least apiculate, loose, 6-9 mm. thick, the axis 7-40 mm. long; bracts triangular-ovate, ciliolate, spreading, persistent, 1 mm. long; pedicels 1.5-2 mm. long; flowers pink; sepals broadly ovate, short-mucronate, ciliolate, 1.1-1.4 mm. long; wings oblong-ovate, about 3 mm. long, 1.3-1.5 mm. wide, inflexed and very short-mucronate at apex, rounded at the oblique sessile base, stipitate-glandular-ciliolate on the upper margin, 7-nerved; keel 2.8 mm. long, the crest on each side of a triangular lamella and 2 entire lobes; capsule orbicular, plump, strongly winged beneath on the stipelike base, 1.4-2.2 mm. long and wide; seed plump, ellipsoid, somewhat shining, short-pubescent, 1.2 mm. long; aril equaling the seed, the 2 linear lobes appressed. In low pinelands in e. Tex., Apr.-Aug.; along the coast from Fla. to Tex.

19. *Polygala cruciata* L. Slender erect annual, 6-40 cm. tall, simple or usually cymosely branched; leaves in whorls of 3 or 4 throughout or the uppermost scattered, linear to linear-elliptic, the upper largest, 8-35 mm. long, 1-5 mm. wide, usually apiculate at the obtuse to rounded apex, narrowed at base; peduncles to 5 cm. long; racemes thick-cylindric to ovoid-cylindric, obtuse to apiculate, 1-1.7 cm. thick, the axis 6 cm. long or less; bracts subulate-attenuate from an ovate base, ciliolate, spreading, persistent, 1.5-2.5 mm. long; pedicels 2-2.4 mm. long; flowers rosy-purple to greenish or rarely white; sepals ovate, obtuse to acutish, ciliolate, 0.8-1.4 mm. long; wings broadly deltoid-ovate, 3.5-5.6 mm. long, 2.7-3.6 mm. wide near base, subsessile or very shortly clawed at the truncate or slightly oblique base, acuminate and strongly cuspidate at apex, about 9-nerved; keel 2.8-3.5 mm. long, the crest on each side of a lamella and 2 or 3 entire or bifid lobes; capsule suborbicular, very plump, strongly oblique and winged below on the stipelike base, 2-2.2 mm. long, 1.8-2.1 mm. wide; seed ellipsoid, plump, short-pubescent, 1.1-1.3 mm. long; aril 0.9-1.1 mm. long, the 2 linear lobes appressed. In and on edge of bogs, on seepage slopes and in savannahs in e. Tex., May-Sept.; from Fla. to e. Tex., n. along the coast to Va. and inland to Ky.

20. *Polygala incarnata* L. Simple or sparsely branched annual, about 35 cm. tall, the glaucous stem sulcate and sparsely leaved; leaves scattered (the very lowest often opposite or even whorled), linear, 4-6 mm. long, 0.3-0.6 mm. wide, acuminate, cuspidate, glaucous; peduncles 2-3.5 cm. long; racemes dense, 6-38 mm. long, 1-1.3 cm. thick in flower, 5.5-6 mm. thick in fruit; pedicels 0.5 mm. long; flowers rose-purplish; sepals oblong-ovate to lanceolate, rounded to subacuminate, serrulate, 2-2.5 mm. long; wings linear-oblong, about 3 mm. long and 0.6 mm. wide, somewhat undulate-convolute, obtuse to submucronulate, not clawed; upper petals 6.7 mm. long; keel 7 mm. long, united with the staminal tube and upper petals into a trough 5 mm. long; crest on each side of about 3 lobes, these variously lobed or cleft; capsule suborbicular-ovate, cordate at base, 2.4 mm. long, 2 mm. wide; seed plump, pilose, 2.2 mm. long; aril 1.1 mm. high, membranaceous-cellular, equitant, erect, scarcely lobed. In open grassy areas, savannahs and bogs, and open flat woodlands in the e. third of Tex., May-Sept.; from Fla. to Tex. and Mex., n. to L.I., N.J., Pa., s. Ont., s. Mich., s. Wisc., Ia. and Neb.

21. *Polygala polygama* L. Stems solitary to many from a biennial rootstock, erect or ascending, simple or sparsely branched, 1.5-3 dm. tall, glabrous, bearing loose racemes of cleistogamous flowers from the base or (in late season) from the axils of the leaves; leaves all alternate or the very lowest sometimes opposite, the lower or sometimes all spatulate to obovate and obtuse to rounded and mucronulate, slightly fleshy, the longer upper leaves usually linear to spatulate-linear and acutish, 12-31 mm. long, 2-8 mm. wide; peduncles 1-2 cm. long; racemes cylindric, obtuse, loose, 9-14 mm. thick, the axis 13.5 cm. long or less; bracts ovate to oblong-ovate, glabrous, deciduous, 1-1.3 mm. long; pedicels 1-4 mm. long; flowers pink to pink-purple, rarely pale-lilac or nearly white; sepals oval to oval-ovate, rounded to acutish, glabrous, 1.3-2.2 mm. long; wings oval to oval-obovate, 3.2-6 mm. long, 2-3.8 mm. wide, obtuse or rounded at apex, cuneate or clawed at base, about 3-nerved, glabrous; keel 3-5 mm. long, the crest on each side of a lamella and 2 or 3 divided lobes; capsule oval, margined, sometimes erose, plump, 2.5-4 mm. long, 2-3 mm. wide; seed ellipsoid, short-pointed at base, plump, pilose, 1.8-2.8 mm. long; aril 0.8-2 mm. long, the pilose corneous umbo terminating the beak of the seed, the 2 linear-elliptic to oval cellular-scarious lobes appressed. Incl. var. *obtusata* Chod. In bogs, low sandy soil in open woodlands and along streams in open woods in e. Tex., Apr.-June; from Fla. to e. Tex., n. to N.S., s.w. Que., s. Ont., Mich., Wisc. and Minn.

22. *Polygala nana* (Michx.) DC. Stems several from an annual or biennial rootstock, simple, erect to ascending, 7-17.5 cm. tall; basal leaves tufted, spatulate to obovate or elliptic-obovate, 15-43 mm. long, 3-17.5 mm. wide, rounded and sometimes mucronulate at apex, narrowed at base, thickish, 3- to 5-nerved; stem leaves few, alternate, linear-spatulate to oblanceolate or obovate, 1.3-4 cm. long, 1.5-8 mm. wide, rounded to acuminate and mucronulate at apex; peduncles solitary, 23-75 mm. long; racemes conic-capitate, becoming ovoid-ellipsoid or thick-cylindric, acute to very obtuse, 1-1.7 cm. thick, 1-3.7 cm. long; bracts linear-subulate, ciliolate, at length deciduous or sometimes persistent, 5.5-6.5 mm. long; flowers subsessile, yellow turning deep- or bright-green in drying; sepals elliptic-lanceolate to linear-subulate, 3-5.3 mm. long, cuspidate-acuminate, ciliate; wings elliptic, 6.5-7.5 mm. long, 1.8-2.8 mm. wide, acuminate and somewhat involute at apex into a cusp to 1 mm. long, scarcely narrowed at base, sparsely ciliolate, 3- to 5-nerved; keel 4.5-5.8 mm. long, the crest on each side of 3 linear entire to 3-parted lobes; anthers 6; capsule oval to suborbicular-oval, 1.6-2 mm. long, 1.2-1.6 mm. wide; seed ellipsoid to subpyriform, pilose, with a prominent thick blunt rostrum at base, 0.8-1.8 mm. long; aril 0.7-1.1 mm. long, the 2 linear scarious lobes appressed, one third to nearly as long as seed. *Pilostaxis nana* (Michx.) Raf. On seepage slopes, in savannahs and low open pinelands in s.e. Tex., Apr.-June; from Fla. to S.C. and Tex.

Plants of this species are sometimes confused with the more eastern *P. lutea* L. The cusp of the largest sepals of that species, however, is less than 1 mm. long and the sepals are orange-color instead of yellow.

23. *Polygala ramosa* Ell. Erect glabrous annual, 1.5-4 dm. tall, fibrous-rooted; stems solitary, simple or branched; basal leaves in a small tuft, elliptic to obovate, 7-20 mm. long, 2-6 mm. wide, rounded at apex, usually narrowed into a petiolelike base; stem leaves linear to spatulate or elliptic, 7-24 mm. long, 1.5-8 mm. wide, acute to obtuse at each end; branch leaves linear, reduced; racemes numerous, terminal and on axillary branches forming a flattish cymose panicle to 14 cm. broad, the separate racemes loosely flowered and 7-11 mm. thick and 18 mm. long or less; bracts lance-ovate, ciliolate, spreading, persistent, 1.5 mm. long; pedicels narrowly winged, 1.3-2.3 mm. long; flowers yellow, turning very dark-green in drying; sepals ovate, ciliolate, acuminate, 1.1-2 mm. long; wings obovate to elliptic-obovate, strongly cuspidate at the somewhat involute apex, 2.9-3.5 mm. long, 1.1-1.3 mm. wide, 3-nerved; keel 2.1 mm. long, the crest on each side of a lobed lamella and a 2- or 3-parted lobe; capsule suborbicular, plump, 0.8 mm. long and wide; seed ellipsoid, very plump, short-hairy, 0.6-0.7 mm. long; aril 0.2 mm. long, the 2 lobes oval, appressed. *Pilostaxis ramosa* (Ell.) Small. In seepage areas of savannahs, open slopes and in boggy open pinelands in s.e. Tex., May-Sept.; from Fla. to Tex., n. to N.J.

24. *Polygala hemipterocarpa* Gray. Stems several, sparsely branched, erect from a fruticulose base, sulcate, essentially glabrous, slightly glaucous, 12-56 cm. tall; leaves linear, 6-23 mm. long, 0.6-1 mm. wide, acute to subacuminate and mucronate at apex, obtuse at base, thickish, flattish above, beneath convex, 1-nerved, scarcely sulcate, glabrous; racemes 3-21 cm. long; flowers white, greenish-veined; sepals oval to ovate, obtuse, 1.6-2.3 mm. long; wings obovate, 3.5-4 mm. long, 1.6-1.8 mm. wide, rounded at apex, 5-nerved; keel 3.4 mm. long, the crest on each side of about three 2- to 4-lobed processes; capsule oblong, 5 mm. long, 2.3 mm. wide, the upper cell noticeably the longer and broadly scarious-winged with the wing erose-crenulate, the lower cell wingless, filled by the seed; seed short-silky-pilosulous, 2.7 mm. long; aril (of seed in winged cell) 2 mm. long, the 2 scarious lobes linear; aril of seed in wingless cell obsolescent. Grassy stony slopes of canyons in mts. of the Trans-Pecos, May-July; from w. Tex. to s. Ariz. and Mex.

The broad, irregularly erose-crenulate wing of the upper cell of the capsule distinguishes this species from *P. scoparioides* with the wing uniformly narrow and essentially entire.

25. *Polygala scoparioides* Chod. Stems numerous, angulate, finely incurved-puberulous, 9-30 cm. tall, slightly glaucescent; leaves linear-acicular, 7-14 mm. long, 0.6-1.3 mm. wide, acute to acuminate at each end, mucronate, more or less strongly bisulcate beneath, glabrous or nearly so; racemes 15-78 mm. long; flowers white, greenish-veined; sepals oblong-ovate, rounded, glabrous, 1.3 mm. long; wings spatulate-obovate, 2.6-3 mm. long, 1.3-1.6 mm. wide, barely mucronulate at the obtuse apex, 5-veined; keel 2.8 mm. long, the crest on each side of 3 weak lobes; capsule oblong-elliptic, very narrowly winged on

upper side, 3-3.5 mm. long, 1.6 mm. wide, the upper cell slightly the longer, both cells dehiscent; seed subcylindric, puberulous, 2.5-3 mm. long; aril 1-1.9 mm. long, the 2 linear lobes appressed. Incl. var. *multicaulis* Gray. On limestone slopes and hills, in rubble of talus slopes and in crevices of limestone ledges on w. edge of Edwards Plateau and in the Trans-Pecos, Apr.-Nov.; from Tex. to Ariz. and n. Mex.

Closely allied to *P. hemipterocarpa*.

FAM. 102. EUPHORBIACEAE JUSS. SPURGE FAMILY

Herbs, shrubs or trees; leaves opposite or alternate or whorled, usually stipulate (but stipules commonly very small or caducous); highly variable as to inflorescence and flower form but the flowers are always unisexual; petals can be present or absent; a lobate "disk" is commonly present at least in the pistillate flowers; the ovary is nearly always 3-celled and each locule has a separate style which in some species is deeply dissected (exceptions are *Crotonopsis* with one locule; *Croton monanthogynus* with only one locule well-developed; *Jatropha dioica* and *Bernardia obovata* regularly have fewer than 3 locules); the placentation is axile and the ovules pendulous (attached near the middle in *Reverchonia*), anatropous, with a ventral raphe; seeds 1 or 2 per cell, when 2 then collateral; the micropyle in many species is covered by a caruncle; the fruit is usually a capsule (except an achene in *Crotonopsis*), when ripe the dorsal walls of the locules usually separate septically from the central placental axis called the columella (this small, fragile or obsolete in *Stillingia*, *Acalypha* and those species mentioned above as having regularly fewer than 3 cells); the seeds are liberated through the ventral (axile) openings of the locules which are in many species eventually loculicidal.

A vast and diverse family of over 200 genera and several thousand species. It is said by some authors that most Euphorbiaceae are poisonous. A number of our species are known to be toxic to livestock. The starchy, tuberous roots of *Manihot* species replace grains as staple starchy crops in much of the hot, forested lowlands of South America; these roots have to be specially treated, steeped, dried and heated, before the edible materials (mandioca, cassava, tapioca) can be prepared from them. The Brazilian rubber trees (genus *Hevea*) are widely planted in Malaysia and Africa. The castor-bean (*Ricinus*) formerly was valuable for its oil. Croton oil is prepared from species of *Croton*. Some species of the family are valued as ornamentals (*Breynia*, *Acalypha*, *Ricinus*, *Codiaeum*, etc.).

1. Flowers without perianth, borne from a rather small cup-shaped or urn-shaped calyxlike involucre (individual bracts not discernible except as lobes at the rim), often with glands attached to the top between the lobes and near the rim; staminate flowers each of a single naked stamen, few to many, in groups within the involucre; pistillate flower solitary, central, with a 3-lobed ovary (one ovule per locule); sap usually milky20. *Euphorbia*, p. 955.
1. Flowers with a calyx, manifestly unisexual (2)
 - 2(1). Leaves palmately lobed, the margins usually serrate (3)
 2. Leaves not palmately lobed (6)
 - 3(2). Leaf blades peltate16. *Ricinus*, p. 953.
 3. Leaf blades not peltate (4)
 - 4(3). Flowers in terminal racemes19. *Manihot*, p. 955.
 4. Flowers in forking cymelike panicles (5)
 - 5(4). Leaves and stems armed with translucent aciculate stinging hairs18. *Cnidoscolus*, p. 954.
 5. Leaves and stems essentially glabrous or only sparingly pubescent17. *Jatropha*, p. 953.
 - 6(2). Stems perennial, fleshy, rising wandlike 2-6 dm. from underground horizontal rootstocks (oozing "blood" when freshly broken); leaves fasciculate on short lateral spurs; male and female flowers borne on separate plants; cells of ovary 1 or rarely 2; seeds 1 per locule; columella absent ...17. *Jatropha (dioica)*, p. 953.
 6. Plants otherwise (7)

- 7(6). Plants clothed with stellate or forked hairs or lepidote scales (8)
7. Plants with simple or malpighiaceus hairs or glabrous (11)
- 8(7). Seeds not carunculate; anthers erect in bud; plants shrubby; staminate calyx lobes 3; hairs stellate or forked10. *Bernardia*, p. 942.
8. Seeds usually carunculate; anthers turned inward and down in bud; plants herbaceous or shrubby; staminate calyx lobes 4 or usually 5; plants clothed with stellate or forked hairs or lepidote scales (9)
- 9(8). Margins of pistillate calyx lobes with a number of linear lacinations 6. *Julocroton*, p. 939.
9. Margins of pistillate calyx lobes essentially entire (10)
- 10(9). Fruit one-seeded, indehiscent 5. *Crotonopsis*, p. 937.
10. Fruit usually 3-seeded and always dehiscent 4. *Croton*, p. 929.
- 11(7). Ovules 2 in each of the 3 cells of the ovary, collateral; seeds ecarunculate, wedge-shaped; stamens (at least the outer ones) opposite the sepals; if plant entirely staminate then leaves entire and plant subglabrous (12)
11. Ovules 1 in each cell; seeds mostly carunculate; stamens (at least the outer ones) alternate with the sepals; if plant entirely staminate then margins of leaves crenate or serrate or plants pubescent (14)
- 12(11). Plants shrubby, mostly 4-6 dm. tall; male and female flowers on separate plants, both sorts of flowers with petals 1. *Andrachne*, p. 925.
12. Plants herbaceous or if appearing subshrubby then shorter than 2 dm.; male and female flowers either on separate plants or on the same plant, neither kind of flower petaliferous (13)
- 13(12). Annual herbs of sandy soils, with only a single main stem; flowers and upper stipules distinctly purplish-red; leaves at least 4 times as long as broad; flowers in groups of 6 to 12 per axil; pistillate calyxes relatively small in relation to fruit, hidden by fruit in a distal view 3. *Reverchonia*, p. 929.
13. Annual or perennial herbs, usually several-stemmed from the base; flowers and upper stipules sometimes pale-reddish but not distinctly purple; leaves rarely as much as 4 times as long as broad; flowers solitary or in two or threes in the axils; lobes of pistillate fruiting calyxes long enough to be visible from a distal view 2. *Phyllanthus*, p. 925.
- 14(11). Stamens 2 or 3 or rarely 4 per male flowers; inflorescences terminal spikes or spiciform thyrses; juice of plant often milky (15)
14. Stamens more than 3, or if so few (in *Tragia*) then inflorescences lateral, flowers pedicelled and plants with stinging hairs; juice never milky (17)
- 15(14). Lower part of ovary enlarged and indurated after anthesis and at maturity separating from the upper dehiscent portion and persisting as a 3-pointed gynobase; columella fragile and not long persisting after dehiscence 15. *Stillingia*, p. 951.
15. Ovary and dehiscence otherwise, columella persistent (16)
- 16(15). Seeds with caruncles falling at dehiscence13. *Sebastiania*, p. 951.
16. Caruncles absent; seeds white, persistent on the placenta and columella long after dehiscence14. *Sapium*, p. 951.
- 17(14). Stamens 2 to 5 (up to 10 in terminal flowers) per male flower; pubescence of stiff stinging hairs intermingled with soft spreading ones 12. *Tragia*, p. 947.
17. Stamens more numerous, usually 8 to 20; pubescence otherwise (18)
- 18(17). Plants shrubby, with fascicled spatulate leaves .. 9. *Adelia*, p. 942.
18. Plants herbaceous; foliage otherwise (19)
- 19(18). Inflorescence terminal or apparently so; petals absent 11. *Acalypha*, p. 943.

19. Inflorescences axillary; petals present at least in the pistillate flowers and usually in both kinds (20)
- 20(19). Perennials, not aquatic; hairs on some of them (when present) malpighiaceae; capsules not glandular-setulose 7. *Argythamnia*, p. 939.
20. Aquatic annuals; hairs not dibrachiate; capsules glandular-setulose 8. *Caperonia*, p. 942.

1. ANDRACHNE L.

Unarmed mostly glabrous low (mostly less than 1 m. high) shrubs, usually rhizomatous; leaves alternate, 4-32 mm. long, 1 to 2 times as long as broad, entire, penninerved, with short petioles; stipules 1-2 mm. long, darkly pigmented; staminate and pistillate flowers borne on separate plants, petaliferous, borne solitary or in small groups on short pedicels from the upper axils; *staminate* calyx deeply 5-lobed; petals 5, alternate with and shorter than the sepals and rising from beneath a disk; stamens 5, opposite the sepals; rudimentary ovary of 3 columnar structures; *pistillate* calyx deeply 5-lobed; petals 5, alternate with and shorter than the sepals and rising from beneath a fleshy disk; ovary 3-celled, each cell with 2 collateral ovules; capsules 3-5 mm. long; seeds 2 per cell, wedge-shaped, about 3 mm. long.

A genus of about 15 species scattered in warmer parts of the world; the genus *Savia* Willd. is weakly segregated from it.

1. Leafy twigs 10-30 (-55) cm. long, usually weakly arcuate; leaf blades mostly more than 1 cm. long; staminate pedicels 6-12 mm. long; pistillate pedicels 8-22 mm. long 1. *A. phyllanthoides*.
1. Leafy twigs 5-10 cm. long, grayish-white, rigidly straight; leaf blades mostly less than 1 cm. long; staminate pedicels 2-3.2 mm. long; pistillate pedicels 3-4 mm. long 2. *A. arida*.

1. *Andrachne phyllanthoides* (Nutt.) Coult. MAIDENBUSH. Leafy twigs 10-30 (-55) cm. long, usually weakly arcuate; leaf blades elliptic-oblong to obovate-oblong, occasionally nearly round, (6-) 10-15 (-32) mm. long, 1 to 1.6 times as long as broad, apically usually rounded, occasionally emarginate, rarely shortly acute; *staminate* pedicels 6-12 mm. long, the calyx 4.5-7 mm. across; *pistillate* pedicels 8-12 (-22) mm. long, the calyx 7-11 mm. across; capsules 4-5 mm. long, 7-7.5 mm. across; seeds 3-3.2 mm. long. *Savia phyllanthoides* (Nutt.) Pax & K. Hoffm. Infrequent to rare, limestone cliffs and crevices near streams, Edwards Plateau and n.-cen. Tex., (summer-) fall; Mo., Ark., Okla. and Tex.; reportedly also in Ala.

2. *Andrachne arida* (Warnock & M. C. Johnst.) G. L. Webst. Intricately branched shrubs (25-) 40-60 (-75) cm. tall; leafy twigs 5-10 cm. long, rigidly straight; leaf blades 4-10 mm. long, 1.2 to 2 times as long as broad, apically rounded or obscurely mucronulate, basally rounded; *staminate* pedicels 2-3.2 mm. long, the sepals about 1.8-2 mm. long; *pistillate* pedicels 3-4 mm. long, the calyx 5-5.5 mm. across; capsules 3.5-4 mm. long, about 7 mm. across; seeds 2.7-3 mm. long. *Savia arida* Warnock & M. C. Johnst. Rare in limestone desert mts., s. Brewster and Presidio cos. in the Trans-Pecos, July-Oct.; also Coah.

2. PHYLLANTHUS L.¹¹³

LEAF-FLOWER

Trees, shrubs or herbs; branches persistent or deciduous (in the latter instance, leaves on main stem then reduced to scales); leaves entire; petioles short; stipules deciduous or persistent; male and female flowers borne on same plant in ours (except perhaps in *P. ericoides* and *P. polygonoides*); flowers usually axillary, solitary or in cymes, apetal-

¹¹³ Contributed by Grady L. Webster.

ous, gamosepalous; disk usually present; *staminate flowers* with mostly 3 to 6 stamens, the filaments free or connate; disk usually dissected; pistillode absent; pollen grains colpate (in local taxa); *pistillate flowers* pedicellate or sessile; calyx lobes usually 5 or 6, entire; disk continuous or segmented (rarely absent); carpels 3 (in ours); ovules 2 in each locule, hemitropous; styles free or united, bifid or variously divided or dilated; fruits capsular and ballistically dehiscent (indehiscent in some exotic taxa); seeds usually 2 in each locule, collateral; seed coat dry and crustaceous; endosperm copious; embryo straight or slightly curved.

A polymorphic genus of some 700 species, best developed in the Old World tropics.

1. Perennials with leaves spirally arranged on all axes; disk of female flower dissected into 6 obtuse segments; seeds verruculose (2)
1. Annuals with leaves distichous at least on ultimate axes; disk of female flower entire (except in *P. abnormis*); seeds smooth, striate or verruculose (3)
- 2(1). Subshrubs with distinctly woody stems; leaves small (mostly less than 5 mm. long) and sharp-pointed; filaments united their entire lengths into a column; seeds about 1 mm. long 1. *P. ericoides*.
2. Perennial with woody caudex bearing wiry herbaceous stems; leaves larger and usually not sharp-pointed; filaments united about halfway into a column; seeds 1.1-1.5 mm. long 2. *P. polygonoides*.
- 3(1). Main axes leafy and floriferous; leaves distichous; stamens 3; anthers dehiscing more or less horizontally; seeds verruculose (4)
3. Main axes with leaves reduced to scales, the developed leaves and flowers borne on specialized deciduous branchlets; seeds various (5)
- 4(3). Filaments free; stems terete, not winged; capsule 1.7-2 mm. in diameter; seeds 0.8-1 mm. long 3. *P. carolinensis*.
4. Filaments connate; stems compressed-winged; capsule 2.9-3.2 mm. in diameter; seeds 1.2-1.5 mm. long 4. *P. pudens*.
- 5(3). Leaves minutely rough-scrabrid beneath; female flowers (and capsules) sessile; stamens 3, the filaments completely connate; anthers dehiscing vertically; seeds transversely ribbed on sides and back 5. *P. Urinaria*.
5. Leaves not scabrid beneath with sharp point; female flowers distinctly pedicellate; stamens 2 or 3; anthers dehiscing horizontally or obliquely; seeds not transversely ribbed (6)
- 6(5). Leaves oblique at base; stamens 3, the filaments connate halfway or less; style branches capitate; fruiting calyx lobes 3-3.5 mm. long; female disk entire; seeds verruculose, 1.5-1.8 mm. long 6. *P. Niruri*.
6. Leaves not oblique at base; stamens (in most male flowers) 2, the filaments entirely connate; style branches not capitate; fruiting calyx lobes scarcely over 1 mm. long; female disk cut into 3 segments; seeds longitudinally striate, 1.1-1.5 mm. long 7. *P. abnormis*.

1. *Phyllanthus ericoides* Torr. Subshrub 5-10 (-15) cm. high, with woody caudex to 15 mm. thick, monoecious (and also dioecious?); stems woody; leaves spirally arranged, densely imbricate and appressed, narrowly oblanceolate, pungently tipped, glaucous, pitted, 1.5-3.5 (-5) mm. long, 0.7-1.5 mm. broad; stipules attenuate-acuminate, 0.7-1.3 mm. long; flowers solitary, the female at distal axils; *male flowers* with pedicels 0.6-0.8 mm. long; calyx lobes 6, narrowly oblong-lanceolate, 0.9-1.2 mm. long; disk segments 6, orbicular; stamens 3; filaments completely connate, the column 0.3-0.5 mm. high; anthers discrete, dehiscing vertically, 0.3-0.35 mm. long; *female flowers* with pedicels becoming 0.9-1.2 mm. long; calyx lobes 6, ovate to elliptic, glaucous, 1.1-1.4 mm. long; disk segments 6, obtuse; ovary smooth; styles thickish, about 0.3 mm. long, emarginate; capsules obovate, about 2 mm. in diameter; seeds dark-brown, verruculose, 0.9-1 mm. long. Rocky calcareous soil, known only from 1 station in Terrell Co. in the Trans-Pecos, summer (?); also known from 1 station in Chih.

2. *Phyllanthus polygonoides* Spreng. Glabrous perennial herb, becoming more or less suffruticose, 1-5 dm. high, mostly monoecious but unisexual plants not uncommon;

branches upright, whiplike; leaves spirally arranged, not markedly imbricate on expanded axes, narrowly oblong to obovate, acute or mucronulate at the tip, obtusish at base, glaucous beneath and with lateral veins sometimes visible, mostly 5-10 mm. long, 1.5-5 mm. broad; stipules acuminate, auriculate at base, mostly 1-2 mm. long; cymules unisexual or bisexual, with 1 (rarely 2) female flower and/or several male flowers; *male flowers* with pedicels 1.5-3.5 mm. long; calyx lobes 6 (rarely 5), oblong to obovate, 0.7-1.3 mm. long; disk segments 6, orbicular; stamens 3; filaments 0.6-0.8 mm. long, connate into a column 0.4-0.5 mm. high; anthers dehiscing more or less vertically, about 0.3 mm. long; *female flowers* with pedicels 2.5-7 mm. long; calyx lobes 6 (rarely 5), ovate to obovate, acute, green and herbaceous, pinnately veined, 1.5-2.5 mm. long in fruit; disk segments 6, obcuneate; ovary smooth or nearly so; styles spreading or ascending, 0.25-0.3 mm. long, bifid, the style branches subcapitate; capsules oblate, 2.7-3.2 mm. in diameter; seeds usually dark-brown, irregularly verruculose, (1.1-) 1.2-1.4 (-1.5) mm. long. Cen., s., and w. Tex., commonly on rocky calcareous soils, Apr.-Nov. or throughout the year on the Rio Grande Plains; Okla. and Tex., s. into the Mex. plateau, with outliers in Mo. and La.

3. *Phyllanthus caroliniensis* Walt. subsp. *caroliniensis*. Glabrous erect annual monoecious herb 1.3 dm. high; branches terete to somewhat compressed but not winged; leaves distichous, elliptic to obovate, obtuse or rounded and sometimes apiculate at the tip, acute at the base, 5-20 (-30) mm. long, 4-10 (-13) mm. broad; stipules lanceolate, acuminate, basally denticulate, (0.5-) 0.8-1.3 mm. long; most axils on all axes floriferous; cymules bisexual, with 1 or 2 male and 1 or 2 female flowers; *male flowers* with pedicels 0.5-1 mm. long; calyx lobes 6 (rarely 5), oblong to ovate or suborbicular, 0.5-0.8 mm. long; disk segments 6 (5), more or less cuneate; stamens 3; filaments free, 0.2-0.3 mm. long; anthers dehiscing transversely, about 0.3 mm. broad; *female flowers* with pedicels becoming geniculate-reflexed and 0.5-1 (-1.5) mm. long; calyx lobes 6 (rarely 5), linear-lanceolate to narrowly spatulate, greenish or reddish, with unbranched midrib, 0.7-1.2 (-1.4) mm. long; disk patelliform, entire or nearly so; ovary smooth; styles nearly free, spreading, bifid, 0.3 mm. long or less, style branches obtuse or subcapitate; capsules oblate, 1.7-1.9 mm. in diameter; seeds fuscous-brown, verruculose (with verrucae in wavy lines), 0.8-1 mm. long. An infrequent weed in e. and n.e. Tex. (from Tarrant and Harris cos. eastw.), June-Nov.; Ill. and Pa., s. to Arg. and Urug.

4. *Phyllanthus pudens* Wheeler. Erect annual monoecious herb 2-5 dm. high; stems compressed and distinctly but narrowly winged, scabridulous; leaves distichous, oblong or elliptic, acute or obtuse and apiculate at the tip, obtuse to rounded at the base, 1-2 cm. long, 3-10 mm. broad; stipules ovate-lanceolate, acuminate, basally more or less denticulate, 1.2-2 mm. long; most axils on all axes floriferous; cymules bisexual, with 1 to 3 male and 1 or 2 (rarely 3) female flowers; *male flowers* with pedicels about 0.5 mm. long; calyx lobes 5 or 6, ovate, 0.5-0.7 mm. long; disk segments 5 or 6, suborbicular or cuneate; stamens 3; filaments completely united into a column 0.2-0.3 mm. high; anthers dehiscing horizontally, about 0.25 mm. broad; *female flowers* with pedicels becoming geniculate-reflexed and (1-) 1.4-2.2 mm. long; calyx lobes 6 (rarely 5), oblong to ovate, often reddish at base, herbaceous with unbranched midrib, 0.7-1.2 mm. long; disk patelliform, 6-angled, entire; ovary smooth; styles horizontal, bifid, basally fused into a triangular platform 0.5-0.6 mm. across, style branch tips subcapitate; capsules oblate, sometimes reddish-tinged, 2.9-3.2 mm. in diameter; seeds yellowish- to fuscous-brown, verruculose (with verrucae in irregular wavy lines), 1.2-1.5 mm. long. Coastal prairies, from Matagorda Co. to Chambers Co. and e., May-Nov.; also s. La.

5. *Phyllanthus Urinaria* L. Erect or procumbent annual monoecious herb, 1-5 dm. high; primary axes angled, with spirally arranged scale leaves 2-3 mm. long, the stipules of scale leaves auriculate and denticulate; deciduous branchlets (3-) 5-10 cm. long, flattened and winged, with 20 to 35 distichous leaves; leaves mostly oblong, acute or obtuse and apiculate at tip, obtuse or inequilateral at base, hispidulous beneath and marginally, 6-25 mm. long, 2-9 mm. broad; stipules unequal, the longer 0.8-1.5 mm. long; flowers only on branchlets, the 5 to 20 proximal axils with solitary female flowers, distal axils with cymules of several male flowers; *male flowers* with pedicels less than 0.5 mm. long; calyx lobes 6, elliptic to obovate, 0.3-0.5 mm. long; disk segments 6, roundish; stamens 3; filaments completely united into a slender column 0.1-0.15 mm.

high; anthers discrete, dehiscent vertically, less than 0.2 mm. long; *female flowers* subsessile (pedicel not exceeding 0.5 mm. even in fruit); calyx lobes 6, reflexed in fruit, linear-oblong, 0.6-0.9 mm. long, dorsally hispidulous, midrib unbranched; disk patelliform, 6-angled; ovary conspicuously papillate-bullate; styles flattened, bifid, fused into a horizontal plate 0.3-0.4 mm. across, style branches obtuse; capsules oblate-spheroidal, 2-2.2 mm. in diameter, smooth or scurfy; seeds light-brown, with 12 to 15 sharp transverse ridges on back and sides, often laterally foveolate as well, 1.1-1.2 mm. long. Reported only from Jefferson Co., summer (?); Old World trop., introd. into the Am. trop. and (sporadically) into the Gulf States.

6. *Phyllanthus Niruri* L. subsp. *lathyroides* (H.B.K.) G. L. Webst. Glabrous erect annual monoecious herb, 1-5 dm. high; primary axes terete, with spirally arranged scale leaves 1.5-3 mm. long; stipules of scale leaves narrowly lanceolate-acuminate, entire, not auriculate; deciduous branchlets 6-12 cm. long, more or less terete, with 15 to 30 (rarely fewer) distichous leaves; leaves elliptic, obtusely pointed, inequilateral at base, with 8 to 10 pairs of lateral veins, 1-2 cm. long, 4-9 mm. broad; stipules unequal, linear-lanceolate, the longer 1.2-1.8 mm. long; flowers only on branchlets, proximal cymules with 3 to 7 male flowers, distal ones with solitary female flowers; *male flowers* with pedicels 1.2-1.8 mm. long; calyx lobes 5 (rarely 6), obovate, 1.5-3 mm. long, 1-1.8 mm. broad; disk segments 5 (6), roundish, thickened and punctate; stamens 3; filaments 0.5-0.8 mm. long, united about half way into a column; anthers dehiscent more or less obliquely, 0.2-0.4 mm. long; *female flowers* with straightish pedicels 4-7 mm. long; calyx lobes 5, elliptic to obovate, clearly to obscurely pinnately veined, 3-3.5 mm. long; disk patelliform, 5-angled, rather massive; ovary smooth; styles free and ascending, bifid, 0.5-0.6 mm. long, style branches capitate; capsules oblate, about 3.5 mm. in diameter; seeds dark-brown, densely verruculose, 1.5-1.8 mm. long. In Tex. definitely recorded only from Ottine Swamp, Gonzales Co., excessively rare and now possibly extinct, summer (?); otherwise known from n. Mex. s. to Arg.

7. *Phyllanthus abnormis* Baill. Erect or somewhat procumbent annual monoecious herb, 1-5 dm. high; primary axes terete, basally thickened and sometimes lignescent (plants then appearing as though perennial), above with spirally arranged scale leaves 0.7-1.5 mm. long; stipules of scale leaves deltoid, often reddish, not auriculate; deciduous branchlets 3-6 (-17) cm. long, subterete, glabrous or scabridulous, with 15 to 30 distichous leaves; leaves elliptic to oblong, obtuse to emarginate at tip, cuneate to subcordate at base, smooth or scabridulous, with rather conspicuous lateral veins, 3-10 mm. long, 1-4 mm. broad; stipules ovate- to linear-lanceolate, acuminate, 0.6-1.5 mm. long; flowers only on branchlets, first few proximal cymules with paired male flowers, distal cymules usually with 1 male and 1 female flower; *male flowers* with pedicels 0.7-1.5 mm. long; calyx lobes 4 (5 or 6 in the first few larger proximal flowers), ovate or elliptic, 0.5-1 mm. long; disk segments 4 (5 or 6), roundish; stamens 2 (3 in larger proximal flowers); filaments completely connate into a column 0.2-0.3 mm. high; anthers connivent, dehiscent transversely, about 0.3 mm. broad; *female flowers* with straightish pedicels 1-3 (-3.5) mm. long; calyx lobes 5 or 6, often unequal, ovate to obovate or oblong, midrib unbranched, 0.7-1.1 mm. long; disk segments 3, more or less unequal (one or more often bifid or divided), ligulate to reniform; ovary smooth; styles spreading, free, bifid, about 0.2 mm. long, style branches unthickened; capsules oblate, often reddish-tinged, 2.3-2.7 mm. in diameter; seeds yellowish-brown, finely longitudinally ribbed, 1.1-1.5 mm. long. Two varieties are distinguished as follows:

Var. *abnormis*. Stems smooth and glabrous to densely scabridulous; leaves usually smooth; female flower always accompanied by 1 male flower; disk segments loriform, usually unequal, the larger ones often bifid or divided but all segments as long as or longer than broad; seeds (1.2-) 1.3-1.4 mm. long. Sandy soils, w. Tex. to e.-cen. Tex., Apr.-Oct.; extending into n. Mex. (Tam.) and with a disjunct population in peninsular Fla.

Var. *riograndensis* G. L. Webst. Stems and leaves densely scabridulous; female flower accompanied by 1 to 3 male flowers; disk segments equal or nearly so, broader than long; seeds 1.1-1.3 mm. long. Known only from semidesert scrub, lower Rio Grande Valley (Webb to Hidalgo cos.), Apr.-Nov.

3. REVERCHONIA GRAY¹¹⁴

A monotypic genus.

1. *Reverchonia arenaria* Gray. Glabrous annual herb becoming 5 dm. high, with sparsely branched taproot; main stem subterete, smooth, glaucous-white; lower lateral branchlets 2-3 dm. long (upper ones shorter), mostly 1.5-2 mm. thick; stipules lanceolate, acuminate, persistent, to 2.3 mm. long, usually much shorter; leaf blades elliptic to narrowly oblong-elliptic or nearly linear, (15-) 20-40 (-45) mm. long, (1.8-) 2.5-8 (-9) mm. wide, apiculate at tip, narrowed to the base; petiole 1-3 mm. long; flowers in reduced bracteolate cymules axillary to the leaves on lateral branchlets (never on main stem), each cymule typically producing 1 central female and 4 to 6 lateral male flowers; *male flowers*: pedicel slender, 1.5-2.5 mm. long; calyx lobes 4, ovate-oblong, submedianly constricted, 1-veined, obtuse, purplish to pinkish with a narrow central stomatiferous greenish strip, 1.5-2.5 mm. long, 0.7-1.5 mm. broad; disk of 4 roundish lobes continuous across the center of the flower (between the stamens), with the outline of an I-beam; stamens 2, opposite the outer calyx lobes; filaments free, subterete, 0.7-1.2 mm. long; *female flower*: pedicel stout, 1.5-2 mm. long at anthesis, becoming as much as 8.7 mm. in fruit; calyx lobes 6 (rarely 5), oblong, colored and distally constricted as in the male but not especially inflated, becoming as much as 2.9 mm. long; disk flat, rather thin, 1.1-1.8 mm. in diameter, roundish or 6-angled in outline; styles erect, 0.5-0.8 mm. high, united halfway or less, the stigmas somewhat dilated, emarginate or slightly bilobed; capsule oblate-spheroidal, smooth, stramineous, 7-9.8 mm. in diameter; columella usually deciduous; seeds trigonous, dark- or reddish-brown, smooth on the back (tangential face), papillate on the lateral (radial) faces, (4.4-) 4.7-6.2 (-6.6) mm. long. Local in deep sand of dunes in the Plains Country and Trans-Pecos, summer-fall; Ut., Ariz., N.M., Okla., Tex. and Chih.

4. CROTON L. CROTON

Herbs or shrubs, with stellate trichomes or peltate scales on the epidermis of at least some parts; leaves alternate (seeming opposite or whorled just below the inflorescence), unlobed, marginally serrate or entire, diverse in shape, petiolate; stipules present though often small and caducous; flowers in terminal spikes or racemes, when both male and female flowers are on the same plant the spikes are androgynous; *staminate flowers*: calyxes with 5 or rarely 4 or 6 deep or shallow lobes, valvate in bud; petals absent or present, when present as many as the calyx lobes and alternate with them; disk (of lobes) often present when the petals are absent; stamens 5 or more, usually 10 to 20 in ours; rudiment usually absent or poorly developed, usually represented merely by a mound in the center; *pistillate flowers*: calyxes with 5 or 6 or up to 9 deep or shallow lobes, valvate in bud; petals absent or when present as many as the calyx lobes and alternate with them; disk sometimes present as a series of lobes, usually present when petals absent; ovary 3-celled (or in *C. monanthogynus* with fewer cells), each cell with one pendulous ovule, the ovules usually markedly carunculate and with a decided raphe; styles 3, each one or more times dichotomous; capsule 3-celled (or with only 1 recognizable cell in *C. monanthogynus*) and 3-seeded (1-seeded in *C. monanthogynus*).

This is a genus of more than 600 species of herbs, shrubs and trees in warm regions of the world. Many, or perhaps all, of them are aromatic, and to many are ascribed medicinal properties, but the only known pharmaceutical is croton oil, obtained from the Old World *C. Tiglium* L. The seeds of several of our species furnish much food for doves and other wild birds. The herbage of several of our species is reputed to be toxic upon ingestion. The glandular secretions of the epidermal hairs of *C. ciliatoglandulifer* cause contact dermatitis and conjunctivitis. Plants of the genus generally increase greatly in abundance under the prevalent agricultural regime of abusive overstocking. Stock animals rarely eat Crotons, even where desirable herbage is scarce or absent.

¹¹⁴ Adapted from Grady L. Webster and Kim I. Miller in *Rhodora* 65:193-207. 1963.

1. Styles only once-dichotomous, giving 6 ultimate stigmatic ends per flower (or only 4 in *C. monanthogynus*) (2)
1. Styles or at least some of them on each plant more than once-dichotomous (in *C. argyranthemus* some styles may appear trifold or quadrifold), giving usually at least 10 ultimate stigmatic ends per flower (11)
- 2(1). Leaves distinctly serrate; a minute gland present on each side of the base of the midvein on the lower surface of the blade; lower petioles usually less than half as long as the blades they support 14. *C. glandulosus*.
2. Leaves not serrate (sometimes appearing very minutely serrate in *C. Torreyanus*, *C. Cortesianus* and *C. fruticulosus*); blades not biglandular below at base (in species 1, 2 and 3 often with several stalked glands at the base) (3)
- 3(2). Petioles of lower leaves usually at least half as long as the blades they support (often as long as the blades in *C. leucophyllus* and *C. Lindheimerianus*) (4)
3. Petioles of most leaves less than a third as long as the blades they support; collections almost always fragmentary, usually of outer branches of shrubby plants (7)
- 4(3). Styles 2, ultimate stigmatic ends 4 per flower; mature capsule 1-seeded 20. *C. monanthogynus*.
4. Styles 3, ultimate stigmatic ends 6 per flower; mature capsule 3-seeded (5)
- 5(4). Pistillate calyx lobes very unequal with 3 lobes well-developed and 2 lobes weak or suppressed 18. *C. leucophyllus*.
5. Pistillate calyxes with 5 equal or subequal lobes (in *C. Lindheimerianus* rarely only 4 lobes well-developed) (6)
- 6(5). Mature pistillate calyxes about half as long as the fruit; stamens and styles usually at least 1 mm. long; collections usually fragmentary, usually broken near ground level but the lower part usually obviously ligneous and perennial 17. *C. Pottsii*.
6. Mature pistillate calyxes at least three quarters and usually fully as long as the fruit; stamens and styles usually about 1 mm. long, rarely more than 1.5 mm. long; collections often of complete plants showing annual taproots 19. *C. Lindheimerianus*.
- 7(3). Leaf blades oblong (most of them distinctly more than twice as long as broad, tomentose beneath, above short-pubescent and not tomentose) 5. *C. Torreyanus*.
7. Leaf blades tapering from near the middle to the apex (8)
- 8(7). Leaf blades ovate, tapering from near the base to the apex, often shallowly cordate at base (tomentose on both surfaces but less densely so above, usually about twice as long as broad) 4. *C. fruticulosus*.
8. Leaf blades widest near the middle, tapering to a pointed apex and to a pointed or shortly rounded base, rarely with cordate tendencies (9)
- 9(8). Both male and female flowers present on same plant. 6. *C. suaveolens*.
9. Male and female flowers on separate plants (10)
- 10(9). Petioles 2-4.5 mm. long 7. *C. Sancti-Lazari*.
10. Petioles 5-29 mm. long 8. *C. Cortesianus*.
- 11(1). Pistillate calyxes (or most of them) having at least 6 lobes, usually 6 to 9 (12)
11. Pistillate calyxes 5-lobed (in *C. argyranthemus* a few of them 6-lobed) (13)
- 12(11). Leaves pinnate-nerved, the lateral (secondary) nerves of the lower surface curving, not parallel, most of them prominent; petals of staminate flowers not conspicuous; styles 1-2 mm. long 15. *C. capitatus*.
12. Leaves pinnate-nerved, the secondaries of the lower surface straight and rather strictly parallel, not raised above the tomentum; staminate flowers with 5 conspicuous silvery-scaly petals; styles about 4 mm. long 16. *C. Coryi*.
- 13(11). Most petioles of lower mature leaves at least half as long as the blades they support (14)
13. Most petioles less than half as long as the blades they support (17)

- 14(13). Most styles 1-2 mm. long, the ends not spreading; leaf blades broad, rounded apically or if pointed the angle greater than 100° ... 10. *C. punctatus*.
14. Most styles 3-5 mm. long, the ends tending to spread; leaf blades tapered from near the middle to the pointed acute apex which forms a $40-70^\circ$ angle (15)
- 15(14). Stipules and margins of leaves conspicuously glandular-ciliate 3. *C. ciliatoglandulifer*.
15. Stipular and foliar glandular ciliation (when present) not noticeable without a lens (16)
- 16(15). Epidermis rather densely stellate-pubescent or even thinly tomentose 1. *C. humilis*.
16. Epidermis nearly glabrous, the trichomes few and remote and markedly appressed 2. *C. Soliman*.
- 17(13). Styles 2-4 mm. long (usually 3 mm.), relatively slender, near their midpoints appearing trifid or quadrid; leaves and stems conspicuously silvery-scaly, brightest on the underside of the leaves; staminate and pistillate flowers appearing on the same plant 9. *C. argyranthemus*.
17. Styles at most 3 mm. long (usually 2 mm.), relatively thick and squat, the first dichotomy being near the base; leaves when scaly not brightly so; staminate flowers never occurring on the same plant as pistillate flowers (18)
- 18(17). Leaves scaly silvery-canescens beneath, dark-grayish above; base of plant usually manifestly ligneous with several stems (perennial but flowering first year) 11. *C. dioicus*.
18. Leaves green to yellowish-green or yellowish-gray, never at all silvery; specimens often fragmentary but when intact the single stem can be seen to arise from the thick annual taproot (19)
- 19(18). Plants often as much as 6 dm. tall; mature capsules 5-8 mm. long 12. *C. texensis*.
19. Plants more robust, often 10 dm. tall; mature capsules 8-9 mm. long 13. *C. Parksii*.

1. *Croton humilis* L. SALVIA. Weak shrub 5-23 dm. tall, usually rather freely branched, often growing up through other shrubs; leaf blades (15-) 20-80 mm. long, 1-2 (-5) cm. broad, ovate, widest about a third the length from the base and long-tapered to the acute or very slightly acuminate apex, basally rounded or rarely very slightly marginally entire or with very minute glandular teeth, often near the base on each side of the petiolar attachment with a few stalked glands about 0.5 mm. long, or rarely longer; surfaces of the blade with a dense but thin stellate-tomentum; petioles of the mature leaves (7-) 10-30 (-60) mm. long, mostly at least half as long as their blades; stipules of a group of 2 to 5 stalked glands about 0.5 mm. long, soon falling; racemes often androgynous, less commonly unisexual (occasionally entire plants seem to be unisexual); *staminate flowers*: calyxes 5-lobed; petals 5, thin, slightly shorter than the sepals; stamens 30 to 35; *pistillate flowers*: calyx of 5 essentially distinct linear sepals; petals absent or represented by a disk of 5 linear lobes alternate with and about half to a third as long as the sepals; styles 3-5 mm. long, usually twice-dichotomous, giving up to 12 or more usually spreading ultimate stigmatic ends; capsule nearly globose, 4-5 mm. long; columella slender; seeds ellipsoidal, with prominent caruncle. *C. Berlandieri* Torr. Locally abundant, in brush, Rio Grande Plains (Nueces, Zapata, Starr, Willacy, Hidalgo and Cameron cos.), nearly all year following rains; Fla., Tex., N.L., Tam. S.L.P., Ver., Yuc., P.R. and Jam.

2. *Croton Soliman* Cham. & Schlecht. Taprooted slender-branched shrub 5-10 dm. tall; leaf blades (2-) 3-8 cm. long, (1-) 2-4 cm. broad, widest about a third the length from the base and long-tapered to the acute or slightly acuminate apex, basally rounded, marginally with a sparse fringe of glandular projections less than 1 mm. long, minutely serrulate near the base on each side of the petiolar attachment with a few glandular projections about 0.6 mm. long, the surface nearly glabrous with very rare scattered stellate trichomes; petioles of mature blades more than half as long as their blades; stipules of 4 or 5 stalked glands 1-1.5 mm. long, easily dislodged; racemes androgynous, few-flowered; *staminate flowers*: calyxes 5-lobed; petals 5, thin, slightly shorter than the

sepals; stamens about 15 or 20; *pistillate flowers*: calyx of 5 lanceolate acute gland-margined sepals 3-4 mm. long; petals absent or represented by 5 linear disk lobes 2-3 mm. long and alternate with the sepals; styles 3-5 mm. long, usually twice-dichotomous, giving up to 12 or more usually spreading ultimate stigmatic ends; capsule nearly globose, about 5 mm. long; columella slender; seeds ellipsoidal, about 4.5 mm. long, with prominent caruncle. Very rare, known from 1 shrub in n.e. Cameron Co. in extreme s. Tex., nearly all year; Oax., Ver., Hgo., S.L.P. and Tex.

3. *Croton ciliatoglandulifer* Ort. Taprooted weak-stemmed shrub 5-10 (-20) dm. tall; leaf blades (2-) 3-8 cm. long, (1-) 2-4 cm. broad, ovate, widest about a third the length from the base and long-tapered to the acute or very slightly acuminate apex, basally rounded or less commonly very shallowly cordate, marginally usually rather densely glandular-ciliate-fringed (the cilia 1-2 mm. long), often serrulate, the glands nearest the petiolar attachment often longer than the rest, the surfaces with a dense but thin stellate-tomentum; petioles of mature leaves noticeably more than half as long as their blades; stipules of a group of stalked glands 2-3 mm. long; racemes sometimes androgynous; *staminate flowers*: calyx 5-lobed; petals 5, thin, white, slightly longer than the sepals; stamens 30 to 45; *pistillate flowers*: calyx of 5 essentially separate linear glandular-ciliate sepals; petals absent or represented by a disk of 5 stalked glands about half as long as and alternating with the sepals; styles 3-6 mm. long, usually twice- (some thrice-) dichotomous, giving up to 18 usually spreading ultimate stigmatic ends; capsule nearly globose, about 6 mm. long; columella slender; seeds about 5 mm. long, with prominent caruncles. Infrequent or rare in brush, s. Tex. (Kleberg and Starr cos.), nearly all year; widespread in the warmer parts of Mex., n. to Ariz. and Tex.

In Tamaulipas and Nuevo Leon are found plants seemingly intermediate between this species and *C. humilis*. Some authors have misspelled the name "ciliatoglandulosus."

4. *Croton fruticosus* Torr. ENCINILLA, HIERBA LOCA. Shrub 15-100 cm. tall; leaf blades ovate to ovate-lanceolate, tapering more than half their lengths to the apex, 2-8 cm. long, 1.5 to 2.5 times as long as broad, apically attenuate, acute (angle 20-35°), basally truncate or usually slightly cordate, below tomentose or merely stellate-pubescent, above sparsely stellate-pubescent, marginally essentially entire but minutely glandular-serrulate; petioles (0.2 or) 0.3 to 0.4 (to 0.5) times as long as their blades; stipules columnar-papillate, about 0.1 mm. long, almost hidden by the trichomes; flowers in androgynous racemes; *staminate flowers*: sepals 5, lance-ovate, acute, tomentose dorsally; petals 5, oblanceolate to spatulate-unguiculate, about 2 mm. long, a little longer than the sepals; disk 0.8 mm. across, the glands bulbous and 0.2-0.3 mm. long and opposite the sepals; stamens 14 to 16; *pistillate flowers*: sepals 5, lanceolate, about 2.2 mm. long, dorsally stellate-pubescent; petals absent; glands annular, bulbous, whitish, rather large; styles 3-4.5 mm. long, bifid nearly to the base; capsules subglobose, 5-6 mm. long; columella rather slender; seeds 4-5 mm. long, 3.2-3.8 mm. wide; caruncle 0.7-0.8 mm. long, broadly reniform. Frequent in brush on limestone uplands, Edwards Plateau and Trans-Pecos, infrequent on caliche cuevas in Rio Grande Plains, summer-fall; S.L.P., Tam., N.L., Coah., Tex. and N.M.

5. *Croton Torreyanus* Muell. Arg. VARA BLANCA. Shrub 1-2 m. tall; leaf blades oblong, 1.5-4 (-6) cm. long, (1.5 to) 2 to 3 (to 4) times as long as broad, apically acute (with an angle of 40° or more) to rounded or truncate, usually apiculate, basally rounded, marginally entire, tomentose; petioles 0.1 to 0.2 times as long as their blades; stipules linear-subulate, 2-3.1 mm. long; flowers in androgynous racemes; *staminate flowers*: sepals 5, lance-oblong, acute, subcucullate, 1.7-2 mm. long, tomentose dorsally; petals 5, oblanceolate, about as long as the sepals; disk brownish, about 0.9 mm. across, with indistinct bulbous lobes opposite the sepals; stamens 11 to 16; *pistillate flowers*: sepals 5, lance-subulate, 1.2-2.3 mm. long, tomentose dorsally; petals absent; disk flat, thin, obscurely 5-lobed; ovary subglobose; styles 3, 1.8-3.5 mm. long, bifid essentially to the base; capsules oblong, 6-7.1 mm. long; columella rather stout; seeds oblong to elliptic-oblong, 4.5-5.6 (-6) mm. long, 3-3.5 (-3.9) mm. broad; caruncle semilunate, about 0.5 mm. long. Calcareous loams and uplands, Rio Grande Plains and n.w. to extreme e. Brewster Co., summer-fall; S.L.P., N.L., Tam., Coah. and Tex.

Apparently intergrades with *C. incanus* H.B.K. to the south in Hidalgo.

6. *Croton suaveolens* Torr. SCENTED CROTON. Hemispheric shrub 20-35 (-50) cm. tall; leaf blades rather thick, obovate to ovate or broadly elliptical, 20-54 mm. long, 10-36

mm. broad, about twice or a little less than twice as long as broad, broadest near the middle, rounded to obtuse and apiculate or angled apically (90-120°), narrowed or rounded basally, marginally entire, densely and shaggily tomentose at least below; petioles 5-20 mm. long, stout and tomentose like the stems; stipules a little longer than the tomentum, of 5 to 10 unequal glandular papillae each 0.2-0.5 mm. long and bearing a few stellate trichomes, arranged palmately on the thin disk (0.3 mm. across); male and female flowers usually on the same plant, the racemes then androgynous; *staminate flowers*: sepals 5, ovate, about 2 mm. long; petals 5, slightly longer than the sepals; glands about 0.2 mm. long, narrowly oblong; stamens 14 to 16; *pistillate flowers*: sepals 5, lanceolate or narrowly triangular-acuminate; petals reduced to mere stalked glandular papillae between the sepals; glands of the disk thin, narrow, elongate, brownish; ovary subglobose; styles 4-6 mm. long, bifid to the base; capsules oblong to subglobose, 6-8 mm. long and broad; columella stout; seeds 5.5-7 mm. long (including the caruncle which is reniform and 2.5 mm. broad and 1 mm. long). Infrequent, locally abundant on syenite bluffs above Old Fort Davis, Jeff Davis Co. in the Trans-Pecos, summer-fall; also Coah.

7. *Croton Sancti-Lazari* Croizat. Shrub 1-3 (-4) dm. tall; leaf blades ovate to elliptic-ovate, 10-30 (-45) mm. long, 5-15 (-19) cm. broad, about twice as long as broad or a little more, widest just below the middle, apically acute or rounded, basally rounded or occasionally narrowed, marginally entire, densely and shaggily canescent-stellate-tomentose below; petioles stout, 2-3 (-4.5) mm. long; stipules 0.1 mm. long, papillose-glandular, usually hidden by the trichomes; male and female flowers never on the same plant; *staminate flowers*: calyxes hemispheric or broadly campanulate, with 5 (rarely 4) triangular-acute lobes 2 mm. long; petals 5 (rarely 4), 1.8-2 mm. long, whitish; glands 5, orangish, 0.2 mm. long, oblong or rounded, opposite the sepals; stamens 9 to 12 (usually 11); *pistillate flowers*: calyx deeply 5-lobed, tomentose; glands 5, opposite the sepals; petals absent or only the merest glandular-rudiments present; ovary globose; styles 1.5-2 mm. long, bifid to the base; capsules 5.5-6 mm. long; columella 3.8-4.5 mm. long; seeds 4.4-4.7 mm. long including the caruncle which is broadly reniform and about 0.8 mm. long. *C. abruptus* M. C. Johnst. Desert areas of s. Brewster and s. Presidio cos. in the Trans-Pecos, infrequent, Apr.-Oct.; Chih., Coah. and Tex.

8. *Croton Cortesianus* H.B.K. PALILLO. Shrub 1-2 m. tall, weak-stemmed; leaf blades lance-elliptic to narrowly ovate or narrowly obovate, widest near the middle, tapering to a pointed apex and to a pointed or shortly rounded base, rarely or never with cordate tendencies, 3-10 cm. long, 2.5 to 3.5 times as long as broad, thinly stellate-tomentose beneath, glabrous above, marginally entire or microscopically serrulate; stipules subulate, about 1 mm. long, caducous; petioles 5-29 mm. long, those of the lower leaves about a third as long as their blades, or shorter; male and female flowers on separate plants; *staminate flowers*: sepals 5, tomentose dorsally, 2 mm. long, acute; petals 5, equaling sepals; glands 5, bulbous, opposite the sepals; stamens 12 to 16; *pistillate flowers*: sepals 5, acute, tomentose dorsally, about 2 mm. long; petals 5, linear, about half as long as sepals; disk very small; ovary subglobose; styles bifid essentially to the base, 4-5 mm. long; capsule 6-8 mm. long, very long-fuzzy or setulose; seeds about 5 mm. long, 3.5-4 mm. broad. *C. trichocarpus* Torr. Infrequent in thickets, Cameron, Hidalgo and Starr cos., extreme s. Tex., spring-fall (winter); very abundant and widespread in Mex., especially e. Mex., n. to Tex.

9. *Croton argyranthemus* Michx. SILVER CROTON. Perennial herb or usually somewhat subshrubby, (5-) 10-30 cm. tall, subrhizomatous and spreading basally; leaf blades oblanceolate-elliptic to less commonly narrowly obovate, 1-5 cm. long, commonly (2 to) 3 to 5 times as long as broad, basally acute, marginally entire, apically acute or blunt or rounded, beneath silvery-scaly (the scales overlapping and with ciliate edges and rounded nonprominent umbos), above with similar structures but there very sparse; petioles 2-10 mm. long, much less than half as long as their blades; stipules subulate, about 0.2 mm. long, caducous; flowers almost always in androgynous racemes; *staminate flowers*: calyx campanulate, about 5 mm. across, 5-lobed about half the length, the lobes deltoid-acute, silvery-scaly dorsally; petals 5, about as long as the calyx, silvery-scaly dorsally; glands of the disk bulbous, opposite, the calyx lobes; stamens 10 to 12; *pistillate flowers*: calyx 4-5 mm. long and broad, 5-lobed about two thirds the length, silvery-scaly dorsally, the lobes acute; petals absent; glands 5, laminar, coherent to the calyx cup below and opposite the lobes; ovary subglobose; styles each appearing trifid or quadrifid most of the length,

3-4 mm. long; capsule about 5-5.3 mm. long; columella weak, narrowly 3-winged; seed about 4.7 mm. long, acute apically. Locally abundant in loose sandy soil, e. Tex. and Rio Grande Plains; e. to Ga. and Fla.

10. *Croton punctatus* Jacq. **HIERBA DEL JABALI, BEACH-TEA.** Perennial herb or usually subshrubs, (5-) 10-30 cm. tall, rhizomatous and extensively spreading; leaf blades ovate, less commonly elliptic, (2-) 3-5 cm. long, (7-) 16-35 mm. broad, basally rounded or rarely very shallowly cordate, even more rarely narrowed, marginally entire, apically rounded to acute (angle greater than 100°), on both surfaces densely stellate-tomentose, the central processes of the stellae setulose or some of them commonly damaged and appearing as brown spots; petioles of the lower leaves about half as long as their blades; stipules obsolete; male and female flowers rarely on the same plant; *staminate flowers*: in racemes usually only 1 cm. long; calyx campanulate, deeply 5-lobed, tomentose; petals absent; disk of 5 bulbous structures opposite the sepals; stamens about 12; *pistillate flowers*: in racemes about 1 cm. long; calyx deeply 5-lobed; petals absent; gland annular; ovary subglobose; styles 1-2 mm. long, each near the base twice-dichotomous; capsule 6-8 mm. long, 6-11 mm. broad, 3-celled and 3-seeded; columella thinly 3-winged; seeds 5-6 mm. long, with large caruncle. *C. maritimus* Walt. Locally abundant in loose deep sands all along the coast, nearly all year; coastal areas from N.C. to Venez.; also Sin.

11. *Croton dioicus* Cav. **ROSVAL, HERBA DEL GATO, RUBALDO.** Perennial herb 15-50 cm. tall; leaf blades linear-lanceolate, less commonly narrowly ovate-oblong or narrowly elliptical, or even rarely broadly ovate, (10-) 20-40 (-65) mm. long, (2 to) 3 to 5 (to 13) times as long as broad, apically acute or less often rounded, basally rounded, marginally entire, beneath lepidote as the stems and of the same color, above less densely lepidote and greener; petioles 3-6 (-15) mm. long, from a twelfth to two fifths as long as their blades; stipules about 0.1 mm. long; male and female flowers always on separate plants; *staminate flowers*: in racemes 2-8 cm. long; calyx hemispheric, about 3 mm. across, with 5 deltoid acute lobes; petals absent; disk flat; stamens 10 to 12; *pistillate flowers*: racemes about 1 cm. long; calyx hemispheric, about 3 mm. across, with 5 deltoid acute lobes; petals absent; disk flat; ovary globose, densely whitish-lepidote; styles 0.5-1.5 mm. long, twice- or thrice-dichotomous; capsules globose, 5-6 mm. long; columella stout, 3-winged by the persistence of portions of the septa; seeds 3.5-4.5 (-5) mm. long; caruncle about 0.3 mm. long. *C. gracilis* H.B.K., *C. neomexicanus* Muell. Arg. Widespread and locally very abundant in w. part of Tex. e. to Hardeman, Coleman, McMullen and Duval cos., summer-fall; Oax., Hgo., Pue., S.L.P., Dgo., Zac., Chih., Coah., N.L., N.M., Tam. and Tex.

12. *Croton texensis* (Kl.) Muell. Arg. **TEXAS CROTON, SKUNK-WEED.** Annual herb 2-8 dm. tall; leaf blades linear-lanceolate to narrowly ovate-oblong, (10-) 15-35 (-50) mm. long (sometimes much-reduced at top of plant), (3 to) 4 to 5 (to 6) times as long as broad, apically rounded or acute, basally rounded, marginally entire, grayish to yellowish-green and densely clothed with stellate trichomes (less densely above than below); petioles a fourth to two fifths as long as their blades; stipules simple, 0.1-0.2 mm. long; male and female flowers always on separate plants; *staminate flowers*: in racemes 1-2 cm. long; calyx hemispheric, 2-4 mm. across, with 5 deltoid acute lobes; petals absent; glands distinct, opposite the calyx lobes; stamens 8 to 12; *pistillate flowers*: in racemes about 1 cm. long; calyxes hemispheric, 2.5-4 mm. across, with 5 deltoid acute lobes; petals absent; disk thin, annular; ovary depressed-globose; styles 3, repeatedly dichotomous, 1-2 mm. long; capsules globose or globose-ovoid, 4-6 mm. long, broader, stellate-tomentose and usually slightly warty; columella 3-4 mm. long, 3-winged by persistence of parts of the septa, fragile; seeds ovoid, 3.5-4 mm. long, the caruncle about 1 mm. long. *C. virens* Muell. Arg., *C. luteovirens* Woot. & Standl. Abundant in n.-cen. Tex., e. part of Plains Country and w. and s. parts of e. Tex., in sandy loam, also occurring scattered through the higher parts of the Plains Country and localized in loose blowing sand in the Trans-Pecos (El Paso Co.), summer-fall; S.D. and Wyo., s. to Tex. and widespread in the Southwest (Son., Chih., Ariz., N.M., Ut. and Colo.) w. of the Front Ranges.

The plants from west of the Front Ranges are often shorter and more yellowish-green and the flower and fruit parts average slightly smaller than those from farther east; this is the sort which occurs near El Paso.

13. *Croton Parksii* Croizat. Very like *C. texensis* but larger in all dimensions, the plants on the average more robust, and the mature capsules 8-9 mm. long and very

strongly warty. Very abundant, loose fine sandy loam, coastal parts of Rio Grande Plains, summer-fall; endemic. Intergrading with *C. texensis* in a zone from Jim Wells and Kleberg cos. n.e. to Aransas Co.

14. *Croton glandulosus* L. Taprooted annual stellate-pubescent herb, 5-55 cm. tall; branches usually numerous, ascending; leaf blades oblong to ovate-oblong or linear, rarely nearly lanceolate, 8-63 mm. long, (1.2 to) 1.5 to 6 times as long as broad, apically and basally rounded, serrate, bearing on the lower surface at the base (on each side of the petiolar attachment) a whitish cartilaginous usually obconical "gland" which is usually cupped at the distal end; stipules minute, often glandular-papillate or merely a minute cluster of stipitate glands; petioles of the mature leaves half to two thirds as long as their blades, those of the higher leaves a fourth to a sixth as long as their blades; male and female flowers on the same plant, in terminal androgynous racemes about 1 cm. long; *staminate flowers*: 2.5-4 mm. across; sepals 5 (rarely 4), essentially separate, deltoid to ovate-oblong; petals 5 (or 4), 1 to 1.5 times as long as the sepals, oblanceolate, ochroleucous; glands orange, bulbous, opposite the sepal, 0.1-0.3 mm. long; stamens 7 to 13; *pistillate flowers*: sepals 5, almost free, about 1.5 mm. long at anthesis (much-acrescent afterwards), linear-oblanceolate; petals perhaps represented in some populations by fragile linear structures about 0.1 mm. long; disk flat, crenate with 5 scallops, 1 opposite each sepal; ovary subglobose; styles 3, 1.5-2 mm. long, each once-dichotomous near the base; capsules subglobose, 4.5-5.5 mm. long; seeds 2.9-4 mm. long, grayish, often mottled. Widespread in open sandy or loamy areas over the state, with several intergrading races, spring-fall. We have the following:

Var. *septentrionalis* Muell. Arg. Usually more than 25 cm. tall, with larger leaves usually more than 3 cm. long, the pubescence exceedingly variable but the central process of the trichomes not more than 6 times as long as the radii and the basal glands 0.5-0.8 mm. thick terminally; seeds oblong, 3-4 mm. long. Frequent in e. and s.e. Tex., becoming less frequent in n.-cen. Tex. and the e. part of the Plains Country; occurring generally in s.e. U.S.

Var. *Lindheimeri* Muell. Arg. Plants averaging 1-2 dm. tall, the larger leaves about 25 mm. long; central process of trichomes mostly shorter than the radii; basal glands 0.1-0.4 mm. thick terminally; seeds 3-4 mm. long, oblong. Frequent in the Plains Country and Rio Grande Plains, becoming infrequent in n.-cen. and s.e. Tex.; also Tam.

Var. *pubentissimus* Croizat. Plants relatively robust, usually 2-3 dm. tall, the larger leaves ovate and about 3 cm. long or longer; central processes of the trichome many times longer than the radii (often 2 mm. long); basal glands 0.7-1 mm. across apically; seeds 3-4.5 mm. long, nearly as broad as long. Locally in coastal sands (Aransas, Harris, Kenedy, Kleberg, Nueces and Willacy cos.). A few plants exhibit all the characters of this race except the central processes of the trichome are short as in the other races.

15. *Croton capitatus* Michx. HOGWORT, WOOLLY CROTON. Taprooted annual herb, stellate-tomentose, (2-) 3-10 (-15) dm. tall, usually widely branched; leaf blades (2-) 3-10 (-15) cm. long, lanceolate to ovate or lance-elliptic, blunt or acute, basally usually rounded or rarely shallowly cordate, marginally subentire or minutely serrate; stipules subulate, caducous; male and female flowers on the same plant, in terminal androgynous spikelike racemes 1-2 (-3) cm. long; *staminate flowers*: sepals 5, nearly free, subulate or deltoid, about 1 mm. long; petals 5, oblanceolate, about 1 mm. long; glands minute; stamens 7 to 12; *pistillate flowers*: calyx deeply 6- to 9-lobed, the lobes oblong or linear, 2-3 mm. long at anthesis, later accrescent and almost as long as the fruit; petals absent; styles 3, each deeply twice- or thrice-dichotomous, about 1 mm. long; ovary subglobose; capsule nearly globose, 6-9 mm. long; seeds 3.5-5.2 mm. long. Sandy soil in the e. half of the state, in summer through fall. Represented with us by two races:

Var. *capitatus*. Leaf blades usually blunt, not strongly tapered from the base, the petioles nearly as long at the top of the plant as at the middle; seed smooth and uniformly colored (not mottled), nearly orbicular in outline, lenticular (ventrally compressed), larger (about 5 mm. in diameter). Infrequent in extreme n. part of n.-cen. Tex. and n.e. part of Plains Country; Tex., Okla., Kan., Ark., Mo., Ill., Ind., Ky., Tenn. and Ga.

Var. *Lindheimeri* (Engelm. & Gray) Muell. Arg. Leaf blades mostly acute, long-tapered from near base to apex, the petioles long at the middle of the plant but diminishing toward the top; seeds longer than broad (the degree of ventral compression very

variable), mottled when fully mature, the slight roughening of the testa evident under a lens. *C. Engelmannii* Ferg. and var. *albinooides* Ferg., *C. Muelleri* Coult. and var. *albinooides* (Ferg.) Croizat, *C. capitatus* var. *albinooides* (Ferg.) Shinners. Very abundant in e., s.e. and n.-cen. Tex. and the Rio Grande Plains; Tam., Tex., Okla., Mo., Tenn., Ark., La., Miss., Ala., Ga. and Fla.

16. *Croton Coryi* Croizat. Taprooted annual (3-) 6-10 dm. tall, very densely and shaggily whitish-stellate-tomentose all over; leaf blades ovate to narrowly ovate, (3-) 4-7 cm. long, basally rounded or uncommonly slightly cordate, marginally entire, apically rounded to slightly acute; petioles of mature leaves more than half as long as the blades; stipules subulate, deciduous; flowers in terminal androgynous spikelike racemes; *staminate flowers*: calyx of 5 nearly separate sepals about 3 mm. long; petals 5, about 3.5 mm. long, oblanceolate, covered with silvery scales; disk of 5 small bulbs opposite the sepals; stamens 12 to 15, with filaments exceeding the petals; *pistillate flowers*: calyx of usually about 7 subulate lobes; petals absent; disk obsolete; ovary subglobose; styles slender, about 4 mm. long, usually each one twice-dichotomous; capsule shallowly tricocous, 4.5-5 mm. long; seeds somewhat ovoid, acute at the micropylar end, about 4 mm. long, with a lunate caruncle, dark-brown when immature, mottled gray-brown when mature. Locally abundant in loose fine sand in s. Tex. (Brooks, Jim Hogg, Kenedy, Kleberg, Nueces and Willacy cos.), summer-fall; endemic.

17. *Croton Pottsii* (Kl.) Muell. Arg. LEATHER-WEED. Perennial herb, probably rhizomatous, 1-4 (-6) dm. tall; main stems several from the crowns, thinly but densely tomentose; leaf blades ovate-oblong or obovate-oblong to nearly orbicular or ovate-elliptic, 8-60 mm. long, the lower ones 1 or 2 times as long as broad, the upper 1.5 to 3.5 times as long as broad, apically acute or rounded, basally rounded, marginally entire; petioles of lower leaves 0.5 to 1.5 times as long as their blades, of upper leaves 0.25-0.5 times as long as their blades; stipules subulate; flowers in terminal androgynous spikelike racemes 10-25 mm. long; *staminate flowers*: calyx of 5 (rarely 4) nearly distinct lanceolate to deltoid subcucullate sepals; petals 5 (rarely 4), oblanceolate, a little longer than the sepals; disk with 5 orangish bulbous glands opposite the sepals; stamens 11 to 15 (to 18); *pistillate flowers*: calyx 1.5-3 mm. long at anthesis, of 5 nearly distinct oblong acute lobes appressed to ovary and 0.4 to 0.5 times as long as the capsule at maturity; petals absent; styles 3, bifid essentially to the base, 1.5-3 (-4.5) mm. long; capsules oblong to ovoid-oblong, rounded at both ends. Desert grasslands and scrub in the w. half of the state, spring-fall. Represented with us by two races as follows:

Var. *Pottsii*. Leaf blades longer than 15 mm.; branches at bases of old racemes diverging from each other at angles of 20 to 50°; leafy stems and branches usually straight; racemes mostly longer than 1 cm.; staminate calyx 2.5-4.5 (-6) mm. across; capsule 4-6 (-7) mm. long; columella 3.2-3.9 mm. long; seed 3.5-4.3 mm. long not including the caruncle; central processes of trichomes shorter than the radii, the tomentum thus relatively smooth or appearing appressed. *C. corymbulosus* Engelm. Abundant in deserts and desert grasslands in the Trans-Pecos and s. part of Plains Country, infrequent in Edwards Plateau and rare in w. part of Rio Grande Plains; Qro. n.w. to Son., Ariz., N.M. and Tex.

Var. *thermophilus* (M. C. Johnst.) M. C. Johnst. Leaf blades 15 mm. long or less; branches at bases of old racemes diverging at angles of 50 to 80°; leafy stems and branches tending to zigzag; racemes mostly about 1 cm. long; staminate calyx 2-2.8 mm. across; capsule about 4 mm. long; columella 2.9-3.1 mm. long; seed 3-3.25 mm. long not including the caruncle; central processes of trichomes longer than radii, the tomentum thus relatively shaggy. *C. corymbulosus* var. *thermophilus* M. C. Johnst. S. Brewster Co., in desert scrub, Trans-Pecos; also Coah.

18. *Croton leucophyllus* Muell. Arg. Taprooted annual 1-3 (-5) dm. tall, thinly stellate-tomentose, widely branched; leaf blades ovate to ovate-oblong, (1-) 2.4 (-5) cm. long, basally rounded or rarely narrowed, marginally entire, apically rounded or often a little acute, much less densely stellate above than below; stipules subulate, caducous; petioles of lower leaves 0.5 to 1 times as long as their blades; flowers in terminal androgynous racemes less than 1 cm. long; *staminate flowers*: sepals 5, deltoid, about 1 mm. long; petals 5, oblanceolate, slightly surpassing the sepals; disk nearly obsolete; stamens about 9; *pistillate flowers*: calyx lobes 5, markedly unequal, the three farthest from the raceme axis well-developed and oblong, the two nearest the axis minute and subulate; styles 3, slender, each bifid nearly to the base; capsule about 4 mm. long; seed

about 3.5 mm. long. *C. Palmeri* Wats. Locally abundant in calcareous clay soil, Rio Grande Plains, (summer-) fall; Tam., N.L., Coah. and Tex.

19. *Croton Lindheimerianus* Scheele. Taprooted annual herb 2-50 cm. tall, profusely and widely branched; leaf blades lanceolate to nearly orbicular, 1-8 cm. long, 0.8 to 3 times as long as broad, apically blunt to acute, basally rounded, marginally entire, stellate-tomentose (less densely above); petioles ascending, 0.5 to 2 times as long as the lower blades to 0.25 to 0.65 times as long as the upper blades; stipules glandlike; flowers in few-flowered terminal erect androgynous spikelike racemes 10-15 mm. long; *staminate flowers*: calyx 2-2.5 mm. across, of 5 (occasionally 4) nearly distinct sepals which are oblong-lanceolate, subcucullate and acute; petals linear-oblancoelate, about as long as the sepals; disk small and thin, with 5 indistinct lobes opposite the sepals; stamens 7 to 9 (reportedly rarely to 12); *pistillate flowers*: calyx about 3 mm. long, of 5 nearly distinct sepals which are at first nearly lanceolate, acute, appressed to and about as long as the ovary, becoming dilated or oblancoelate and 0.7 to 1.1 times as long as the capsule at maturity; petals absent; disk thin, lobed, very small and flat; ovary subglobose; styles 2-3 mm. long, each bifid to the base; capsules 4-5 mm. long and almost as broad, rounded at both ends; columella 3.2-3.7 mm. long; seeds oblong, 3.2-3.6 mm. long not including caruncles. Widespread but local over the state in sandy or alluvial usually disturbed soil, spring-fall.

Represented with us by two varieties as follows:

Var. *Lindheimerianus*. Leaf blades suborbicular to rhombic-ovate or oblong, many of them less than twice as long as broad, the apexes rounded to broadly acute, most with apical angles greater than 95°; plants densely velvety-appressed tomentose; at least some of the fruiting pedicels curved, the fruit drooping at maturity. Scattered over the state, most common in n.-cen. Tex. and Rio Grande Plains; Tex., Okla., Kan., Ark., Coah., N.L. and Tam.

Var. *Tharpia* M. C. Johnst. Leaf blades lance-ovate, many of them more than twice as long as broad, acute, most with apical angles less than 90°; plants relatively rough- or shaggy-tomentose; fruiting pedicels erect. Local in the Trans-Pecos, s. part of Plains Country and w. Edwards Plateau, usually in alluvial desertic flats or floodplains; Coah., Tex. and Ariz.

20. *Croton monanthogynus* Michx. PRAIRIE-TEA. Taprooted annual herb 4-35 cm. tall, profusely and widely branched, appressed stellate-pubescent, the small central limb or umbo of the trichomes rounded and often brownish so that the stems appear minutely brownish-lentiginous; leaf blades ovate-oblong to nearly round (lower) or to narrowly elliptic (upper), 10-25 mm. long, 1 to 2 times as long as broad (lower) or 2 to 4.5 times as long as broad (upper), apically rounded (lower) to acute (upper), basally rounded or narrowed, marginally entire; petioles half to 1 (to 2) times as long as their blades (lower) or only half to a fourth as long (upper); stipules 0.05-0.3 mm. long, glandlike; flowers in terminal androgynous racemes only 1 cm. long; *staminate flowers*: calyx 1.7-2.3 mm. across; sepals 4, rarely 5, nearly distinct, ovate-lanceolate, subacute, cucullate; petals narrowly oblong to oblancoelate, about as long as the sepals; disk very flat with five glands about 0.1 mm. long; stamens (4 or) 5; *pistillate flowers*: sepals 5, subequal, narrowly oblong-lanceolate, 1.5-2 mm. long, acute, appressed to the ovary and accrescent, about half to two thirds as long as capsule at maturity; petals absent; disk very flat, thin; ovary ovoid or subglobose, 2-celled with 1 cell large and 1-ovulate, the other small and the ovule early aborted; styles 2, 0.8-1.2 (-1.5) mm. long, bifid almost to the base; capsules ovoid, prolonged apically, tapering from well below the middle to the apex, 4 mm. long, with 1 large central fertile locule and a very small abortive locule, dehiscing septically into 2 equal valves which then break equally loculicidally; seed 2.8-3.1 mm. long. Abundant in calcareous soil in much of the state except absent in the higher parts of the Plains Country and absent from Trans-Pecos deserts, spring-fall; Gulf States n. to Md., O., Ind., Ia., w. to Kan., Okla., Tex., Tam. and N.L.

5. CROTONOPSIS MICHX.

RUSH-FOIL

Taprooted annuals 1-9 dm. tall; stem usually solitary at the base and 1-2 (-2.5) mm. thick, much-branched near the middle, the branches rather rigidly ascending or erect, covered rather densely by stellate trichomes with usually raised umbos, the radii of the trichomes more or less coalescent at their bases (usually not to their tips) into scalelike

structures, the trichomes white and often giving a silvery sheen to the stems; leaves alternate, essentially sessile or with slender petioles 1-2 mm. long; blades linear to narrowly lanceolate or narrowly elliptic, entire, 1-4 cm. long, lower surface silvery-vested like the stems, above much less densely pubescent with stellate-trichomes that occasionally are nearly simple or have only a few radii; stipules minute, subulate, caducous; flowers in androgynous axillary spikes 3-40 mm. long, with 1 to 6 pistillate flowers below and several staminate ones above; *staminate flowers* minute: calyx about 1 mm. long, deeply 4- to 5-lobed, vested externally like the stems; the white delicate petals slightly shorter than the calyx lobes and spatulate; stamens about 6; *pistillate flowers*: calyx deeply 4- to 5-lobed, about 1 mm. long in flower, slightly longer after anthesis, vested externally like the stems; disk suppressed; ovary with seemingly a single cell, elliptic or ovate in outline but plumply elliptic in transection (thus somewhat compressed), with a single apically attached ovule; style branches 3, minute, each microscopically bifurcate very near the apex; fruit an achene 2.5-3 mm. long, in outline elliptic or ovate but in transection plumply elliptic, with stellate trichomes like those of the stems but the umbos often raised into spinelike processes; seed lenticular, with no apparent caruncle, the coat very thin and closely invested by the fruit wall; endosperm copious, as thick as the embryo; embryo straight.

A genus of two species endemic to eastern and southern United States, both species in Texas; obviously closely allied to *Croton monanthogynus* and might well be placed in the genus *Croton*.

1. Spikes not densely flowered, several cm. long, usually (at least by fruiting state) with 3 to 6 pistillate flowers setting fruit in the lower part; staminate flowers usually more than 1 mm. across, the filaments surpassing the calyx lobes and much longer than the anthers; fruit often obovate-elliptic in outline, the radii of the numerous trichomes separate nearly to the umbo (scalelike coalescent portion thus minute), the free portion of the radii much longer than the coalescent portion and often raised slightly to give the fruit a fuzzy appearance when it is viewed under the dissecting microscope; umbos of trichomes either rounded or usually sharp and spinelike and as long as the radii; upper surfaces of the leaves of midstem with stellate trichomes, the radii free to the center and appressed, the trichomes sparse so that the radii of adjacent ones do not overlap, the number of radii usually 5 to 8 per trichome; leaves usually 1-3 mm. broad; lower surface of leaves with stellate trichomes, the free portion of the radii as long as or longer than the coalescent portion1. *C. linearis*.

1. Spikes usually less than 1 cm. long, with 1 or 2 crowded fruits at the base (appearing sessile in the axil of the subtending leaf); staminate flowers usually less than 1 mm. across, the filaments not surpassing the calyx lobes and only slightly longer than the anthers; fruit usually ovate in outline, less commonly elliptic, the radii of the sparse trichomes coalescent for most or all their length and appressed, the umbo usually blunt or rarely spinelike; lower surfaces of midstem leaves with scalelike stellate trichomes, the coalescent portion of the radii longer than the free portion, upper surfaces with stellate trichomes with radii free their entire length and often slightly raised, those nearest the midvein often with only 1 to 3 radii and these conspicuously raised and often pointing away from the midrib toward the margin so that the surface is pilose as seen under a lens; leaves (1-) 2-4 (-6) mm. broad2. *C. elliptica*.

1. *Crotonopsis linearis* Michx. Characters as given in the key. *C. spinosa* Nash. Local in deep loose fine sand, openings in forested areas, e. Tex., rare w. to n.-cen. Tex. (Anderson, Dallas, Henderson, Shelby and Smith cos.), June-Aug.; S.C., Ga., Fla., Va., Ill., Okla., Tex., Miss. and Mo. Most abundant in Fla., perhaps adv. in Tex. though collected at Dallas as long ago as 1876.

2. *Crotonopsis elliptica* Willd. Characters as given in the key. Frequent in deep fine loose sandy soil, openings in forested areas, e. Tex., (May-) June-Sept.; widespread in e. U.S., w. to Kan., Okla. and Tex.

6. JULOCROTON MART.

A tropical American genus of a couple of dozen species, of which we have one. The genus is very weakly distinguished from *Croton*, and it has recently been treated as sect. *Julocroton* (Mart.) G. L. Webst. of that genus.

1. *Julocroton argenteus* (L.) Didr. Taprooted annual herb (2-) 3-7 (-10) dm. tall, profusely and widely branched, thinly white-stellate-tomentose; leaf blades ovate to rhombic-ovate, (2-) 3-7 (-15) cm. long, basally rounded, apically usually rounded or rarely slightly acute, marginally usually finely serrate, with 3 to 5 veins from the base; petioles of mature leaves about half as long as their blades; stipules subulate, hirsutestellate, 5-10 mm. long; flowers in terminal androgynous spikelike racemes 2-4 cm. long; *staminate flowers*: sepals 5, nearly distinct, deltoid, 1.5-2 mm. long; petals 5, linear, slightly surpassing the sepals; disk thin, with 5 bulbs opposite the sepals; stamens 12 to 15; rudiment obsolete; *pistillate flowers*: calyx very unequally 5-lobed, the 3 sepals away from the raceme axis well-developed, narrowly deltoid, marginally laciniate-fringed to laciniate-serrate and accrescent so that they are as long as the capsule at maturity, the 2 sepals nearest the raceme axis nearly obsolete; petals absent; disk very thin and nearly obsolete, with minute glands opposite the sepals; ovary subglobose, 3-celled, 3-ovulate; styles 3, about 2 mm. long, each twice-dichotomous; capsule about 5 mm. long, 3-celled, 3-seeded, loculicidal and septicial; columella 4-4.5 mm. long; seeds 3.5-4 mm. long, oblong, carunculate, dark-gray-brown mottled. *Croton argenteus* L. Local in loamy soils along the Rio Grande in Cameron and Hidalgo cos., summer-fall; Arg. to Tex.

7. ARGYTHAMNIA P. BR.¹¹⁵

WILD MERCURY

Perennial herbs, with appressed or subappressed malpighiaceous hairs or rarely glabrous and with erect, ascending, spreading or trailing stems usually from a woody crown; leaves alternate, usually basally trinerved, with malpighiaceous hairs or rarely glabrous, entire or serrate; flowers in axillary bracteate racemes, the lower 1 to 3 flowers pistillate, the remaining all staminate (or in some species the staminate flowers borne on different plants from the pistillate); *staminate flowers*: sepals 5, valvate; petals 5, in the Texas species free from the androphore; glands 5, adnate to or free from the androphore; stamens 7 to 10 in 2 whorls, the filaments coherent and forming an androphore; staminodia present or absent; *pistillate flowers*: sepals 5, imbricate, accrescent in fruit and often becoming 2 to 3 times longer than when in flower; petals 5, well-developed or rudimentary or absent; glands 5, opposite the sepals, inserted on disk of the ovary; ovary subglobose, sessile; ovules solitary in each cell, anatropous, pendulous, with a ventral raphe; endosperm present; styles 3, in all Texas species essentially distinct or joined only toward the base, once-bifid, glabrous or pubescent on upper side below the bifurcation; stigmas terete or flattened and dilated; fruit a schizocarpous capsule splitting into three 1-seeded cocci leaving a persistent columella; seeds ovoid to subspheroidal, ecarunculate, slightly roughened to faveolate, the cotyledons broader than the radicle.

Our species are all of the subgenus *Ditaxis* (Vahl) Croizat. It includes about 50 species native to North America and South America, mostly in the subtropics and tropics with just a few in the warm-temperate zone. The leaves and flowers of some species often dry a dull-purple. When such are boiled, the water turns a reddish-purple.

1. Inflorescences elongated, much longer than the leaves (2)
1. Inflorescences usually congested in the leaf axils, shorter than the leaves (5)
- 2(1). Glands of the pistillate flowers wider than long; glands of the staminate flowers rectangular, adnate to the base of the androphore (3)
2. Glands of the pistillate flowers linear; glands of the staminate flowers linear, free from the androphore (4)

¹¹⁵ Contributed by John W. Ingram.

- 3(2). Staminate petals obovate-cuneate; stamens 10; androphore slender; pistillate glands thick; styles erect1. *A. aphoroides*.
3. Staminate petals ovate to cordate; stamens 7 or 8; androphore stout; pistillate glands thin; styles spreading2. *A. simulans*.
- 4(2). Glands of all flowers glabrous3. *A. mercurialina* var. *mercurialina*.
4. Glands of all flowers pubescent3. *A. mercurialina* var. *pilosissima*.
- 5(1). Stems, leaves and ovaries glabrous5. *A. humilis* var. *laevis*.
5. Stems, leaves and ovaries pubescent (6)
- 6(5). Style branches terete; glands of the pistillate flowers triangular6. *A. neomexicana*.
6. Style branches flattened and dilated at tip; glands of the pistillate flowers linear (7)
- 7(6). Male and female flowers on separate plants; plants silvery from appressed malpighiaceae hairs; styles bifid only one fourth their length; stamens 104. *A. argyrea*.
7. Male and female flowers on the same plant; plants pubescent but not silvery; styles bifid one half their length; stamens usually 8 or 9 ..5. *A. humilis* var. *humilis*.

1. *Argythamnia aphoroides* Muell. Arg. Stems several, to 5 dm. tall, ascending, unbranched, densely pubescent; leaves sessile or subsessile, usually elliptic, sometimes lanceolate or oblanceolate, 20-45 mm. long, 1-2 cm. wide, densely villous (particularly the lower surface), entire; staminate and pistillate flowers usually borne on separate plants, in racemes to 6 cm. long; *staminate flowers*: sepals lanceolate to oblong-lanceolate, 4 mm. long, pubescent dorsally, glabrous within, entire; petals obovate-cuneate, 4-5 mm. long, clawed; glands wider than long, adnate to base of androphore; androphore 3-4 mm. long; stamens 8 to 10, 5 in the lower whorl; *pistillate flowers*: sepals lanceolate, about 5 mm. long, pubescent dorsally and near the apex ventrally; petals absent or rudimentary; glands thick, square or rectangular in outline; ovary densely pilose; styles erect, pubescent, bifid one half their free part; stigmas flattened and dilated; seeds subspheroidal, 4-5 mm. wide and long, faintly reticulate. *Ditaxis aphoroides* (Muell. Arg.) Pax. In dry sandy and rocky soil over limestone on the Edwards Plateau, Apr.-June; rare endemic.

2. *Argythamnia simulans* J. Ingram. Stems several, to 5 dm. tall, ascending to erect, unbranched, with appressed hairs; leaves sessile to subsessile, elliptic to lanceolate or oblanceolate, 2-9 cm. long, 7-25 mm. wide, acute to obtuse, with hairs on both sides, entire; flowers usually in androgynous racemes 4-10 cm. long; *staminate flowers*: sepals lanceolate or oblong-lanceolate, 2.5-3 mm. long, pubescent dorsally, glabrous within; petals ovate to cordate, 2-3 mm. long, the claws free from the androphore; glands wider than long, adnate to base of androphore; androphore stout, 1.5-2 mm. long; stamens 7 or 8 in 2 whorls, 5 in the lower whorl; *pistillate flowers*: sepals ovate, 4.5-6 mm. long, pubescent dorsally; petals frequently absent, when present punctiform to lanceolate; glands wider than long, thin; ovary with hairs; styles thick, pilose, spreading, bifid one half their free part; stigmas flattened and dilated; seeds subspheroidal, about 3 mm. long and 4 mm. wide, apiculate, faintly reticulate. Frequent on rocky and sandy soil over limestone on the Edwards Plateau, Mar.-July; endemic.

3. *Argythamnia mercurialina* (Nutt.) Muell. Arg. Stems several, to 7 dm. tall, ascending, unbranched, pubescent; leaves sessile or subsessile, lanceolate or elliptic to elliptic-ovate or elliptic-obovate, 30-85 mm. long or sometimes longer, 10-35 mm. wide, pubescent on both surfaces; flowers usually in androgynous racemes 4-12 cm. long; *staminate flowers*: sepals oblong-lanceolate or lanceolate to narrowly oblanceolate, about 3 mm. long, pubescent dorsally, glabrous within; petals oblanceolate to broadly oblanceolate, about 3 mm. long, the claws free from the androphore; glands linear, free from the androphore, pubescent or not; androphore slender, about 2 mm. long; stamens usually 8, 5 in the lower whorl, the whorls sometimes not entirely distinct; *pistillate flowers*: sepals lanceolate, about 4.5 mm. long, acute, pubescent dorsally, glabrous within; petals usually absent, when present 1 to 5, punctiform to lanceolate; glands linear, glabrous or pubes-

cent; ovary densely or sparsely pubescent; styles spreading, stout, pubescent, bifid only toward tip; stigmas flattened and dilated; seeds subspheroidal, about 5 mm. long and wide, apiculate, faintly and irregularly reticulate. We have the following two varieties:

Var. *mercurialina*. Glands of all flowers glabrous. *Ditaxis mercurialina* (Nutt.) Coult. Dry prairies over limestone in sand in cen. and e. Kan., s. to Gillespie, Hays and Caldwell cos. (also isolated in Jeff Davis and Culberson cos.) in Tex., Eddy Co., N.M. and Navajo Co., Ariz.; Apr.-July.

Var. *pilosissima* (Benth.) Shinners. Glands of all flowers pubescent. Sandy soil over limestone on the Edwards Plateau, s. in the Rio Grande Plains, Apr.-July; endemic.

4. *Argythamnia argyrea* Cory. Stems several, to 4 dm. tall, moderately branched, silvery with appressed hairs; leaves lanceolate or elliptic to ovate or oblanceolate, 15-40 mm. long, 5-10 mm. wide, acute, densely silvery-pubescent; petioles about 1 mm. long; staminate and pistillate flowers on separate plants; staminate flowers in racemes to 2 cm. long, the pistillate flowers solitary on peduncles to 1 cm. long; *staminate flowers*: sepals linear-lanceolate, 3-4 mm. long, densely pubescent dorsally; petals linear-lanceolate, 3-5 mm. long, free from the androphore; glands linear, erect, free from the androphore; androphore about 2.5 mm. long; stamens 10 in two whorls of 5; *pistillate flowers*: sepals lanceolate-ovate to ovate, about 4 mm. long, pubescent outside and in the upper half within; petals elliptic-ovate, about 1 mm. long; glands linear, about 2 mm. long, acute; styles erect, pubescent, bifid only one fourth or less of their free part; stigmas flattened. Atascosa, La Salle and Maverick cos., Apr.-July; endemic.

5. *Argythamnia humilis* (Engelm. & Gray) Muell. Arg. Stems few to many, to 45 cm. long, weak, usually trailing or spreading, freely branching, pubescent or not; leaves elliptic to oblanceolate, 1-5 cm. long, 5-15 mm. wide, acute to rounded, pubescent or not, narrowing into a petiole 2-3 mm. long; flowers in androgynous racemes to 1 cm. long; *staminate flowers*: sepals linear-lanceolate to oblong-lanceolate, 2-3 mm. long, glabrous or with hairs outside, glabrous inside, entire; petals narrowly lanceolate to oblanceolate, about 3 mm. long; glands linear, erect, free from the androphore; androphore stout, 0.5-1 mm. long; stamens 8 or 9 in two whorls with 5 in the lower whorl; *pistillate flowers*: sepals lanceolate or ovate-lanceolate, about 3 mm. long, glabrous or with hairs outside, glabrous inside, the margin with minute glandular teeth; petals often absent, when present 1 to 5, linear and about 0.2 mm. long or lanceolate and 0.5 mm. long; glands linear, erect, obtuse or emarginate; ovary glabrous or pilose with stiff hairs; styles erect, thick, glabrous or with stiff hairs, bifid one half their free part; stigmas flattened and dilated; seeds ovoid-spheroidal, about 2.5 mm. long and 4 mm. wide, apiculate, slightly roughened to reticulately ridged with stellately marked pits. We have two variants.

Var. *humilis*. Plants pubescent. *Ditaxis humilis* (Engelm. & Gray) Pax. In dry grassland and scrub at higher elev. in e. Colo. and w. Kan. s. through cen. Tex. and e. N.M. to Tam., N.L. and e. Coah.; Apr.-Oct.

Var. *laevis* (Torr.) Shinners. Plants entirely glabrous and rather succulent, becoming brittle when dried. Usually above 3,000 ft., on basic soils and gypsum flats in w.-cen. Tex. and the Trans-Pecos, Apr.-Oct.; also s.e. N.M.

6. *Argythamnia neomexicana* Muell. Arg. Stems several, to 3 dm. long or sometimes longer, usually much-branched, usually spreading to trailing, with appressed hairs; leaves elliptic to oblanceolate, 10-35 mm. long, occasionally longer, 3-20 mm. wide, acute, with appressed hairs on both sides, the margin entire or bearing minute glands; petioles 2-5 mm. long; flowers in congested androgynous racemes 5-10 mm. long; *staminate flowers*: sepals narrowly lanceolate to lanceolate, 2-3 mm. long, with hairs outside, glabrous inside, entire; petals oblanceolate to elliptic, about 3 mm. long; glands erect, obtuse to acute, free from the androphore; androphore slender, 1.5-2 mm. long; stamens 10 in two whorls of 5; *pistillate flowers*: sepals lanceolate, 3-5 mm. long, with hairs dorsally, glabrous or with hairs inside, the margin white, bearing minute glands; petals obovate to oblanceolate-obovate, about 2 mm. long; glands triangular in outline, thick; ovary with dense setose hairs that extend beyond the styles, the hairs with one arm much longer than the other; styles setose, bifid over one half their free part; stigmas terete, not flattened and dilated; seeds ovoid, truncate at base, about 2.5 mm. long, reticulately ridged with stellately marked pits. *Ditaxis neomexicana* (Muell. Arg.) Heller. In desert areas in calcareous soil in w. Edwards Plateau, Rio Grande Plains and the Trans-Pecos, Feb.-Nov.; w. in the U.S. and s. to Tam., N.L. and Coah.

This taxon is doubtfully distinct from *A. serrata* (Torr.) Muell. Arg., of Arizona, California and northwestern Mexico; apparently forming an intergrading complex that needs further intensive study.

8. CAPERONIA ST.-HIL.

A tropical genus of about 40 species, of which we have one.

1. *Caperonia palustris* (L.) St.-Hil. Annual herb, (2-) 3-10 dm. tall, stout, mostly simple in the lower half, with few ascending branches above, the upper stem and branches with spreading whitish occasionally gland-tipped hairs; leaves alternate; blades broadly lanceolate or elliptic-lanceolate, (3-) 5-15 cm. long, serrate, with numerous closely parallel secondary nerves ending at the marginal teeth, the tertiaries percurrent; petioles 3-25 mm. long, pubescent like the adjacent stem; stipules triangular to subulate, 3-5 mm. long; flowers in lax secund androgynous spikes in the upper axils, the peduncles about half as long as the leaves; each flower subtended by a minute bract; *staminate flowers* 6 to 20 per spike, sessile; calyx 5-lobed, the lobes about 1 mm. long; petals spatulate-lanceolate, obtuse, slightly exceeding the calyx; androphore columnar, bearing two whorls of short stamens and prolonged above the upper whorl; stamens short, about 5 in each whorl; *pistillate flowers* 1 to 6 per spike, essentially sessile; calyx deeply and unequally 6-parted, with 3 longer (2-3 mm. long) lobes opposite the carpels and 3 shorter ones opposite the petals, all the lobes acute, the whole calyx glandular-setulose on the exterior; petals 5 or 6, shorter than the longer calyx lobes, whitish, clawed, caducous soon after anthesis; disk absent; ovary tricocous, densely glandular-setulose; styles 3, laminar, each about 4- or 5-lobed about half the length; capsule deeply tricocous, about 4 mm. high and 6 mm. broad, loculicidal and septicidal; columella short; seeds about 3 mm. long, nearly spherical, foveolate. Frequent in rice fields and other marshy areas, s.e. Tex. (Harris, Jefferson and Matagorda cos.), July-Oct.; widespread in warmer parts of Am., s. to Parag. and n. to Tex., La. and Fla. The species arrived in Tex. about 1920.

9. ADELIA L.

A tropical American genus of about 15 species.

1. *Adelia Vaseyi* (Coulter) Pax & Hoffm. Erect usually narrow shrub 1-2 (-3) m. tall, the branches usually ascending; leaves alternate or usually fascicled at short shoots; essentially sessile, spatulate or linear-spatulate, pale-green, basally attenuate, marginally entire, apically rounded or rarely emarginate, (1-) 2-3 (-4) cm. long; male and female flowers on separate plants; flowers solitary in the axils or in few-flowered glomerules at the short shoots, pedicellate; *staminate flowers*: pedicels 2 mm. long, puberulent; calyx nearly globose, valvate in bud, of 5 essentially free dorsally puberulent linear-elliptic sepals about 2 mm. long; petals absent; disk thin, annular, puberulent; androphore columnar, 0.5-1 mm. high, puberulent; stamens about 14 to 17, arising from a zone just below the top of the androphore; filaments about 1.5 mm. long; rudiment of 3 bifurcate objects 0.5-1 mm. high at the top of the androphore; *pistillate flowers*: pedicels 3-5 mm. long (elongating to 5-20 mm. in fruit), puberulent; calyx valvate in bud, of 5 (or 6) lanceolate dorsally puberulent sepals 2-3 mm. long; petals absent; disk of 5 (or 6) lobes opposite the sepals; ovary subglobose, 3-celled and 3-seeded; styles 3, subulate, shortly lacinate marginally; capsules shallowly tricocous, 6-7 mm. high, 7-8 mm. broad, the 3 carpels first separating from each other and then each splitting at the ventral angle to release the seed; columella about 5 mm. long; seed nearly globose or usually slightly prolate, 4-5 mm. long, dark-brown to black; caruncle absent. Infrequent in brush on loamy soils, Rio Grande delta (Cameron and Hidalgo cos.), Jan.-June; also Tam.

10. BERNARDIA MILL.

Unarmed shrubs 5-15 (-25) dm. tall, much-branched; branches of 2 kinds, elongated ones 5 to 25 cm. long and short lateral spurs with very short internodes (these spurs bearing the inflorescence and then eventually bearing from their apexes more elongate

branches); herbage and capsules rather densely stellate-tomentose or at least with forked or branched hairs; leaves alternate (the ones on the spurs appearing fascicled); blades simple, 7-30 mm. long, 5-20 mm. broad, apically obtuse or rounded, crenate; petioles 1-3 (-5) mm. long; stipules very small, brownish, deciduous; male and female flowers always on separate plants, in much-reduced inconspicuous inflorescence; *staminate flowers*: few to several in racemes from the axils of the spurs or rarely from the elongating branchlets; peduncles 1-3 mm. long and terminating in a whorl of 1 to 4 triangular-cordate bracts to 1 mm. long; pedicels about 1 mm. long; calyx lobes 3, minute, greenish; petals absent; stamens 3 to 18; *pistillate flowers*: seemingly solitary and sessile in the axils of the spurs (only one per spur maturing fruit) or rarely appearing terminal or in the axils of an elongate branch; calyx of 4 or 5 minute sepals; petals absent; disk obsolete; ovary 2- or 3-celled, 1- to 3-seeded; styles 2 or 3, bifid or fimbriate-lacerate; capsules 6-8 mm. long, 6-10 mm. broad, dehiscing septicidally and loculicidally; columella present or absent; seeds 5-6 mm. long, 4-5 mm. broad, ecarunculate.

An American genus of perhaps 30 species.

1. Leaves predominately elliptic or oblong, prominently reticulate beneath, densely stellate-pubescent, drying dark-green; capsules mostly 3-celled, 3-seeded; stamens mostly more than 10 per flower1. *B. myricaefolia*.
1. Leaves predominately obovate, not prominently reticulate beneath, drying grayish-green, the hairs merely forked or branched, sometimes stellate; capsules mostly 2-celled and 1- or 2-seeded; stamens mostly fewer than 10
.....2. *B. obovata*.

1. *Bernardia myricaefolia* (Scheele) Wats. OREJA DE RATÓN, PALO DE TARUGO. Shrub usually 10-25 dm. tall, with rather dense stellate pubescence; leaf blades usually narrowly elliptic but rather variable, drying dark-green; stamens 12 to 18; capsule usually 3-celled and 3-seeded, 7-8 mm. long, about 1 cm. thick; columella well-developed; seeds about 6 mm. long, 5 mm. broad. Widespread in Rio Grande Plains n. to Travis, Hays, Comal, Bexar and Val Verde cos., in brush on calcareous soil, spring-fall; Tam., N.L., Coah. and Tex.

2. *Bernardia obovata* I. M. Johnst. Shrub, usually only about 5 dm. tall, with rather sparse pubescence of merely forked or branched hairs (only stellate in spots); leaf blades obovate or rarely subelliptic, drying pale-grayish-green; stamens 3 to 8 per flower; capsule usually 2-celled and 1- or 2-seeded, 6-7 mm. long, about 6 mm. broad at the broadest point; styles 2; columella in the usual sense absent. Widespread in dry scrub in the Trans-Pecos, e. to Crane and Val Verde cos., summer-fall; N.M., Tex., Coah. and Chih.

11. ACALYPHA L.¹¹⁶

THREE-SEEDED MERCURY

Annual or less commonly perennial herbs or rarely subshrubs; stems erect or decumbent, branched or unbranched; leaves alternate, varying greatly in size and shape, entire or toothed, petiolate; stipules small, lanceolate; male and female flowers either on the same or separate plants; inflorescence rarely paniculate, mostly spicate; spikes terminal or axillary bearing staminate and pistillate flowers in various relative positions (i.e., pistillate flowers may appear on the basal portion of the spike with the staminate above or vice versa; if on separate spikes, pistillate may be terminal, staminate axillary); *staminate flowers* in clusters with each subtended by an inconspicuous lanceolate bract, apetalous, with 4-parted calyx, 4 to 8 (and reportedly to 16) stamens united at base, each stamen with 2 unilocular pendulous anther sacs often becoming twisted with maturity; pollen grains tricolporate; *pistillate flowers* subtended by a variously lobed often foliaceous bract, apetalous, with 3-parted calyx; main style branches divided several times (except in *A. Poirerii*); ovary usually 3-locular; ovules solitary in each locule; seeds ovoid, carunculate, variously pitted or tuberculate, brown to black or with a tawny mottling; endosperm whitish; embryo straight; cotyledons much broader than the radicle.

¹¹⁶ Contributed by Lillian W. Miller.

A genus of about 390 species distributed in temperate and tropical regions of both the New World and Old World.

- 1. Male and female flowers on separate plants; perennial herbs or subshrubs (2)
- 1. Male and female flowers on the same plant; annual or perennial herbs (3)
- 2(1). Leaves deeply lobed (radiate)4. *A. radians*.
- 2. Leaves crenate5. *A. hederacea*.
- 3(1). Flowering spike with pistillate flowers at the base and staminate flowers at the apex (4)
- 3. Pistillate and staminate flowers on separate spikes (10)
- 4(3). Plants with woody root and herbaceous stems; spikes terminal
.....1. *A. Lindheimeri*.
- 4. Plants herbaceous throughout; spikes axillary (5)
- 5(4). Fruit one-seeded9. *A. monococca*.
- 5. Fruit three-seeded (6)
- 6(5). Leaves linear or narrowly ovate to lanceolate, margins entire to slightly crenate; petiole usually less than one fourth length of leaf blade (7)
- 6. Leaves narrowly ovate or elliptic to lanceolate or broadly rhombic, margins crenate to serrate; petiole one fourth as long as or equal to length of leaf blade (8)
- 7(6). Leaves lanceolate to linear-lanceolate, margins crenate to remotely crenate; staminate portion of spike not usually greatly exceeding the pistillate bracts
.....8. *A. gracilens* var. *gracilens*.
- 7. Leaves linear, margins entire (or rarely remotely crenate); staminate portion of spike often exceeding the pistillate bracts8. *A. gracilens* var. *Delzii*.
- 8(6). Leaves narrowly rhombic to broadly lanceolate; pistillate bracts with dense long spreading hairs, cut into 9 to 12 lanceolate lobes ...7. *A. virginica*.
- 8. Leaves ovate or elliptic to broadly rhombic; pistillate bracts cut into 7 to 9 lobes (9)
- 9(8). Pistillate portion of spike with few bracts deeply cut into 7 to 9 lanceolate lobes, sparsely pubescent6. *A. rhomboidea*.
- 9. Pistillate portion of spike compact with several bracts shallowly cut into 7 to 9 lanceolate lobes, densely pubescent10. *A. Poiretii*.
- 10(3). Perennial herbs or subshrubs, decumbent; staminate spike terminal; pistillate flowers axillary5. *A. hederacea*.
- 10. Annual herbs (11)
- 11(10). Pistillate bracts foliaceous with mostly 8 to 12 shallow deltoid lobes, the median lobe much larger than the others3. *A. neomexicana*.
- 11. Pistillate bracts divided deeply into 13 to 17 linear lobes
.....2. *A. ostryaefolia*.

1. *Acalypha Lindheimeri* Muell. Arg. Perennial herb, mostly erect, branching, 2-5 dm. tall, with sparse recurved hairs and long soft hairs; leaf blades thin, rhombic to ovate-rhombic, serrate, 19-58 mm. long, 9-28 mm. wide, sparse to moderately dense short stiff hairs on both surfaces; petioles 2-17 mm. long, mostly 0.1 to 0.2 as long as blade; stipules 1-1.5 mm. long; spikes terminal, androgynous, compact, 5-48 mm. long; pistillate portion of spike bearing many bracts with each subtending a single flower; bracts 4-12 mm. long, 5-11 mm. wide, cut into 3 to 8 (mostly 5 to 7) moderately deep lobes with recurved and short stiff hairs sparse on lower surface and white short-stalked plus red and white long-stalked glands mostly on lower surface; fruit a 3-seeded capsule, glabrous at base, sparsely hirsute at apex; seeds brown, shallowly pitted, 1.4-1.9 (mostly 1.7) mm. long. In dry sandy soil in Wichita Co. s. to Gonzales Co. w. to Culberson and Presidio cos., spring-fall; s. N.M. into s.e. Ariz. and n. Mex.

2. *Acalypha ostryaefolia* Ridd. Annual herb; stems erect, branched, 35-70 cm. tall, with sparse to moderately dense recurved and short stiff hairs and long-stalked white glands varying from sparse to dense; leaf blades thin, 33-82 mm. long, 16-53 mm. wide, ovate, base slightly cordate, 3- to 5-nerved, dentate, with sparse short stiff hairs; petioles

14-66 mm. long (usually about equal to blade length); stipules 1-1.5 mm. long; male and female spikes on the same plant; *staminate spikes* axillary, 5-34 mm. long; *pistillate spikes* terminal, somewhat loose; bracts 3-7.5 mm. long, 5-12 mm. wide, deeply cut almost to the base into 9 to 19 (mostly 13 to 17) filamentous lobes with white long-stalked glands sparse, surface of bract lobes muricate; bract subtending a single pistillate flower; styles 1-2 mm. long, basal portion very slightly fleshy and green; capsule 3-seeded, slightly puberulous, when mature echinate, with fleshy projections near apex; seed brown, tuberculate, 1.6-2.2 mm. long. Dry sandy soil in open woods, fields, roadsides from Cooke and Grayson cos. w. to Nolan Co. s. to Medina, San Patricio and Harris cos., summer-fall; Pa. to s. Fla., Ia. and Okla. to w. Tex., N.M. and Ariz.

3. *Acalypha neomexicana* Muell. Arg. Annual herb; stems erect, simple or branched, 10-35 cm. tall, with sparse to dense recurved hairs; leaf blades somewhat rhombic, serrate, 19-50 mm. long, 7-27 mm. wide, with sparse short stiff hairs; petioles 9-43 mm. long, usually half to equal the length of blade; stipules 0.5-1 mm. long; male and female spikes on same plant; *staminate spike* axillary, 1-4.5 mm. long; *pistillate spikes* terminal, those terminating short axillary branches appearing almost as axillary spikes, moderately compact; bracts 5-12 mm. long, 5-9.5 mm. wide, shallowly cut into 5 to 17 (mostly 9 to 13) deltoid acute lobes, the median lobe frequently elongated to become several times longer than the other lobes, with sparse short stiff hairs and few white long-stalked glands; styles 2-2.5 mm. long, white; capsule 3-seeded, smooth below, pubescent above, occasional glands present; seeds brown, with large deep pits in distinct rows, 1.2-1.6 (mostly 1.2-1.4) mm. long. Moist shady conditions in mts., usually along streams in Hudspeth, Culberson, Jeff Davis and Brewster cos., summer-fall; s. N.M. and Ariz. into n. Mex.

4. *Acalypha radians* Torr. Perennial herb, somewhat decumbent, much-branched, 2-4 dm. tall; stem with dense short stiff and long-spreading hairs; leaf blades reniform to orbicular, deeply lobed, 5-12 mm. long, 8-20 mm. wide, with sparse to dense recurved hairs and sparse to dense soft spreading hairs, also occasional white short-stalked glands; petioles 4-16 mm. long, usually as long as or exceeding the length of the blade; stipules 0.5-1 mm. long; male and female spikes on separate plants; *staminate spikes* terminal, 14-57 mm. long; *pistillate spikes* mostly terminal, compact, some axillary; bracts 3.5-10 mm. long, 6-16 mm. wide, each subtending a single flower, cut about half their length into 7 to 13 (mostly 8 to 10) broad blunt-tipped lobes, with recurved short stiff and long-spreading hairs varying from sparse to dense (usually dense) and sparse white short-stalked glands; styles 9-14 mm. long, bright-red; capsule 3-seeded, with short stiff and long soft hairs and sparse white short-stalked glands; seeds brown, shallowly pitted, 1.5-2 (mostly 1.8) mm. long. Dry sandy or gravelly sites from Llano and Burnet cos. e. to Austin Co. s. to Zapata, Hidalgo and Cameron cos., summer-fall; also n. Mex.

5. *Acalypha hederacea* Torr. Subshrub or perennial herb, somewhat sprawling, branching, 15-40 cm. tall; stem with dense recurved and short stiff hairs, also few long soft hairs; leaf blades orbicular or reniform, crenate, thin, 7-24 mm. long, 8-25 mm. wide, with sparse recurved and long-spreading hairs and dense short stiff hairs; petioles 5-24 mm. long, usually equal to blade length or longer; stipules 0.3-1 mm. long; staminate and pistillate spikes usually on separate plants; *staminate spikes* terminal, 16-84 mm. long; *pistillate spikes* terminal and axillary, compact; bracts (each subtending a single flower) 4-8.6 mm. long, 7.3-12 mm. wide, cut about one fourth their length into 8 to 14 (mostly 10 to 12) broad blunt lobes, with short stiff hairs moderately dense to dense and recurved long soft hairs sparse, also white short-stalked glands sparse and red short-stalked glands occasional; styles 5-14 mm. long, bright- or dark-red; capsule 3-seeded, with dense long soft hairs and few white short-stalked glands; seeds brown, shallowly pitted, 1.4-2 (mostly 1.5-1.8) mm. long. Dry rocky or gravelly soil from Presidio, Brewster and Pecos cos. e. to Bexar Co. and s. to Cameron Co., summer-fall; also n. Mex.

Some authors unite this taxon with the widespread Mexican species, *A. monostachya* Cav.

6. *Acalypha rhomboidea* Raf. Plant herbaceous, 15-60 cm. tall; stems simple or branching, above densely pubescent with recurved hairs, below sparsely pubescent; leaf blades thin, 3-nerved at base, 17-103 mm. long, 8-45 mm. wide, ovate to broadly rhombic, crenate-serrate, subglabrous (short stiff hairs few); petioles 3-72 mm. long, mostly one half as long as or equal to length of blade; stipules lanceolate, 0.3-1 mm. long; spikes

androgynous, axillary; *staminate* flower cluster terminating the flowering spike, rarely exceeding the pistillate bracts; calyxes sometimes appearing reddish-brown, or green; *female* bracts 1 to 3 (each subtending 1 to 3 flowers) at base of spike, 4.6-5.3 mm. long, 6.5-30 mm. wide, cut about one half their length into 5 to 11 (mostly 7 to 9) oblong-lanceolate lobes, hirsute to long-ciliate and with stalked white glands sparse to dense; capsule 3-seeded, smooth at base, becoming pubescent and sometimes glandular at apex; seeds brown or mottled, with shallow pits in rows, 1.2-2 (mostly 1.5-1.7) mm. long. Moist to dry sandy sites, rare in Tex. from Tarrant and Dallas to Sabine, Panola and Harris cos., summer-fall; Me., s. to Ga. and La., w. to Mich., Minn., N.D. and Tex.

7. *Acalypha virginica* L. Annual herb; stems erect, sparsely branched, 1-5 dm. tall, with sparse to dense recurved and long soft spreading hairs; leaf blades thin, narrowly rhombic to broadly lanceolate, crenate, 12-112 mm. long, 4-38 mm. wide, with few short stiff hairs; petioles 2-65 mm. long, mostly a fourth to a half as long as blade; stipules 0.5-1 mm. long; spikes androgynous, axillary; pistillate bracts 1 to 3 (each subtending 1 to 3 flowers) at base of spike, 4.6-8 mm. long, 6.5-21 mm. wide, deeply cut a half or more its length into 8 to 16 (mostly 10 to 14) lanceolate lobes, with short stiff hairs sparse and long spreading hairs on margins and sparse to dense on lower surface, also white and red short-stalked glands very sparse; staminate upper portion of spike 1-21 mm. long, usually less than 1 cm.; the spikes very rarely axillary; styles white, about 2 mm. long; capsule 3-seeded, pubescent, glandular; seeds brown, shallowly pitted in rows, 1.2-1.8 (mostly 1.5) mm. long. Moist or dry sandy soil, Clay Co. to Bowie Co. s. to Angelina and Brazos cos., summer-fall; N.H. s. to S.C., Ga. and La. w. to Ia. and Neb. s. to Tex.

8. *Acalypha gracilens* Gray. Annual herb; stems erect, simple or branching mostly at base, 1-6 dm. tall, with moderately dense to dense recurved hairs; leaf blades thin, narrowly ovate to broadly lanceolate or linear, margins slightly crenate to almost smooth or entire, 16-63 mm. long, 4-21 mm. wide, with sparse to dense short stiff suppressed hairs on both surfaces; petioles 2-17 mm. long, one tenth to two tenths the length of the blade; stipules 0.3-1 mm. long; spikes androgynous or rarely some of them entirely staminate, axillary; *staminate* spike or portion of spike 0.5-28 mm. long, occasionally surpassing the bract; *female* bracts 1 to 3 (each subtending 1 to 3 flowers) at the base, 4-14 mm. long, 6-17 mm. wide, cut about a fourth its length into 7 to 19 (mostly 9 to 13) deltoid acute lobes, with sparse to dense short stiff hairs and few long hairs on margins, with moderately dense sessile red, short red and long-stalked white glands; styles 1-2 mm. long, slender, white or pinkish; capsule 3-seeded, sparsely pubescent and occasionally glandular; seeds brown or mottled, pitted in rows, 1.2-2.1 mm. long.

We have 2 varieties.

Var. *gracilens*. Leaves narrowly ovate to broadly lanceolate, slightly crenate to almost smooth, 3 to 5 times as long as broad; petiole usually about two tenths the length of leaf blade; staminate part of spikes 0.5-28 mm. long, often not exceeding the female bract; seeds 1.2-2.1 (mostly 1.3-1.6) mm. long. Usually in dry sandy soil, rare in Bowie and Shelby cos. s. and w. to Gonzales Co., summer-fall; Me., N.Y. and Minn. s. to Fla. and Tex.

Var. *Delzii* L. Mill. Leaves linear, rarely slightly crenate to entire, 4 to 6 times as long as broad; petioles usually 0.1 to 1.6 times as long as leaf blades; staminate part of spikes 2.5-26 mm. long, frequently much-surpassing the bract; seeds 1.2-1.9 (mostly 1.5-1.7) mm. long. In dry sandy soil from Bowie Co. s. to Travis, Liberty, Brazoria and Gonzales cos., summer-fall; e. into La. and Ark.

9. *Acalypha monococca* (Engelm.) L. Mill. Annual herb; stems erect, simple or branched, 15-40 cm. tall, with sparse to moderately dense recurved hairs; leaf blades thin, linear or lanceolate, very slightly crenate to entire, 20-69 mm. long, 3-13 mm. wide, frequently 6 to 7 times as long as wide, with few short stiff hairs; petioles 2-12 mm. long, mostly one tenth to two tenths the length of blade; stipules 1 mm. long; spikes androgynous or rarely a few may be entirely staminate, axillary; *staminate* parts of spike 0.5-28 mm. long, frequently much-exceeding the pistillate bract; *pistillate* bracts 1 to 3 (each subtending 1 to 3 flowers) per spike at base, 4-13.5 mm. long, 5-16 mm. wide, cut about one third the length into 7 to 17 (mostly 9 to 13) deltoid acute lobes, with sparse to dense short stiff hairs and long spreading hairs on the margin, also red short-stalked

glands sparse to dense and white long-stalked glands sparse; styles 1.5-2 mm. long, mostly whitish; capsule 1-seeded, pubescent, occasionally sparsely glandular; seeds brown to mottled, shallowly pitted, 1.4-2.4 (mostly 1.7-2.2) mm. long. *A. gracilens* var. *monococca* Engelm. Dry sandy soil from Grayson, Jack and Titus cos. s. to Gillespie, DeWitt and Harris cos., summer-fall; Ark., Kan. and s. Ill. into Tex.

10. *Acalypha Poiretii* Spreng. Annual herb; stems erect, simple or branched, 4-36 cm. tall, densely pubescent with recurved hairs; leaf blades ovate to elliptic, 1-5 cm. long, 7-35 mm. wide, crenate, subglabrous; petioles 6-40 mm. long, usually half to equal the length of the blade; stipules lanceolate, 0.5-1 mm. long; spikes axillary and terminal, androgynous, compact; *staminate* part of spike rarely exceeding the pistillate bracts; *pistillate* bracts at base of spike (each usually subtending only 1 flower), 3-5 mm. long, 4-8 mm. wide, shallowly cut into 7 to 9 lanceolate lobes, densely hirsute to long-ciliate and with stalked white glands sparse; styles simple or nearly so; capsule 3-seeded, smooth at base, becoming pubescent toward apex; seeds brown or slightly mottled with shallow pits in rows, 1-1.5 mm. long. Dry sandy or gravelly sites in Cameron, Wilson, Starr and Hidalgo cos., summer-fall; s. into Mex.

12. TRAGIA L.¹¹⁷

NOSEBURN

Perennial herbs, sometimes becoming suffrutescent, erect or decumbent to trailing or twining; stems solitary to many from the woody crown of the taproot, alternately branched; pubescence of stiff stinging hairs intermingled with soft spreading hairs; leaves alternate, petiolate or sessile, the margins entire to serrate or coarsely toothed to lobed; stipules lanceolate to ovate, acute to attenuate, entire, ciliate, usually persistent; racemes androgynous, opposite the leaves at the upper nodes (actually terminal, but soon surpassed by the branch from the axil of the subtending leaf), the lower 1 (or 2) flowers pistillate, the remaining 2 to 20 or more staminate; individual flowers bracteolate; bracts of the pistillate flowers lanceolate, ciliate, entire or 3-lobed; bracts of the staminate flowers lanceolate, pubescent, entire; flowers apetalous; calyx-lobes 3 to 6 (or 7); disk absent in all flowers; *staminate flowers* pedicellate, the slender pedicels with an abscission zone below the middle (the basal portion persistent); stamens 2 to 6 (to 10 in the terminal flowers), typically 2 to 4; filaments connate at least at the base, the anthers free; pistillode small; *pistillate flowers* pedicellate with an abscission zone below the middle of the pedicel, the entire structure with the calyx and columella usually persistent; staminodia absent; ovary usually of 3 carpels, subglobose, hispid to densely hispid with stiff stinging hairs; styles 3, spreading or coiling outward at anthesis, united at the base to half or more their length; stigmatic surfaces smooth, roughened or papillate; fruit an explosively dehiscent capsule, the cocci separating from a persistent columella; columella with 3 interocular points apically; seeds 1 per locule; seed coat dry, crustaceous, smooth or slightly rough, brownish-black or with a tawny mottling when mature, ecarunculate; endosperm whitish; embryo straight; cotyledons foliaceous and considerably broader than the terete radicle.

A genus of about 150 species of nettle-like plants that are widely distributed in tropical and subtropical or warm-temperate regions of both the New World and Old World.

1. Stamens 2; calyx lobes of the staminate flowers usually 4 or 5 (rarely 6); plants never twining (2)
1. Stamens 3 or 4 (rarely 5, up to 10 in the terminal flowers); calyx lobes of the staminate flowers 3 or 4 (to 5, up to 7 in the terminal flowers); plants often twining (3)
- 2(1). Leaf blades cuneately narrowed at base; seeds 3-4 mm. long 10. *T. urens*.
2. Leaf blades rounded to obtuse at base; seeds 4-4.5 mm. long 9. *T. Smallii*.
- 3(1). Inflorescence with conspicuous stalked glandular hairs; seeds 1.9-2.2 mm. long ..
..... 1. *T. glanduligera*.
3. Inflorescence without conspicuous stalked glandular hairs; seeds 2.8-5.3 mm. long (4)

¹¹⁷ Contributed by Kim I. Miller.

- 4(3). Stems essentially glabrous; leaf blades deeply and sharply toothed, cuneately narrowed at base; filaments connate one-third to one-half or more their length 8. *T. nigricans*.
4. Stems pubescent; leaf blades variously marginated, truncate to cordate or hastate at base; filaments connate only at base (5)
- 5(4). Persistent base of the staminate pedicel usually as long as or exceeding the subtending bract; stigmatic surfaces extremely papillate; styles connate one-third to one-half their length with a slight constriction at the juncture with the ovary 3. *T. urticifolia*.
5. Persistent base of the staminate pedicel conspicuously shorter than the subtending bract; stigmatic surfaces smooth to papillate; styles free or connate without a constriction at the juncture with the ovary (6)
- 6(5). Leaf blades broadly ovate, 45-130 mm. long, 36-100 mm. broad, acuminate, deeply cordate at base; seeds 4.3-5.3 mm. long 2. *T. cordata*.
6. Leaf blades rounded to triangular or lanceolate, scarcely acuminate, not broadly ovate, with a deeply cordate base; seeds 2.6-4 mm. long (7)
- 7(6). Calyx lobes of the pistillate flowers longer than the gynoecium at anthesis; staminate flowers 14 to 75 per inflorescence, usually compactly arranged on the axis 4. *T. betonicifolia*.
7. Calyx lobes of the pistillate flowers shorter than the gynoecium at anthesis; staminate flowers 2 to 30 per inflorescence, usually not compactly arranged on the axis (8)
- 8(7). Stigmatic surfaces not papillate (except in aberrant specimens where the papillation is slight and always in combination with narrowly lanceolate leaf blades); styles connate one-third to one-half or more their length and usually terminating in slender round recurved tips; leaf blades usually 2 to 4 times as long as broad 6. *T. ramosa*.
8. Stigmatic surfaces papillate; styles connate only at the base or slightly more (to one-fourth their length); leaf blades rounded to triangular (9)
- 9(8). Plants copiously to densely pubescent especially on the young stems, the entire plant having a grayish-green cast; leaf blades crenate to serrate or dentate, truncate to sagittate at base; staminate flowers 3 to 30 per inflorescence 7. *T. amblyodonta*.
9. Plants not densely pubescent on the stems and leaves; leaf blades serrate, truncate to shallowly cordate at the base; staminate flowers 3 to 6 (to 10) per inflorescence, fruits usually of 2 kinds on the same plant, 3-seeded and wingless or 1-seeded and winged 5. *T. brevispica*.

1. *Tragia glanduligera* Pax & Hoffm. Stems to 1 m. or more long, trailing and twining; leaves elliptic to ovate, 25-40 mm. long, 15-20 mm. broad, apically acute to acuminate, basally truncate to cordate, marginally crenate to serrate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 10 to 30 nodes staminate; bracts of the pistillate flowers 0.9-2 mm. long, abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 0.5-1.5 mm. long; glandular hairs present over the entire inflorescence; *staminate flowers*: pedicels 1-2 mm. long, the lower persistent part 0.3-0.7 mm. long; calyx lobes 3, 0.7-1.2 mm. long; stamens 3; filaments thickened and fleshy, 0.2-0.4 mm. long, connate basally; *pistillate flowers*: pedicels 1-2.3 mm. long, elongating to 3-7 mm. in fruit; calyx lobes 6, 0.7-1.5 mm. long at anthesis, 1.2-2.3 mm. long in fruit; styles connate for one-third their length, the stigmatic surfaces papillate; fruit 2-2.5 mm. long, 4-5 mm. broad; columella 1.5-2 mm. long; seeds 1.9-2.2 mm. long. Usually in dry sandy soil in Kenedy, Willacy, Hidalgo and Cameron cos., spring-fall; s. to Yuc.

2. *Tragia cordata* Michx. Stems to 15 dm. long or more, trailing and twining; leaves broadly ovate, 45-130 mm. long, 36-100 mm. broad, apically acuminate, basally cordate, marginally coarsely serrate; racemes with the single lowermost node pistillate, the remaining 20 to 60 nodes staminate; bracts of the pistillate flowers 1.6-2 mm. long, abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 1.5-2 mm. long; *staminate flowers*: pedicels 1.5-2.2 mm. long, the lower persistent part 0.7-1 mm. long; calyx lobes

3 (or 4), 0.7-1.5 mm. long; stamens 3 (to 5); filaments thickened and fleshy, 0.2-0.5 mm. long, connate basally; *pistillate flowers*: pedicels 1-1.5 mm. long, elongating to 2.5-3 mm. in fruit; calyx lobes 6 (or 7), 1.5-2 mm. long at anthesis, 2-3 mm. long in fruit; styles connate for one-fourth to one-third their length; stigmatic surfaces papillate; fruit 5-7 mm. long, 11-13 mm. broad; columella 2.2-3.4 mm. long; seeds 4.3-5.3 mm. long. Rocky wooded bluffs along streams and rich soil in open woods in e. Tex. from Bowie Co. s. to Jasper Co., spring-fall; Ind. s. to Ga. and Fla., Mo., Okla. and Tex.

3. *Tragia urticifolia* Michx. Stems 25-65 cm. tall, erect to decumbent; leaves triangular-lanceolate to narrowly ovate, 27-67 mm. long, 9-32 mm. broad, apically acute, basally cordate to truncate, margins serrate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 11 to 40 nodes staminate; bracts of the pistillate flowers 1-1.5 mm. long, glabrous or abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 0.7-1.5 mm. long; *staminate flowers*: pedicels 1.5-2 mm. long, the lower persistent part 1-1.8 mm. long, as long as or exceeding the subtending bract; calyx lobes 3 (or 4), 1.2-2.1 mm. long; stamens 3; filaments thickened and fleshy, 0.3-0.8 mm. long, connate basally; *pistillate flowers*: pedicels 0.5-1 mm. long, elongating to 3-4 mm. in fruit; calyx lobes (5 or) 6, 1.3-2.2 mm. long at anthesis, 2-3 mm. long in fruit; styles connate for one-third to one-half their length with a constriction at the juncture with the ovary; stigmatic surfaces extremely papillate; fruit 3.5-4.5 mm. long, 7-8 mm. broad; columella 2-2.8 mm. long; seeds 3-4 mm. long. Sandy soil in open woods and fields in e. Tex. w. to Gonzales and Bastrop cos., n. to Wood and Upshur cos., spring-fall; N.C. s. to Fla. and w. to Ark. and e. Tex.

4. *Tragia betonicifolia* Nutt. Stems 2-5 dm. tall, erect or decumbent to trailing; leaves ovate to ovate-lanceolate or triangular-lanceolate, 15-55 mm. long, 9-35 mm. broad, apically acute, basally cordate to truncate, marginally sharply serrate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 14 to 75 nodes staminate; bracts of the pistillate flowers 1.5-2 mm. long, abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 1-2 mm. long; *staminate flowers*: pedicels 0.7-1 mm. long, the lower persistent part 0.3-0.6 mm. long; calyx lobes 3 or 4 (or 5), 1.2-2.3 mm. long; stamens 3 or 4 (or 5); filaments thickened, 0.4-1 mm. long, connate basally; *pistillate flowers*: pedicels 0.7-1 mm. long, elongating to 3-4 mm. in fruit; calyx lobes 6, 1.8-3 mm. long at anthesis, 3-5 mm. long in fruit; styles connate only at the base or slightly more; stigmatic surfaces papillate; fruit 4-5 mm. long, 7-9 mm. broad; columella 2.5-3 mm. long; seeds 3-4 mm. long. *T. urticifolia* var. *texana* Shinnery. Dry sandy soil in open woods and fields in cen. Tex. from Wichita and Lamar cos. s. to Duval and Jim Wells cos., e. to Galveston Co. and w. to Uvalde and Stonewall cos., spring-fall; Mo. and Kan. s. through Okla. and Ark. to s. Tex.

5. *Tragia brevispica* Engelm. & Gray. Stems 2-10 dm. long or longer, erect to trailing and twining; leaves broadly triangular, 18-50 mm. long, 13-30 mm. broad, apically acute, basally truncate to shallowly cordate, marginally finely and shallowly serrate; racemes with the lowermost node pistillate, the remaining 3 to 6 (to 10) nodes staminate; bracts of the pistillate flowers 1-1.4 mm. long; bracts of the staminate flowers subcucullate, 1-1.8 mm. long; *staminate flowers*: pedicels 1-1.5 mm. long, the lower persistent part 0.4-0.7 mm. long; calyx lobes 3 or 4 (or 5), 1-1.5 mm. long; stamens 3 or 4 (or 5); filaments slender to thickened and fleshy, 0.3-0.6 mm. long, connate basally; *pistillate flowers*: pedicels 0.5-1 mm. long, elongating to 2-4 mm. in fruit; calyx lobes 6, 1.3-2 mm. long at anthesis, 1.8-3.5 mm. long in fruit; styles connate only at the base or to one-third their length; stigmatic surfaces papillate; fruits often of 2 kinds on the same plant; some fruits 3-seeded and wingless, typically dehiscent, 3.5-4 mm. long, 6.5-7 mm. broad; some fruits with 1 to 3 (typically 2) distinct wings, more or less indehiscent; columella 1.8-2.8 mm. long; seeds 2.8-3.8 mm. long. Open woods and fields in the limestone region of cen. Tex. from Grayson and Delta cos. s. to Kleberg Co., Brazos Co. w. to Edwards and Scurry cos., spring-fall; possibly extending into Mex.

6. *Tragia ramosa* Torr. Stems 12-50 cm. tall, green, erect, decumbent, trailing or sometimes with a tendency to twine; leaves linear-lanceolate to ovate (basal leaves rarely reniform), 1-4 cm. long, 4-20 mm. broad, apically acute, basally truncate to cordate, marginally serrate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 2 to 20 nodes staminate; bracts of the pistillate flowers 1.5-2 mm. long, sometimes abaxially

sparingly pubescent; bracts of the staminate flowers subcucullate, 1.2-1.8 mm. long; *staminate flowers*: pedicels 0.7-2 mm. long, the lower persistent part 0.4-1.5 mm. long; calyx lobes 3 or 4 (to 6), 1-2.2 mm. long; stamens (very rarely 2) to 3 or 4 (to 5, as many as 10 in the terminal flowers); filaments thickened and fleshy, 0.3-1 mm. long, connate basally; *pistillate flowers*: pedicels 1-1.5 mm. long, elongating to 2-2.5 mm. in fruit; calyx lobes (5 to) 6 (or 7), 0.8-2.5 mm. long at anthesis, 1.5-3 mm. long in fruit; styles connate for one-third to one-half or more their length; stigmatic surfaces not papillate (except slightly so in aberrant specimens); fruit 3-4 mm. long, 6-8 mm. broad; columella 1.5-2.6 mm. long; seeds 2.5-3.5 mm. long. *T. stylaris* Muell. Arg., *T. nepetifolia* var. *leptophylla* (Torr.) Shinn. Ubiquitous in open areas and disturbed habitats in cen. and s.w. Tex., spring-fall; Mo. and Ark., w. to Calif., Neb. and Colo., s. into Mex.

7. *Tragia amblyodonta* (Muell. Arg.) Pax & K. Hoffm. Stems 12-50 cm. tall, erect to decumbent or trailing; leaves ovate to triangular or hastate, 10-45 mm. long, 8-30 mm. broad, apically acute to obtuse, basally truncate to cordate or hastate, marginally crenate to serrate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 3 to 30 nodes staminate; bracts of the pistillate flowers 0.9-1.3 mm. long, abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 0.9-1.5 mm. long; *staminate flowers*: pedicels 0.7-1 mm. long, the lower persistent part 0.2-0.4 mm. long; calyx lobes 3 or 4 (or 5), 0.9-1.9 mm. long; stamens (very rarely 2) to 3 or 4 (or 5); filaments thickened and fleshy, 0.2-0.7 mm. long, connate basally; *pistillate flowers*: pedicels 0.3-0.4 mm. long, elongating to 1.5-2 mm. in fruit; calyx lobes (5 or) 6, 1-2.3 mm. long at anthesis, 2-3.5 mm. long in fruit; styles connate only at the base or up to one-third their length; stigmatic surfaces papillate; fruit 3-4.5 mm. long, 5.5-8 mm. broad; columella 1.8-2.5 mm. long; seeds 2.6-3.6 mm. long. Rocky open areas usually on limestone in s. Tex. in Starr and Karnes cos., n. to Kent Co. and w. to El Paso Co., spring-fall; Ariz., N.M. and Tex. s. into Mex.

8. *Tragia nigricans* Bush. Stems 15-55 cm. tall, turning black in drying, erect; leaves oblong to oblong-lanceolate, 3-7 cm. long, 10-25 mm. broad, apically acute, basally acute to cuneate, margins deeply dentate; racemes with the single lowermost node pistillate, the remaining 2 to 5 nodes staminate; bracts of the pistillate flowers 2-2.6 mm. long; bracts of the staminate flowers 1-2 mm. long; *staminate flowers*: pedicels 1.3-1.6 mm. long, the lower persistent part 0.2-0.4 mm. long; calyx lobes 3 or 4 (or 5), 1.5-2.5 mm. long; stamens (3) to 4 or 5 (or 6); filaments slender, 0.7-1.3 mm. long, connate for one-third to one-half or more their length; *pistillate flowers*: pedicels 0.7-1 mm. long, elongating to 2-3 mm. in fruit; calyx lobes (5 or) 6, 1-2.3 mm. long at anthesis, 2.4-4 mm. long in fruit; styles connate only at the base; stigmatic surfaces very slightly papillate; fruit 3-3.5 mm. long, 6.5-7 mm. broad; columella 1.7-3.2 mm. long; seeds 2.5-3.2 mm. long. Rocky soil of open woods and fields in Uvalde, Real, Medina, Bandera, Kerr and Comal cos., spring-fall; endemic.

9. *Tragia Smallii* Shinn. Stems 12-25 cm. tall, erect; leaves orbicular to elliptic, 2-4 cm. long, 8-25 mm. broad, apically rounded to acute, basally rounded to obtuse, margins coarsely serrate or crenate to lobed, thick, pubescent, ciliate; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 4 to 11 nodes staminate; bracts of the pistillate flowers 1.5-2.5 mm. long, sometimes abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 0.8-1.2 mm. long; *staminate flowers*: pedicels 1.5-1.9 mm. long, the lower persistent part 0.4-0.6 mm. long; calyx lobes 4 or 5 (or 6), 0.9-1.5 mm. long; stamens 2 (very rarely 3); filaments thickened and fleshy, flattened laterally, 0.2-0.5 mm. long, connate basally; *pistillate flowers*: pedicels 0.5-1 mm. long, elongating to 2.8-3.4 mm. in fruit; calyx lobes 6, 1.3-1.7 mm. long at anthesis, 1.5-2.3 mm. long in fruit; styles connate about one-fourth their length; stigmatic surfaces roughened but not papillate; fruit 5-7 mm. long, 9-13 mm. broad; columella 2.2-3.2 mm. long; seeds 4-4.5 mm. long. Dry sandy soil at the edge of woods, in fields and along roadsides in Newton, Jefferson and Hardin cos., spring-fall; Ga. and Fla. w. to e. Tex.

10. *Tragia urens* L. Stems 2-5 dm. tall, erect; leaves broadly oblanceolate to linear, 2-8 cm. long, 2-14 mm. broad, apically acute to rounded, basally acute to attenuate, marginally entire to round-toothed or lobed; racemes with the lowermost 1 (or 2) nodes pistillate, the remaining 3 to 45 nodes staminate; bracts of the pistillate flowers 1-2.5 mm. long, abaxially sparsely pubescent; bracts of the staminate flowers subcucullate, 1-1.5 mm.

long; *staminate flowers*: pedicels 1.3-2 mm. long, the lower persistent part 0.3-0.6 mm. long; calyx lobes 4 or 5, 1-1.5 mm. long; stamens 2 (very rarely 3); filaments thickened and fleshy, 0.2-0.4 mm. long, connate basally; *pistillate flowers*: pedicels 0.6-1 mm. long, elongating to 3.5-4 mm. in fruit; calyx lobes 6, 1-1.5 mm. long at anthesis, 1.5-1.8 mm. long in fruit; styles connate for one-fourth to one-third their length; stigmatic surfaces roughened but not papillate; fruit 3-4 mm. long, 7-8 mm. broad; columella 1.9-2.6 mm. long; seeds 3-4 mm. long. *T. linearifolia* Ell. Sandy soil of open woods and clearings and along roadsides in Shelby, Polk and Hardin cos., spring-fall; Va. s. to Fla. and w. to e. Tex.

13. SEBASTIANIA MUELL. ARG.

A tropical genus of a dozen or so species.

1. *Sebastiania fruticosa* (Bartr.) Fern. SEBASTIAN BUSH. Weak essentially glabrous unarmed shrubs, usually 10-15 dm. tall; leaves alternate; blades elliptic, (2-) 3-7 (-10) cm. long, basally acute to rarely acuminate, marginally entire, apically acuminate, thin, green; petioles (1-) 2-6 (-10) mm. long; stipules lanceolate, brownish, 1-2 mm. long, deciduous; flowers in compact terminal androgynous (but strongly protandrous) spiciform thyrses 2-3 cm. long, each of the minute bractlets of the spike with 2 glandular stipules; *staminate flowers*: calyx cup-shaped, about 0.5 mm. high, 3-lobed more than half the length, yellow-green; petals absent; disk essentially absent; stamens 3, opposite the sepals and only slightly surpassing them; rudiment one; *pistillate flowers*: pedicels about 1 mm. long, (to 6 mm. when in fruit); calyx cup-shaped, of 3 nearly distinct bluntly deltoid fimbriate-erose thin-margined sepals, occasionally in two of the sinuses with two other obsolete minute sepals; petals, disks and glands absent; ovary globose, about 1 mm. high, 3-celled, each cell with a single ovule; styles 3, scorpioid-coiled, simple, the ventral (stigmatic) surface papillate; capsule dry, shallowly tricoccus-globose, about 7 mm. high and 8 mm. thick, dehiscing schizocarpically and loculicidally; columella stout, about 5 mm. long; seed ovoid or plumply ellipsoid, about 5 mm. long, brown-mottled, with a flat platelike caruncle at the upper end, falling at maturity. *S. ligustrina* (Michx.) Muell. Arg. Infrequent in woodlands along streams, e. and s.e. Tex., May; s.e. U.S.

14. SAPIUM P. BR.

A genus of about 100 species in the warmer parts of the world.

1. *Sapium sebiferum* (L.) Roxb. CHINESE TALLOW TREE. Rapid-growing, weedy tree with milky sap, essentially glabrous, unarmed, (2-) 3-10 m. tall, weak-stemmed, with arcuate and often drooping slender branches, the stems and branches brittle; leaves alternate; blades rhombic, 3-7 (-9) cm. long, basally biglandular and rounded to acute, marginally entire, apically acuminate or denticulate; petioles longer than their blades; stipules subulate, caducous; flowers in terminal spiciform androgynous thyrses (3-) 5-15 cm. long, the minute bractlet at each node with two persistent bulbous-glandular stipules; *staminate flowers* in clusters at the upper nodes, each on a pedicel about 1 mm. long, with a cup-shaped irregularly 3-toothed calyx about 1 mm. across; petals, glands and rudiment absent; stamens 2; *pistillate flowers* few, solitary at the nodes; calyx of 3 triangular nearly distinct sepals; petals, glands and disks absent; ovary subglobose, 3-celled, triovulate; styles 3, free and spreading about half the length, entire, the free portion brown, papillate-fungoidal ventrally; fruit 3-coccus, about 1 cm. long, the walls falling readily; seeds 7-8 mm. long, long-persistent on the placenta after the dehiscence of the fruit, chalky-white. Locally abundant near towns, in vacant lots, along rivers, thickets and woods in s.e. Tex., escaped from cult., spring; nat. of Asia, widely introd.

The seeds yield an oil by pressure, and the seed coat yields a whitish wax by boiling.

15. STILLINGIA L.

Glabrous unarmed perennial herbs with milky sap, the shoots from thick erect woody crowns; leaves alternate, ascending, entire, narrow, glandular-serrulate, usually acute,

nearly sessile; stipules of a few subglandular emergences; petioles absent or less than 2 mm. long; flowers in terminal androgynous spiciform thyrses, the minute bract at each node of the inflorescence with 2 glandlike stipules larger than the bract itself; *staminate flowers* on short pedicels, either solitary or clustered at the upper nodes, much-reduced, with a cup-like calyx (only 1-2 mm. long) obscurely, shallowly and unequally 2-lobed; petals and disk absent; stamens 2; *pistillate flowers*: calyx shallowly to deeply 3-lobed with 1 lobe toward (the other 2 away from) the thyrses axis, the lobes 0.7-2 mm. long; petals and disk absent; ovary subglobose, 3-celled, triovulate; styles 3, simple; gynobase (lower part of ovary) after anthesis becoming thick and indurated, persistent; capsules shallowly 3-coccus, 4-12 mm. long, 3-celled, 3-seeded, the upper portion separating from the gynobase and dehiscing loculicidally and septicidally; columella fragile, usually soon broken; seeds 4-8 mm. long not including the caruncle, with a prominent bulbous or semilunate caruncle.

A mainly tropical genus of a couple of dozen species.

1. Staminate flowers solitary at the upper nodes of the spike; leaves 2 to 4 times as long as broad; caruncle of seed half-moon-shaped in ventral view and about 2 mm. across; styles 2 mm. long 3. *S. Treculiana*.
1. Staminate flowers in bracted glomerules of 5 to 15 flowers at each node of the thyrses; leaves 4 to 15 times as long as broad; styles 4-5 mm. long (2)
- 2(1). Leaves (3 or) 4 to 7 (to 10) times as long as broad; capsule about 12 mm. long and broad; caruncle of seed subreniform, about 4-5 mm. across 1. *S. sylvatica*.
2. Leaves 6 to 12 (to 15) times as long as broad; capsule about 6 mm. long and broad; caruncle of seed bulbous and about 1 mm. across ... 2. *S. texana*.

1. *Stillingia sylvatica* L. QUEEN'S DELIGHT. Herb 30-50 (-75) cm. tall; leaf blades narrowly elliptic to lanceolate or oblanceolate, (2-) 3.5-7 (-12) cm. long, (3 or) 4 to 7 (to 10) times as long as broad, apically and basally acute, marginally serrulate or crenulate with a small deciduous gland in each notch; staminate flowers in many-flowered bracted cymules; capsules broadly oblong, distinctly roundly 3-lobed, about 12 mm. long and about as broad, green, very hard and tough; gynobase thick and horny, triangular, each lobe about 6 mm. long; columella about 8 mm. long, triangular with 3 interocular points subterminally, stout but brittle and usually not long persistent, leaving a mere triangular nub on the gynobase; seeds ovate-oblong, 8 mm. long not including caruncle, about 6 mm. broad; caruncle subreniform, about 4-5 mm. across, white, smooth. Frequent in loose sandy soil over most of Tex. e. of the Trans-Pecos, spring-early summer; Va. to Fla., w. to La. and Tex., n. to Kan. and N.M.

2. *Stillingia texana* I. M. Johnst. Herb 2-4 (-6) dm. tall; leaf blades linear or linear-lanceolate, 3-6 (-8) cm. long, 6 to 12 (to 15) times as long as broad, apically and basally acute, marginally serrulate or crenulate and with a minute dark deciduous gland in each notch; staminate flowers in many-flowered bracted cymules; capsules broadly oblong, 3-lobed, about 6 mm. long and about as broad; gynobase thick and horny, triangular, each lobe 3-3.5 mm. long; columella about 5 mm. long, triangular, with 3 subterminal interocular points, stout but brittle and rarely persistent very long after dehiscence; seeds ovate-oblong to elliptic-oblong, about 5 mm. long not including caruncle, about 4 mm. broad; caruncle bulbous, about 1 mm. long and broad. Calcareous uplands of the Edwards Plateau and n.-cen. Tex., w. to Val Verde Co., Apr.-May (June); Okla., Tex. and Coah.

3. *Stillingia Treculiana* (Muell. Arg.) I. M. Johnst. Herb 10-45 cm. tall; leaves sessile, oblong to obovate-oblong, sometimes narrowly so, 1-3.8 cm. long, 6-15 mm. broad, about 2 to 4 times as long as broad, apically rounded to bluntly angled, basally narrowly cuneate or acuminate, marginally coarsely incised-dentate at least toward the apex; staminate flowers solitary at nodes of spike; capsules ovate-oblong, very shallowly 3-lobed, 4.5-5 mm. long, about as broad, pale-green; gynobase triangular, green, fleshy, not at all horny, the acuminate lobes pointed with each about 1.2 mm. long; columella 3.5-4 mm. long, apically enlarged with 3 points and 3 narrow wings, the column very brittle and breaking soon after dehiscence; seeds ovate-oblong, 3.4-3.8 mm. long excluding caruncle,

about 2 mm. broad, strongly narrowed in apical third of length and apiculate; caruncle meniscoid in ventral view, about 1 mm. across, whitish, fleshy, waxy, nearly smooth. Calcareous soils of Rio Grande Plains and Edwards Plateau, n. to Tom Green Co., w. to Crockett and Val Verde cos., local and infrequent, Mar.-June; Tex., Tam., Coah. and N.L.

16. RICINUS L.

A genus of one species.

1. *Ricinus communis* L. CASTOR-BEAN, FIGUERILLA. Coarse mostly glabrous annual (rarely over-wintering in the south) herb, 1-5 m. tall, usually simple-stemmed below and with numerous ascending branches above; internodes hollow, often glaucous; leaves alternate, long-petiolate, peltate, (1-) 2-6 dm. long and broad, with (5 to) 7 to 9 (to 11) deeply serrate palmate lobes; flowers in terminal gynecandrous racemelike inflorescences; sepals 5; *staminate* calyx valvate in bud; petals absent; antheriferous structures about 15 or 20 from the receptacle, each profusely branched and each ultimate branch terminating in an anther; *pistillate* sepals caduous; ovary 3-celled; the 3 styles reddish, subulate, rough, each bifurcate; cells uniovulate; capsule nearly spherical, 12-16 mm. thick, septi-cidal and then loculicidal; seeds ellipsoid, mottled, 8-11 mm. long. Cult. and rarely escaped, more commonly in the s. part of Tex., all year, especially in summer; probably nat. of Afr., now widely distributed in warmer parts of the world.

The seeds are deadly poisonous when ingested, and are the source of castor oil, formerly highly valued as a purgative and machine oil.

17. JATROPHA L.

Perennial herbs or weak low shrubs, essentially glabrous; leaves alternate or fascicled; inflorescences cymose (these so reduced in *J. dioica* that the true form is obliterated); *staminate flowers*: usually the 5 sepals coalescent at least briefly at the base; petals 5, alternate with the sepals, in some species coalescent in the lower part; glands 5, opposite the sepals; stamens (7 or) 8 to 10, in roughly 2 whorls on an androphore, the upper whorl with 5 stamens, the lower with 5 or fewer or the two whorls so close as to appear monadelphous; *pistillate flowers*: sepals 5, often partly coalescent; petals 5, often partly coalescent; bulbous glands 5, opposite the sepals; ovary subglobose, with 1 to 3 cells and 1 to 3 seeds; styles 1 to 3, when 2 or 3 then briefly coalescent basally, usually bifid apically; columella present when the cells are 3; seeds 1, 2 or 3, carunculate.

A primarily tropical genus of perhaps 200 species.

1. Leaves either entire or shallowly lobed or rarely parted into 2 or 3 entire lobes; staminate and pistillate flowers on separate plants; cymes mostly appearing lateral
.....3. *J. dioica*.

1. Leaves palmately 5- to 9-lobed, usually with each lobe serrate or shallowly lobed; staminate and pistillate flowers in the same terminal cyme (2)

2(1). Corolla red; Rio Grande Plains1. *J. cathartica*.

2. Corolla not red; Trans-Pecos grasslands2. *J. macrorhiza*.

1. *Jatropha cathartica* Teran & Berl. JICAMILLA. Perennial herb from enlarged tuber-like woody roots 3-15 (-25) cm. thick and deeply buried; stems usually (5-) 10-30 cm. tall and rather branched and spreading; leaf blades palmately and very deeply 5- to 7-lobed, (3-) 5-10 cm. long, the larger lobes laciniate marginally; petioles as long as or usually longer than the blades; inflorescence open-cymose, bisexual; *staminate flowers* usually the more distal in the cyme, the red corollas 5-8 mm. long; *pistillate flowers* usually lower on the cyme, the corollas red and caducous; styles about 1 mm. long; capsules usually 10-13 mm. long, 3-celled and 3-seeded. *J. Berlandieri* Torr. Scattered in brush on clay soil, Rio Grande Plains, spring-fall; Tex., Tam., N.L. and Coah.

2. *Jatropha macrorhiza* Benth. Perennial herb 3-8 dm. tall; roots fleshy; main stem solitary, stout; leaf blades palmately 3- or 5-lobed more than half their length, often

about 18 cm. long and 15 cm. broad or vice versa, the lobes ovate or lanceolate to oblong-lanceolate and marginally coarsely incised-serrate; *staminate flowers* usually distal in the open cymose inflorescence; calyx less than 1 cm. long; corolla whitish, about twice as long as the calyx; stamens 8 to 10, seemingly monadelphous; *pistillate flowers* nearly like the staminate but usually lower in the cyme; ovary 3-celled, triovulate; styles 3; capsules about 12 mm. long; seeds 9-10 mm. long. Rare (perhaps not persistent) in grama grasslands in Presidio Co. in the Trans-Pecos, collected once, early summer; cen. Mex. n. and n.w. to Ariz. and Tex.

3. *Jatropha dioica* Cerv. SANGRE DE DRAGO, LEATHER STEM, RUBBER-PLANT. Perennial of peculiar habit, scarcely woody (though usually described as a shrub or woody plant); rootstocks buried, orange-colored, horizontal, as much as 1 m. long or longer; stems (which are perennial) thick, fleshy, terete (folded on drying), simple or sparingly branched, rising at intervals, wandlike, 2-6 dm. tall, usually arcuate, with short lateral spurs; sap clear, astringent, on exposure to air turning reddish like blood; leaves fasciculate on the spurs, sessile, deciduous; blades spatulate or linear, widest toward the tip, occasionally palmately 2- or 3-lobed with the middle lobe longest, apically usually blunt, basally narrowed, marginally entire, 4-5 (-7) cm. long; stipules subulate-lanceolate, about 2.5 mm. long, early-deciduous; male and female flowers on separate plants; *staminate flowers* in greatly reduced cymes, appearing to be in dense terminal or axillary fascicles; bracts and sepals more or less scarious, usually entire and nonglandular; calyx 3-3.5 mm. long, silvery-puberulent without; corolla whitish, about half as long as calyx, cylindric-urceolate with recurved lobes, the reddish tube usually longer than lobes and more or less hirsute within at base; stamens regularly 10, the filaments partially united; anthers ovate to linear, often 1 mm. long or less; *pistillate flowers* in reduced often merely 1-flowered cymes; sepals herbaceous; corolla cylindric-urceolate with recurved lobes, the tube usually longer than the lobes and more or less hirsute within at base; locules of ovary and styles 1 or 2, with one ovule in each locule; styles (when 2) coherent to some extent, unequally or irregularly bilobed, the stigmas thickened and fungoid; capsules 1- or 2-locular, each locule 1-1.2 cm. thick and about 15 mm. long (thus when 2-locular the fruit is wider than long); locules apiculate and loculicidal; persistent columella absent; seeds subglobose or somewhat flattened along the ventral line, essentially smooth, brownish; hilum large and flat; caruncle minute and whitish, the rounded dorsal surface with a faint median keel. In scrub in s. and w. Tex.

Represented by two varieties:

Var. *dioica*. Leaf blades 2.5 to 6 times as long as broad, mostly 6-10 mm. wide, rarely lobed. *Mozinna spathulata* Ort. and var. *sessiliflora* Hook. Frequent in Rio Grande Plains n.w. to Val Verde Co. and n. to Bexar, Blanco and Uvalde cos.; Oax. n.w. to Dgo. and Tex.

Var. *graminea* McVaugh. Leaf blades 6 to 17 times as long as broad, mostly 1-4 mm. wide, occasionally parted into 2 or 3 lobes. Frequent in the warmer Chih. Desert of Brewster, Presidio and Jeff Davis cos. in the Trans-Pecos; Zac., Coah., Chih. and Tex.

18. CNIDOSCOLUS POHL

A tropical American genus of perhaps 50 species; rare northward.

1. *Cnidoscolus texanus* (Muell. Arg.) Small. BULL NETTLE, MALA MUJER. Perennial herb (3-) 4-5 (-10) dm. tall and diffuse, as much as 1 m. across, with milky sap and stinging hairs; roots as much as 2 dm. thick and to 1 m. long; stems several from the roots, branching underground and aboveground, 3-5 mm. thick, green, hispid with pale aciculate stinging hairs, the hairs with elongate white bases; leaves alternate; blades suborbicular in outline, 6-15 cm. broad, palmately deeply 3- to 5-lobed and palmately veined with one vein to each lobe, more or less sparsely hispid with pale aciculate stinging hairs especially along the veins; leaf lobes more than half the total length, ovate, acuminate, angulate or sinuate-dentate or again shallowly lobed; petioles a little shorter than to a little longer than their blades, hispid like the stem; petiolar glands inconspicuous at the summit of the petioles on upper surface of blade, brownish-white, papillate or fungoid, forming a mass 2-3 mm. across; stipules inconspicuous, often deciduous, 3-4 mm. long, deeply 3- or 4-toothed or in some plants only one subulate lobe developed,

the others suppressed; male and female flowers in the same cyme; inflorescences terminal (sometimes overtopped by the lateral axillary branches), cymose, pedunculate, much-branched but few-flowered, determinate, the single truly terminal flower pistillate or in some cymes the pistillate flower apparently absent; branches of inflorescence dichotomous toward the distal end, the paired ultimate branches each bearing a staminate flower with 1 to 3 minute subulate bracts subtending each flower; *staminate flowers*: buds 13-19 mm. long, clavellate; the single perianth whorl white, corollalike, showy, fragrant, bearing some aciculate stinging hairs, trumpet-shaped, the subcylindric tube 15-20 mm. long and slightly longer than the 5 (occasionally only 4) subrotate-oblong to spatulate-oblong lobes; stamens 10 (occasionally 9?), all anther-bearing, included in the perianth tube, in two whorls, the inner whorl coherent into a column, the outer whorl distinct to the base and basally villous, a little longer than the perianth tube; *pistillate flowers*: single perianth whorl whitish, 10-17 mm. long, 5-parted essentially to the base; sepals acuminate, not coherent, falling soon after anthesis; ovary oblong or obovate, slightly 3-lobed, 3-celled and triovulate, hirtellous above, very densely hispid with pale-brownish aciculate stinging hairs; styles 3, shortly coherent basally, about 3 times dichotomous, the ends slender; capsules oblong, 15-20 mm. long, hispid; columella prominent, persistent, white, with 3 narrow pectinate-fimbriate wings; seeds 3, oblong, rounded dorsally, very slightly keeled ventrally, 14-18 mm. long, slightly lobed basally, apiculate, surficially smooth, brownish-white; caruncle prominent, sagittate, 3-4 mm. long, yellowish-white. Sandy often disturbed soils nearly throughout Tex., w. to Ward and Crane cos., May-Nov.; La., Okla., Ark., Tex. and Tam.

19. MANIHOT MILL.¹¹⁸

A genus of more than 150 species of the warmer parts of the New World tropics, of which we have only one. The genus is economically important in that *M. esculenta* Crantz (yuca, cassava, mandioca, manioc, etc.) is a root crop grown in most of the world's lowland tropics, and several minor rubber-bearing species are exploited in Brazil. *Janipha* H.B.K.

1. *Manihot Walkerae* Croizat. Perennial herb with very strong odor of HCN in all parts; roots tuberous, carrot-shaped, with large white fleshy storage parenchyma; stems herbaceous, mostly prostrate, dying back to root crown in dry season; leaves alternate, simple, deeply 5-lobed (sometimes 3- or 7-lobed), pandurate to halberd-shaped, the lower 2 smaller lobes of the fully developed vegetative leaves frequently projecting at a sharp angle downward, the median lobe 2-5 cm. long; flowers in androgynous racemes; staminate flowers opening later than pistillate ones, borne in a simple raceme, the pistillate flowers most often on single peduncles arising at base of staminate raceme, the perianth of a single row of tepals; *staminate flowers* tubular, gibbous at base; tepals 6-10 mm. long, united half their length; stamens 6 or 8 in 2 whorls of shorter and longer; slender filaments arising between the lobes of a circular disk; anthers versatile; *pistillate flowers* with 5 separate strap-shaped tepals 5-8 mm. long; stigmas 3, many-branched, on very short styles; ovary 3-locular, inserted above a circular disk; fruit a dry dehiscent capsule; seeds 3, carunculate. Rare on caliche cuestas near the Rio Grande in extreme s. Tex. (Hidalgo Co.), Apr.-Sept., following rains; also Tam.

A vigorous colony has been transplanted to the campus of The University of Texas at Austin on the south side of Biology Laboratories. Nearest relative is *M. angustiloba* (Torr.) Muell. Arg. from which it differs in broader leaf lobes, numbers of stamens (10 in *M. angustiloba*), in distribution and habitat.

20. EUPHORBIA L. SPURGE

Herbs with milky sap, very diverse in vestiture, phyllotaxy and branching; flowers borne in bisexual groups, the pedicels either included in or exerted from small cup-shaped or urn-shaped calyxlike involucre (the individual bracts of which are not discern-

¹¹⁸ Contributed by David J. Rogers.

ible except as lobes at the rim), often with one or more glands attached to the top of the involucre between the lobes and near the rim, the glands often furnished with "horns" (i.e., pointed appendages, one at each end of the gland) or petaloid appendages; *staminate flowers* each consisting of a single naked stamen, few to many in groups or cymules within the involucre; *pistillate flower* solitary, central in each cyathium and often long-exserted from it, lacking a recognizable perianth, with a 3-celled 3-ovulate ovary; styles 3, each usually bifid; seeds 3, one in each cell. *Tithymalus* Trew; *Poinsettia* Grah.; *Agaloma* Raf.; *Chamaesyce* S. F. Gray.

An enormous genus with species in all the tropical and temperate parts of the world. The genus is reputed to be difficult taxonomically but our species offer no great problems of determination. Complete specimens, with roots and mature seeds, can easily be determined.

1. Glands of the involucre without petaloid appendages (some species with hornlike appendages on the glands); leaves alternate or opposite; leaf blades (at least those of the main stem) essentially bilaterally symmetrical (subg. *Poinsettia* and *Esula*) (2)
1. Glands of the involucre with petaloid appendages (in one species these several and folded over the gland), OR if appendages absent then leaves all strictly opposite and with inequilateral bases (blades then not bilaterally symmetrical) (subg. *Agaloma* and *Chamaesyce*) (13)
- 2(1). Involucral glands flat or convex; leaves mostly alternate on the main stem or (if opposite) decussate, also forming a single whorl just beneath the inflorescence which is an umbelliform cyme (pleiochasium), also opposite above at the pseudo-dichotomies of the branches of the pleiochasium; glands 4 or 5 per cyathium (subg. *Esula*) (3)
2. Involucral glands deeply cupped; stems never branched into a symmetrical 3- to several-rayed inflorescence; glands only 1 to 3 per cyathium (subg. *Poinsettia*) (10)
- 3(2). Glands of the involucre with rotund and entire margins (4)
3. Glands of the involucre either with a horn at each end or semilunate with the concave side and the points outward (5)
- 4(3). Main branches of the main pleiochasium 5; capsules never warty 8. *E. Helioscopia*.
4. Main branches of the main pleiochasium 3; capsules usually warty (smooth in one rare form) 7. *E. spathulata*.
- 5(3). Seeds quite completely smooth, whitish, ovoid 2. *E. Helleri*.
5. Seeds with pits or depressions (or if minutely tuberculate see *E. exigua* under *E. Peplidion*) (6)
- 6(5). Pits of seeds in regular rows (at least on the 2 ventral facets) or with a single long vertical pit on each ventral facet (7)
6. Pits of seeds irregularly disposed, at least nowhere in distinct vertical rows (8)
- 7(6). Each ventral facet of the seed with a single long depression 3. *E. Peplidion*.
7. Each ventral facet of the seed with a vertical row of smaller pits 4. *E. tetrapora*.
- 8(6). Strong perennial; west Texas east to Edwards Plateau 1. *E. brachycera*.
8. Slenderly taprooted annuals (9)
- 9(8). Seeds with small deep pits; opposite leaves of the pleiochasial branches only very slightly connate basally 5. *E. longicuris*.
9. Seeds with broad pits and ridges between; opposite leaves of the pleiochasial branches connate to the middle 6. *E. Roemeriana*.

- 10(2). Rather humble perennial from tuberous roots; stems several; cyathia in compact terminal cymes subtended by discolored floral leaves, the flowering stems otherwise bearing only bractlike leaves, the leafy shoots appearing in summer after the vernal flowering; capsules usually longer than 5 mm. 21. *E. radians*.
10. Stems solitary from annual taproots; shoots not dimorphic; capsules shorter than 5 mm. (11)
- 11(10). Leaves mostly opposite; seeds mostly 2.6-2.8 (-3.1) mm. long 22. *E. dentata*.
11. Leaves alternate between the first or second pair of leaves and those at the top of the plant; seeds mostly (2.7-) 3-3.5 mm. long (12)
- 12(11). Gland and its opening (depression) at top oblong, about 1 mm. long, shallowly bilabiate; seeds not strongly angular in transection .. 23. *E. cyathophora*.
12. Gland and its opening (depression) on top circular, much less than 1 mm. long, not bilabiate; seeds in transection showing a dorsal keel and 2 lateral angles 24. *E. heterophylla*.
- 13(1). Robust annual herbs to 1 m. tall, with single main stem and a few short pseudodichotomous branches at top; leaves alternate, the uppermost (near the flowers) with thin white margins (14)
13. Plants various, usually much less than 1 m. tall; leaves in most species opposite, never white-margined (15)
- 14(13). The white-margined bracteal leaves at top of plant narrowly lanceolate 12. *E. marginata*.
14. White-margined bracteal leaves at top of plant linear .. 13. *E. bicolor*.
- 15(13). Strongly perennial plants, caespitose, with numerous essentially leafless glaucous fleshy branches 2-5 (-10) dm. long and 2-4 mm. thick rising erect from the woody horizontal primary stems 9. *E. antisiphilitica*.
15. Plants various, when many-branched from a woody base then the branches comparatively slender and/or leafy; leaves in most species opposite (16)
- 16(15). Stipules glandlike or obsolete; leaf blades symmetrical; branching at the top of the plant usually pseudodichotomous, with cyathia borne in the forks (17)
16. Stipules well-developed for the most part (at least on one side of the stem) or if stipules poorly developed then blades asymmetrical and their bases inequilateral (subg. *Chamaesyce*) (27)
- 17(16). Appendages 2 or several per gland (actually solitary and deeply parted to the base); erect nearly glabrous annual herbs with subentire linear leaves (18)
17. Appendages solitary per gland, if deeply lobed then the leaves serrulate (19)
- 18(17). Glands more than 3 per cyathium (usually 5); appendages 2 per gland (solitary and deeply bifid); main stem 0.5-2.5 mm. thick ... 17. *E. bilobata*.
18. Glands usually only 3 per cyathium; appendages 5 to 7 per gland, linear, hairy, folded upward and inward covering the gland; main stem 3-12 mm. thick 18. *E. eriantha*.
- 19(17). Leaf blades ovate, the margins serrulate to the rounded or truncate base; petioles nearly as long as blades; slender erect annual herb 14. *E. bifurcata*.
19. Leaf blades linear to linear-lanceolate OR if ovate then much longer than the petioles (20)
- 20(19). Taprooted annual herbs, single-stemmed from the base (21)
20. Perennials, usually with more than one stem at ground level (22)

- 21(20). Plant usually not more than 2 dm. tall; leaves usually manifestly serrate; seeds 2.2-2.9 mm. long, with 2 broad tuberculate transverse ridges and a slight widening at the narrow apical end, with rounded protuberances at the intersections of the ridges and longitudinal angles15. *E. exstipulata*.
21. Plant usually 3-10 dm. tall; leaves usually not manifestly serrate; seeds ovoid, not angular, about 3 mm. long, with low bumps scattered all over the surface
.....16. *E. hexagona*.
- 22(20). Leaves about as broad as long to twice as long as broad, blunt; stems usually prostrate on coastal sands20. *E. innocua*.
22. Leaves more than twice as long as broad; stems mostly ascending (23)
- 23(22). Stems (at least the younger parts) usually densely white-pubescent; leaf blades ovate, widest near the base, sharp-pointed, mostly less than 5 times as long as broad; plants mostly less than 2 dm. tall; petaloid appendages usually present and often crenate25. *E. acuta*.
23. Stems if pubescent minutely so; character combination otherwise differing (24)
- 24(23). Seed 2.3-2.5 mm. long; appendages of glands 1.5-4 mm. long, much longer than the gland is broad; plants usually in sandy soils of eastern half of Texas
.....19. *E. corollata*.
24. Plants not with above combination of characters, mostly of calcareous or sandy uplands of western half of Texas (25)
- 25(24). Spring (lowermost) leaves deciduous but when present oblong and shorter and much broader than summer leaves that are linear; perennial underground parts mostly less than 5 mm. thick; involucre sessile or the peduncles rarely more than 3 mm. long26. *E. angusta*.
25. Spring and summer leaves linear or linear-filiform; perennial underground parts usually more than 5 mm. thick; peduncles slender, 3-8 mm. long or longer (26)
- 26(25). Opposite or whorled leaves at top of plant longer than the subtended peduncles10. *E. Wrightii*.
26. Opposite or whorled leaves at top of plant shorter than the subtended peduncles ...
.....11. *E. strictior*.
- 27(16). The 3 styles very short (about 0.5 mm.) and abruptly and thickly round-capitate, not bifid; low perennials, all glabrous; stipules united into short scales (28)
27. The 3 styles bifid OR if appearing entire then not abruptly thickly round-capitate; plants various in habit and pubescence (29)
- 28(27). Appendages forming a narrow entire margin on the gland; leaves often appearing clasping; plants glaucous or grayish-green49. *E. astyla*.
28. Appendage deeply dissected and lobed; leaves short-petiolate; plants drying dull-greenish or brownish48. *E. jejuna*.
- 29(27). Appendages deeply parted, lobed or dissected at least halfway to the gland (30)
29. Appendages entire, lacerate, undulate or crenulate but not parted more than halfway to the gland OR appendages absent (31)
- 30(29). Glabrous perennial; each of the 4 appendages parted to the base into 3 or 4 (to 6) narrow linear segments47. *E. Fendleri* var. *triligulata*.
30. Plants short-lived (probably annual); herbage and capsules shaggy or villous; each of the 4 appendages parted into 3 to 5 narrow attenuate lobes
.....53. *E. setiloba*.
- 31(29). Appendages markedly unequal on each involucre, the 2 nearest the ovary at least twice (usually 3 to 5 times) as long as the other 2 appendages; prostrate annual57. *E. indivisa*.
31. Appendages subequal or absent (32)

- 32(31). On each side of the stem the 2 stipules at each node united into a white or reddish-white membranous glabrous scale which may be either entire or lacerate; plants commonly rooted at the lower nodes (33)
32. Stipules otherwise or if seeming united into a scale then only so on one side of the stem OR the entire structure deeply lobed or dissected; plants only rarely rooted at the lower nodes (34)
- 33(32). Annual; staminate flowers fewer than 12 per involucre51. *E. serpens*.
33. Perennial; staminate flowers more than 12 per involucre50. *E. albomarginata*.
- 34(32). Plants essentially glabrous, including the herbage, inflorescence, ovaries and capsules (sometimes the stipules ciliate or the inside of the involucre may be beset with hairs) (35)
34. Plants with some pubescence on herbage or inflorescence or both (52)
- 35(34). Leaves linear, more than 6 times as long as broad; plants annual; leaf margins entire (36)
35. Leaves not linear OR if narrow then serrulate OR less than 6 times as long as broad; plants various (38)
- 36(35). Capsules shorter than 1.7 mm.; delicate erect annual, the stems mostly less than 1 mm. thick and the plants less than 2 dm. tall; seeds with 1 to 3 transverse ridges33. *E. revoluta*.
36. Capsules longer than 1.8 mm.; stems rather robust, often at least 1 mm. thick; seeds plump and smooth (37)
- 37(36). Petaloid appendages forming narrow margins on the glands and usually more or less ascending; stems usually spreading, prostrate .31. *E. Parryi*.
37. Petaloid appendages mostly longer than the glands are wide, ovate, conspicuous, more or less spreading; stems usually erect or ascending32. *E. missurica*.
- 38(35). Capsules longer than 2.8 mm. (mostly 3 or 5 mm. long); plants robust; larger leaves usually longer than 1 cm.; leaf margins entire (39)
38. Capsules shorter than 2.8 mm. long (usually much shorter); most leaves shorter than 1 cm. OR if most leaves longer than 1 cm. then the margins serrate or serrulate (40)
- 39(38). Strong perennial; stems apparently not prostrate; leaves usually about 1 cm. long with blunt apices; capsules about 3 mm. long at maturity; seeds not laterally compressed46. *E. perennans*.
39. Robust annual with spreading prostrate stems; leaves usually about 15 mm. long and pointed; capsules about 5 mm. long at maturity; seeds laterally compressed28. *E. carunculata*.
- 40(38). Leaves mostly serrate or serrulate at least toward the apex; annuals (41)
40. Leaves entire as seen under a lens (45)
- 41(40). Capsules about 1.3 mm. long; cyathia densely glomerulate; erect or ascending herbs of extreme south Texas36. *E. hypericifolia*.
41. Capsules mostly longer or if approaching as short as 1.4 mm. long then cyathia not glomerulate (42)
- 42(41). Erect annuals, comparatively robust, with most mature leaves more than 15 mm. long; capsules 1.6-2.3 mm. long, mostly more than 1.8 mm. long (43)
42. Usually prostrate or decumbent annuals with most mature leaves less than 15 mm. long; capsules 1.4-1.9 mm. long, mostly less than 1.8 mm. long (44)
- 43(42). Seeds finely wrinkled35. *E. nutans*.
43. Seeds with 2 or 3 broad very shallow depressions separated by low smooth transverse ridges34. *E. hyssoipifolia*.

- 44(42). Seeds sometimes with shallow transverse rugae but these faint; stems (at least toward the tips) often "winged" (flattened somewhat in the plane of the leaves); staminate flowers more than 5 per involucre40. *E. serpyllifolia*.
44. Seeds with definite transverse ridges or corrugated; stems not noticeably flattened; staminate flowers usually about 4 or 5 per involucre41. *E. glyptosperma*.
- 45(40). Seeds with 3 or 4 strong transverse ridges; appendages small or absent; capsules 1.2-1.5 mm. long; stems not flattened toward the tips; plants annual; staminate flowers more than 20 per involucre42. *E. theriaca*.
45. Seeds smooth or wrinkled but without ridges (46)
- 46(45). Capsules shorter than 1.7 mm.; glands without appendages or with but very small ones; seeds shorter than 1.3 mm. (47)
46. Capsules longer than 1.7 mm. OR if shorter then appendages developed; seeds longer than 1.3 mm. (48)
- 47(46). Perennial (or at least often becoming ligneous at base by the end of the winter); staminate flowers more than 10 per involucre45. *E. stimulans*.
47. Annual; staminate flowers fewer than 10 per involucre, usually only 2 to 544. *E. micromera*.
- 48(46). Seeds smooth and plump (49)
48. Seeds often wrinkled or if smooth then slender, not plump (50)
- 49(48). Leaf blades about 3 times as long as broad; style branches usually slightly thicker than the united portion; plants of Coastal Plain within 100 miles of the coast29. *E. ammannioides*.
49. Leaf blades usually about twice as long as broad; style branches about as thick as the united portion; distributed farther inland, rare within 100 miles of the coast ..30. *E. Geyeri*.
- 50(48). Stipules parted into numerous filiform segments; sands of east and southeast Texas52. *E. cordifolia*.
50. Stipules mostly linear; dry uplands of central and west Texas (51)
- 51(50). Taprooted annual; leaves apically rounded; petioles 1-2 mm. long43. *E. Golondrina*.
51. Perennial herb; leaves apically acute; petioles 0.5-1 mm. long47. *E. Fendleri*.
- 52(34). Ovary and capsule glabrous (53)
52. Ovary and capsule not glabrous (58)
- 53(52). Robust erect annuals with serrate leaves; most mature leaves longer than 15 mm.; capsules 1.6-2.3 mm. long, most of them more than 1.8 mm.; seeds with wrinkles or low ridges (54)
53. Comparatively humble annuals or perennials; leaves various but all shorter than 15 mm.; capsules mostly shorter than 1.8 mm. or if longer then the seeds usually smooth (55)
- 54(53). Stems usually crisply hairy at least toward the tips, rarely pilose; seeds finely wrinkled35. *E. nutans*.
54. Stems pilose (sometimes sparingly so); seeds with broad very shallow depressions separated by low smooth ridges34. *E. hyssopifolia*.
- 55(53). Annual or perennial, usually erect; stems pilose; capsules deeply 3-lobed, 1.3-1.9 mm. long; leaf margins entire to coarsely serrate; seeds smooth or faintly wrinkled, not transversely ridged55. *E. villifera*.
55. Annuals; stems usually decumbent or prostrate; capsules not deeply 3-lobed but merely tricocous, usually triangular in transection (56)
- 56(55). Stems pilose; leaf margins sharply serrulate; capsules longer than 2 mm.; seeds quite smooth, sharply angled, pale-brownish to chalky-white56. *E. serrula*.
56. Pubescence of stems (if any) short; capsules shorter than 2 mm.; staminate flowers usually only 5 per cyathium (57)

- 57(56). Capsules about 1.3 mm. long, all shorter than 1.6 mm.; leaf margins entire; seeds smooth or faintly wrinkled44. *E. micromera*.
57. Capsules 1.4-1.7 mm. long; leaf margins serrulate at least toward the apex; seeds transversely ridged (here will key out unusual individuals of this species of usually glabrous plants)41. *E. glyptosperma*.
- 58(52). Capsules 2.8-3.1 mm. long; strong perennial, erect or ascending, mostly less than 2 dm. tall; leaves ovate or ovate-lanceolate, widest near the base, 1-2 cm. long, sharp-pointed, the margins entire; appendages usually developed and usually distinctly crenate25. *E. acuta*.
58. Capsules shorter than 2.6 mm. OR if about 2.6 mm. long then plants not as above (59)
- 59(58). Perennial, erect; spring (lowermost) leaves when still present oblong, shorter and broader than summer leaves that are linear, at least 6 or 7 times as long as broad, the margins entire; capsules 2-2.6 mm. long; appendages usually developed26. *E. angusta*.
59. Plants various; leaves not linear OR if almost so then capsule almost 2.5 mm. long (60)
- 60(59). Perennial by slender rootstocks; shoots ascending or erect, mostly less than 2 dm. tall; spring leaves broader than summer leaves; blades ovate-deltoid-falcate to long-deltoid or virtually linear by revolution of the entire margins, shorter than 12 mm., blunt; capsules 1.9-2.3 mm. long27. *E. lata*.
60. Plant various; capsules 2 mm. long or shorter (61)
- 61(60). Perennial, the stems prostrate or ascending; involucre borne in dense cymose glomerules or a few of them in addition sometimes solitary in the upper forks; leaves relatively large, 7-15 mm. long, the margins sometimes with a few teeth; capsules 1.3-2 mm. long; appendages usually developed; Trans-Pecos plants38. *E. pycnanthema*.
61. Plants not having the above combination of characters (62)
- 62(61). Ascending taprooted annual; cyathia very small and numerous, borne in very dense essentially leafless stalked glomerules from upper axils of the usually rhombic leaves; rare weed of southern coastal Texas37. *E. hirta*.
62. Plants not with the above combination of characters (63)
- 63(62). Pubescence of stems and capsule short, not shaggy or villous; leaf margins entire; appendages small or absent; facets of seeds essentially smooth, at least without transverse rugae (64)
63. Pubescence of stems shaggy or villous or pilose and that of the capsules somewhat similar (65)
- 64(63). Perennial; stems rather densely clothed with crisped short mostly appressed hairs; lower surfaces of leaves often closely tomentose; entire plant taking on to some extent the grayish color of the vestiture39. *E. cinerascens*.
64. Annual; pubescence short and sparse44. *E. micromera*.
- 65(63). Perennial; stems villous or pilose, the hairs appearing clavellate or glandular at times under a lens; leaf margins entire; appendages usually well-developed; capsules about 1.5 mm. long; involucre narrowly urceolate54. *E. arizonica*.
65. Annuals; stems usually prostrate and "shaggy" pubescent or villous; leaf margins usually serrate or serrulate; appendages present but often very small; involucre obconical (66)
- 66(65). Seeds punctately pitted and mottled, the base depressed-truncate, the apex sharply acute; styles entire (sometimes emarginate)60. *E. stictospora*.
66. Seeds neither punctately pitted nor mottled, the base obtuse, the apex not sharply acute; styles bifid at least briefly (67)

- 67(66). Seeds with low rounded transverse ridges not whitened on the summit or with merely granular surfaces; capsules strigose (68)
67. Seeds with narrow sharp transverse ridges or rounded transverse ridges whitened on the summit; capsules tomentose or with crisped spreading hairs (69)
- 68(67). Styles about 0.3 (-0.4) mm. long, clavate; nodes never rooting 58. *E. maculata*.
68. Styles 0.5-0.7 mm. long, slender; nodes often rooting .. 59. *E. humistrata*.
- 69(67). Herbage grayish-pilose-tomentose; seeds 1.1-1.3 mm. long, the rounded ridges about the same width as the intervening valleys 62. *E. laredana*.
69. Herbage green or greenish, less densely pubescent to subglabrous; seeds 0.9-1 mm. long, the minute sharp ridges narrower than the intervening valleys 61. *E. prostrata*.

1. *Euphorbia brachycera* Engelm. Mostly glabrous perennial herb 1-6 dm. tall; main stems 6 to many from the woody crown, 1-2.5 mm. thick, erect, 7-45 cm. long; branches mostly from the upper half of main stems; main stems and branches each topped by a whorl of 3 branches (forming a pleiochasium) that are repeatedly pseudodichotomous, divergent, forming the upper sixth to third of the plant; leaves of the stems and branches alternate, at the bases of the pleiochasia whorled, at the forks of the pleiochasia opposite; alternate leaf blades elliptic-oblong to lanceolate or oblanceolate to even obovate, 5-20 mm. long, (2 or) 3 to 4 (or 5) times as long as broad, at apex usually acute, at base attenuate or rounded, marginally entire, with petioles less than 1 mm. long; whorled leaves with rhombic-deltoid to ovate blades 5-15 mm. long, at apex acute, marginally entire, with petioles less than 1 mm. long; opposite leaves rhombic-deltoid, at base truncate or broadly rounded, at apex acute, marginally entire, essentially sessile; stipules absent; cyathia solitary in the forks of the pleiochasia; peduncles shorter than 1 mm.; involucre turbinate to slightly campanulate, 1-2 mm. long to base of glands; glands 4, stalked, yellow, glabrous, about 0.5 mm. long, the ends protruding outward as short horns, the margin between the horns entire or dentate; appendages absent; *staminate flowers* several per cyathium; *pistillate flower*: gynophore well-exserted from the involucre, recurved at maturity; styles 3, erect, bifid half their length, about 1 mm. long, the stigmas clavate or subcapitate; capsule 2-3 mm. long, 3-lobed or often 1- or 2-lobed by abortion, smooth; columella about 2.1 mm. long; seed smoothly round-ovoid, 1.8-2.6 mm. long, grayish with irregular fuscous shallow pitting throughout except on the ventral micropylar beveled caruncular surface; caruncle about 0.5 mm. long, rounded-conic. Incl. *E. montana* Engelm. var. *gracillior* Engelm. and var. *trifaris* Nort., *E. odontadenia* Boiss., *Tithymalus brachycerus* (Engelm.) Small. Frequent in Trans-Pecos mts. at elev. of 4,500 to 7,000 ft. and infrequent or rare near creeks in the Edwards Plateau, Mar.-July; Colo., N.M., Ut., Ariz., Tex. and Chih.

2. *Euphorbia Helleri* Millsp. Taprooted glabrous annual (5-) 10-30 cm. tall; stems several (rarely solitary) from ground level, ascending, with few ascending alternate branches about equaling the main stem, at the base of the pleiochasium pseudotrichotomous (rarely pseudodichotomous) above which all the branching is sparse and pseudodichotomous; leaves of main stem alternate, spatulate, 6-15 mm. long, 3-5 mm. broad, obtuse or retuse, narrowed basally, the lowest ones with petioles 1-3 mm. long; leaves at base of pleiochasium in a whorl of 3 (rarely opposite), oblong or cuneate-oblong; leaves of the branches opposite, orbicular-ovate to nearly reniform, subpandurate, unequal, obtuse, mucronate, broadly cuneate to truncate basally, 3-8 mm. long, 5-10 mm. broad; stipules absent or minute and glandlike; cyathia solitary in the upper forks; involucre about 1 mm. long, the incurved lobes ovate, truncate and ciliate; glands 4, transversely elliptical, about twice as long as broad, at each end with a small whitish curved horn about half as long as the body of the gland, other appendages absent; *staminate flowers* about 10 per cyathium; *pistillate flowers*: ovary well-exserted; styles 3, bifid, the branches clavellate; capsule depressed-globose, 2.5 mm. long, 3 mm. broad, tricocous; seeds ovoid, whitish, quite smooth, 1.4-1.6 mm. long, 1-1.2 mm. broad and thick; caruncle thin but raised into a cone at the center. *Tithymalus Helleri* (Millsp.) Small. Rare and local in clay loam or calcareous soil, coastal s. Tex., Nueces and Cameron cos., Feb.-Mar.; also N.L.

3. *Euphorbia Peplidion* Engelm. Glabrous annual herb 5-20 cm. tall; stems 1 to several from the base, 1-2 mm. thick, erect, (3-) 6-10 (-14) cm. long; branches few, alternate, more slender than main stem, erect, attaining nearly the same height as main stem; main stem and branches each topped by a whorl of 3 (or 4, rarely 5) branches (forming a pleiochasium) which are repeatedly pseudodichotomously branched, divergent and forming the upper third of the plant; leaves of the stem and branches alternate, whorled at the bases of the pleiochasia, opposite at the nodes of the pleiochasial branches, all sessile; blades of stem- and branch-leaves linear-oblongate or narrowly spatulate, 5-20 mm. long, 1-4 mm. wide, at apex rounded, at base attenuate, marginally entire, without stipules; whorled leaves narrowly rhombic-lanceolate, 8-15 mm. long, rounded apically and basally; opposite leaves narrowly deltoid-lanceolate, asymmetrically falcate, 6-10 mm. long, acute at apex, marginally entire or somewhat erose, without stipules; cyathia solitary in the forks of the pleiochasia; peduncles short; involucre broadly turbinate or usually campanulate, 0.6-0.9 mm. long to base of glands, whitish; glands 4, short-stalked, oblong with a long white erect horn at each end, marginally smooth, 0.5 mm. long, 0.2 mm. wide, other appendages absent; *staminate flowers* 5 to 10 per cyathium; *pistillate flower*: gynophore about 2 to 3 times as long as the involucre at maturity, erect or usually curved; styles 3, 0.5 mm. long, bifid nearly to the base, erect or spreading; stigmas capitellate; capsule depressed, deeply 3-lobed, 2-2.3 mm. long, about 3 mm. broad, smooth, the lobes rounded or flattened or rarely even slightly round-keeled; columella 1.7-1.9 mm. long; seed oblong, 1.6-1.9 mm. long, 0.9 mm. thick, subhexagonal, brownish, the angles rounded, with 4 or 5 vertical rows of pits or depressions visible from the dorsum (2 or 3 pits per row) and the 2 ventral facets each with a single vertically elongate pit or depression; caruncle situated on a ventral micropylar beveled surface, flat, umbonate, bilobed, vesicular, rather small. *Tithymalus Peplidion* (Engelm.) Small. Calcareous soil, rare and local, in Trans-Pecos (Pecos Co.), Edwards Plateau (Tom Green, Uvalde and Val Verde cos.) and Rio Grande Plains (Jim Wells and Duval cos.), spring; endemic.

Plants with a rather similar superficial appearance to *E. Peplidion* but with seeds tuberculate all over are *E. exigua* L., collected once in Nueces Co. (adventive from Old World); probably not a persistent member of our flora.

4. *Euphorbia tetrapora* Engelm. Delicate taprooted annual 7-20 cm. tall; main stem solitary or 2 or 3 from the base, usually nearly simple below the pleiochasium, with internodes a half to a third as long as the leaves; pleiochasium trichotomous at the base, the 3 branches 1-8 cm. long, several times dichotomous when longer than 2 cm.; stem leaves alternate, cuneate-spatulate, apically retuse or obcordate, the lower ones 3 mm. long and 1 mm. broad and with short petioles, the higher ones about 1 cm. long and 5 mm. broad and nearly sessile; leaves at base of pleiochasium in a whorl of three, more obovate than the stem leaves; leaves of branches opposite, triangular-ovate, mucronate, truncate or cordate at the base, basally subconnate, 3-6 (-10) mm. long, 5-8 (-14) mm. broad; stipules absent or minute and glandlike; cyathia solitary in the upper forks; involucre about 1 mm. high and broad; lobes ovate, shortly ciliate; glands 4, about 1 mm. long and 0.5 mm. broad, transversely oblong, short-stipitate, on each end with a slender horn 1 mm. long and diverging or usually erect, other appendages absent; *staminate flowers* 10 to 15 per cyathium; *pistillate flowers*: ovary long-exserted; styles 3, 0.5-1 mm. long, united at base, short-bifid apically, the branches capitellate; capsule subglobose, about 2.5 mm. thick, roundly tricocous; seeds oblong, slightly dorsiventrally flattened, 1.3-1.4 mm. long, 0.8-0.9 mm. broad, 0.7 mm. thick, each of the 2 inner facets with 4 to 6 shallow pits or these rarely confluent into irregular oblong grooves, the dorsum with 15 to 20 irregularly arranged shallow pits or almost smooth; caruncle with a dome-shaped umbo in the center. *Tithymalus tetraporus* (Engelm.) Small. Local in sandy soils, e. and n.-cen. Tex., rare in Llano region of Edwards Plateau, spring; Ga., Ala., La., Ark., Okla. and Tex.

5. *Euphorbia longicruris* Scheele. Taprooted delicate annual 5-20 (-25) cm. tall; main stem simple below the pleiochasium with internodes 2-6 mm. long, giving way upward to a trichotomy and above that the 3 branches 1-3 cm. long and repeatedly dichotomous with very short internodes; stem leaves alternate, cuneate-spatulate below to obovate above, 5-15 mm. long, 2-6 mm. broad, at apex mucronate, obtuse to retuse, at

base narrowed, marginally entire, the very short petioles present only on the lowest leaves and stipules absent or minute and glandlike; leaves of pleiochasium whorled at base, opposite on branches, overlapping, reniform or suborbicular, 4-7 mm. long, 7-13 mm. broad, slightly connate and very inequilateral basally; cyathia solitary in the forks of the pleiochasium; involucre 1.5-2 mm. long, 1-1.5 mm. thick, its lobes oblong, minutely ciliate; glands 4, crescent-shaped, on each end with an erect rarely lobed horn twice as long as the body is broad; appendages absent; *staminate flowers* 10 to 15 per cyathium; *pistillate flower*: styles 3, about 0.5 mm. long, bifid; capsule, ovoid-spherical, depressed basally, about 2.5 mm. long, 2.5-3 mm. thick; seeds oblong in outline, slightly dorsiventrally flattened, about 1.5 mm. long and 1 mm. broad and thick, with a slightly dorsal ridge and a prominent projection from the chalaza and surficially with numerous pits the diameter of which is less than half the width of the space between them; caruncle small, depressed-conical, umbonate. *Tithymalus longicruris* (Scheele) Small. Infrequent and local in calcareous soil, Edwards Plateau, n.-cen. Tex. and e. part of Plains Country, spring; Tex., Okla. and N.L.

6. *Euphorbia Roemeriana* Scheele. Taprooted annual 1-3 dm. tall; main stem 1 or few, erect (in shade forms weak and basally decumbent), sparingly branched below the pleiochasium; internodes much shorter than the leaves; pleiochasium trichotomous basally, each branch 1 to 4 times dichotomous and with internodes 2-10 mm. long; leaves of main stems alternate, the blades cuneate, the lower ones obtuse apically and 3-10 mm. long and 1-5 mm. broad with petioles 1-6 mm. long, the upper ones to 2 cm. long and 1 cm. broad and nearly sessile; leaves at base of pleiochasium whorled, ovate to oblong, very obtuse, 1-2 cm. long or longer, 5-10 mm. broad or more; leaves of the pleiochasial branches opposite, semicircular, connate to the middle, 1-2 cm. broad, 7-10 mm. long; cyathia solitary in the upper forks; involucre campanulate, 1.5-2 mm. high, its lobes broadly oblong and minutely ciliate; glands 1 mm. long and broad including the horns, at each end with a slender horn shorter than the width of the body, usually incurved; appendages absent; *staminate flowers* about 10 per cyathium; *pistillate flowers*: ovary long-exserted; styles 1.5 mm. long, bifid a third to a fourth the length; capsule subglobose, about 3 mm. thick; seeds oblong-ovoid, somewhat dorsiventrally flattened, 1.6-1.8 mm. long, 1.4-1.5 mm. broad, about 0.9 mm. thick, rather deeply and broadly pitted, the chalazal projection prominent; caruncle small, low, conical, umbonate. *Tithymalus Roemerianus* (Scheele) Small. Locally abundant in rich calcareous soil, creek canyons, e. part of Edwards Plateau, spring; endemic.

This is the southern counterpart of *E. commutata* Engelm. and probably should be considered merely a race of it; reports of the occurrence of *E. commutata* in Texas have been based on specimens of *E. Roemeriana*.

7. *Euphorbia spathulata* Lam. Glabrous annual herb 5-40 cm. tall; main stems 1 to 3 (or 4 or 5) from the base, rarely as many as 10, 1-4 mm. thick, erect, 5-30 cm. long; branches few basally, many in the upper half, alternate, more slender than the main stems, ascending to erect, attaining about the same height as the main stems; stems and branches of the pleiochasium 3 in a whorl, repeatedly pseudodichotomous, several cm. long (very variable and apparently indeterminate); leaves alternate on stems and branches except opposite at the forks of the pleiochasia and whorled at the bases of the pleiochasia, all sessile; leaf blades of stems and branches obovate-oblong, widest above the middle, rounded at both ends or tapering to the base, obtuse to emarginate at apex, 10-25 mm. long, 5-10 mm. broad, marginally serrulate at least on the upper half, with stipules apparently absent; leaf blades of the pleiochasial branches broadly elliptical to ovate, rounded at the base and rounded or acute at apex, usually serrulate toward the apex, 3-9 mm. long, with no stipules; cyathia solitary and sessile in the forks of the pleiochasia; involucre narrowly turbinate, about 1 mm. long or less; glands usually 4, sessile, glabrous, minute, elliptical; appendages and horns absent; *staminate flowers* several per cyathium; *pistillate flower*: gynophore not exserted, erect at maturity; ovary warty at summit; styles 3, bifid nearly to the middle, erect or spreading, about 1 mm. long, the divisions terete; capsule 3-lobed, 1.5-3 mm. long, smooth except for many warts near apex and along lobes (or these rarely absent!); columella well-developed, 1.2 mm. long; seed roundish-ovoid, slightly dorsiventrally flattened, brown, 1.3-1.9 mm. long including caruncle, with low sharp irregularly reticulate ridges throughout; caruncle

white, minute, obscurely cordate, vesicular. *E. obtusata* Pursh, *E. dictyosperma* Fisch. & Mey. and vars. *mexicana* Engelm. and *leiococca* Engelm., *E. arkansana* Engelm. & Gray. Abundant nearly throughout Tex., spring; widespread in temp. N.A.

8. *Euphorbia Helioscopia* L. Taprooted annual 1-3 dm. tall, the single main stem (1-) 3-6 mm. thick, slightly swollen just below the pleiochasium, sometimes sparingly branched at the base or just below the pleiochasium; main branches of the main pleiochasium 5, 3-15 cm. long, pseudotrivotomous then several times pseudodichotomous; leaves of main stem and branches alternate, spatulate-obovate, serrate, obtuse or retuse at apex, the lower ones attenuate into a subpetiolar base, 5-40 mm. long, 3-15 mm. broad; leaves of pleiochasium elliptic or obovate, somewhat oblique, smaller and wider in proportion than the stem leaves; cyathia solitary in the forks of the pleiochasium; involucre about 2 mm. long, the small lobes oblong and fimbriate, ciliate; glands 4, transversely elliptical, yellowish, 1 mm. long, 0.5 mm. broad; *staminate flowers* about 15 per cyathium; *pistillate flower*: ovary well-exserted; styles about 1 mm. long, bifid about a third to half their length, the divisions clavellate; capsules subglobose, depressed basally, 2.5-3 mm. long, 3.5-4 mm. thick, roundly tricoccous; seeds ovoid to subglobose, apically somewhat acute, yellowish-brown, about 2 mm. long, 1.5 mm. thick; carunculate, surficially areolate, the depressions 0.2-0.3 mm. broad. *Tithymalus Helioscopius* (L.) Hill. Rare near towns, Rio Grande Plains and probably elsewhere, escaped, spring; introd. widely from Eur.

9. *Euphorbia antisiphilitica* Zucc. CANDELILLA. Cespitose perennial; rhizomes fleshy, 3-10 mm. thick, dark-barked, intricately branched and ultimately leading into numerous erect stems; aerial stems mostly simple, rarely branched, 2-5 (-10) dm. tall or even more, 3-4 mm. thick, terete or when dry longitudinally wrinkled, grayish-green, glaucous with a waxy bloom; nodes with enlarged buttresses, purplish-brown, minutely strigose; leaves alternate, sessile, linear-subulate, 2-3 mm. long, terete, grooved on upper surfaces, brown, minutely pubescent with curved white more or less appressed hairs, early-deciduous, present only on new growth; stipules none or minute and glandular; cyathia solitary or in twos or threes in the upper axils; peduncles about 1 mm. long, purplish-brown, densely strigose; bracts one per peduncle, about 1 mm. long, lanceolate, purplish-brown, densely strigose; involucre campanulate, with 5 round-keeled ridges, 1-1.3 mm. long, purplish-brown, densely white-puberulent; glands 5, alternate with the ridges, purplish-brown, glabrous with shallow central depression, 4 of them oblong and about 0.5 mm. long and 1 mm. wide, the 5th gland round and half as large, each gland with a spreading white to lavender triangular-lanceolate appendage 1.5-2.5 mm. long that is truncate or erose apically; *staminate flowers* 50 to 70 per cyathium; *pistillate flower*: gynophore long-exserted, 3-4 mm. long, recurved, glabrous, purplish, slender but thickened just beneath the ovary; ovary oblong, shallowly 3-lobed, glabrous or minutely scurfy; styles 3, 0.5 mm. long, bifid nearly to the middle, the slender divisions spreading; capsule oblong, shallowly 3-lobed, truncate at apex, 3.5-4 mm. long, widest at the middle, glabrous, greenish or purplish; columella about 3 mm. long, slender, clavellate; seed roundish-ovoid, 2.5 mm. long, whitish, dull, microvesicular, irregularly rugose; caruncle yellowish-vesicular, obscurely cordate, about 0.5 mm. long, sessile. Locally abundant in limestone deserts, lower parts of Hudspeth, Presidio, Brewster and Terrell cos. in the Trans-Pecos, after rains; Tex. s. to Qro. and Hgo.

When boiled in water the branches yield a good grade of wax.

10. *Euphorbia Wrightii* T.&G. Perennial herb 2-5 dm. tall, rushlike or scoparioid; caudexes fleshy or softly white-fibrous woody, 8-14 mm. thick, dark-barked, wrinkled after drying; stems several to numerous at each shoot, 3-5 mm. thick basally, narrowing to 1-2 mm. thick above, much-branched; stems and branches rather strictly ascending, striate; branching usually alternate in lower half, often becoming pseudodichotomous in the upper third; leaves alternate below, becoming opposite above at the floriferous nodes; blades linear to linear-filiform, 2-6 cm. long, 1.5-3.5 mm. wide, margins entire, subcartilaginous; petiole absent or indistinguishable from blade; stipules about 0.1 mm. long, glandlike; cyathia solitary at the upper nodes; peduncles 5-6 (-8) mm. long, slender, glabrous or sparingly strigillose, striate; involucre broadly campanulate, broader than long, 1.3-1.5 mm. long to base of glands or about 3 mm. long including glands and appendages, densely strigose; glands 5, subequal, erect, short-stalked or nearly sessile, rotundly elliptic-oblong, 0.9-1.1 mm. long, flat, cupped or with a shallow longitudinal

depression; appendages white to sordid-pink, semilunate, broader than the gland is long and about as long as the gland is wide, the margin nearly entire or minutely erose-crenate; *staminate flowers* 10 to 15 (to 20) per cyathium; *pistillate flower*: gynophore long-exserted, erect; ovary ovoid, densely white-strigose; styles 3, 0.6-1.2 mm. high or to 1.5-1.8 mm. if unrolled, bifid a fifth to half their length; capsule depressed-globose, 3-lobed (or often 1 of the lobes abortive), 3.7-4.2 mm. long and 4-4.5 mm. broad when fully mature, sparsely strigose to subglabrate; columella 3.5-3.9 mm. long, white, often with three fragile wings; seed plumply round-ovoid, 2.8-3 mm. long, with a few regular prominent pits, a shallow raphe and slight nipple at apex; caruncle minute, not visible without a good lens, set on a slight beveled ventral facet at the micropylar end. Infrequent on dry limestone outcrops, caprock of the Plains Country and w. Edwards Plateau (Garza and Taylor cos. s. to Upton, Pecos and Crockett cos.), summer-fall; also Coah.

11. *Euphorbia strictior* Holz. Perennial herb; stems diffusely branched near the base, 25-80 cm. tall, glabrous except in the upper cyathophorous portion; branches simple below, straight, rigid, striate, alternate below, opposite or pseudodichotomous or trichotomous above; lower leaves alternate, 25-50 mm. long, about 2 mm. broad or less, shorter above, entire, firm, essentially sessile; stipules absent or minute and glandlike; opposite leaves of the upper branches also linear but much shorter; cyathia solitary in the upper forks and axils; peduncles 3-8 mm. long, erect; involucre as broad as high, minutely puberulent; glands 4 or 5, yellowish; appendages merely narrow minutely scalloped margins; *staminate flowers* several per cyathium; *pistillate flower*: ovary well-exserted; styles 3, bifid about a third the length; capsule strongly tricocous; seeds ovoid, about 3 mm. long, gray-green, obscurely pitted, the chalazal end with a large pit. Infrequent in higher parts of the Plains Country (in Panhandle), Aug.-Sept.; apparently endemic.

12. *Euphorbia marginata* Pursh. SNOW-ON-THE-MOUNTAIN. Annual herb; main stem 2-5 mm. thick, erect, 3-10 dm. tall, simple below the pleiochasium, terete, villous on younger portions, glabrate on the older; internodes at midstem 15-40 mm. long; pleiochasial branches 3, terminal, 3 to several cm. long, whorled, divergent, densely villous, several times (repeatedly) dichotomous, the nodes floriferous; leaves of the stem alternate, sessile, oblong to ovate or elliptical, 3-8 cm. long, 2 to 4 times longer than broad, at apex acute or obtuse, at base rounded or subamplexicaul, marginally entire and the uppermost in some specimens with thin white margins, mostly green, thin and glabrous or sparingly ciliate along the margins, with stipules none or minute, glandlike and fugacious; leaves whorled at the base of the pleiochasial branches and opposite at the several forks, those at the forks narrowly lanceolate with white entire margins and apically acuminate; cyathia solitary in the forks of the pleiochasium; peduncles slender, erect, 7-15 mm. long, densely villous; involucre campanulate to turbinate, about 4 mm. long, green, villous; glands 5, oblong, about 1 mm. long, very narrow, cupped, ochroleucous; appendages white, 2-3 mm. long and almost as broad, obtuse, marginally erose; *staminate flowers* about 35 per cyathium; *pistillate flower*: gynophore exserted, reflexed; ovary shallowly 3-lobed; styles 3; capsule depressed-globose, with 3 rounded lobes, 5 mm. broad, usually pubescent; columella well-developed; seed ovoid to globose, about 4 mm. long, dark-gray but beset with light-gray tubercles in a reticulate pattern; caruncle small or absent(?). *Agaloma marginata* (Pursh) Löve & Löve. Locally abundant, usually in calcareous uplands, w. half of Tex. (rare in Rio Grande Plains and Trans-Pecos), late spring-fall; Mont. and Minn. s. to Tex. and N.M.

Cultivated extensively for the showy bracts. Contact with the plant causes dermatitis in many persons.

13. *Euphorbia bicolor* Engelm. & Gray. SNOW-ON-THE-PRAIRIE. Annual herb, very much like *E. marginata* but the leaves and especially the bicolored bracts much narrower, the leaves themselves rarely with white margins; the variegated bracts at the top of the plant linear or oblanceolate-linear, (2-) 3-6 cm. long, (2-) 3-4 (-5) mm. broad, the apexes merely acute. Locally abundant, usually in tight clay soil. Coastal Plain, s.e. Tex., rare inland in e. and n.-cen. Tex., w. to Bell and Travis cos., summer-fall; also Okla.

14. *Euphorbia bifurcata* Engelm. Slender mostly glabrous annual herb, 13-35 cm. tall; main stem erect, 1-2 (-4) mm. thick, rising simply 10-18 cm. and giving way higher to pseudodichotomous floriferous branching; lower branches opposite or alternate, more

slender than main stem, also rising to pseudodichotomies toward the summit, strictly ascending or absent; leaves opposite, occasionally imperfectly so and appearing alternate or occasionally at the base of the first dichotomy in a whorl of 3; blades thin, ovate when mature (upper leaves of the floriferous dichotomies often appearing obovate or oblong when young), truncate or narrowed at base, obtuse or rounded at apex, 17-40 mm. long, 10-27 mm. wide, less than twice as long as broad, sharply serrate marginally, the teeth larger and conspicuous near the base; petioles slender, about as long as the blades of the longer leaves but only about half as long in the smaller less mature blades; stipules minute, glandular; cyathia solitary or in twos or threes in the upper forks, the erect peduncles 0.5-2 (-3) mm. long; involucre obconic, 1.3-2 mm. long; glands 1 or 2 (rarely 3) per cyathium, cupped, short-stalked, oblong; appendage whitish, oblong, 1 to 4 times as long as the gland is wide and a little wider than the gland is long, entire or very slightly emarginate; *staminate flowers* few, only 3 to 5 per cyathium; *pistillate flower*: gynophore rather stout, long-exserted, ordinarily recurved at maturity; styles 3, bifid a little more than half their lengths, 0.8-1 mm. long, the divisions rather stout and flattened; capsule deeply and roundly 3-lobed, flattened basally and apically, 2.6-2.9 mm. long, about 3.5 mm. broad, smooth; columella 2.5-2.6 mm. long, often with 3 lacerate thin wings and apically irregularly clavate; seed ovoid, acute at apex, truncate at base, 2-2.1 mm. long, dark-gray with numerous pale-gray prominent tubercles except the caruncular facet which is smooth; caruncle vestigial, perhaps deciduous and contributing to the clavateness of the columella. *Zygophyllidium delicatulum* Woot. & Standl. Infrequent in creek bottoms, Davis (and perhaps Chisos) Mts. in the Trans-Pecos at elev. above 5,000 ft., July-Sept.; also N.M.

15. *Euphorbia exstipulata* Engelm. Annual herb 5-20 (-30) cm. tall; stems erect, 0.3-2 mm. thick, subglabrous to usually strigose or even densely scurfy-granular especially at the nodes and on the striae; lower branching normal, often decussate; main stem rising 4-15 cm., giving way above to pseudodichotomous floriferous branching; glandlike excrescences present at many of the nodes representing accrescent leaf bases after leaf-fall; leaves opposite; blade symmetrical, linear to ovate (see varieties), marginally subcartilaginous; petioles short and indistinct (blades long-acuminate to base); stipules minute, glandlike; cyathia solitary in the forks; peduncles stout, 0.5-1.5 mm. long; involucre 1-2 mm. long including the glands; glands 4, narrowly oblong to roundish, 0.5 mm. long, with a central depression or cup; appendages white, half to three times as long as wide, truncate to erose or lacerate or lacinate, occasionally regularly 2- to 4-fid to the base, the divisions triangular; appendages rarely obsolete or reduced to a narrow border; *staminate flowers* 8 to 14 per cyathium, often crowded to one side in the involucre by the developing gynophore after pistillate anthesis; *pistillate flower*: gynophore exerted, eventually recurved; styles 3, 0.8-1 mm. long, erect, bifid more than half their length; capsule ovoid-triangular, as broad as long, 2.5-3.4 mm. long; columella 2-2.4 mm. long; seed 2.2-2.9 mm. long, ovoid-quadrangular, broad and truncate at base, narrowed to micropylar end, with 2 broad tuberculate transverse ridges and a slight widening at the narrow apical end, with rounded protuberances at intersections of the ridges and longitudinal angles, beveled on the ventral apex, the surface buffy-fuscous, mottled gray or brown to grayish-white or almost chalky-white at times, microvesicular; caruncle minute, whitish, obscurely reniform, 0.1 mm. long or shorter.

Represented with us by 2 varieties as follows:

Var. *exstipulata*. Leaves including petioles 15-60 mm. long, 2-8 cm. broad; blades thin, linear to lanceolate, gradually acuminate to base, with teeth parallel to the margin; ratio of length including petioles to maximum width of the leaves at midstem greater than 5, often 8 to 12 or more; dimensions of the other parts of the plants usually approaching the lower limits given in the general description. Usually in shallow calcareous soil over limestone at moderate elev., less common in sandy soil over basic igneous rock, rarely in gypsiferous soil, in the Trans-Pecos, summer-fall; Tex., N.M., Ariz., Coah., Chih. and Son.

Var. *lata* Warnock & M. C. Johnst. Leaves including petioles 1-3 (-5) cm. long, 6-28 mm. broad; blades firm or at times subchartaceous, rather abruptly narrowed toward the bases, ovate to ovate-lanceolate, with salient teeth and slight tendency to roll; ratio of length including petioles to maximum width of leaves at midstem less than 5, often only

2 or 3; dimensions of other parts of plants usually approaching the upper limits given in the general description above. Infrequent in a variety of soils, Brewster and Presidio cos. in the Trans-Pecos, summer-fall; also Chih.

Some plants in Texas and Arizona are intermediate between these two varieties.

16. *Euphorbia hexagona* Nutt. Taprooted annual, usually with one stem from the base, (2-) 4-10 dm. tall, decussately and pseudodichotomously branched, the branches ascending, minutely strigillose; leaves opposite; blades linear, (15-) 20-50 mm. long, 1-3 mm. broad, acute at both ends, entire; petioles 1-3 mm. long; stipules absent or minute and glandlike; cyathia solitary in the upper forks and axils, on peduncles about 1 mm. long; involucre campanulate, about 1.5 mm. long, strigillose; glands 5, transversely elliptical, about 0.6 mm. long and 0.2 mm. broad, deeply cupped, olivaceous; appendages whitish or greenish-white, deltoid, about twice as long as the gland is broad; *staminate flowers* 20 to 40 per cyathium; *pistillate flower*: ovary long-exserted, subglobose; styles 0.5-0.8 mm. long, bifid about half their length, the branches subclavate; capsule about 4 mm. long, shallowly tricoccus; seeds 2.8-3 mm. long, ovoid, with low bumps scattered all over the surface, not angular nor deeply pitted. In loose sandy soil, local, Plains Country and n.-cen. Tex., late summer; Neb. and Colo., s. to Tex.

17. *Euphorbia bilobata* Engelm. Slender annual herb 15-40 cm. tall; main stem erect, 0.5-2.5 mm. thick, rising 5-20 cm. before giving way to pseudodichotomous floriferous branching above; lower branches normal, often decussate, more slender than main stem, ascending; leaves opposite; blades linear to linear-oblong, acute apically, long-tapering basally, 15-40 mm. long, 1.5-4 mm. wide (but folded along midvein in drying, appearing narrower), about 10 to 20 times longer than wide, entire marginally; petioles 2-3.5 mm. long; stipules oblong, about 0.05 mm. long, glandlike; cyathia solitary in the upper forks; peduncles 1-2.2 mm. long, slender; involucre narrowly campanulate, 1.1-1.6 mm. long including the glands and erect appendages; glands 5, subequal, flat or shallowly cupped, each deeply 2-lobed distally, with lobes pointing up, the whole thus broadly reniform or obcordate, 0.5 mm. long measured parallel with the lobes and 0.7 mm. long measured across the lobes; appendages white, 2 per gland (one on each lobe or one per gland bilobed to the base), erect, a little longer than the lobes of the gland, narrowly triangular or lanceolate, usually acute; *staminate flowers* 9 to 16 per cyathium; *pistillate flower*: gynophore long-exserted and reflexed at maturity; styles 3, bifid a third to half their length, 0.6-0.8 mm. long, erect; capsule deeply 3-lobed, 1.9-2.1 mm. long, about 2.5 mm. broad; columella about 1.3 mm. long; seed oblong-ovoid, weakly quadrangular in transverse section, with 4 or 5 strong transverse sulci on each facet, strongly angulate-tuberculate especially at the intersections of the transverse costae and longitudinal angles, dark reddish-brown to black, microvesicular, 1.8-1.9 mm. long, truncate basally; caruncle irregular and indistinct or appearing absent, sessile, vesicular, whitish. Rare along creeks, Davis Mts. and Eagle Mts. in the Trans-Pecos at elev. above 5,500 ft., Aug.-Sept.; Ariz., N.M. and Tex.

18. *Euphorbia eriantha* Benth. Robust annual herb 2-5 dm. tall; main stem 3-12 mm. thick, erect; branches numerous, usually alternate, occasionally opposite near base of plant, divergent or usually strict, ascending or erect; leaves alternate or occasionally appearing opposite; blades linear to linear-lanceolate, (2-) 4-6 (-7) cm. long, 1-6 mm. wide, at apex attenuate and mucronate, at base attenuate, marginally entire or with a few remote teeth; petioles 3-6 mm. long, strigose; stipules minute, glandlike; cyathia solitary or in irregular dense corymbiform clusters of 5 to 20 at summits of stems, the clusters subtended by whorls of 3 to 8 or many bracteal leaves; peduncles erect, 2-3 mm. long, whitish, densely scurfy-strigose; involucre turbinate, about 2 mm. long and broad, densely white-strigose; glands 3, very rarely 4, sessile, roundish, cupped, grayish; appendages each of 5 to 7 grayish strigose linear lobes attached at the exterior margin and curved upward and inward over the gland to hide it; *staminate flowers* 25 to 35 per cyathium; *pistillate flower*: gynophore exserted and reflexed at maturity; styles 3, entire, tapering to the apex, about 1 mm. long; capsule ovate-oblong to oblong, obscurely 3-lobed, longer than broad, about 5 mm. long, densely strigose; columella 4-4.2 mm. long; seed oblong, weakly quadrangular, 4 mm. long, truncate, dorsiventrally compressed, with 3 to 4 low rounded transverse ridges most noticeable on the ventral facets, mottled gray and white; caruncle reniform, 0.8 mm. long, wider than long, yellowish-vesicular. Desert

or subdesert areas, s. Brewster and Presidio cos. in the Trans-Pecos, Jan.-July; Tex. and Coah. w. to Calif. and Baja Calif.

19. *Euphorbia corollata* L. Perennial glabrous or minutely puberulent herb, (1-) 2-8 dm. tall; roots dark-barked; stems one or few from the crown, erect or ascending, with branches few and alternate for most of the length, opposite and pseudodichotomous or -trichotomous in the uppermost (cyathophorous) portion; leaves alternate (opposite or whorled only in the uppermost cyathophorous portion); leaf blade of the midstem (1-) 2-4 (-6) cm. long, mostly oblong or less commonly linear, rounded at apex, acute at base, entire marginally, the petioles short; opposite leaves much smaller, nearly sessile; stipules minute, glandlike; cyathia solitary in the upper forks; peduncles (1-) 2-30 mm. long; involucre campanuloid, 1.5-3 mm. long and broad; glands 5, cupped, transversely linear, 0.6 mm. long, 0.2 mm. broad; appendages 1.5-4 mm. long, white, conspicuous; *staminate flowers* about 10 to 15 per cyathium; *pistillate flower*: styles 3, about 0.7 mm. long, bifid about half their length, the divisions clavellate; capsule 2.5-4 mm. long, roundly tricoccous; seed 2.3-2.5 mm. long, ovoid, smooth, white. Incl. var. *angustifolia* Ell. and var. *mollis* Millsp., *E. paniculata* L., *E. ziniiflora* Small, *Agaloma corollata* (L.) Raf., *A. angustifolia* (Ell.) Raf. Frequent in sandy soils, e., s.e. and n.-cen. Tex., rare w. to e. edge of Edwards Plateau, June-Nov.; s.e. U.S.

20. *Euphorbia innocua* Wheeler. Perennial herb; roots 2-10 mm. thick, to 3 dm. long, deeply buried and tenacious; stems several from the crown, prostrate to decumbent or (in thick herbaceous vegetation) ascending, (5-) 10-45 cm. long, weak, often flattened, densely pilose with hairs to 1 mm. long; branches alternate below, pseudodichotomous at the cyathiferous nodes; leaves alternate below, opposite above, all rather densely pilose, alternate ones short-petiolate, the opposite ones subsessile; blades ovate to broadly oblong to even bluntly deltoid, 1 to 2 times as long as broad, 8-30 mm. long, entire, basally often shallowly cordate, apically blunt or rounded; stipules glandlike, minute; cyathia solitary in the distal forks on peduncles about 1 mm. long; involucre 1.5-2.5 mm. long and broad, campanuloid, densely pilose; glands 4, transversely elliptic, about 0.6 mm. long, 0.2 mm. broad, glabrous, cupped; appendages greenish white, a little longer than the gland is wide and wider than it is long, pilose beneath; *staminate flowers* 6 to 9 per cyathium; *pistillate flower*: ovary shortly exserted, pilose; styles 0.6-0.7 mm. long, bifid about half their length, the divisions subclavate; capsule depressed-globose, roundly tricoccous, 2.4-2.8 mm. long; seeds 1.6-1.8 mm. long, ovoid, white-ridged and shallowly brown-pitted all over, ecarunculate. *E. refugii* Croizat. Infrequent in sands near the coast, Refugio Co. to Willacy Co., late summer-Dec. (also spring); endemic.

21. *Euphorbia radians* Benth. Mostly glabrous perennial herb; fleshy tuberous root vertical, 5-13 mm. thick, branching toward the crown, brownish, deeply fissured in dried specimens; stems 5 to 20, 1-2 mm. thick, ascending or erect, 12-25 cm. long, essentially simple, glabrous; internodes 3-10 cm. long; floriferous branches very sparsely leafy and vernal; sterile branches leafy and appearing after anthesis; leaves alternate and sessile; blades on the floriferous stems few, 5-7 mm. long, oblong or oblanceolate, green, strigose along the entire margin; blades on sterile branches linear, 2-4 cm. long, densely long-strigose, attenuate at both ends, marginally entire; stipules for both kinds of leaves brownish, glabrous, glandular and minute; cyathia 4 to 8 in irregular corymbiform terminal clusters, subtended by a whorl of 5 to 9 or more bracteal leaves which are whitish to pinkish, somewhat green toward the apex, lanceolate to oblanceolate, 15-30 mm. long, sessile and glabrous; peduncles 1-3 mm. long, stout, purplish, erect; involucre campanulate, 3 mm. long, broader than long, glabrous, greenish to brownish, with 5 white long fimbriate lobes at the summit; glands 1 to 3, deeply cupped, pinkish or purplish, oblong, fleshy, exappendiculate; *staminate flowers* 40 to 50 per cyathium; *pistillate flower*: gynophore very long-exserted and reflexed at maturity; styles 3, stout, recurved, glabrous, bifid two thirds their length, the divisions tapered to the apex; capsule obovate to ovate, 4-5 mm. long, obscurely 3-lobed, brownish, glabrous; columella unknown; seed 4-5 mm. long, narrowly ovoid, with a smoothish white coat and shallow irregular brownish depressions all over; caruncle a minute glandlike structure about 0.2 mm. in diameter. *Poinsettia radians* (Benth.) Kl. & Gke. Grama grasslands, above 4,500 ft. elev. in the Trans-Pecos, Mar.-May; Oax. n.w. to Ariz. and Tex.

22. *Euphorbia dentata* Michx. Annual herb 1-4 (-6) dm. tall; main stem erect, 1-4 mm. thick, with dense short sordid retrorse pubescence and also some relatively long white trichomes; branches decussate, generally many, more slender than main stem, ascending, often as tall as main stem; leaves opposite, rarely alternate; blades narrowly lanceolate to narrowly ovate, 15-60 mm. long, acute at apex, acuminate and shortly attenuate at base, marginally dentate, sparsely scurfy-pubescent beneath; petioles 5-25 mm. long, pubescent like the stems; stipules absent or minute and glandlike; cyathia irregularly clustered at summits of stems, the clusters subtended by opposite leaves that are somewhat pale but never discolored basally; peduncles 1-2 mm. long, glabrous, erect; involucre campanulate, 1.5-2.2 mm. long, glabrous, laciniately toothed, greenish; glands 1 to 3, short-stalked, cupped, exappendiculate; *staminate flowers* many per cyathium; *pistillate flower*: gynophore stout, exserted, reflexed at maturity; ovary broader than long, roundly 3-lobed, glabrous; styles 3, 1-2 mm. long, bifid nearly to the base, the divisions slender; capsule shallowly 3-lobed, 2-3 mm. long, 4-5 mm. broad, green, glabrous; columella narrowly 3-winged, 2.5 mm. long; seed plump, ovoid to subspherical, 2.2-2.5 mm. long, dark-brown, densely microtuberculate, pointed apically; caruncle situated on beveled ventral surface at micropylar end, short-stalked, yellowish-vesicular, heart-shaped, about 0.6 mm. long. *Poinsettia dentata* (Michx.) Kl. & Gke. Abundant in a variety of soils throughout, spring-fall; s. Mex. to Ariz., Wyo., S.D., Minn. and N.Y.

23. *Euphorbia cyathophora* Murr. Mostly glabrous herbs 2-5 (-7) dm. tall, annual in our area; taproot yellowish, 2-7 mm. thick, vertical; main stem 1-5 mm. thick, erect, greenish, 2-7 dm. tall; branches few to many, often decussate at the lowermost nodes, alternate at midstem, pseudodichotomous in the uppermost (inflorescence) regions, more slender than main stem, ascending to erect, equal to main stem in height, green; internodes at midstem 5-10 cm. long; leaves opposite or occasionally alternate; blades linear-lanceolate to linear or narrowly obovate, the wider ones panduriform, acuminate at both ends, 6-15 cm. long, marginally serrate or entire, bright, rather glossy-green, rather thin, usually with scattered minute appressed hairs on lower surfaces, the uppermost leaves often with small reddish splotches near the base; petioles very slender, 4-12 mm. long; stipules absent or minute and glandlike; cyathia irregularly clustered at summit of stem and branches (actually terminal in the extreme distal pseudodichotomies with greatly shortened internodes), the clusters subtended by decussate leaves that are pale-reddish basally; peduncles stout, costate, 1.5-3 mm. long, glabrous, broadened just beneath the involucre; involucre narrowly urceolate-campanulate, 2-2.5 mm. long, toothed; gland usually solitary, deeply cupped, shallowly bilabiate, with a narrowly oblong opening 1 mm. long, green, sessile, exappendiculate; *staminate flowers* many per cyathium; *pistillate flower*: gynophore long-exserted and reflexed at maturity; ovary roundly 3-lobed, essentially smooth, green; styles 3, about 2 mm. long, bifid about a third their length; capsule roundly 3-lobed, 3-4 mm. long, 5-6 mm. broad; columella about 2 mm. long, narrowly 3-winged; seed ovoid or subglobose, not angular, 2.9-3.1 mm. long including caruncle, truncate at the base, pointed at the apex, dark-brown but covered with low pale-brown tubercles; caruncle very small. *Poinsettia cyathophora* (Murr.) Kl. & Gke. Scattered throughout the state, though rare in the deeper soils of the Coastal Plain, May-Sept.; rather widely distributed in temp. N.A., s. to Oax.

The name *E. heterophylla* has for a long time been used for both this species and the next, through failure to observe their distinctness. Plants of this species are often cultivated for the attractive bracts.

24. *Euphorbia heterophylla* L. CATALINA. Annual herbs (1-) 2-8 dm. tall; main stem 1-5 mm. thick, erect, (1-) 2-8 dm. tall; branches several and the lowermost 1 or 2 nodes opposite but always alternate over most of the height, then pseudodichotomous at the extreme top of the plant (inflorescence-region) and more slender then but almost as high as the main stem; internodes at main stem (3-) 5-11 cm. long; leaves opposite at the lowest 1 or 2 nodes, alternate over most of the height, opposite again in the uppermost (inflorescence) region; blades mostly ovate to ovate-elliptic or rhombic-ovate, rarely notched at the sides (panduriform), rarely broadly lanceolate, (3-) 4-10 cm. long, marginally serrate (rarely subentire), acute at apex, rounded to acuminate at base, thin, the uppermost blades (subtending the clusters of cyathia) never red basally but often slightly discolored whitish or purplish near the base; petioles (5-) 10-40 mm. long, often sparsely hispid; stipules absent or minute and glandlike; cyathia irregularly clustered at

summit of stem and branches; peduncles stout, 1-3 mm. long; involucre narrowly urceolate-campanulate, 2-2.5 mm. long, toothed; gland usually solitary, deeply cupped, with a circular opening much less than 1 mm. broad, green, short-stalked, exappendiculate; *staminate flowers* numerous; *pistillate flower*: gynophore long-exserted and reflexed at maturity; ovary roundly 3-lobed, essentially smooth, green; styles 3, 1-2 mm. long, bifid about half their length; capsule roundly 3-lobed, 4 mm. long, 6 mm. broad; columella about 3 mm. long, narrowly 3-winged; seed ovoid, 3-3.5 mm. long including caruncle, truncate basally, in transection angular (with a dorsal keel and 2 lateral angles), dark brownish-gray mottled, with coarse blunt tubercles; caruncle very small. *Poinsettia heterophylla* (L.) Kl. & Gke. Infrequent in loamy soil, Rio Grande delta in extreme s. Tex., waifed elsewhere near the coast, spring-fall; widespread in trop. Am.

25. *Euphorbia acuta* Engelm. Strongly perennial herb; rhizomes stout, woody, 3-15 mm. thick, at least 1 dm. long and occasionally longer than 9 dm., dark-barked, gemmiferous, often vertical near the crown but horizontal and spreading deep underground; stems several to many from the woody crown, erect or ascending, (5-) 10-20 (-30) cm. long, 0.5-1.5 mm. thick, often densely white-woolly when young, often pseudodichotomously branched distally; leaves opposite; blades ovate-acuminate to ovate-lanceolate, 8-15 (-20) cm. long, 3-8 mm. wide, rather rigid, olive-green, sparingly long-villous to densely canescent-appressed-tomentose beneath, less pubescent or glabrate above, marginally entire and subcartilaginous, often revolute, produced at acute apical angle into a sharp spinulose point, at base subequilateral and rounded or truncate; petioles shorter than 1 mm., white-woolly to glabrate; stipules minute to absent; cyathia solitary at the nodes, often in the upper forks; involucre narrowly campanulate to usually urceolate, 1.8-2.2 mm. long, whitish-villous or strigose; glands 4, oblong-elliptic; appendages 0.5-1 mm. long, uniformly crenate, white, ascending to erect; *staminate flowers* 20 to 25 per cyathium; *pistillate flower*: gynophore exserted, villous; styles 3, bifid about half their length, about 1 mm. long; capsule oblong-triangular, 2.8-3.1 mm. long, white-villous, more densely so on the angles; columella 2.7-2.8 mm. long; seed oblong, distinctly quadrangular, 2.2-2.5 mm. long, facets slightly concave, superficially microreticulate, white, ecarunculate. *Chamaesyce acuta* (Engelm.) Millsp. Common in dry limestone uplands, Edwards Plateau, e. to Uvalde Co., w. to Crane, Pecos and Brewster cos., Apr.-Nov.; N.M., Tex. and Coah.

26. *Euphorbia angusta* Engelm. Perennial herb 10-45 cm. tall; taproot woody, 3-10 mm. thick, slenderly napiform or branched at one or both ends; stems 6 to 50 from the woody crown, erect, 10-45 cm. long, sparingly branched (branching occasionally pseudodichotomous distally), strigose; leaves opposite; lowest (spring) blades elliptic to linear-oblong, 7-25 mm. long, acute at both ends, marginally entire, glabrous above, strigose beneath; higher (summer) blades narrower, linear, more than 12 times as long as broad, acute at both ends or basally rounded, marginally entire, strigose below, less densely so above; petioles 0.5-1.5 mm. long; stipules minute, distinct, subulate, about 0.3 (-0.9) mm. long, deciduous, apparently often absent except for glandlike bases; cyathia solitary at the distal nodes or in the forks; involucre narrowly campanulate, about 1 mm. long, strigose; glands 4, narrowly oblong, depressed centrally; appendages white, 2 or 3 times as long as gland is wide, erect or ascending, marginally erose or irregularly toothed; *staminate flowers* 16 to 26 per cyathium; *pistillate flower*: styles 3, shortly bifid, about 0.5 mm. long, the divisions spreading and clavellate; capsule ovoid, roundly triangular, 2-2.6 mm. long, broader than long, strigose; columella 1.9-2.2 mm. long; seed broadly oblong, 1.5-2 mm. long, 1.3-1.4 mm. thick, bluntly quadrangular, grayish-white to chalky, with a few low irregularly anastomosing transverse ridges, ecarunculate. *E. Nealleyi* Coult. & Fish., *Chamaesyce angusta* (Engelm.) Small. Frequent, Edwards Plateau, from Travis and Bexar cos. w. to Tom Green, Pecos and Brewster cos., spring-fall; endemic.

27. *Euphorbia lata* Engelm. Perennial herb 5-15 cm. tall; rhizomes slender, 2-5 mm. thick, shallowly buried, gemmiferous with shoots at intervals, branched, at least 3 dm. long in some specimens; stems solitary or several at each shoot, erect or ascending, 1-3 cm. long, reddish-brown, crisply white-pubescent to glabrate, giving way above to pseudodichotomous branching with internodes 5-20 mm. long and greenish-gray, densely crisply white-hairy; leaves opposite; blades narrowly to broadly deltoid, occasionally acuminate, usually falcate and appearing narrower by revolution of the entire margin,

4-12 mm. long, 2-9 mm. wide, truncate at base, above grayish-brown to olive-drab or sordid, minutely crisply white-hairy, beneath white-strigose; petioles 0.5-1 mm. long, densely white-strigose; stipules united, subulate, about 1 mm. long, densely white-strigose; cyathia solitary in the distal forks; involucre campanulate, 1-1.3 mm. long to base of glands, crisply white-hairy; glands 4, short-stalked, oblong, folded or shallowly cupped, 0.5-0.8 mm. long; appendages occasionally obsolete, usually well-developed, ochroleucous, about as long as gland is wide or shorter, semilunate, marginally erose to crenate; *staminate flowers* 12 to 35 per cyathium; *pistillate flower*: styles 3, 0.3-0.8 mm. long, bifid almost to the base, the spreading divisions blood-red and clavate; capsule ovoid-triangular, 1.9-2.3 mm. long, about as broad as long, acutely angled, white-strigose especially on the angles; columella 1.5-1.8 mm. long; seed oblong, obscurely quadrangular, 1.5-1.8 (-2) mm. long, apically acute, ventral facets often concave, superficially smooth, brownish to white, ecarunculate. *Chamaesyce lata* (Engelm.) Small. Dry calcareous sandy plains, Plains Country, Trans-Pecos and w. part of Edwards Plateau (rarely e. as far as Coryell Co.), Apr.-Sept.; Colo. to Kan. s.w. to Coah. and Tex.

28. *Euphorbia carunculata* Waterfall. Prostrate glabrous annual herb; stems several to many, 2-4 mm. thick, prostrate, 1-10 (-15) dm. long, somewhat succulent, buttressed at the nodes, branching pseudodichotomous distally; internodes 2-12 cm. long, usually much longer than the subtending leaves; leaves opposite; blades ovate to elliptic-oblong, 10-26 mm. long at midstem and usually about half as broad, at apex acute (85-95°) and mucronate, at base slightly asymmetrical and truncate or even occasionally shallowly cordate, marginally entire, rather firm and with no tendency to roll on drying; petioles 3-7 mm. long; stipules lanceolate, 0.9-1.8 mm. long, bifid, rarely trifid, the divisions subulate, thin to subscarios; cyathia solitary in the forks and at the distal nodes; peduncles elongating after anthesis to 3-6 (-7) mm.; involucre broadly campanulate, 2-2.2 mm. long to base of glands; glands 4, short-stalked, erect, rotund, 0.3-0.8 mm. long, 0.2-0.7 mm. wide, flat or usually cupped; appendages sometimes absent, sometimes forming a mere narrow margin or in some specimens prominent, erect, yellowish, 0.8-1.1 mm. long, 0.8-1.5 mm. wide, with entire or erose margin; *staminate flowers* (15 to) 18 to 26 per cyathium; *pistillate flower*: styles 3, 0.7-0.8 mm. long, bifid about a third their length, the divisions tapering to a mucro; capsule ovoid, narrowed apically, narrowly truncate basally, (4.5-) 5-6 mm. long, 4-5 mm. broad, deeply 3-lobed, the lobes sharply angled; columella 4-5 mm. long, slender, whitish, clavellate; seed very distinctive, laterally compressed, not at all angulate except perhaps medially near the micropyle, acuminately narrowed from base to micropylar end, (3.7-) 4.3-5 mm. long, 1.6-2 mm. thick radially near the base and 0.7-0.9 mm. tangentially, grayish-white or mottled reddish-brown or fuscous, much paler to even whitish at the apex which is enlarged or apiculate dorsally and reflexed very slightly away from the raphe; "caruncle" (if it is properly to be called that) actually rather small, linear, white, 0.5 mm. long, protruding slightly in the median ventral angle at the micropylar end. *Chamaesyce carunculata* (Waterfall) Shinners. Locally plentiful in loose quartz dune sand, Plains Country (Crane, Hardeman, Ward, Wheeler, and Wilbarger cos.), summer-fall; Okla., Tex. and Chih.

29. *Euphorbia ammannioides* H.B.K. Glabrous annual herb, often glaucous; stems 6 to 25, prostrate, 5-100 cm. long, 0.4-2 mm. thick; leaves opposite; blades usually narrowly oblong, about 3 times as long as broad, 4-15 mm. long, at apex obtuse or sometimes mucronate, oblique and obtuse or rounded at base, marginally entire; petioles 1-2 mm. long; stipules distinct, 1-1.3 mm. long, parted into usually 3 linear segments; cyathia solitary in the upper forks; involucre campanulate, 1-1.6 mm. long to the base of the gland; glands 4, usually elliptical, 0.4-0.6 mm. long; appendages usually about twice as long as the gland is wide; *staminate flowers* 4 to 13 (rarely to 16) per cyathium; *pistillate flower*: styles 3, 0.2-0.5 mm. long, bifid about half their length, the branches often slightly thicker than the united basal portion; capsule ovoid, triangular, about 2 mm. long, broader than long, the 3 lobes usually narrowly rounded; columella 1.7-1.8 mm. long; seed ovoid, plump, very shortly if at all acute at apex, 1.2-1.6 mm. long, about 1 mm. thick, pale reddish-brown to nearly white, ecarunculate, essentially smooth. *Chamaesyce ammannioides* (H.B.K.) Small. Abundant on loose fine sands along the coast and in extreme s. Tex. inland as far as Brooks Co., spring-fall; Coastal States, Va. to Ver., and nearly all Gulf and Carib. beaches.

Exceedingly closely related to and probably conspecific with *E. Geyeri*. According to recent work by A. Dugand, the correct name for this species may be *E. bombensis* Jacq.

30. *Euphorbia Geyeri* Engelm. Glabrous annual herb; stems 6 to 25, prostrate, 5-45 cm. long, 0.4-1.4 mm. thick; leaves opposite; blades oblong to ovate-oblong or elliptic-oblong, 4-11 mm. long, about twice as long as broad, obtuse or emarginate at apex, often mucronate, oblique and obtuse or rounded at base, marginally entire; petioles 1-2 mm. long; stipules distinct or the ventral united occasionally, 1.1-1.5 mm. long, usually trifid, the divisions filiform; cyathia solitary in the upper forks; involucre turbinate to narrowly campanulate, 0.9-1.5 mm. long to the base of the glands; glands 4, broadly oval to round, 0.2-0.4 (-1.6) mm. long; appendages white, half to twice as long as the gland is wide, entire to slightly erose or absent (see varieties below); *staminate flowers* 5 to 15 (to 25) per cyathium, pale, even the anthers often whitish or ochroleucous, not yellow as in most species; *pistillate flower*: styles 3, usually erect and fairly rigid, 0.2-0.3 (-0.6) mm. long, bifid a third to a half their length, the divisions terete to subclavate; capsule ovoid, triangular, about 2 mm. long and 2.5 mm. broad, the 3 lobes angular to narrowly rounded; columella 1.7-1.8 mm. long; seed ovoid, plump, acute at apex, 1.3-1.4 (-1.6) mm. long, 1 mm. thick, pale reddish-brown to nearly white, ecarunculate, superficially smooth. *Chamaesyce Geyeri* (Engelm.) Small. Plants of sandy soils, widely distributed and actually making up the inland race of the coastal *E. ammannioides*.

We have two races as follows:

Var. *Geyeri*. Glands with appendages. Sandy soils of the Plains Country, s. and w. to Ward, Winkler and Crane cos., rarely e. to n.-cen. Tex.; N.D., Wisc., Minn. and Ia. s. to our area.

Var. *Wheeleriana* Warnock & M. C. Johnst. Glands without appendages. Rare and local in dune areas in the e. part of El Paso Co.; endemic.

31. *Euphorbia Parryi* Engelm. Glabrous annual herb; stems 5 to 25, 0.5-3 mm. thick, prostrate in our area, 10-50 (-85) cm. long; leaves opposite; blades linear, 5-28 mm. long, (5 to) 8 to 12 times as long as broad, rounded and mucronate at apex, slightly inequilateral at base, marginally entire; petioles 1-2 mm. long; stipules distinct, triangular, 0.8-1.2 mm. long, usually deeply bifid, the divisions narrowly lanceolate to subulate, whitish to purplish with a definite narrow yellowish transverse zone of abscission basally; cyathia solitary in the upper forks; involucre campanulate-calyculate, 1-1.2 (-1.5) mm. long to the base of the glands; glands 4, rotundly elliptic, deeply cupped, 0.3-0.5 mm. long; appendages narrow, white, forming a margin on the gland, entire, occasionally as long as the gland is wide, usually erect or sometimes forming a cup; *staminate flowers* 34 to 55 per cyathium, the anthers yellow; *pistillate flower*: styles 3, rather short, rigid, 0.7-0.8 mm. long, white to ochroleucous, bifid a third to two thirds their length, the divisions terete; capsule globose to ovoid, triangular or even more deeply 3-lobed, 2-2.1 mm. long; columella about 1.8 mm. long, clavate; seed ovoid, plump, acute, very obscurely and roundly triangular, 1.3-1.5 (-1.8) mm. long, about 0.9 mm. thick, uniformly pale reddish-brown to tawny-white or occasionally mottled brown and white, ecarunculate. *Chamaesyce Parryi* (Engelm.) Rydb. Local in blowing sand areas of the Trans-Pecos (El Paso and Culberson cos.), July-Nov.; Calif. and Ut., s.e. to Tex.

Closely related to *E. missurica* and doubtless to be considered merely the western race of that species.

32. *Euphorbia missurica* Raf. Glabrous annual herb to 1 m. tall; stems several, ascending to erect or often arcuate-ascending, 7-100 cm. long, 0.5-4 (-6) mm. thick, much-branched; leaves opposite; blades linear to oblong, at midstem 10-28 mm. long, 1.5-5 mm. broad, 4.7 to 14 times as long as broad, rounded to truncate or subemarginate at apex, occasionally subacute and often mucronate, at base narrowed or shortly rounded and slightly asymmetrical, marginally entire, usually folded up along the midvein or revolute; petioles 1-2 (-3.2) mm. long, slender; stipules linear to triangular-subulate, distinct to partly united, entire to parted, 1-1.5 mm. long, the divisions subulate, whitish or purplish with a distinct narrow yellow transverse zone of abscission basally; cyathia solitary in the upper forks or appearing cymose by shortening of the distal internodes and leaves; involucre narrowly to broadly campanulate, 1.2-1.7 mm. long to base of glands; glands 4, round or slightly elliptic, 0.2-0.4 mm. in diameter, cupped or folded; appendages white to pink, ovate, entire, subacute to rounded, occasionally emarginate, 1.5 to 4 times as

long as gland is wide, usually spreading and often reflexed or arched outward; *staminate flowers* 29 to 53 per cyathium; *pistillate flower*: styles 3, white, 0.7-1.2 mm. long, rather stout, bifid half their length, the terete divisions usually arched and widely spreading; capsule globose-ovoid, roundly triangular or more deeply 3-lobed, 2-2.5 mm. long, 2.5-3 mm. broad; columella 1.9-2.1 mm. long; seed plumply ovoid to broadly ovoid-triangular, 1.8-2 mm. long, 1.2-1.4 mm. thick, brownish-white, the angles (if any) broadly rounded, ecarunculate. Incl. var. *intermedia* Wheeler, *Chamaesyce missurica* (Raf.) Shinnors and var. *callicola* Shinnors. Common and widespread e. of Trans-Pecos (rare in extreme e. Tex.), June-Nov.; Minn. to Mont., s. to Tex. and N.M.

There have been attempts to distinguish "varieties" on the proportions of the leaves, the angularity of the achenes and the length of peduncles. There is a slight tendency toward narrower leaves on calcareous soils and broader ones on sandy soils, but it is absolutely impossible to erect meaningful varieties in our area.

33. *Euphorbia revoluta* Engelm. Glabrous annual herb 3-23 cm. tall; main stem erect, 2-6 cm. long, 0.7-1.1 mm. thick, giving way above to widely divergent pseudodichotomous branching, the branches progressively finer and wirelike, the ultimate ones 0.14-0.25 mm. thick, dark-purple or almost black, occasionally yellowish on one side and black on the other; leaves opposite; blades narrowly linear, 2.5-26 mm. long, 1-1.2 mm. broad, usually 9 to 13 times as long as broad, acute at apex, in some specimens mucronate, almost symmetrical and acute at base, marginally entire, revolute, green, firm; petioles 0.5-1.5 mm. long; stipules distinct, entire, linear-subulate, 0.3-0.8 mm. long; cyathia solitary in the forks or appearing cymose-clustered by shortening of distal internodes; involucre shortly campanulate, 0.7-0.9 mm. long to base of glands; glands 4, discoid, 0.15-0.3 mm. across, lightly cupped; appendages white to dark-purple, occasionally obsolete, usually shortly ovate, a little shorter than to occasionally a little longer than the gland is wide, spreading, rather rigid, marginally entire; *staminate flowers* 3 to 8 per cyathium; *pistillate flower*: styles 3, 0.3-0.5 mm. long, white, rather stout, entire or very shortly notched apically; capsule ovoid, acutely triangular, basally truncate, 1.3-1.7 mm. long; columella 1.2-1.5 mm. long; seed ovoid, sharply angled, 1.2-1.3 mm. long (to 1.5 mm. when moistened) and 0.7-0.8 mm. thick (1.1 mm. when moistened), very slightly flattened dorsiventrally, with about 3 prominent transverse ridges, these not or scarcely involving the angles; "testa" brownish, covered with a thick white coat which is hydrophilic and upon moistening becomes a thick white mucilaginous villous fur, ecarunculate. *Chamaesyce revoluta* (Engelm.) Small. Locally abundant on rocky desert slopes in the Trans-Pecos (El Paso, Hudspeth, Jeff Davis, Presidio and Brewster cos.), July-Oct.; Colo., s. to Chih. and w. to Ariz.

34. *Euphorbia hyssopifolia* L. Annual mostly glabrous herb to 6 dm. tall; main stem erect, 0.8-3 mm. thick, a few cm. tall, giving way above to ascending branches, pseudodichotomous distally; stems occasionally with scattered pilose hairs especially on the younger parts; leaves opposite; blades lanceolate to oblong, often falcate, 5-30 mm. long, rounded to very acute at apex, inequilateral and rounded to truncate at base, marginally serrate, occasionally some pilose hairs on blades (especially near the bases); petioles 1-1.5 mm. long; stipules mostly united or at distal nodes partly distinct; cyathia solitary in the distal forks and by shortening of internodes clustered; involucre turbinate, 1.2-1.7 mm. long to base of glands; glands circular to slightly elliptic, 0.15-0.3 mm. long; appendages white to reddish or purplish, semilunate, much shorter than to twice as long as the gland is wide, entire; *staminate flowers* 4 to 15 per cyathium; *pistillate flower*: styles 3, 0.5-0.9 mm. long, bifid more than half their length; capsule ovoid-triangular, 1.5-2.1 mm. long; columella 1.3-1.6 mm. long; seed ovoid-quadrangular, 1-1.4 mm. thick, the angles definite, larger (dorsal) 2 facets with 2 or 3 transverse sulci and low rounded ridges (not involving the angles), pale-brownish to whitish, ecarunculate. *Chamaesyce hyssopifolia* (L.) Small. Locally abundant in moist canyons in Trans-Pecos mts. (Brewster, El Paso, Jeff Davis and Presidio cos.), July-Oct.; Arg. n. to S.C., La., N.M. and Ariz.

35. *Euphorbia nutans* Lag. EYEBANE. Annual herb, in some areas to 1 m. tall; main stem erect, 2-5 mm. thick, only a few cm. long, giving way above to long erect or ascending pseudodichotomous branches distally, 1-4 mm. thick, distal internodes often crisply white-pubescent on one or two sides; leaves opposite; blades often with central splotch, oblong-lanceolate to oblong, often slightly curved or falcate, 8-35 mm. long, rounded or

acute at apex, inequilateral and rounded or truncate at base, marginally serrate, mostly glabrous above, usually pilose beneath at least at base; petioles 1-1.5 mm. long; stipules mostly united or at distal nodes distinct, triangular to subulate, 0.5-1 mm. long, lacerate or ciliate; cyathia solitary in the forks or in cymose clusters; involucre turbinate, 0.8-1.1 mm. long to bases of glands; glands 5, stalked, circular or slightly elliptic, 0.1-0.3 mm. in diameter; appendages obsolete or even a little longer than the gland is wide, entire or irregularly lobed; *staminate flowers* 5 to 11 per cyathium; *pistillate flower*: styles 3, bifid about half their length, 0.6-1 mm. long, yellowish; capsule ovoid-triangular, 1.9-2.3 mm. long; columella 1.8-2 mm. long; seed ovoid, 1.1-1.6 mm. long, 0.9-1.1 mm. thick, finely and irregularly wrinkled (with 5 to 9 faint wrinkles) or rippled, whitish to fuscous, ecarunculate. *Chamaesyce nutans* (Lag.) Small, *E. Preslii* Guss. Abundant nearly throughout (local in Plains Country and Trans-Pecos), May-Nov.; widespread in warmer parts of the world, in Am. n. to S.D., Minn., Mich., N.Y. and N.E.

In recent years many authors, through error, have applied the name *E. maculata* to this species. Reputedly poisonous.

36. *Euphorbia hypericifolia* L. Annual glabrous herb 1-5 dm. tall; main stem erect, 1-2 (-3) mm. thick, only a few cm. long, giving way above to the erect or ascending branches, pseudodichotomous distally, about 1 mm. thick; internodes glabrous; leaves opposite; blades oblong-lanceolate varying from oblong to oblong-spatulate or even lanceolate, 10-35 mm. long, marginally serrulate especially toward apex and on the lower margin, oblique and blunt at base, usually rounded at apex; petioles 1-1.5 mm. long; stipules distinct or united, deltoid, membranous, 1-2 mm. long, sometimes ciliate on the inner edge; cyathia strongly clustered in lateral and terminal nearly leafless stalked glomerules 5-10 mm. across; peduncles of the individual cyathia 0.4-2 (-4) mm. long; involucre obconical, 0.4-0.9 mm. across, glabrous; glands 5, subcircular, 0.05-0.2 mm. across; appendages white to purplish-white, rotund and usually thrice as wide as the larger glands, developing late and appearing absent on young cyathia; *staminate flowers* 2 to 20 per cyathium; *pistillate flowers*: styles 3, bifid to about their middle, about 0.4 mm. long; capsules ovoid, roundly triangular, about 1.3 mm. long; columella about 1.1 mm. long; seed ovoid, 0.9-1 mm. long, about 0.5 mm. thick, with slight irregular depressions separated by very low smooth ridges, brownish or reddish with a very thin whitish bloom. *Chamaesyce hypericifolia* (L.) Millsp., *C. glomerifera* Millsp. Locally abundant in extreme s. Tex. (Cameron and Hidalgo cos.), occasionally waifed in flower beds farther n. (Webb, Jefferson and Matagorda cos.), spring-fall; Venez. and Col., n. to Ga., Fla. and Tex.

37. *Euphorbia hirta* L. Taprooted pubescent annual; stems few, erect to decumbent, 2-60 cm. long, 1-1.5 mm. thick, strigose and (especially the distal internodes) commonly pilose with long yellowish tapering hairs; internodes 5-30 (-70) mm. long; leaf blades prevailing broadly rhombic-lanceolate, varying to narrowly lanceolate to ovate, 4-40 mm. long, above sparsely strigose and glabrate, below with appressed to spreading crisped hairs, at base strongly inequilateral, acute at apex, marginally sharply to bluntly serrate; petioles 1-2 mm. long; stipules deltoid, long and slenderly attenuate, about 1 mm. long, distinct, mostly with a few linear lobes near the base and with short scattered hairs; cyathia in dense stalked essentially leafless glomerules in the upper axils; involucre obconic-campanulate, 0.6-0.9 mm. thick, antrorsely strigose; glands 5, stipitate, cupuliform to patelliform, circular to transversely oval, 0.15-0.3 mm. thick; appendages white, glabrous, entire, small or often absent; *staminate flowers* 2 to 8 per cyathium; *pistillate flower*: ovary antrorsely short-strigose; styles 0.2-0.4 mm. long, bifid half to two thirds their length; capsule 1-1.2 mm. long, sharply 3-angled, widest below the middle; seeds ovoid, sharply quadrangular, 0.7-0.9 mm. long, 0.5-0.6 mm. thick, truncate basally, with subregular to quite irregular low smooth wrinkles, pale-brown. *Chamaesyce hirta* (L.) Millsp. Very rare as a waif in coastal s. Tex., not persistent, summer; widespread in the warmer parts of the world.

38. *Euphorbia pycnanthema* Engelm. Perennial herb (or some lasting only one season?) a few cm. tall; stems 5 to 50 from the crown, about 1 mm. thick, 5-35 cm. long, prostrate or ascending at the ends, tan to rubescent, closely and crisply white-pubescent, all sparingly branched; leaves opposite; blades ovate-oblong to ovate-lanceolate, (5-) 7-4 (-22) mm. long, at base very inequilateral and truncate or occasionally obscurely

cordate, at apex rounded or often acute with 40-90° angle, marginally mostly entire or the abaxial longer side with a few teeth, grayish-green to greenish-gray, clothed with short crisped whitish hairs or occasionally glabrous above; petioles 0.3-1 mm. long, purple to reddish-tan, with whitish hairs; stipules well-developed on both sides of stems at least at the distal nodes, distinct, lanceolate to subulate, usually unequally bifid or trifid and the finer division subulate, 0.8-1.2 mm. long, whitish to pinkish, submembranaceous, apparently deciduous; cyathia in dense cymose glomerules and a few of them borne singly in the penultimate forks; involucre turbinate to campanulate, 0.9-1.3 mm. long to base of glands, short white-hairy; glands 4, short-stalked or sessile, nearly round, reddish to dark-maroon; appendages white to pinkish-white, conspicuous, 1 or 2 times as long as the gland is wide, erose or irregularly crenate; *staminate flowers* 10 to 18 per cyathium; *pistillate flower*: styles 3, bifid more than half their length, the slender divisions occasionally clavellate; capsule oblong-ovoid, roundly triangular, 1.3-1.9 (-2) mm. long, longer than broad, shortly white-hairy; seed narrowly oblong-quadrangular, 1.1-1.4 mm. long, 0.6-0.8 mm. thick, acute apically, with faint low regular or irregular transverse wrinkles, brownish or whitish-brown, ecarunculate. *Chamaesyce pycnanthema* (Engelm.) Millsp. Local in Chih. Desert in s. Brewster Co. in the Trans-Pecos, Apr.-Nov.; Chih., Coah. and Tex.

Our plants are related to and have been considered conspecific with *E. capitellata* Engelm. of Ariz., Son. and Baja Calif.

39. *Euphorbia cinerascens* Engelm. Perennial herb; taproot woody, 1-8 mm. thick, dark-barked, sometimes branched; stems numerous, prostrate, 4-35 cm. long, somewhat branched, crisply white-strigillose; leaves opposite; blades ovate to ovate-elliptic or ovate-oblong, 2-9 mm. long, 2-6 mm. wide, obtuse at apex, slightly inequilateral and truncate or rounded at base, marginally entire, white-strigillose at least below, dark olive-green to almost canescent grayish-green; petioles about 1 mm. long; stipules dorsally united, ventrally distinct at least at distal nodes, 0.15-1.3 (-1.4) mm. long, lanceolate to subulate, densely white-strigillose; cyathia solitary at distal nodes or in forks; involucre turbinate, 0.8 mm. long to base of glands, whitish-strigillose; glands 4, round to oblong, 0.1-0.4 mm. long, flat to cupped, dark-purplish to cherry-red; appendages occasionally absent, usually developed but shorter than the gland is wide, white to purplish or cherry-red, marginally erose; *staminate flowers* 10 to 20 per cyathium; *pistillate flower*: styles 3, 0.2-0.4 (-0.8) mm. long, bifid to the base, cherry-red, the divisions terete to slightly clavellate; capsule ovoid, roundly triangular, 1.2-1.5 (-1.75) mm. long, white-strigose especially on the purple angles; columella 1.1-1.3 mm. long; seed oblong-quadrangular, 1-1.3 (-1.5) mm. long, 0.5-0.7 (-0.9) mm. thick, smooth, apically narrowed and acute, white to tawny-white, ecarunculate. *Chamaesyce cinerascens* (Engelm.) Small. Common on calcareous uplands and deserts in the Trans-Pecos (w. to Hudspeth Co.), w. Edwards Plateau and Rio Grande Plains (e. to Kimble and Duval cos.), Apr.-Nov.; S.L.P., Tam. and Chih. n. to Tex.

40. *Euphorbia serpyllifolia* Pers. Glabrous annual herb, 5-200 mm. tall; stems few to numerous, 0.5-1.5 mm. thick, usually prostrate (more commonly ascending on calcareous soils), 5-35 cm. long, much-branched, the branching occasionally pseudodichotomous distally, usually the distal internodes and occasionally the older ones "winged" (meaning flattened in the plane of the leaves with narrow decurrent buttresses); leaves opposite; blades very variable, usually oblong or obovate-oblong, often falcate or appearing bowed-in along the sides by revolution of the lateral margins, 3-12 (-17) mm. long, 2 to 4 (to 7) times as long as broad, proportionately narrower on calcareous soils, inequilateral at base, usually rounded at apex, marginally toothed at least toward the apex (use lens) and on the abaxial longer side toward the base often with an elongate median splotch; petioles slender, less than 1 mm. long; stipules relatively large and conspicuous, distinct, usually deeply bifid to trifid, the divisions subulate, membranaceous, 1.1-1.6 mm. long; cyathia solitary at the nodes and distal forks or appearing cymose-clustered by shortening of the distal internodes; involucre turbinate to narrowly campanulate, occasionally slightly urceolate, about 0.5 mm. long to base of glands; glands 4, sessile to short-stalked, oblong, 0.15-0.25 mm. long, cupped; appendages about as long as gland is wide or shorter, apron-shaped, marginally entire to crenulate or subdentate; *staminate flowers* 5 to 18 per cyathium; *pistillate flower*: styles 3, 0.2-0.5 mm. long,

merely notched or bifid less than a third their lengths; capsules ovoid-triangular, 1.5-1.9 mm. long; columella 1.3-1.6 mm. long; seed narrowly oblong-quadrangular, 1-1.4 mm. long, apically acute, smooth or with a few indistinct low rounded transverse wrinkles, tawny-white to sordid purplish-white to ochroleucous, ecarunculate. *Chamaesyce serpyllifolia* (Pers.) Small. Frequent in desert grasslands in the Trans-Pecos, infrequent to rare in Edwards Plateau e. to Edwards Co., July-Nov.; Jal. and Qro. n. to B.C., Alta., and Minn.; adv. in Eur. and S.A.

41. *Euphorbia glyptosperma* Engelm. Glabrous annual herb; stems 5 to 45, 0.5-1.5 mm. thick, prostrate, 5-33 cm. long, much-branched; branching occasionally pseudodichotomous distally; internodes not at all winged, a few aberrant specimens have lines of short hairs on the stems; leaves opposite; blades oblong, occasionally obovate-oblong or rarely ovate-oblong, 2-8 (-15) mm. long, usually (2 or) 3 or 4 (to 6) times as long as broad, often subfalcate by revolution of lateral margins, very inequilateral and rounded or truncate at base, marginally serrulate at least at the rounded apex (use strong lens) and often on the abaxial side toward the base; petioles about 0.3-1 mm. long; stipules glabrous, distinct, bifid or trifid, the divisions subulate, 0.3-1 mm. long, membranaceous; cyathia solitary at the distal nodes or in the forks; involucre turbinate, 0.4-0.6 mm. long to base of glands; glands 4, minute, short-stalked to sessile, oblong to almost rotund, about 0.1 mm. long, cupped; appendages apron-shaped, usually shorter than gland is wide or even occasionally obsolete, entire to erose or subcrenate; *staminate flowers* 1 to 5, usually only 4, per cyathium; *pistillate flower*: styles 3, 0.15-0.3 mm. long, bifid about a third to half their length, the terete divisions occasionally subclavellate; capsule ovoid-triangular, 1.4-1.7 mm. long; columella 1.2-1.4 mm. long; seed oblong-quadrangular, 1-1.3 mm. long, 1.7-1.9 mm. thick, apically acute, all facets traversed by 4 to 6 (to 8) definite transverse ridges occasionally anastomosing but usually distinct and regular and usually somewhat involving the four definite angles, tawny with thick white coat, ecarunculate. *Chamaesyce glyptosperma* (Engelm.) Small. Frequent over much of Tex. (rare in extreme e.), June-Sept.; widespread in N.A.

42. *Euphorbia theriaca* Wheeler. Glabrous annual herb; stems 5 to 40, prostrate or ascending, 5-30 cm. long, 0.3-1.5 mm. thick, flexuous or rarely zigzag, much-branched (distal branching occasionally pseudodichotomous); leaves opposite; blades oblong-orbicular or shortly ovate to obovate or shortly oblong, 2-5.5 mm. long, about 1 to 2.2 (to 2.7) times as long as broad, at apex rounded or truncate, occasionally emarginate, at base rounded, marginally entire; petioles 0.7-1.2 mm. long; stipules glabrous, 0.7-1 mm. long, on lower side usually united into an entire or shortly bifid scale, on upper side usually distinct, subulate, entire; cyathia solitary at the distal nodes; involucre campanulate or hemispheric, occasionally suburceolate, 0.9-1.5 mm. long to base of glands; glands 4, sessile or short-stalked, nearly round or slightly elliptic, 0.3-0.6 (-0.7) mm. long; appendages absent or present, white, semilunate or bib-shaped, essentially entire, narrower than the diameter of the gland; *staminate flowers* (15 to) 23 to 36 per cyathium; *pistillate flower*: styles 3, 0.3-0.4 mm. long, bifid about half their length, the divisions clavellate; capsule ovoid, roundly and rather deeply 3-lobed or merely triangular in some specimens, 1.1-1.6 mm. long, 1.5-1.7 mm. broad; columella 1-1.3 mm. long; seed oblong-quadrangular, 1-1.2 mm. long, 0.7-0.8 mm. thick, acute apically, rounded or truncate basally, the facets convex with 2 to 4 very definite high rounded transverse ridges meeting the ridged angles, tawny with whitish seed coat, ecarunculate. *Chamaesyce theriaca* (Wheeler) Shinn. Locally abundant in deserts, s. Brewster and Presidio cos. in the Trans-Pecos, July-Oct.; Tex., Chih. and Coah.

The Brewster Co. specimens have suborbicular dark-green leaves with slender contorted petioles, exappendiculate glands and capsules that are deeply and roundly 3-lobed in transection. The Presidio Co. specimens have shortly oblong, yellow-green leaves, appendiculate glands and capsules which are triangular in transection.

43. *Euphorbia Golondrina* Wheeler. Glabrous annual herb; stems several, prostrate, 5-35 cm. long, 0.7-1.5 mm. thick, occasionally zigzag below with slenderer branches at the nodes, distally more normally pseudodichotomous; leaves opposite; blades oblong or ovate-oblong to narrowly elliptic-oblong or even almost orbicular, 5-10 mm. long, inequilateral and rounded at base, rounded at apex, marginally entire; petioles 1-1.7 (-2) mm. long; stipules on lower side of stem single (united), subulate, bifid, occasionally with a

few minute hairs near the tip, those on upper side of stem distinct and subulate; cyathia solitary at the nodes and in the forks; involucre shortly rounded, slightly urceolate, 0.9-1 mm. long to base of glands; glands 4, remote, stalked, erect, round, 0.15-0.5 mm. in diameter, cupped; appendages sometimes obsolete, usually slightly developed, white, semilunate, narrower than the gland; *staminate flowers* 28 to 40 per cyathium (reportedly 39 to 50 in the type specimen); *pistillate flower*: styles 3, ochroleucous, 0.2-0.3 (-0.4) mm. long, notched or bifid; capsule ovoid-triangular, 1.8-2 mm. long, green; columella 1.7-1.8 mm. long; seed narrowly oblong-quadrangular or occasionally the 2 ventral facets almost plane, 1.7-1.8 mm. long, about 0.8 mm. thick (when moistened 1.8-1.9 mm. long and about 1 mm. thick), apically acute, tawny-white with thick white hydrophilous "coat," smooth or with 6 to 8 very faint low rounded transverse wrinkles on the ventral facets, ecarunculate. *Chamaesyce Golondrina* (Wheeler) Shinn. Local in alluvial or eolian soil, deserts of s. Brewster Co., Tex., July-Oct.; endemic.

44. *Euphorbia micromera* Engelm. Mostly glabrous annual herb; stems 5 to 40, prostrate, 5-22 cm. long, 0.1-1.5 mm. thick, usually not markedly zigzag, much-branched, the distal branching occasionally pseudodichotomous; leaves opposite; blades ovate-oblong to ovate-elliptic, 2-5 mm. long, 1-2.7 mm. broad, usually less than twice as long as broad, very inequilateral and truncate at base, rounded at apex, marginally entire, greenish, rather firm, occasionally almost appearing dimorphic because of reduction in size at the floriferous nodes; petioles 0.2-0.8 mm. long; stipules 0.4-0.6 mm. long, subulate, distinct on upper side of stem, approximate or united on lower side at least at the distal nodes, distinctly short-ciliate at least at the tip; cyathia solitary at the distal nodes and forks; involucre campanulate, sometimes suburceolate, 0.4-0.5 mm. long to base of glands; glands 4, remote (the minutely ciliate subulate lobes of the involucre clearly visible between them), short-stalked, often erect, nearly round, 0.05-0.15 mm. in diameter, flat or faintly cupped; appendages absent; *staminate flowers* 2 to 5 per cyathium (usually exactly 5); *pistillate flower*: styles 3, 0.1-0.2 mm. long, stout and rigid, pinkish to purplish-white, notched or bifid, the divisions shortly clavellate; capsule ovoid-oblong, roundly triangular, 1.2-1.4 mm. long, about as broad; columella 1-1.2 mm. long; seed narrowly oblong-quadrangular, 0.8-1.1 mm. long, about 0.5 mm. thick, acute at apex, essentially smooth or with very faint irregular wrinkles, tawny with thick white hydrophilic coat, ecarunculate. *Chamaesyce micromera* (Engelm.) Woot. & Standl. Infrequent in sandy deserts in the Trans-Pecos (common near El Paso), Aug.-Oct.; Ut., Calif. and N.M., s. to Chih. and Coah.

45. *Euphorbia simulans* (Wheeler) Warnock & M. C. Johnst. Glabrous perennial herb (or occasionally behaving as a winter annual?) 1-12 cm. tall; stems 10 to 25, 7-32 cm. long, 0.4-2 mm. thick, usually prostrate, occasionally ascending, buttressed at the nodes, greenish to dark-purple or reddish or almost black, usually distinctly zigzag from node to node with more slender secondary branches at each node complementary to the main ones or distally the branching occasionally pseudodichotomous; leaves opposite; blades shortly oblong, 2-4 (-5) mm. long, usually about 1 to 1.7 times as long as broad, very inequilateral and truncate or rounded at base, truncate or rounded at apex, occasionally emarginate, marginally entire, firm and a little thickened; leaves at the distal floriferous nodes somewhat reduced, the foliage almost dimorphic at times; petioles 0.8-1.6 mm. long; stipules united on lower side of stem into a single lanceolate bifid structure, the divisions subulate, ochroleucous to pale-purple, sometimes minutely ciliate near the tips; stipules on upper side of stem (at least at the floriferous nodes), distinct, each subulate, whitish to purplish, occasionally minutely ciliate toward the tip, with a definite zone of abscission sometimes visible at the base, deciduous, 0.5-0.8 mm. long; cyathia solitary at the distal nodes or in the forks; involucre campanulate, 0.8-1.2 mm. long to base of glands; glands 4, approximate, sessile or nearly so, rotundly oblong, about 0.5 mm. long, nearly flat or folded; appendages absent; *staminate flowers* 15 to 32 per cyathium; *pistillate flower*: styles 3, stout, 0.2-0.3 mm. long, bifid two thirds their length, the usually erect divisions firm and terete; capsule ovoid, roundly triangular, 1.5-1.7 mm. long, about as broad, columella 1.2-1.5 mm. long; seed oblong, roundly quadrangular, 1.1-1.3 mm. long, apically acute, with 6 to 8 very faint low rounded transverse regular or irregular wrinkles especially visible on the ventral facets, tawny with thick white coat, ecarunculate. *E. polycarpa* Benth. var. *simulans* Wheeler, *Chamaesyce polycarpa* (Benth.) Parish var. *simulans* (Wheeler) Shinn. Locally abundant in sandy and rocky deserts, s.

Brewster and s. Presidio cos. in the Trans-Pecos, Apr.-Oct., rarely Dec., Feb.; endemic.

46. *Euphorbia perennans* (Shinners) Warnock & M. C. Johnst. Glabrous perennial herb, 13-47 cm. tall; taproot 3-10 mm. thick, woody; stems 5 to 20, 0.5-3 mm. thick, erect, pseudodichotomously branched; herbage somewhat glaucous; leaves opposite; blades rather firm, rather variable in shape, the older ones usually ovate-deltoid to nearly orbicular and the ones at the floriferous nodes relatively narrower and usually ovate or ovate-elliptic, at apex rounded, at base rounded to truncate or even cordate, marginally entire, 5-17 mm. long, 4-16 mm. wide, often nearly as broad as long; venation in some specimens evident, showing 5 to 7 veins from the base, with the midvein much the most prominent; petioles 0.8-2 mm. long; stipules usually approximate but distinct on "lower" side of stem, usually united above into a single linear bifid structure, the subulate divisions 0.4-0.7 mm. long; cyathia solitary in the forks; involucre campanulate to hemispheric, often very slightly urceolate, 1.5-2.2 mm. long to base of glands; glands 4, short-stalked or usually sessile, erect, elliptic to oblong, distinctly cupped, 0.7-1 mm. long; appendages absent; *staminate flowers* 35 to 45 per cyathium; *pistillate flower*: styles 3, 0.7-1.1 mm. long, curved and spreading when young, becoming erect with age, bifid about half their length, the rather stout divisions terete; capsule ovoid-triangular, 3-3.3 mm. long; columella 2.7-2.8 mm. long; seed oblong-triangular or subquadrangular (the ventral facets almost parallel and plane), 2.2-2.4 mm. long, acute at apex, rounded at base, essentially smooth or only with faint irregular wrinkles, the ventral facets slightly concave, whitish or pinkish with a thick white hydrophilic (mucilaginous) coat, ecarunculate. *Chamaesyce perennans* Shinners. Deserts of s.w. Brewster Co. (Terlingua-Lajitas areas), July-Sept.; endemic.

47. *Euphorbia Fendleri* T.&G. Glabrous low perennial herb; taproot woody; stems many, slender, to about 15 cm. long, often pseudodichotomously branched; leaves opposite; blades acute at apex, inequilateral at base, marginally entire, rather firm, occasionally glaucous, occasionally reticulate-veiny; petioles 0.5-1 mm. long; stipules approximate or sometimes united into a bifid structure or at the floriferous nodes distinct, subulate, 0.5-1 mm. long, occasionally lacerate along the margins near the tip with the divisions hairlike; cyathia solitary at the nodes or in the forks; involucre turbinate to campanulate, 1.2-1.8 mm. long to base of glands; glands 4, usually quite sessile, oblong, 0.4-1 mm. long, more or less cupped, with or without appendages; *staminate flowers* 8 to 35 per cyathium; *pistillate flowers*: styles 3, 0.3-0.7 mm. long, bifid at least half their length, the divisions terete and occasionally slightly clavellate; capsule ovoid-triangular, some plumply so, mostly less than 2.2 mm. long; columella 1.6-1.9 mm. long; seed oblong-quadrangular (or the ventral facets sometimes almost parallel, making it triangular), the angles rounded or at least obtuse, acute at apex, truncate at base, essentially smooth or with a few faint irregular wrinkles, pale pinkish-brown to tawny with a white coat, ecarunculate. *Chamaesyce Fendleri* (T. & G.) Small. Widespread in the western drier half of the state and represented with us by three varieties, as follows:

Var. *Fendleri*. Taproot usually 1.5-3 mm. thick, the crown often buried along with the basal parts of the many stems which are all annual, 0.1-0.3 mm. thick and decumbent; leaf blades ovate, 1 or 2 times as long as broad, 2-6 mm. long, at base truncate to rounded or slightly cordate; glands purplish-green to reddish-brown; appendages absent or obtuse and shorter than the gland is wide; staminate flowers 15 to 22 per cyathium; anthers ochroleucous; capsule 1.9-2.1 mm. long; seed 1.4-1.8 mm. long. Frequent in calcareous or sandy soil in the w. half of Tex., e. to n.-cen. Tex. and caliche cuerdas of the Rio Grande Plains, Apr.-Sept.; Okla. and Kan. to Wyo. and Ut., s. to Tex.

Var. *chaetocalyx* Boiss. Taproot 3-9 mm. thick at summit; crown usually aerial; some stems basally persisting and perennial, often thicker than 0.3 mm. at least basally, erect or ascending; leaf blades ovate-lanceolate to linear-lanceolate, 6-11 mm. long, 3 or 4 (to 6) times as long as broad, basally acute to truncate; appendages lanceolate or deltoid, 1 to 3 times as long as the gland is broad, sometimes bifid or coarsely crenate; staminate flowers 8 to 20 per cyathium; anthers yellowish or ochroleucous; capsule 2-2.3 mm. long; seed 1.8-2 mm. long. *E. chaetocalyx* (Boiss.) Tidestr., *Chamaesyce chaetocalyx* (Boiss.) Woot. & Standl., *C. Fendleri* var. *chaetocalyx* (Boiss.) Shinners. Frequent in dry calcareous soils of desert mts. in the Trans-Pecos, Apr.-Sept.; Tex. and N.M. w. to Ariz. and Calif.

Var. *triligulata* Wheeler. Taproot 8-15 mm. thick at summit; crown usually aerial; stems at least basally often perennial and suffrutescent and becoming woody with a gray minutely longitudinally fissured bark, the stems basally thicker than 0.3 mm. and ascending; leaf blades lanceolate to linear-lanceolate, 3-6 mm. long, 3 or 4 (to 6) times as long as broad, basally acute to truncate; glands usually bright-green; appendages longer than the gland is broad, parted to the base into 3 to 5 linear-subulate white lobes 0.5-1.5 mm. long; staminate flowers 22 to 35 per cyathium; anthers violet; capsule 1.8-2.1 mm. long. *Chamaesyce Fendleri* var. *triligulata* (Wheeler) Shinn. Rare, known only from limestone cliffs above Boquillas Canyon, s. Brewster Co. in the Trans-Pecos, July-Sept.

48. *Euphorbia jejuna* Warnock & M. C. Johnst. Glabrous low perennial herb; taproot 3-14 mm. thick, dark-barked; stems 20 to 60 from the woody crown, annual, decumbent, 1-9 cm. long, 0.2-1.1 mm. thick, often flexuous, much-branched, the branching often pseudodichotomous or even whorled with several leaves and branches emerging at a single node; leaves opposite; blades rotundly obovate or ovate or nearly elliptical, 3-6 (-8) mm. long, 1 to 1.5 times longer than broad, at apex rounded or angled (90°-180°), at base shortly rounded or truncate and inequilateral, marginally entire, rarely glaucous, occasionally reticulate-veined; petioles 0.7-1 mm. long; stipules on both sides of stems united into a very short scale which is lacerate to lacinate or rarely bifid, firm, lanceolate or muticous-deltoid, less than 1 mm. long, not conspicuous without a strong lens, or at floriferous nodes stipules rarely separate and each lanceolate on the upper side of the stem; cyathia solitary at the upper nodes in the forks; peduncles 0.9-2 mm. long; involucre hemispheric or broadly campanulate, 1.2-1.5 mm. long to the base of the glands; glands 4, subequal, oblong, about 1.6 mm. long, cupped; appendages conspicuous, erect or spreading, white, about 0.6 mm. long, rarely entire or merely crenate, usually deeply dissected into 4 or 5 acute or acuminate lobes or even parted nearly to the base into 4 to 6 distinct segments, the form rather variable even on a single individual; *staminate flowers* 12 to 25 per cyathium; *pistillate flower*: styles 3, about 0.5 mm. long, entire (not bifid), thickly round-capitate; capsule ovoid, plumply triangular, olive-green, 1.8-2.2 (-2.7) mm. long; columella 1.7-2 (-2.3) mm. long; seed oblong, angled, 1.6-2 (-2.3) mm. long, apically narrowed and acute, the facets with faint irregular transverse wrinkles or with up to 10 or 11 faint but definite low rounded transverse ridges, pale-brownish or tawny-pink with a thick white coat, ecarunculate. Rare and local in calcareous soils in the Trans-Pecos, Edwards Plateau and Plains Country (Brewster, Mitchell, Nolan, Terrell and Val Verde cos.), Mar.-May; endemic.

49. *Euphorbia astyla* Boiss. Glabrous low perennial herb; root 5-12 mm. thick; stems several to many from the crown, succulent (wrinkled upon drying), 0.7-1.2 mm. thick, 4-23 cm. long, prostrate; leaves opposite, essentially sessile; blades orbicular-reniform to deltoid-oblong, 2-8 mm. long, almost as broad, rounded or truncate at apex, cordate to clasping and inequilateral at base, marginally entire, green to somewhat glaucous, firm; stipules on both sides of the stem united into a white scale about 0.2 mm. long, wider, erose or minutely lacerate and sometimes fringed; cyathia solitary at the most distal nodes; involucre hemispheric to broadly campanulate, about 1.2 mm. long to base of glands, wider; glands 4, shallowly cupped, oblong, about 0.5 mm. long; appendages entire, shorter than the gland is wide, forming a narrow margin; *staminate flowers* 22 to 26 per cyathium; *pistillate flower*: styles 3, 0.2-0.3 mm. long, entire (not bifid), the ends thickly round-capitate; capsule ovoid, plumply triangular, 1.9-2.6 mm. long; columella 1.8 mm. long; seed oblong-quadrangular, 1.5-1.7 mm. long, 0.8-1 mm. thick, apically subacute, basally subrounded, with low irregularly anastomosing transverse ridges separated by narrow grooves, the angles often notched at these grooves, the thick coat white and mucilaginous, obscuring any deeper coloration, ecarunculate. *Chamaesyce astyla* (Engelm.) Millsp. Rare in low calcareous areas, perhaps alkaline soils, in the Trans-Pecos (Pecos Co. only), summer; Coah., Dgo. and Tex.

50. *Euphorbia albomarginata* T.&G. Glabrous low perennial herb; taproot woody in age, to 3-4 mm. thick; stems several to many, 0.5-1.5 mm. thick, some of the older ones persistent and perennial and becoming dark-barked, mostly annual, 10-35 cm. long, usually quite prostrate, often rooting at the nodes, often flexuous, much-branched, the branching often pseudodichotomous; leaves opposite; blades orbicular to oblong, 3-8 mm. long, almost as broad, rounded at apex, occasionally emarginate or apiculate, strongly inequilateral and rounded at base, marginally entire; petioles 0.5-1.2 mm. long; stipules on both sides of stem united into a white membranous deltoid to acuminate lanceolate

scale 1-2 mm. long and entire to lacerate or erose; cyathia solitary at the nodes and in the forks; involucre turbinate, about 1 mm. long to the base of the glands; glands 4, shallowly cupped, oblong, 0.5-1 mm. long; appendages usually conspicuous, white, 1 to 3 times as long as gland is wide, entire to erose; *staminate flowers* 15 to 30 per cyathium; *pistillate flower*: styles 3, 0.5-0.7 mm. long, bifid nearly their entire lengths, the divisions slender; capsule ovoid, sharply triangular, 1.3-2 mm. long; columella 1-1.3 mm. long; seed oblong-quadrangular (or the ventral facets nearly parallel), 1.2-1.7 mm. long, 0.7-0.9 mm. thick, apically acute, basally truncate, essentially smooth or minutely punctulate in transverse lines, pale-brown with a white coat. *Chamaesyce albomarginata* (T. & G.) Small. Widespread in w. and s. halves of Tex., usually in poorly drained clay soil, Apr.-Sept.; Okla., N.M. and Nev. s. to Sin., Dgo. and Tam.

51. *Euphorbia serpens* H.B.K. **HIERBA DE LA COLONDRINA**. Glabrous annual herb (or occasionally winter annuals or over-wintering?); stems numerous, 0.1-1.1 mm. thick, 5-20 (-50) cm. long, prostrate, often rooting at the nodes, often flexuous, much-branched, the branching occasionally pseudodichotomous distally; leaves opposite; blades ovate-orbicular or broadly oblong to orbicular, 2.7 mm. long, almost or quite as broad; rounded at apex, rounded and somewhat inequilateral at base, marginally entire; petioles about 0.5 mm. long; stipules on both sides of stem united into a white to pink membranous scale 0.2-1.2 mm. long and entire to erose or lacerate; cyathia solitary at the nodes and in the forks; involucre urceolate-turbinate, about 0.7 mm. long to base of glands; glands 4, oblong, short-stalked, about 0.1 mm. long, cupped; appendages about as long as the glands are wide, marginally erose, sometimes obsolete; *staminate flowers* 3 to 8 (to 10) per cyathium; *pistillate flower*: styles 3, about 0.5 mm. long, notched; capsule ovoid-oblong, triangular, 1-1.2 mm. long; columella about 1 mm. long; seed narrowly oblong, quadrangular, sometimes roundly so, 0.7-0.9 mm. long, apically acute, essentially smooth, brownish with white coat, ecarunculate, the ventral facets slightly concave. *Chamaesyce serpens* (H.B.K.) Small. Usually in calcareous soils, throughout Tex. but less frequent in the w. half, Mar.-Nov.; widespread in trop. and temp. Am. n. to Ont., O., Ind., N.M. and Ariz.

52. *Euphorbia cordifolia* Ell. Glabrous taprooted annual; stems numerous, prostrate, (4-) 15-60 cm. long; leaf blades elliptic-orbicular to oblong and ovate-oblong, 4-12 mm. long, more or less inequilateral and often cordate at base, marginally entire; petioles about 1 mm. long; stipules parted to the base into few to several filiform segments to 1.4 mm. long, mostly with short scattered hairs at least when young, the dorsal ones distinct, the ventral ones often united; peduncles 0.4-4 mm. long; cyathia solitary at the nodes and at the branch tips but often congested by the marked shortening of the upper internodes; involucre broadly campanulate, 1.3-1.6 mm. across; glands transversely elliptical to oblong, often strongly folded, 0.5-0.9 mm. long; appendages 1 to 3 times as long as the gland is high, to 1.3 mm., the wider ones radially broadly elliptical to reniform, glabrous, entire or with 2 or 3 low blunt teeth; *staminate flowers* 29 to 44 per cyathium; *pistillate flower*: styles bifid to the base, 0.6-0.9 mm. long; capsule glabrous, sharply 3-angled, wider below the equator, 1.7-2.1 mm. long; seeds ovoid-triangular, 1.2-1.5 mm. long, 0.7-0.9 mm. broad and thick, ovate to oblong-ovate, usually acute, with low faint wrinkles, slightly concave to slightly convex, the angles blunt and the coat white, micro-reticulate. *Chamaesyce cordifolia* (Ell.) Small. Frequent in openings on sandy soil, e. and s.e. Tex., s.w. in sand stringers to Atascosa Co. and s. near the coast to Cameron Co., summer-fall; Coastal States, N.C. to Tex.

53. *Euphorbia setiloba* Engelm. Pubescent annual herb; stems several, 0.5-1.1 mm. thick, 5-20 cm. long, prostrate, profusely branched (occasionally pseudodichotomously but usually unequally), the larger ("main") stems appearing zigzag, villous with long white trichomes; leaves opposite; blades oblong or orbicular to rarely oblong-ovate, 2-7 mm. long, 1 to 2 times longer than broad, rounded at apex, rounded and very inequilateral at base, marginally entire, villous like the stems but less densely so on upper surface; petioles 0.5-1 mm. long; stipules distinct, 0.1-1.2 mm. long, subulate and hairlike, caducous; cyathia solitary at the distal nodes; involucre slenderly urceolate, 1-1.3 mm. long to base of glands; glands 4, oblong, 0.2 mm. long, shallowly cupped, erect; appendages white to pink, much larger than the glands, 0.5-0.8 mm. long, parted at least half their lengths into 3 to 6 lanceolate acuminate lobes; *staminate flowers* 3 to 7 per cyathium; *pistillate flower*: styles 3, 0.2-0.3 mm. long, bifid about half their length, the divisions

slender; capsule ovoid-triangular, 1.1-1.4 mm. long, villous; columella 1-1.2 mm. long; seed oblong-triangular or quadrangular (the ventral facets variously forming a dihedral angle or nearly parallel), 0.9-1.1 mm. long, apically acute, basally truncate, sharply angled, essentially smooth or with very faint rounded irregular wrinkles, tawny with a thin white coat, ecarunculate. *Chamaesyce setiloba* (Engelm.) Millsp. Gravelly and sandy desert plains, s. Brewster Co. in the Trans-Pecos, Aug.-Sept.; N.M. w. to Calif., s. to Sin., Baja Calif; also Tex.

54. *Euphorbia arizonica* Engelm. Pubescent low perennial herb (occasionally behaving as winter annuals^p); taproots 1-5 mm. thick; stems several to many, 0.3-2 mm. thick, 7-30 (-40) cm. long, decumbent to ascending, densely pubescent with fine spreading translucent clavellate hairs, much-branched, the branches alternate and slender and often flexuous or rarely approaching the pseudodichotomous condition; leaves opposite; blades deltoid-ovate to ovate or the uppermost (smallest) ovate-oblong, 1-10 mm. long, 1.2 to 2 times as long as broad, rounded at apex, rounded and inequilateral at base, marginally entire, often slightly revolute, pubescent like the stems but less densely so on upper surface; petioles 1-2 mm. long; stipules minute, not visible without a strong lens, the lower united, the upper distinct; cyathia solitary at the nodes and in the forks; involucre narrowly cylindrical and urceolate, 1-1.5 mm. long to base of glands, pubescent with fine spreading white hairs; glands 4, shortly oblong, cupped, very small; appendages much larger than the glands, flabellate, 2 to 4 times as long as the glands (thus to 1 mm. long), spreading, usually entire marginally; *staminate flowers* 5 to 15 per cyathium; *pistillate flower*: styles 3, 0.5 mm. long, bifid less than half their lengths, the divisions slender; capsule ovoid, roundly triangular or sometimes widest at the middle, about 1.5 mm. long and about as broad, villous with clavellate hairs; columella about 1 mm. long; seed oblong or ovoid-quadrangular, 1-1.2 mm. long and about 0.6 mm. thick, apically acute, the facets traversed by rounded irregularly anastomosing transverse ridges separated by narrow grooves, the angles thus slightly crenulate, orangish with whitish bloom, ecarunculate. *Chamaesyce arizonica* (Engelm.) Arthur. Locally common in deserts of Brewster and Presidio cos. in the Trans-Pecos, July-Dec.; Tex. w. to Calif. and Baja Calif. and s.w. to Chih. and Dgo.

55. *Euphorbia villifera* Scheele. Pubescent or rarely glabrous perennial herb (flowering the first year), 5-25 cm. tall; stems few to many from the crown, 0.2-2 mm. thick, a few persistent at the base and becoming woody but these only about 1-2 cm. long, most of the stems annual and ascending or erect, 5-25 cm. long (or perhaps at times even longer), pilose with long white tapering hairs (rarely glabrous), pseudodichotomously much-branched; leaves opposite; blades ovate to ovate-oblong or the youngest ones sometimes ovate-deltoid, (3-) 5-8 (-10) mm. long, 1.2 to 2 times as long as broad, rounded or rarely subacute at apex, truncate and strongly inequilateral at base, marginally toothed at least on the distal half around the apex, beset with some very thin white spreading hairs 0.8-1.2 mm. long, at least near the margin on the lower surface and very sparse elsewhere; petioles slender, 0.5-1.7 mm. long; stipules united at the nonfloriferous nodes and distinct at the floriferous ones on both sides of the stem, at the nonfloriferous nodes forming an acuminate-deltoid scale which is serrulate or laciniate along the margins and about 1 mm. long, at the floriferous nodes narrowly deltoid-acuminate and serrulate or laciniate marginally and about 0.5 mm. long; cyathia solitary in the forks; involucre campanulate, sometimes narrowly so, 0.8-1.1 mm. long to the base of the glands, glabrous; glands 4, elliptical to nearly orbicular or oblong, 0.2-0.4 mm. long, cupped, erect, sessile or short-stalked; appendages 1 or 2 (to 4) times as long as the gland is wide and considerably wider than long, spreading or nearly erect, marginally entire; *staminate flowers* 9 to 23 per cyathium; *pistillate flower*: ovary deeply 3-lobed, quite glabrous and broader than long; styles 3, 0.4-0.6 (-0.7?) mm. long, bifid half to two thirds their length, the divisions spreading and terete; capsule 1.3-1.9 (-2.1) mm. long, broader than long, deeply 3-lobed, glabrous, the lobes oblong or occasionally narrowly deltoid; columella 1.1-1.5 mm. long; seed elongate-ovoid and rounded-quadrangular, 1-1.3 mm. long, 0.7-1 mm. thick, apically obtuse, essentially smooth, orange or ochraceous with thick white coat, ecarunculate. Incl. var. *nuda* Engelm., *Chamaesyce villifera* (Scheele) Small. Dry uplands, Trans-Pecos and Edwards Plateau e. to Bell and Travis cos., May-Oct.; Tex. s. and s.e. to Guat. and Yuc.

The diverse plants included here need much further analysis; possibly more than one species is represented.

56. *Euphorbia serrula* Engelm. Low annual herb; stems few to many, 0.5-1.5 mm. thick, prostrate, 5-25 cm. long, pilose with spreading hairs about as long as the stem is thick or longer, repeatedly pseudodichotomously branched; leaves opposite; blades oblong to slightly ovate- or obovate-oblong, 3-11 mm. long, 1.3 to 3 (to 4) times as long as broad, rounded at apex, very inequilateral and truncate at base, marginally sharply serrulate at least apically and on the abaxial margin, often with a median splotch, often falcate or at least appearing so by revolution of the lateral margins, pilose but more sparsely so than the stems or even glabrate; petioles 0.5-1.2 mm. long; stipules distinct, glabrous to rarely ciliate, deltoid, marginally fimbriate, 0.5-1.2 mm. long; cyathia solitary in the forks; involucre shortly campanulate, 0.5-1 mm. long to base of glands, mostly glabrous; glands 4, oblong to nearly round, 0.1-0.2 mm. long; appendages 1 to 4 times as long as the gland is wide, rounded, marginally entire to erose, spreading to erect; *staminate flowers* 7 to 13 per cyathium; *pistillate flower*: styles 3, 0.3-0.4 mm. long, bifid half to all their length, the divisions clavellate to terete; capsule broadly ovoid, plumply triangular, 1.9-2.2 mm. long, 3-3.5 mm. broad, truncate basally, glabrous; columella 1.7-1.9 mm. long; seed oblong, plumply quadrangular, 1.4-1.5 mm. long, about 1 (-1.5) mm. thick, angles sharp except the raphal one, apically acute, basally rounded to truncate, superficially smooth or porous like unglazed pottery, chalky-white to grayish-white, ecarunculate. *Chamaesyce serrula* (Engelm.) Woot. & Standl. Abundant in calcareous deserts in the Trans-Pecos, June-Sept.; Tex. to N.M., Ariz., Zac., Dgo. and Coah.

57. *Euphorbia indivisa* (Engelm.) Tidestr. Annual herb; stems several, 0.5-1 mm. thick, prostrate, 5-15 (-25) cm. long, crisply villous or basally glabrate, sparingly branched; branching unequally pseudodichotomous; leaves opposite; blades ovate-deltoid to oblong, 5-8 (-13) mm. long, 1.5 to 2 times as long as broad, acute at apex, very inequilateral at base, often falcate by the bowing inward of the abaxial margin, marginally serrulate, mostly glabrous above, sparsely crisply villous beneath or glabrate; petioles about 1 mm. long; stipules distinct, larger and more conspicuous on the lower side of the stem, subulate, 1-1.7 mm. long, usually entire or on the lower side of stem usually trifid with the middle lobe longest, crisply pubescent or the margin fimbriate; cyathia solitary at the distal nodes, often clustered by shortening of distal internodes; involucre narrowly campanulate or subcylindric, about 1 mm. long to base of glands; glands 4, oblong, cupped, erect, the 2 near the sinus 0.4-0.6 mm. long, the 2 distal ones 0.2-0.3 mm. long; appendages white to red to purple, on the distal glands symmetrical and only about 0.2 mm. long, on the proximal glands very asymmetrical and distended 1.1-1.4 mm. toward and beyond the glands, the margins erose or nearly entire; *staminate flowers* 5 to 15 per cyathium; *pistillate flower*: styles 3, essentially entire, 0.7-1.3 mm. long; terete; capsule ovoid-triangular or more deeply 3-lobed, 1.4-1.6 mm. long, truncate basally, strigose; columella 1.2-1.4 mm. long; seed oblong-quadrangular, 0.9-1.2 mm. long, 0.4-0.6 mm. thick, apically acute, basally truncate, with 3 to 5 transverse ridges separated by deep sharp grooves somewhat involving the angles, pale pinkish-brown with white coat, ecarunculate. *Chamaesyce indivisa* (Engelm.) Millsp. Grasslands on soil derived from dark basic igneous rocks, 4,500-6,500 ft. elev. in the Trans-Pecos, July-Aug. (-Sept.); Tex., N.M., Ariz., s. to Jal. and S.L.P.

58. *Euphorbia maculata* L. Low pubescent annual herb; stems several, usually prostrate or decumbent, mostly shaggy pubescent (villous) or glabrate basally, 10-45 cm. long; leaves opposite; blades elliptic-ovate or oblong-ovate to linear-oblong, 4-17 mm. long, apically various, basally inequilateral and truncate, marginally serrulate to subentire, sparsely villous, less densely so to glabrate above; petioles 1-1.5 mm. long, pubescent like the stem; stipules present, usually deltoid, acuminate, 1-1.5 mm. long, usually 2- or 3-parted, villous; cyathia solitary at the distal nodes but clustered by shortening of the distal internodes; involucre turbinate, about 0.8 mm. long to base of glands, villous; glands 4, oblong and very small; appendages short, white, irregularly crenate; *staminate flowers* 2 to 5 per cyathium; *pistillate flower*: styles 3, 0.3-0.4 mm. long, bifid a fourth to a third their length, the divisions clavellate; capsule ovoid-triangular, strigose, about 1.4 mm. long; columella slender, about 1.2 mm. long; seed oblong-quadrangular, about 1 mm. long, the facets with subregular low transverse ridges often slightly including the angles,

pale-brownish with white coat, ecarunculate. *E. supina* Raf., *Chamaesyce maculata* (L.) Small, *C. supina* (Raf.) Raf. In a variety of soils (commoner in disturbed sandy areas) e. of the Trans-Pecos, rare in the higher parts of the Plains Country and in the Edwards Plateau, summer-fall; throughout e. U.S.; adv. in Calif., Ore. and Eur.

59. *Euphorbia humistrata* Gray. Exceedingly similar to *E. maculata* but tending to root at the lower nodes and having bifid styles almost half as long as the capsule. *Chamaesyce humistrata* (Gray.) Small. Rare in disturbed sandy soil, e. and s.e. Tex. (Angelina, Bowie and Harris cos.), summer-fall; O., Ill. and Kan., s. to Ala., La. and Tex.

60. *Euphorbia stictospora* Engelm. Low annual pubescent herb; stems several, 0.8-1.5 (-3.5) mm. thick, prostrate, 5-25 (-35) cm. long, crisply villous, branching sparse to profuse, not pseudodichotomous, mostly consisting of many very short floriferous laterals with internodes only 1-3 mm. long; leaves opposite; blades shortly oblong to nearly orbicular or even oblong-obovate, 3-7 (-10) mm. long, 0.9 to 2.1 times as long as broad, rounded or usually bluntly pointed at apex, inequilateral and truncate or rounded at base, marginally serrulate at least toward the apex, shortly crisply villous, less densely so above or glabrate; petioles about 1 mm. long; stipules often united on lower side of stem and distinct above but variable, when united broadly deltoid, 2- to 6-laciniate, the lobes subulate and fimbriate, when distinct narrowly deltoid and acuminate, 2- or 3-laciniate or entire, the lobes subulate, the whole 0.5-0.8 (-1) mm. long; cyathia solitary at the nodes but mostly on congested short densely leafy lateral branches; involucre narrowly turbinate, 0.7-0.9 mm. long to base of glands, white-strigose; glands shortly oblong to round, 0.1-0.3 mm. long, cupped, often blood-red; appendages ochroleucous to pinkish (not white), 1 to 2 times as long as the gland is wide, marginally entire to erose; *staminate flowers* 3 to 7 per cyathium; *pistillate flower*: styles 3, about 0.2 mm. long, essentially entire, subclavellate, often yellowish-brown with slightly enlarged blood-red tip; capsule ovoid, roundly triangular, 1.4-1.6 (-1.9?) mm. long, truncate basally, with spreading or strigose pubescence more dense on the margins; columella 1.2-1.3 mm. long; seed oblong-quadrangular, 1.1-1.2 (-1.4?) mm. long, apically acute, basally truncate, with shallow irregular pits to subregular indistinct transverse wrinkles, pale-brown with thin white coat, ecarunculate. *Chamaesyce stictospora* (Engelm.) Small. Commonest in disturbed calcareous areas or areas of dark basic igneous rocks in the Trans-Pecos, infrequent in the Plains Country and Edwards Plateau, rare as a waif e. to n.-cen. Tex., July-Sept.; Wyo. and S.D., s. to Coah. and Zac., rare s. to Jal.

61. *Euphorbia prostrata* Ait. Pubescent annual herb; stems several to many, 0.3-1.5 mm. thick, prostrate, 7-20 mm. long, crisply short-villous or glabrate basally; branches numerous, occasionally but not usually pseudodichotomous; leaves opposite; blades oblong to ovate-oblong, 3-11 mm. long, 1.3 to 3 times as long as broad, rounded at apex, inequilateral and rounded at base, marginally serrulate especially toward the apex, sparsely short-villous below, nearly glabrate above; petioles 0.5-1 mm. long; stipules mostly distinct but approximate on lower side of stem, narrowly deltoid, subulate, yellowish to purplish, white-strigose along margins; cyathia solitary at the distal nodes; involucre turbinate, 0.4-0.7 mm. long to base of glands, sparsely villous; glands 4, nearly round, maroon, cupped, 0.05-0.15 mm. long; appendages pinkish-white, shorter than the gland is wide, erose; *staminate flowers* 2 to 5 per cyathium; *pistillate flower*: styles 3, 0.1 mm. long, bifid to the base or nearly so; capsule ovoid-triangular; 1.1-1.3 (-1.4) mm. long, yellowish, strigose or crisply villous along the angles; columella about 1 mm. long; seed oblong, quadrangular, 0.9-1 mm. long, acute at apex, sharply angled, pale pinkish-brown with a white coat, the facets with 5 to 7 low sharp transverse ridges, ecarunculate. *Chamaesyce prostrata* (Ait.) Small. Common in disturbed soils, most of Tex. but infrequent in the far w. part., June-Sept.; widespread in the lowlands of N.A. including the W.I.

For several years, through error, this species went under the name "*E. Chamaesyce* L.," but that name is correctly applied to an Old World species.

62. *Euphorbia laredana* Millsp. Exceedingly similar to *E. prostrata*; distinguished by the seeds averaging slightly larger (1.1-1.3 mm.) with broader more rounded transverse ridges and the herbage grayish-pilose-tomentose. *Chamaesyce laredana* (Millsp.) Small. Local in caliche-sand uplands, Rio Grande Plains (Duval, Frio, Hidalgo, Jim Hogg, McMullen, Starr and Webb cos.), Mar.-Nov.; also Tam.

FAM. 103. CALLITRICHACEAE LINK
WATER-STARWORT FAMILY

Aquatic or terrestrial annual or perennial herbs with delicate stems; leaves opposite, entire, without stipules; flowers unisexual, either both kinds on one plant or on separate plants, the perianth lacking, each flower subtended by a pair of falciform or obliquely oval bracteoles (or these wanting); *staminate flowers* 1 to 3 in the axil of a foliage leaf, consisting of a single anther and slender filament; *pistillate flowers* 1 or rarely more, similarly placed, composed of a single pistil of 2 carpels; styles 2, slender, often much longer than the ovary; carpels splitting on maturity and usually forming a fruit of 4 achenelike mericarps; mericarps flattened, winged, margined or smooth, each bearing 1 seed.

A monotypic family.

1. CALLITRICHE L.¹¹⁹

WATER-STARWORT. WATER-CHICKWEED

Characters of the family. A group of highly polymorphic species due to apomixis in many of the species and to variations and different outward appearances resulting from the same species inhabiting diverse habitats, either amphibious or terrestrial.

About 25 species distributed throughout the world.

1. Fruit as high as wide or a little higher, rarely slightly wider than high; stigmas to 6 mm. long; stamens elongating to 1.5-3 mm. as the fruit matures; anthers to 1.5 mm. wide; flowers with 2 whitish inflated bracteoles at base; leaves of various types on different or the same plant; plant amphibious, growing entirely submersed or with a terminal rosette of floating leaves, or as a mat on mud (2)
1. Fruit broader than high; stigmas to 1 mm. long; stamens to 1.2 mm. long and not elongating as the fruit develops; anthers 0.1-0.2 mm. wide; flowers without bracteoles; leaves essentially uniform; plants mostly terrestrial or on mud (3)
- 2(1). Height of fruit exceeding the width by 0.2 mm.; lower end of mericarps curved outward so that the fruit is thickest at base1. *C. verna*.
2. Height of fruit equaling width or not varying by more than 0.1 mm.; lower end of mericarps straight so that fruit is thickest a little below the middle; commissural grooves very narrow2. *C. heterophylla*.
- 3(1). Fruit 0.3-0.8 mm. wide, more or less gibbous at base3. *C. peploides*.
3. Fruit 0.5-1.2 mm. wide, not gibbous at base (4)
- 4(3). Fruit pedicelled; wing and thin margin of carpel turned outward at right angles to the surface of the fruit or revolute and appearing like a thickened margin4. *C. Nuttallii*.
4. Fruit almost sessile; margin of carpel appearing as if not winged but under high magnification showing a minute wing; styles usually deflexed5. *C. terrestris*.

1. *Callitriche verna* L. (*emend.* Kütz.) Fruits sessile, suborbicular, 0.6-1.4 mm. wide, the height always exceeding the width, the width greatest above the middle, the thickness at base greater than at summit; face of mericarps sharply reticulate, the reticulations appearing more or less clearly in vertical rows; margins of carpels widely spreading with a definite scarious wing that is always widest at summit and runs a greater or lesser distance down the sides; pale-green submersed aquatic or sometimes terrestrial on the margin of ponds or streams; stems to about 5 dm. long; leaves very variable, the lower submersed ones often linear, 0.3-1 mm. wide, 1-nerved, shallowly bidentate at apex, the upper ones often dilated and the terminal leaves petioled and narrowly obovate to spatulate and commonly in a floating rosette, various intermediate leaves are present on many plants. *C. palustris* L. In quiet shallow water or stranded on mud in e. and cen. Tex.,

¹¹⁹ Adapted from N. C. Fassett in *Rhodora* 53:137-155, 161-194, 209-222. 1951.

Mar.-June; from Greenl. to Alas., s. to Tex., N.M., Ariz. and Calif.; also Mex., Eur. and Asia.

Young fruits of *C. verna*, when pressed, sometimes widen as they flatten to simulate in outline those of *C. heterophylla*.

2. *Callitriche heterophylla* Pursh (*emend.* Darby). Fruit 0.6-1.2 mm. wide, the height equaling the width or not more than 0.1 mm. greater or 0.1 mm. less than the width; carpels more broadly rounded at summit than at base so that the outline of the fruit is slightly heart-shaped, convex on the face and thickest just above the base; margins of fruits wingless or rarely with a very narrow wing at the summit; styles 1-6 mm. long, erect or spreading, persistent or caducous; plants rather dark-green; leaves of many types, often linear and one-nerved at the lower nodes with a rosette of floating obovate leaves or (on plants stranded on mud) all linear or all obovate or oblong; linear one-nerved leaves shallowly bidentate at tip with an enlarged but scarcely excurrent nerve-ending. In quiet waters and on mud throughout Tex., Feb.-July; from e. Can., throughout the U.S., s. through Mex. to Guat.

3. *Callitriche peploides* Nutt. Fruit black when ripe, 0.5-0.8 mm. wide, not quite so high; mericarps narrowed and elongated at base, pushing against each other so that each is bent at an angle with the face and the fruit appears greatly thickened at base; stigmas about 0.2 mm. long, often persistent and loosely reflexed; filaments about 0.2 mm. long; anther about 0.1 mm. wide; stems rooting below and apparently creeping, the erect branches 1-5 cm. high; leaves only slightly crowded at the tips of the branches, 2-5 mm. long, cuneate to spatulate-obovate, 1- to 3-nerved but often so faintly as to appear nerveless. On mud and in wet sands throughout the e. half of Tex., Feb.-May; from S.C. to Fla., s.e. Ark. and w. to Tex.; also e. Mex. to C.R.

4. *Callitriche Nuttallii* Torr. Fruit with pedicels of various lengths, buried in the mud at maturity, 1 mm. wide, 0.6-0.8 mm. high, 0.3-0.5 mm. thick; mericarps with flat faces, the margins with a thin wing that is curled toward the face to give the appearance of thickened margins; stigmas about 0.8 mm. long, sometimes persistent and loosely ascending or somewhat reflexed; filaments 0.2-0.5 mm. long; anthers 0.2-0.3 mm. wide; plant a minute annual; leaves 3-4 mm. long, 0.5-1.5 mm. wide, oblanceolate-obovate, very obscurely 3-veined. In damp soil in fallow fields and flats in e. Tex., Mar.-May; along Gulf Coast from Ala. to Tex., inland to cen. Ala. and Ark.

5. *Callitriche terrestris* Raf. (*emend.* Torr.). Fruit 0.6-0.9 mm. wide, 0.4-0.7 mm. high, with pedicels mostly 0.2 mm. long or rarely reaching 0.6 mm. long; mericarps usually equally rounded at each end but rarely broadly rounded above so that the fruit becomes slightly heart-shaped; faces of mericarps flat; outer edges of mericarps appearing scarcely winged but under high magnification showing a very narrow wing with radii but little anastomosing of radii; stigmas 0.2-0.4 mm. long, usually persistent and deflexed; anthers 0.1-0.2 mm. wide, on filaments 0.1-0.2 mm. long; a minute annual with simple to much-branched slender stems to about 35 mm. long; leaves rather uniform, obovate-oblanceolate to spatulate, 2-3.5 mm. long, 0.6-1 mm. wide, very obscurely 3-nerved; *C. Austinii* Engelm., *C. deflexa* A. Br. var. *Austinii* (Engelm.) Hegelm. On damp soil, moist pathways, wet open spots in lawns and other such places in e. Tex., Mar.-June; from N.E., s. to s.e. Va., w. Ala., La., Tex., Mo. and Ill.

FAM. 104. ANACARDIACEAE LINDL.¹²⁰

SUMAC FAMILY

Trees, shrubs or vines with resin-ducts in the bark and sometimes in the herbage, with a resinous or milky and usually acrid juice; leaves alternate or rarely opposite, simple to 3-foliolate or pinnate, deciduous or persistent, usually essentially exstipulate; flowers numerous, small, in terminal thyrses or axillary panicles, or rarely in clusters of spikes, perfect or unisexual through abortion, mostly regular with 5-parted (less often 3- or 4-parted) whorls; receptacle various, flat, concave or convex, sometimes forming a cushionlike gynophore, developing into a ring- or cup-shaped disk; calyx inferior, rarely

¹²⁰ Adapted partly from Fred A. Barkley in C. L. Lundell, *Flora of Texas* III:89-108. 1943.

lacking; corolla seldom lacking; stamens as many as and alternate with the petals, sometimes twice as many or partially aborting; carpels 1 or 2 to 5 united; styles separate or more usually coalesced; fruit various, dry or drupaceous, with resinous or ceriferous mesocarp and crustaceous or bony endocarp (stone); seed with little or no endosperm.

About 60 genera and nearly 600 species, mostly in the tropics. The African sumac [*Searsia lancea* (L. f.) Barkl.] has been introduced into Texas as an ornamental, and it may eventually become naturalized. It is an innocuous shrub or small tree somewhat similar in appearance and in fruit characteristics to our native virulently poisonous swamp sumac (*R. Vernix*), but it is an upland plant that usually has three or rarely five leaflets and resinous, not waxy, mesocarps.

- 1. Flowers without perianth1. *Pistacia*, p. 987.
- 1. Flowers with sepals and petals (2)
 - 2(1). Flowers with twice as many stamens as petals; seed suspended; endocarp of fruit bony2. *Schinus*, p. 987.
 - 2. Flowers with as many stamens as petals (3)
 - 3(2). Style or stigma lateral on the fruit; seed basal; leaves simple; pedicels of sterile flowers at length becoming plumose3. *Cotinus*, p. 988.
 - 3. Style or stigma more or less at the apex of the ovary; leaves trifoliolate to imparipinnate4. *Rhus*, p. 988.

1. PISTACIA L.

A genus of about 10 species found in the Mediterranean region, with several in America. The Old World species, *P. vera* L., produces the edible nut of commerce.

1. *Pistacia texana* Swingle. AMERICAN PISTACHIO, MEXICAN PISTACHIO, LENTISCO. Shrub or small tree to about 4 m. high; branches slender, at first puberulent and grayish-tan, becoming glabrate and brownish; leaves alternate, imparipinnately compound with as many as 21 leaflets; leaflets thinly subcoriaceous, usually strongly falcate, obovate or rarely broadly lanceolate or ovate, to 2 cm. long and 1 cm. wide, rounded or obtuse and mucronate at apex, broadly cuneate at base, sparsely puberulent to glabrous, somewhat darker above, the margins entire or slightly irregular and subrevolute; rachis subalate; pistillate and staminate flowers on separate plants; flowers small, sessile or subsessile in lateral spikes; bracts deltoid-ovate, subacute, about 1.5 mm. long, sparsely puberulent; sepals and petals none; stamens 5; fruit red, a nutlike drupe, about 3.5 mm. wide and 5 mm. long, covered with a bloom, becoming almost black on drying. *P. mexicana* of auth. On limestone cliffs and along ravines, Bexar to Val Verde cos. on the Edwards Plateau, throughout the year; also n. Mex.

2. SCHINUS L. PEPPER-TREE

Dioecious evergreen or semievergreen trees or large shrubs; branches with resin-ducts in the cortex and pith; leaves alternate, simple or odd-pinnate, resinous; flowers in bracteate panicles, small, whitish; sepals 5; petals 5, imbricated; stamens 10; ovary sessile, producing a globose drupe.

About 30 species, mostly in South America.

- 1. Inflorescence a pseudoraceme, very short, congested; leaves simple, glabrous at maturity, thinnish, entire, spatulate, obtuse or rarely subacute at apex, narrowly cuneate at base, 2-5 cm. long; petioles 2-4 mm. long; stems spinescent1. *S. longifolius*.
- 1. Inflorescence a panicle, often exceeding the leaves in length; leaves pinnately compound, usually with 17 or more lanceolate leaflets; stems not spinescent2. *S. molle*.
- 1. *Schinus longifolius* (Lindl.) Speg. & Girola. Shrub or small tree; branches few, spinescent, glabrous; branchlets moderately slender; leaves with slender glabrous petioles 2-4 mm. long, at first with a few long hairs, soon glabrate, 2-5 cm. long, 3-12 mm. broad,

thin, narrowly cuneate at base, mostly obtuse at the apex, rarely subacute, essentially entire; inflorescence about 1 cm. long, congested, many-flowered, the axis glabrous or rarely with a few scattered hairs; bracts deltoid to ovate, subacute, glabrous or rarely very sparsely pilose on the dorsal surface, sparsely ciliate, at length deciduous; pedicels about 4 mm. long, slender, glabrous or rarely sparsely short-pilose below the abscission plate; sepals deltoid-ovate, rounded at apex, glabrous on the outer surface, densely ciliate with simple hairs on the margin; petals narrowly ovate, 2 mm. long, 1 mm. broad, with a few hairs on the veins on the dorsal surface or glabrous; anthers ovate; fruit about 6 mm. in diameter, lavender. Introd. into s. Tex. as an ornamental, and apparently naturalized in several localities; nat. of e.-cen. S.A.

2. *Schinus molle* L. PERUVIAN PEPPER-TREE, PIRUL. Tree to 15 m. high, with numerous slender drooping branches and branchlets to form a spreading crown; leaves with petioles 2-3 cm. long, imparipinnately compound, at length thick-membranaceous, to 3 dm. long, glabrous or very sparsely and minutely puberulent; leaflets 15 to 40, sessile, lanceolate to linear-lanceolate, to 6 cm. long, cuneate to obtuse at base, acuminate or rarely acute at apex, the tip usually curved, entire or nearly so, slightly darker above; inflorescences consisting of a terminal thyrus and much-branched panicles axillary in the uppermost leaves, each 8-15 cm. long and minutely puberulent; bracts deltoid, ciliate, very sparsely and minutely puberulent on the dorsal surface, caducous; flowers small, yellowish-white; pedicels about 2 mm. long, slender, puberulent below the abscission plate, glabrous above; sepals semiorbicular, glabrous on the outer surface, sparsely ciliate with simple trichomes; petals narrowly ovate, truncate, glabrous, about 2 mm. long; anthers oblong; fruit lavender-pink, 6-8 mm. in diameter, vernicose. Occasionally volunteering in the Brownsville district where it was introd. as an ornamental; nat. of S.A.

3. COTINUS MILL.

Two or three species in Europe and Asia, 1 in southwest China and 1 in North America.

1. *Cotinus obovatus* Raf. AMERICAN SMOKE-TREE, CHITTAM-WOOD. Small deciduous tree to about 10 m. high, with yellow wood, scaly bark and strong-smelling juice; twigs at first glaucous, later becoming brown; leaves alternate, with petioles 1.5-6 cm. long, scattered, thin, obovate to elliptic-obovate, to 17 cm. long and 9 cm. broad, rounded to obtuse or somewhat acutish at the apex, rarely emarginate, usually cuneate at the base, silky-pubescent beneath when young, at maturity dark-green and smooth above, paler and sparsely pubescent beneath, turning brilliant orange and scarlet in the autumn; staminate and pistillate flowers on separate plants or occasional flowers appearing perfect; flowers numerous, yellowish-white, 5-merous, in short lax terminal panicles about 1 dm. long, mostly abortive, the fruiting panicles about 3 dm. long; sterile pedicels with rather inconspicuous pale-purplish or brownish hairs; bracts of the inflorescence lanceolate, more or less persistent; sepals lanceolate, acute, 1 mm. long, 0.3 mm. broad, persistent, glabrous; petals oblanceolate, rounded, 2 mm. long, 1 mm. broad, glabrous; stamens inserted under the annular disk; fruit produced sparingly, 4 mm. long, reniform. *C. cotinoides* (Nutt.) Britt., *C. americanus* Nutt., *Rhus cotinoides* Nutt. In rocky woods and on hillsides and limestone outcrops, from Kendall and Kerr to Uvalde cos. on the Edwards Plateau, Apr.-May; Ala., Tenn. and Mo., s.w. to Okla. and Tex.

The Old World wig-tree, *C. Coggygria* Scop., is sometimes cultivated in Texas and may eventually become an escapee. It has glabrous leaves 3-8 cm. long, perfect flowers and fruits 3-4 mm. long.

4. RHUS L. SUMAC

Shrubs or small trees, rarely vines; leaves alternate, simple or compound (in ours); flowers polygamous, in axillary or terminal panicles; calyx lobes 4 to 6, usually 5, persistent; petals imbricated in the bud, spreading in anthesis; disk annular; stamens 5; ovary 1-celled, 1-ovuled; styles 3, terminal; drupe small, subglobose or compressed, pubescent or glabrous, the exocarp persistent or deciduous; seed solitary, inverted on a stalk that rises from the base of the ovary.

About 250 species of temperate and tropical regions, most abundant in South Africa. The vernacular name is commonly pronounced "shumac."

1. Drupes white or dun-colored, glabrous or sparingly pubescent, the pubescence not glandular; poisonous small trees, shrubs or vines (2)
1. Drupes red, noticeably pubescent; plants innocuous (5)
- 2(1). Leaflets 5 to 17; large shrubs or trees, in wet habitats 1. *R. Vernix*.
2. Leaflets typically 3; small shrubs or vines of usually dryish habitats (3)
- 3(2). Terminal leaflet oblong-elliptic, with broad blunt apex; leaflets entire or with shallow rounded lobes or broad blunt teeth; low creeping shrub 2. *R. Toxicodendron* var. *Toxicodendron*.
3. Terminal leaflet ovate or rhombic, with narrowed apex; usually with some leaflets deeply lobed or sharply toothed (4)
- 4(3). Petioles and lower surface of leaflets pubescent; low or high-climbing vine, sometimes creeping and with erect branches to 18 dm. tall 2. *R. Toxicodendron* var. *vulgaris*.
4. Petioles and leaflets glabrous; low shrub usually less than 10 dm. tall, forming beds from creeping rootstocks 2. *R. Toxicodendron* var. *eximia*.
- 5(1). Flowers in dense terminal thyrses, appearing after the leaves; bracts linear-lanceolate, deciduous, one subtending each flower; bracteoles absent; branches thick (6)
5. Flowers in terminal and lateral compound spikes, appearing with or before the leaves; bracts deltoid to ovate, persistent, one bract and two bracteoles subtending each flower (8)
- 6(5). Leaf rachis not winged; leaflets mostly sharply toothed 3. *R. glabra*.
6. Leaf rachis winged; leaflets mostly entire (7)
- 7(6). Rachis and its wings on at least some of the leaves over 4 mm. broad; leaflets 7 to 17, ovate-lanceolate, scarcely falcate, 2 to 4 times as long as wide; in eastern half of Texas 4. *R. copallina*.
7. Rachis and its wings usually less than 3.5 mm. broad; leaflets 13 to 19, linear-lanceolate, strongly falcate, 4 to 9 times as long as wide; in north-central Texas, Edwards Plateau and Trans-Pecos regions 5. *R. lanceolata*.
- 8(5). Flowers usually appearing with the leaves; evergreen shrubs and trees; leaves coriaceous, imparipinnately compound; axillary inflorescences surpassed by the subtending leaves (9)
8. Flowers usually appearing before the leaves; mostly deciduous shrubs; leaves usually herbaceous (10)
- 9(8). Leaflets sparsely pubescent beneath, soft to the touch; inflorescences few, usually terminating the branches 6. *R. virens*.
9. Leaflets glabrous, not soft to the touch; inflorescences usually numerous, both axillary and terminal 7. *R. choriophylla*.
- 10(8). Spinescent shrubs with very small 3- to 9-foliolate leaves; rachis winged; bracts and bracteoles approximately the same size 8. *R. microphylla*.
10. Gracefully diffuse or subscaudent shrubs; leaves 3-foliolate; rachis not winged; bracteoles much smaller than the bracts (11)
- 11(10). Terminal leaflet 25-60 mm. long, more or less narrowed at apex 9. *R. aromatica* var. *serotina*.
11. Terminal leaflet 15-33 mm. long, abruptly narrowed to truncate at apex (12)
- 12(11). Mature leaves glabrous 9. *R. aromatica* var. *flabelliformis*.
12. Mature leaves densely pubescent 9. *R. aromatica* var. *pilosissima*.

1. *Rhus Vernix* L. POISON SUMAC, POISON ELDER, POISON DOGWOOD. Shrub or small tree to 7 m. high; branchlets glabrous, glaucous at first, gray at maturity; leaves odd-pinnate, with glabrous petioles; leaflets 5 to 13, short-stalked, elliptic to elliptic-oblong, 4-10 cm. long, acuminate at apex, cuneate at base, entire, slightly pubescent at first, becoming quite glabrous, with 8 to 12 pairs of veins; flowers greenish, in slender axillary panicles to 2 dm. long; fruit subglobose, compressed, 5-6 mm. across, whitish or light yellowish-gray. In swamps, on seepage slopes and in wet thickets in e. Tex., Apr.-June; from Fla. to Tex., n. to N.E. and s.e. Minn.

The plant, at all seasons, is virulently poisonous to the touch. The leaves turn to orange or scarlet in the fall and are most attractive but dangerous!

2. *Rhus Toxicodendron* L. POISON IVY, POISON OAK, HEDRA. Small shrub or vine with slender glabrate to densely pubescent or puberulent stems and branches, sometimes with aerial roots and/or subterranean stolons; leaflets 3, very rarely with some 5, variable, at first more or less pubescent, later glabrate (especially above) or somewhat pubescent beneath, ovate to elliptic or rhombic to obovate, entire or irregularly serrate or dentate to regularly lobate-dentate with 3 to 7 rounded blunt or rarely subacute lobes, rounded to acute or acuminate at apex, rounded to cuneate at the base; terminal leaflet 3-20 cm. long, 1.5-13 cm. wide, with a petiolule 1-4.5 cm. long; lateral leaflets somewhat smaller than terminal one, inequilateral, often subentire on the upper margin and 3- to 7-lobed on the lower margin, with petiolules 1-5 mm. long; inflorescence composed of lateral panicles; fruit mostly whitish or cream-colored, subglobose, 5-7 mm. in diameter, glabrous or somewhat pubescent; seeds about 4 mm. broad, spring-summer; N.S. to B.C., s. to Fla., Ariz. and Oax.

The plants are commonly showy in autumn with the brilliant scarlet or orange tint of their leaves that are very poisonous to the touch. The fumes from burning plants can also be very poisonous. The following varieties, whose difference are given in the key, are in our region.

Var. *eximia* (Greene) McNair [*Rhus verrucosa* Scheele, *R. radicans* var. *verrucosa* (Scheele) Fern. and var. *Rydbergii* (Small) Rehd., *Toxicodendron eximium* Greene, *T. radicans* var. *eximium* (Greene) Barkl. and var. *verrucosum* (Scheele) Barkl.]. In uplands and on limestone outcrops, rather frequent in cen. and w. Tex.

Var. *Toxicodendron* [*Rhus Toxicodendron* var. *quercifolia* Michx., *Toxicodendron quercifolium* (Michx.) Greene]. In sandy woods and open areas mostly in e. Tex.

Var. *vulgaris* Michx. [*Rhus Toxicodendron* var. *microcarpa* Michx. and var. *radicans* (L.) Torr., *R. radicans* L. and var. *vulgaris* (Michx.) DC., *Toxicodendron radicans* (L.) O. Ktze.]. Stream bottoms or hillside woods or thickets, fencerows and disturbed soils, rather frequent throughout most of Tex.

3. *Rhus glabra* L. SMOOTH SUMAC, SCARLET SUMAC. Shrub or small tree to 3 m. high; branchlets glabrous and somewhat glaucous; leaflets 11 to 31, lanceolate to oblong-lanceolate, to 12 cm. long, acuminate at apex, sharply serrate, glaucous beneath; flowers greenish, in a large dense terminal panicle to 25 cm. long, puberulous; fruit scarlet, viscid-pubescent, compressed, about 4 mm. in diameter, in dense panicles. On dry sandy hillsides and banks, in e. Tex. w. to Brazos, Eastland and Armstrong cos., May-July; from N.E. and Que. s. to Fla., Tex., Ariz. and n. Mex.

This species has bright autumn foliage and scarlet fruiting panicles. The somewhat similar staghorn or velvet sumac (*R. typhina* L.), of eastern United States, is occasionally cultivated in Texas and may eventually be found as an escapee. It may be distinguished from *R. glabra* by its densely pilose branchlets and inflorescences.

4. *Rhus copallina* L. WING-RIB SUMAC, DWARF SUMAC, SHINING SUMAC. Large shrub or small tree to 10 m. high, with rather slender branches; older branches with numerous conspicuous lenticels, glabrate, the new branches villous-tomentose; buds tan, lanuginous; leaves compound, to 35 cm. long, with petioles 3-6 cm. long; leaflets 7 to 11, sessile or with the terminal one petiolulate, elliptic-lanceolate to ovate-lanceolate, thin, subrevolute, green, glabrous or sparsely pilose and shining above, somewhat lighter and glandular-hairy on the dull lower surface, entire or serrate-margined, to 85 mm. long and 4 cm. wide, obtuse to acute or less often acuminate at the apex, usually somewhat unequally cuneate at base; rachis segments 15-25 mm. long, winged, the uppermost broadly so; inflorescence a large terminal thyrses about 12 cm. long and 1 dm. broad; flowers greenish-

white; fruit about 4 mm. in diameter, somewhat flattened, with red glandular hairs; seeds 2.5 mm. in diameter, smooth or somewhat roughened, usually larger at one end. *R. copallina* var. *latifolia* Engl. On rocky hills and in woods and bottomlands in the e. half of Tex.; from N.E. to Ill., s. to Ga., Ala., La. and Tex.

Occasionally planted for its lustrous leaves that change to reddish-purple in the fall and for its crimson fruit clusters.

5. *Rhus lanceolata* (Gray) Britt. Small tree or large shrub to 10 m. high, with slender branches; older branches with numerous lenticels on the brown bark, the younger ones villous but soon glabrate; buds whitish, tomentose; leaves compound, with petioles 25-35 mm. long; leaflets 13 to 19, sessile or the terminal one petiolulate, linear-lanceolate, falcate with the abaxial side wider than the adaxial side, thin, subrevolute, entire or subserrate-margined, green and shining above, pilose and somewhat glandular-hairy on the lighter and dull lower surface, to 55 mm. long and 12 mm. wide near the apex, long-acuminate to acuminate, asymmetric at the cuneate base; rachis segments 13-17 mm. long, winged (the lower ones often obscurely so); inflorescence a large terminal thyrse, about 1 dm. long and 7 cm. broad; flowers whitish; fruit 3.5 mm. long, 4 mm. broad, somewhat flattened, red; seeds 3 mm. long, 2 mm. broad, smooth, slightly larger at one end. *R. copallina* var. *lanceolata* Gray. On limestone and in calcareous soils from n.-cen. Tex. and the e. edge of the Edwards Plateau, w. to the Trans-Pecos; also N.M.

6. *Rhus virens* Gray. EVERGREEN SUMAC, TOBACCO SUMAC, LENTISCO. Shrub or small tree to 3 m. high or more; branches brown, at first puberulent, later glabrate; leaves compound, evergreen, with petioles about 15 mm. long; leaflets mostly 5 to 9, petiolulate, rhombic-ovate to rarely ovate or ovate-lanceolate, cuneate at the base, coriaceous, subrevolute and entire-margined, pubescent but shining and dark above, pale and sparsely soft-pilose (with some glandular hairs) beneath, to 4 cm. long and 2 cm. wide; flowers creamy-white or white, in terminal panicles about 4 cm. long; fruit about 6 mm. long, pubescent with simple and glandular hairs. *Schmaltzia virens* (Lindh.) Small. In gullies and on rocky bluffs, slopes and banks, on dry hillsides and mt. sides in the Edwards Plateau and Trans-Pecos; w. to n. Mex.

7. *Rhus choriophylla* Woot. & Standl. EVERGREEN SUMAC, TOUGH-LEAVED SUMAC. Low shrub or small tree to about 3 m. high, with few branches; branches maroon-brown, with a gray puberulence; leaves evergreen; leaflets 3 or 5, petiolulate, ovate, acute to short-acuminate at apex, obtusely rounded to subcuneate at base, coriaceous, glabrate, subrevolute and entire-margined, pale-green, rather dull above and beneath, to 5 cm. long and 25 mm. wide; flowers whitish or creamy-white, in terminal and axillary panicles about 5 cm. long; fruit red, about 7 mm. long, pubescent with simple and glandular hairs. *Schmaltzia choriophylla* (Woot. & Standl.) Barkl. On hills and mts. in the extreme w. Edwards Plateau and Trans-Pecos; w. to Ariz. and n. Mex.

This plant is very close to *R. virens*, from which it differs in having usually larger, glabrate leaflets and more frequently occurring axillary inflorescences.

8. *Rhus microphylla* Engelm. DESERT SUMAC, SCRUB SUMAC, SMALL-LEAVED SUMAC, CORREOSA. A much-branched shrub or rarely small tree to about 5 m. high, usually much smaller; branches tending to be spinescent, brown, at first puberulent; leaves deciduous, the rachis winged; leaflets 5 to 9, sessile, not leathery or shiny, pilose, less than 2 cm. long and 6 mm. wide, rounded to acutish at apex; flowers appearing before the leaves, not very numerous, often in axillary as well as terminal inflorescences about 5 cm. long; fruits red when mature, glandular-pubescent, about 5 mm. in diameter. *Schmaltzia microphylla* (Engelm.) Small. In scrub, dry uplands, thickets and open alkali flats, on desert plains, dry rocky river-banks, mesas and foothills in the w. three-fourths of Tex.; w. to Ariz. and n. Mex.

9. *Rhus aromatica* Ait. POLECAT BUSH, FRAGRANT SUMAC, SWEET-SCENTED SUMAC, LEMON SUMAC. Straggly to upright shrub with ascending branches, to about 2 m. high, pungently fragrant when bruised; branches light-brown at first, usually slender, puberulent or sometimes glabrate; leaves deciduous, with petioles to about 25 mm. long; leaflets 3, thin to somewhat thickened, sessile or subsessile, at first puberulent, later glabrate; terminal leaflet broadly ovate to rhombic-ovate, 2-9 cm. long, 1.5-8 cm. broad, crenate-dentate to serrate near the apex, entire and abruptly cuneate at the base; lateral leaflets oval, 35-45 mm. long, 17-35 mm. wide, crenate-dentate to serrate near the apex, entire

and obtuse at the base; inflorescence a terminal compound spike, about 6 cm. long and 3 cm. broad; flowers pale-yellow; fruit red, subglobose-compressed, 5-6 mm. in diameter, pubescent with simple and glandular hairs. *Schmaltzia crenata* (Mill.) Greene. Apr.-May; from Fla. to Tex., n. to N.E. and Que., w. to Neb., Kan. and Okla.

A conspicuous plant in early spring with its yellow flowers and in fall with the leaves turning orange and scarlet. The following varieties, whose differences are noted in the key, occur in our region.

Var. *flabelliformis* Shinnery (*Rhus trilobata* of auth.). In scrub on limestone outcrops and rocky slopes, prairies, mesquite plains and in sandy woodlands in cen. and w. Tex.

Var. *pilosissima* (Engl.) Shinnery [*Rhus trilobata* var. *pilosissima* Engl., *Schmaltzia trilobata* var. *pilosissima* (Engl.) Barkl.]. In loose sands, sandy soil and on hills in the Panhandle and Trans-Pecos.

Var. *serotina* (Greene) Rehd. [*Schmaltzia serotina* Greene, *S. trilobata* var. *serotina* (Greene) Barkl.]. In sandy woodlands and in ravines in the e. half of Tex.

FAM. 105. CYRILLACEAE ENDL.*

CYRILLA FAMILY

Shrubs or trees; leaves alternate, simple, without stipules, usually borne at the ends of the branchlets, chartaceous to coriaceous, entire, persistent, petiolate; flowers small, regular, perfect, borne in narrow lateral or terminal racemes or panicles; calyx usually 5- (rarely 4- to 8-) parted; sepals equal or unequal, imbricate, persistent; petals hypogynous, the same number as the sepals, sessile or short-clawed, free (in ours), slightly convolute, deciduous; stamens hypogynous, 5 or 10, when 5 alternate with the petals, when 10 those opposite petals shorter; filaments subulate or flattened, distinct, sometimes appendaged; anthers basifixed or dorsifixed, 2-celled, longitudinally dehiscent; disk annular, subcupular or cylindric, confluent with the base of the ovary; ovary superior, 2- to 5-celled, terete or angled; ovules anatropous, 1 or 2 pendulous from the apex of the cell or 3 (rarely 2 or 4) attached to a short placenta pendulous from the apex of the cell; style elongate or wanting; stigma entire or 2- to 5-lobed; fruit small, crustaceous or spongy, indehiscent, sometimes winged; seed usually solitary in each cavity, elongated, with fleshy endosperm; embryo central, elongated; radicle superior.

A small American family of 3 genera and about 13 species.

1. Flowers in lateral racemes; petals lanceolate, acute; stamens 5; ovary 2-celled; fruit ovoid, not winged1. *Cyrilla*, p. 992.
1. Flowers in terminal racemes; petals obovate, rounded; stamens 10; ovary 3- or 4-celled; fruit usually 3-winged2. *Cliftonia*, p. 993.

1. CYRILLA L.

A variable but apparently monotypic American genus.

1. *Cyrilla racemiflora* L. LEATHERWOOD, BLACK TITI. Usually small trees, to 10 m. tall, with a trunk to 3 dm. in diameter; leaves alternate, petiolate, oblanceolate, chartaceous to coriaceous, usually widest above the middle, entire, usually turning a rusty-red or -yellow in the fall; racemes slender, lateral, clustered, arising at the base of twigs of current year, 6-18 cm. long, spreading; flowers numerous, fragrant; pedicels 1.5-3 mm. long, basally jointed, with 1 conspicuous persistent bract at base and 2 persistent bractlets below the calyx; calyx small; sepals 5, equal, acute, coriaceous; petals 5, white, lanceolate to oblong-lanceolate, 2.5-3.2 mm. long; stamens 5, equal, inserted at the base of the corolla; filaments subulate; disk cylindric; ovary oblong, 2-celled; style short, stigma 2-lobed; ovules 3 (rarely 2 or 4) attached to a short placenta pendulous from the apex of the cell; fruit small, indehiscent, ovoid, subterete, 2-3 mm. long, 2-celled, pericarp spongy, cells 1-seeded. In bottomlands, swamps and along streams in s.e. Tex., n. to Trinity Co., May-July; from s. Va., s. to Fla., w. along the coast to Tex.

We have two noticeably distinct flowering forms; plants with racemes mostly less than 10 cm. long and suborbicular-ovoid apically blunted fruits and plants with racemes more than 10 cm. long and narrowly ovoid pointed fruits.

* Cf. C. L. Lundell, *Flora of Texas* III: 109-111. 1943 for a more detailed treatment.

2. CLIFTONIA GAERTN. F.

A monotypic genus of southern United States.

1. *Cliftonia monophylla* (Lam.) Sarg. BUCKWHEAT-TREE. Usually small trees to 15 m. tall, with a trunk to 5 dm. in diameter; leaves alternate, subsessile, coriaceous, elliptic-oblong, obtuse, to about 4 cm. long and 2 cm. wide, usually widest above the middle, entire; flowers very fragrant, in terminal stoutish racemes 2-6 cm. long; pedicels basally jointed, with 1 deciduous bract at base and 2 deciduous bractlets below the middle, 1.5-2.5 mm. long (to 6 mm. in fruit); calyx small; sepals 5 to 8, united at base, equal or unequal; petals 5 to 8, oblong-obovate, narrowed into a short claw, hooded at apex, obtuse or rounded, 3.5-4.3 mm. long; stamens 10, inserted at the base of the corolla, unequal, the 5 opposite the petals shorter; filaments flattened below the middle, subulate above; disk subcupular; ovary 3- to rarely 4-angled, 3- to rarely 4-celled; stigma subsessile, 3- to rarely 4-lobed; ovules solitary in each cell, pendulous from the apex; fruit small, indehiscent, 3- to rarely 4-winged, 3- to rarely 4-celled, 6-7 mm. long, cells 1-seeded; seeds with a soft testa. In pineland swamps on the Coastal Plain from Ga. to n. Fla., w. to La., Apr.-May.

Although at present unknown from Texas it is included here on the basis of its probable occurrence in low savannah-pinelands of the southeastern part of the state.

FAM. 106. AQUIFOLIACEAE BARTL.¹²¹

HOLLY FAMILY

Shrubs or trees, usually evergreen, mostly polygamo-dioecious; leaves alternate, simple, usually stipulate, petiolate, margin entire to toothed or sometimes spiny; inflorescence normally cymose, pedunculate or sessile, axillary, solitary or fasciculate, 1- to many-flowered; flowers regular, small, usually 4- to 6-parted, sometimes more; calyx small, free from the ovary and drupe, persistent, the lobes imbricate; corolla white or greenish, deciduous; petals imbricate, rarely valvate, alternate with the sepals, free or united at the base; stamens usually 4 to 6, inserted at the base of the corolla, alternate with the petals, all fertile; filaments subulate, erect, shorter than the petals; anthers introrse, 2-celled, longitudinally dehiscent; staminodia in pistillate flowers similar to stamens, smaller in size, sterile; ovary free, superior, angled or lobed, sessile, usually 2- to 6- (rarely many-) celled; stigma capitate or discoid, usually sessile, with as many lobes as cells in the ovary; ovules 1 (rarely 2) in each cell, suspended, anatropous; ovary in staminate flowers abortive; fruit drupaceous, globose to ellipsoid or rarely lobed, usually containing 4 to 8 (rarely to 18) horny or crustaceous stones; stones smooth, ribbed or striate, usually 1-seeded; seed suspended, the testa membranaceous, the fleshy endosperm copious.

A family of three genera containing about 500 species.

1. ILEX L. HOLLY

Shrubs or trees; leaves alternate, petiolate, persistent or deciduous, entire to dentate or spinescent; stipules minute, deciduous; staminate and pistillate flowers on separate plants or occasional flowers appearing perfect, small, axillary, cymose, fasciculate or solitary, usually pedicellate; calyx minute, 4- to 9-parted, persistent; corolla rotate; petals 4 to 9, hypogynous, elliptic or oblong, obtuse, free or united at the base, white or greenish, deciduous; stamens inserted on the base of the corolla, as many as and alternate with the petals; filaments subulate; anthers attached on the back, oblong, usually rudimentary in the fertile flower; ovary free, sessile, subcylindrical, usually 2- to 8-celled, rudimentary in the sterile flower; style usually wanting; stigmas as many as the cells of the ovary, distinct or confluent; ovules 1 or 2 in each cell, suspended from near the apex, collateral, anatropous; fruit drupaceous, subglobose, crowned by the persistent stigma, usually containing 4 to 8 bony or crustaceous stones; stones 1-seeded, smooth, ribbed or striate.

¹²¹ Adapted partly from C. L. Lundell, *Flora of Texas III*: 112-122. 1943.

A genus of about 400 species, widely distributed over the temperate and tropical regions of the world, most abundant in China. Many species are grown as ornamentals.

1. Fruit red or black, sometimes yellow, with smooth stones; pistillate flowers with usually 6 to 9 petals and calyx lobes (2)
1. Fruit red or purple, sometimes yellow, with ribbed or striate stones; pistillate and polygamous flowers with usually 4 or 5 (rarely 6) petals and calyx lobes (4)
- 2(1). Sepals ciliate; leaves thin, deciduous 1. *I. verticillata*.
2. Sepals not ciliate but sometimes obscurely ciliolate or erose-denticulate; leaves coriaceous, persistent (3)
- 3(2). Young twigs velutinous-puberulent; leaves crenate or crenate-serrate above the middle, the 1 to 3 marginal teeth closely appressed to sinus, the apex not noticeably spine-tipped 2. *I. glabra*.
3. Young twigs glabrous or viscid-puberulent; leaves mostly spinescent-serrate above the middle, the several teeth erect or spreading, the apex spine-tipped 3. *I. coriacea*.
- 4(1). Leaves relatively thin, deciduous; inflorescence sessile, all the flowers solitary or fasciculate; pedicels without bractlets at base (5)
4. Leaves coriaceous, persistent; inflorescence peduncled, the flowers in cymes or solitary; pedicels with bractlets at base (9)
- 5(4). Sepals and petals ciliate 4. *I. montana*.
5. Sepals entire, not ciliate (6)
- 6(5). Pedicels of fertile flowers mostly less than 4 mm. long; leaf blades broadest at the middle or below it, glabrous beneath 5. *I. ambigua*.
6. Pedicels of fertile flowers 4 mm. or more long; leaf blades broadest above the middle, more or less pubescent beneath (7)
- 7(6). Pedicels 4-6 mm. long; leaf blades mostly spatulate to obovate, attenuate at base, commonly emarginate at apex 6. *I. decidua*.
7. Pedicels 6-30 mm. long; leaf blades typically obovate-elliptic, cuneate at base, acute to acuminate at apex (8)
- 8(7). Leaf blades short-hirtellous or puberulent along midvein beneath 7. *I. longipes* var. *longipes*.
8. Leaf blades hirsute along midvein beneath 7. *I. longipes* var. *hirsuta*.
- 9(4). Leaf blades coarsely toothed (rarely with some entire in *I. opaca*) (10)
9. Leaf blades essentially entire or rarely with several obsolescent teeth above middle (11)
- 10(9). Leaf blades only occasionally with some more than 4 cm. long 8. *I. vomitoria*.
10. Leaf blades usually much more than 4 cm. long 9. *I. opaca*.
- 11(9). Leaf blades typically linear, to 10 mm. wide 10. *I. myrtifolia*.
11. Leaf blades typically oblong-obovate, more than 15 mm. wide 11. *I. Cassine*.

1. *Ilex verticillata* (L.) Gray. BLACK ALDER, WINTER-BERRY. Shrub or small slender tree to 5 m. high; leaves with a petiole 1-1.5 cm. long, round-obovate to elliptic or elliptic-lanceolate, cuneate at base, more or less abruptly acuminate at apex, serrate, appressed-pilose or downy to glabrous beneath, dull above, thin-textured, deciduous, to 8 cm. long and 35 mm. wide; *staminate flowers* clustered, 2 to 10, all short-stalked, 4- to 6-merous; *pistillate flowers* short-stalked, 5- to 8-merous; calyx segments obtuse, ciliate; drupes bright-red varying to yellow, 5-7 mm. in diameter; stones smooth on the back. In or about swamps, pond-margins, river banks and damp thickets in s.e. Tex., Apr.-June; from Nfld. to Minn., s. to Ga. and e. Tex.

2. *Ilex glabra* (L.) Gray. INK-BERRY, GALLBERRY. Shrub to 4 m. high, usually much smaller; twigs slender, angled, finely puberulent; leaves persistent, rather crowded on the short twigs, with finely puberulent petioles usually 2-5 mm. long, coriaceous, lustrous

above, paler on undersurface, oblanceolate to obovate or elliptic, to 5 cm. long and 3 cm. wide, obtuse and mucronulate at apex, acute to subcuneate at base, the margin distantly serrate above the middle with 1 to 3 teeth on each side or rarely entire, punctate, puberulent above along the elevated midvein; inflorescence axillary, peduncled, the staminate with 3 or more flowers, the pistillate 1- to 3-flowered; peduncles slender, puberulent, to 1 cm. long in staminate inflorescence, shorter in pistillate; pedicels puberulent, those of staminate flowers 1-5 mm. long; flowers 5- to 8-parted; calyx glabrous, subcupuliform, 2-3 mm. in diameter, the ovate-triangular lobes often obscurely ciliate; corolla in staminate flowers to 7 mm. wide; petals united at base, broadly elliptic to suborbicular, to 3 mm. long, the margin subentire; stamens and staminodia shorter than the petals; ovary in pistillate flowers suburceolate, about 2 mm. long, 5- to 8-celled, the stigma discoid; drupe globose, black, 5-8 mm. in diameter, 5- to 8-sulcate, crowned by the persistent stigma; stones up to 8 in number, not ribbed, about 4 mm. long. In low sandy soil, usually in pine lands, pine barrens and swamps in n.e. Tex., rare, Feb.-July; from N.S. and e. Mass., s. to Fla. and Tex.

3. *Ilex coriacea* (Pursh) Chapm. BAY-GALL BUSH. Shrub, usually arborescent, evergreen, to 5 m. high and a trunk 5 cm. in diameter; twigs rather slender, subterete or inconspicuously angled, minutely puberulent; leaves with rather stout puberulent petioles 3-10 mm. long, coriaceous, often rigid, dark-green and lustrous above, paler beneath, elliptic to oblong-elliptic or obovate-elliptic to oblanceolate, to 9 cm. long and 3.5 mm. wide, the margin entire or with several small spinescent teeth above the middle, not crenulate, the spinescent apex acute to obtuse or rarely subacuminate, acute or sometimes rounded at base, the midvein puberulent above at first and beneath at base, punctate and sometimes glaucous on the undersurface, the costa conspicuous on both surfaces; flowers solitary or fasciculate, usually in the leaf axils, sometimes appearing racemose on short leafy twigs; pedicels without bractlets at base, those of staminate flowers glabrous and 3-6 (rarely 10) mm. long, those of pistillate flowers puberulent and 5-9 (rarely 15) mm. long; flowers 5- to 9-parted; calyx glabrous, the triangular lobes acute and erose-denticulate, equaling or surpassing the tube; corolla white; petals united at base, elliptic to oblong-elliptic, erose, in staminate flowers to 3.5 mm. long, in pistillate flowers smaller; stamens fully three fourths as long as the petals; staminodia about one half as long as the petals; ovary in pistillate flowers depressed-globose, about 2 mm. long including the short thick style, 4- to 9-celled, the stigma discoid; drupe globose, black, to 8 mm. in diameter, crowned by the persistent stigma; stones as many as 9, laterally compressed, smooth, to 4 mm. long. In swamps, low hammocks and along streams in s.e. Tex., Mar.-Apr.; from Va., s. to Fla. and Tex.

This species is commonly confused with the usually smaller *I. glabra*.

4. *Ilex montana* T.&G. MOUNTAIN-WINTERBERRY. Tall shrub or small tree with slender pubescent to glabrous branchlets, to about 10 m. high; leaves with a petiole about 5 mm. long, elliptic-lanceolate to ovate, membranaceous, broadly cuneate at base, acute to acuminate at apex, sharply serrate, to 1 dm. long and 3 cm. wide, glabrous to velvety-pubescent beneath, often clustered at tips of fruiting spurs; pedicels of pistillate flowers and fruits very short; flowers 4- to 6-merous; calyx ciliate and villous; drupes about 1 cm. in diameter, red or scarlet; stones striately many-ribbed on back. *I. Beadlei* Ashe. On rich wooded slopes in s.e. Tex., Apr.-May; from N.Y., s. to Ala. and e. Tex.

Plants characteristic of our area have been segregated as var. *mollis* (Gray) Britt. because of their pubescence.

5. *Ilex ambigua* (Michx.) Torr. CAROLINA HOLLY, SAND HOLLY. Shrub or small tree, rarely to 6 m. high; twigs slender, glabrous, sulcate at first, subterete with age; leaves deciduous; petioles slender, canaliculate, sparsely hirtellous above, 2.5-7 mm. long; blades membranaceous, sometimes chartaceous with age, slightly paler beneath, elliptic to ovate-elliptic or obovate-elliptic to lanceolate, to 65 mm. long and 33 mm. wide, acute to short-acuminate or sometimes obtuse at apex, cuneate at base, the margin serrulate or crenate-serrulate, the lower third usually entire, sparsely hirtellous above along the midvein, sometimes ciliate; inflorescence axillary, not peduncled, the staminate flowers fasciculate, the pistillate usually solitary; pedicels slender, 1-4 mm. long, glabrous; flowers usually 4- or 5-parted, rarely 3-parted; calyx glabrous, subcupuliform, 1.5-2 mm. in diameter, the broadly ovate lobes apiculate and ciliate; corolla rotate or subrotate;

petals united at base, broadly elliptic, to 2.8 mm. long, ciliolate; stamens and staminodia shorter than the petals; ovary in pistillate flowers ovoid, to 2.5 mm. long, 4- or 5-celled, the stigma capitate; fruiting pedicels very short, usually less than 3 mm. long; drupe subglobose, 5-7 mm. in diameter; stones 4 or 5, striate-sulcate, to 5 mm. long. *I. caroliniana* (Walt.) Trel. In sandy woods, along streams and in hammocks in e. Tex., spring; from N.C., s. to Fla., Ark. and Tex.

6. *Ilex decidua* Walt. POSSUM-HAW, DECIDUOUS HOLLY, WINTER-BERRY. Shrub or small tree to 10 m. high, the trunk to 25 cm. in diameter; twigs terete, pale silvery-gray, glabrous or rarely puberulent, the lateral ones usually spurlike and short, the vigorous shoots slender and elongate; leaves deciduous, usually fascicled on the ends of the short spurlike lateral branches; petioles canaliculate, densely puberulent above with incurved hairs, glabrous beneath, slender, 2-11 mm. long; blades at first membranaceous, firmer with age, pale on undersurface, oblanceolate to oblong-spatulate or obovate to broadly obovate-elliptic, to 8 cm. long and 45 mm. wide, obtuse to rounded or obtusely sub-acuminate at apex, usually emarginate, cuneate or narrowed and acute at base, the margin remotely crenulate-serrulate, the small incurved teeth tipped with glands; flowers solitary or fasciculate, usually aggregated at the ends of the lateral spurlike branches of the previous season, rarely solitary on the shoots of the year, appearing with the leaves; pedicels without bractlets at base, glabrous, those of staminate flowers slender and to 12 mm. long, those of pistillate flowers to 6 mm. long; flowers 4- or 5-parted; calyx lobes triangular, acute, entire or denticulate in staminate flowers, sometimes obscurely ciliolate in pistillate flowers, equaling or surpassing the tube; corolla white; petals united at base, elliptic to oblong-elliptic, 3-3.8 mm. long; stamens in staminate flowers slightly shorter than the petals; staminodia in pistillate flowers about three fourths as long as the petals; ovary in pistillate flowers ovoid, about 1.5 mm. long, usually 4-celled; stigma large, sessile, capitate; drupe globose or depressed-globose, bright-red or orange, to 7.5 mm. in diameter, crowned by the persistent stigma, often persisting on the branches until the leaves appear the following spring; stones usually 4, strongly ribbed, to 5 mm. long. In woods, often bordering streams, swamps or ravines in e. and cen. Tex., Mar.-May; from Va., w. to Ill., s. to Fla., Tex. and Kan.

7. *Ilex longipes* Chapm. GEORGIA HOLLY, CHAPMAN'S HOLLY. Shrub or small tree, rarely to 7 m. high; twigs slender, subterete, glabrous; leaves deciduous; petioles slender, canaliculate, puberulent above with minute incurved hairs, 3-10 mm. long; leaf blades membranaceous or chartaceous with age, dark-green above, paler beneath, elliptic to obovate or oblanceolate-elliptic, to 6 cm. long and 3 cm. wide, short-acuminate to acute or obtusish at apex, minutely mucronulate, subcuneate and acute at base, the margin subcrenulate-serrulate or serrulate, the teeth subappressed-mucronulate, sparsely short-hirtellous above along the midvein, irregularly ciliolate, short-hirtellous or puberulent beneath along the midvein and primary veins; inflorescence axillary, not peduncled, the staminate flowers fasciculate, the pistillate flowers usually solitary; pedicels slender, glabrous, usually 1-2 cm. long, sometimes to 3 cm. long; flowers 4-parted, small; calyx glabrous; staminate calyx subcupuliform, about 2 mm. in diameter, the triangular lobes acute and denticulate; calyx of pistillate flowers slightly larger; corolla rotate; petals united at base, elliptic, to 3.3 mm. long, not ciliolate; stamens subequaling petals, the staminodia a third shorter than petals; ovary in pistillate flowers ovoid, to 2.5 mm. long, 4-celled, the stigma capitate; drupe globose, 5.5-8 mm. in diameter; stones 4, inconspicuously striate-sulcate, to 5.5 mm. long. In woods, often on sandy banks of streams in s.e. Tex., Mar.-May; from N.C. and Tenn., s. to Fla. and Tex.

The var. *longipes* is usually a larger plant than var. *hirsuta* Lundell. Characters used in the key are the main ones for separating these two entities.

8. *Ilex vomitoria* Ait. YAUPON. Shrub or tree, evergreen, to 8 m. high; twigs usually short, rather stout, rigid, obtusely angled, densely puberulent; petioles puberulent, usually 1-3 mm. long, sometimes to 6 mm. long; leaf blades coriaceous, dark-green and lustrous above, paler beneath, elliptic to oblong or oblong-elliptic to ovate-elliptic, sometimes obovate-elliptic, to 55 mm. long and 28 mm. wide, usually much smaller, crenulate to crenate or crenulate-serrulate, the teeth mucronulate, obtuse and usually minutely emarginate and mucronulate at apex, obtuse to rounded or rarely acutish at base, at first puberulent above along the midvein and at base, glabrous otherwise; inflorescences

fasciculate in the leaf axils, the staminate usually 3-flowered, the pistillate 1-flowered; peduncle of staminate inflorescence short, usually puberulent; pedicels 1.3-3.8 mm. long, those of staminate flowers glabrous, those of pistillate flowers puberulent; flowers 4-parted; calyx glabrous, the broadly ovate or rounded lobes about 0.5 mm. long; corolla white; petals united at base, elliptic to oblong-elliptic, 2-3 mm. long, to 2 mm. wide; stamens subequaling the petals; staminodia shorter than the petals; ovary in pistillate flowers conic-ovoid, 1.5-2 mm. long, 4-celled, the stigma capitate; drupe globose, lucid, bright-red, to 6.5 mm. in diameter, crowned by the persistent stigma; stones 4, striate, to 4 mm. long. In low woods, hammocks and sandy pine lands in s.e. and s.-cen. Tex., Apr.-May; from Va., s. to Fla., Ark. and Tex.

This is the most abundant of our hollies. The leaves, which contain a caffeine, were used by the aborigines to decoct a ceremonial drink.

9. *Ilex opaca* Ait. AMERICAN HOLLY. Tree, evergreen, usually small, sometimes to 18 m. high; twigs rather stout, densely puberulent, subterete or striate-sulcate; petioles puberulent, usually 5-12 mm. long, sometimes to 18 mm. long, canaliculate; leaf blades variable, coriaceous, sometimes rigid, dark-green above, paler beneath, elliptic to obovate, to 12 cm. long and 6 cm. wide, acute to subacuminate and spine-tipped at apex, obtuse to rounded or sometimes acutish or subcuneate at base, spinose-dentate or sometimes nearly or quite entire, puberulent above at first along the midvein and at base, often sparsely short-hirtellous beneath along the midvein; inflorescences scattered or fasciculate in the leaf axils, the puberulent staminate cymes 3- to 10-flowered and to 25 mm. long, the pistillate usually 1-flowered; peduncle of staminate inflorescence to 1 cm. long; pedicels puberulent, those of staminate flowers to 7 mm. long and without bractlets, those of pistillate flowers 2-10 mm. long and bearing 2 bractlets near middle; flowers 4-parted; calyx sparsely puberulent or glabrous, ciliate, the ovate-triangular lobes 1-1.5 mm. long and acute or acuminate; corolla white or yellowish; petals united at base, usually elliptic, to 4 mm. long and 3 mm. wide, sometimes sparsely ciliolate; stamens equaling or exceeding the petals; staminodia shorter than the petals; ovary in pistillate flowers conic-ovoid, about 2.5 mm. long, 4-celled, the stigma capitate; drupe globose or ellipsoid, red, rarely yellow, to 12 mm. in diameter; stones 4, ribbed, to 8 mm. long. In moist woods, hammocks, along banks of streams and in swamps in e. and s.-cen. Tex., most abundant near the coast, Apr.-June; from Mass., w. to Wisc., s. to Fla. and Tex.

The small branches of this species, loaded with red "berries," are everywhere gathered for decorative use at Christmas time.

10. *Ilex myrtifolia* Walt. MYRTLE HOLLY. Shrub or small tree, evergreen, rarely more than 5 m. high; twigs rigid, usually slender, finely puberulent; leaves crowded; petioles puberulent above, usually less than 3 mm. long; leaf blades rigidly coriaceous, dark-green above, paler beneath, revolute, linear to narrowly oblong-elliptic or linear-lanceolate, usually 1-2.5 cm. long, sometimes to 4 cm. long, 1 cm. wide, entire or serrate above with a few subappressed spinescent teeth, obtuse or acute and mucronate at apex, obtuse to acutish at base, at first finely puberulent above along the midrib, usually glabrous otherwise, the midrib wide and conspicuous on underside, primary veins often scarcely evident; inflorescence short-peduncled, the staminate 3- to 9-flowered, the pistillate 1-flowered; flowers usually 4-parted; calyx glabrous, 1-1.5 mm. wide, the acute lobes ovate-triangular; corolla in staminate flowers to 5 mm. wide; petals united at base, oblong-elliptic; stamens shorter than corolla lobes; ovary about 2 mm. long, 4-celled, the stigma capitate; drupe red, globose, about 6 mm. in diameter, borne on pedicels about 5 mm. long; stones 4, ribbed. Extremely rare, if still extant, near mouth of Brazos River; to be looked for in and around cypress and pineland swamps near the coast, usually flowering in May; from N.C., s. to Fla. and Tex.

11. *Ilex Cassine* L. DAHOON, DAHOON HOLLY. Small tree, evergreen, to 10 m. high; twigs rather slender, glabrous or pubescent; petioles glabrous or pubescent, canaliculate, stout, to 12 mm. long; leaf blades coriaceous, dark-green and lustrous above, paler beneath, obovate-oblong to oblanceolate or oblong, to 14 cm. long and 45 mm. wide, acute to mucronate or rarely rounded at apex, acute at base, the margin revolute, entire or sometimes serrate above the middle with sharp mucronate teeth, puberulent above, at first densely pubescent beneath but glabrous at maturity except for occasional hairs on the lower surface of the broad midrib; inflorescence peduncled, to 25 mm. long, produced

from the young shoots or occasionally from branches of the previous year, the staminate 3- to 9-flowered, the pistillate usually 3-flowered; peduncles and pedicels pubescent, the peduncles to 15 mm. long but usually much shorter, the pedicels to 6 mm. long; flowers usually 4-parted; calyx glabrous, 1.5-2 mm. in diameter, the ovate-triangular lobes acute to acuminate and ciliate; corolla in staminate flowers to 5 mm. wide; petals united at base, oblong-elliptic, to 2.5 mm. long; stamens subequaling petals; staminodia in pistillate flowers shorter than petals, the small anthers abortive; ovary in pistillate flowers conical, about 2 mm. long, 4-celled, the stigma capitate; drupe globose, red, 5-6 mm. in diameter; stones 4, ribbed, about 4 mm. long. In swamps, hammocks and along streams in s.e. Tex., May-June; from Va., s. to Fla. and Tex.

Texas material is commonly referred to var. *latifolia* Ait.

FAM. 107. CELASTRACEAE R. BR.*

STAFF-TREE FAMILY

Shrubs, woody vines or small trees; leaves simple, opposite or alternate; stipules lacking or minute, fugacious; flowers with jointed pedicels, regular, perfect or unisexual, 4- or 5-merous, the perianth parts imbricated in the bud; stamens 4 to 10, commonly as many as the petals and alternate with them, inserted on a broad flat usually lobed disk that fills the bottom of the calyx and sometimes covers the ovary; ovules anatropous; styles completely united; fruit 1- to 5-celled, free from the calyx; seeds mostly arillate.

About 850 species in more than 50 genera, world-wide in distribution.

1. Leaves opposite1. *Euonymus*, p. 998.
1. Leaves alternate (2)
 - 2(1). Fruit a dehiscent capsule; branches flexible, often vinelike (3)
 2. Fruit a follicle or indehiscent capsule; branches typically rigid, commonly stiffly erect or spreading (4)
 - 3(2). Ovary free from the disk; ovules 2 in each cell; leaves herbaceous; plant scandent; in Trans-Pecos Texas2. *Celastrus*, p. 999.
 3. Ovary confluent with the disk; ovule 1 in each cell; leaves fleshy-coriaceous; plant shrubby; in Rio Grande Valley3. *Maytenus*, p. 999.
 - 4(2). Stamens 10; petals ligulate or oblanceolate; leaves narrowly obtuse to acute at apex4. *Forsellesia*, p. 1000.
 4. Stamens 4 or 5; petals broad; leaves broadly acute to rounded or notched at apex, occasionally mucronate (5)
 - 5(4). Leaves cuneate-obovate to broadly oblanceolate, rounded-cuneate and mostly notched at apex; flowers 4-merous; calyx not tubular; fruit somewhat fleshy, 2-seeded5. *Schaefferia*, p. 1000.
 5. Leaves oval to oblanceolate or suborbicular, acutish to obtuse at apex; flowers 5-merous; calyx tubular-obconic; fruit dry, 1-seeded6. *Mortonia*, p. 1001.

1. EUONYMUS L.

SPINDLE-TREE

Shrubs or small trees with 4-sided green-barked branchlets; leaves opposite, serrulate; flowers small, perfect, 4- or 5-merous, solitary or in loose pedunculate cymes in the leaf axils; sepals united at the base to form a short flat calyx; petals rounded, spreading; stamens short, inserted on the margin of a broad and flat 4- or 5-angled disk that coheres with the calyx to conceal the ovary and more or less adhere to it; style short or none; capsule 3- to 5-lobed and -valved, loculicidal; seeds 1 to 4 in each cell, enclosed in a red aril.

About 175 species, primarily in North America, Eurasia and Australia.

* See Appendix. Cf. C. L. Lundell, *Flora of Texas* II: 339-355. 1969 for a more detailed treatment.

1. Leaves often essentially sessile, with petioles less than 5 mm. long; flowers 5-merous; fruits tuberculate1. *E. americanus*.
1. Leaves with prominent petiole more than 5 mm. long; flowers 4-merous; fruit smooth (2)
- 2(1). Leaves ovate-elliptic to elliptic, acute or abruptly short-acuminate, persistently pubescent beneath2. *E. atropurpureus* var. *atropurpureus*.
2. Leaves lanceolate, attenuate at apex into a long acumen, entirely glabrous2. *E. atropurpureus* var. *Cheatumii*.

1. *Euonymus americanus* L. STRAWBERRY-BUSH, BURSTING-HEART. Low erect or straggling shrub to about 2 m. high; leaves sessile or essentially so, firm, bright-green above, pale beneath, ovate to elliptic or oblong-lanceolate, acute to acuminate, crenulate-serrulate, essentially glabrous, to about 1 dm. long and 35 mm. wide; flowers solitary or in few-flowered cymes, 5-merous, 1-1.2 cm. wide, greenish-purple; petals distinctly clawed; capsules rough-warty, 3- to 5-lobed, depressed, about 15 mm. thick, crimson when ripe, the aril and dissepiments scarlet. In mud along streams, river bottomlands and on forested stream banks in e. Tex., May-June; from Fla. to Tex., n. to N.Y., Pa., W.Va., Ind., Ill., Mo. and Okla.

2. *Euonymus atropurpureus* Jacq. BURNING-BUSH, WAHOO. Erect shrub or small tree to 8 m. high; leaves with petioles 1-2 cm. long, oblong-oval to lanceolate, acute to acuminate or long-attenuate, pubescent beneath or entirely glabrous, 7-13 cm. long, serrulate; peduncles 7- to 15-flowered; flowers dark-red or purple, 4-merous, mostly 6-8 mm. wide; ovules ascending, 2 in each cell; fruits red or purple, depressed-obovoid, about 15 mm. broad, deeply 4-lobed, smooth; seeds brown, with a scarlet aril. Rich moist woods, thickets and ravines, mainly in n.-cen. Tex., Apr.-July; from Ont. to Mont., s. to N.C., Tenn., Ala., Ark., Okla. and Tex.

We have two variants as noted in the key—var. *atropurpureus* and var. *Cheatumii* Lundell.

2. CELASTRUS L.

About 30 species, mostly in eastern Asia.

1. *Celastrus scandens* L. CLIMBING BITTERSWEET, AMERICAN BITTERSWEET. Twining high-climbing shrub to about 15 m. high, the primary stem to 25 mm. thick; leaves alternate, ovate-oblong to elliptic, acuminate, serrulate, 5-10 cm. long; flowers small, greenish, in panicles 3-8 cm. long; capsule globose, 3-valved, loculicidal, orange or orange-yellow, several together, about 1 cm. long, upon splitting exposing the fleshy scarlet to crimson aril-covered seeds; seeds 1 or 2 in each cell, ellipsoid, erect, about 6 mm. long. In woods and in and along streams in canyons of mts. in the Trans-Pecos, Apr.-June; from Que. to Man., s. to N.E., Ga., Ala., La. and Tex.

3. MAYTENUS MOL.

About 225 species in tropical and warm temperate regions.

1. *Maytenus texana* Lundell. GUTTA-PERCHA, LEATHERLEAF, MANGLE DULCE. A much-branched spreading or prostrate shrub with short thickish minutely puberulent branchlets; leaves alternate, thick, with petioles 1-3 mm. long, pale ashy-gray when dry, oblong-elliptic to elliptic-obovate, broadly obtuse to rounded and usually minutely apiculate at apex, rounded at base, 1.5-3 cm. long, 1-2 cm. wide, entire to often remotely several-toothed, sparsely puberulent, persistent; stipules minute, deciduous; flowers unisexual, yellowish-green, fasciculate in leaf axils; pedicels less than 2 mm. long; calyx lobes rounded, 5-parted, minutely erose-ciliolate, punctate, about 0.65 mm. long; petals 5, spreading, ovate, 1.2-1.5 mm. long, punctate, erose at apex; stamens 5, inserted below annular disk; capsules obovoid, coriaceous, about 12 mm. long; seeds lineate, oblong-obovoid, about 5 mm. long, covered with a red fleshy aril. *M. phyllanthoides* Benth. var. *ovalifolia* Loes. In thickets on clay and sandy-clay mounds and rises in the Brownsville area, also Kleberg and Nueces cos., Jan.-July; also adj. Mex.

4. FORSELLESIA GREENE¹²²

GREASE-BUSH

Small deciduous intricately branched shrubs with slender greenish angled mostly spinescent branches with decurrent lines from the nodes; leaves small, simple, entire, alternate, lanceolate to obovate, pubescent or glabrous, commonly with minute stipules, with 2 to 4 lateral veins parallel to the margin; flowers perfect, regular or nearly so, usually axillary, borne on slender pedicels with reduced scarious bracts at the base; sepals 5 or rarely 4 or 6, ovate, hyaline-margined; petals 5 or rarely 4 or 6, white, narrowly oblanceolate, distinct, deciduous, much longer than the sepals, inserted by a narrow base under the edge of a fleshy crenately 6- to 10-lobed disk; stamens equal or unequal, the longer ones inserted opposite the sepals; carpels 1 to 3, ovate, distinct, attenuate to the stigma, sessile upon the disk; ovary superior, 1-celled with 1 or 2 ovules; fruit an asymmetrical ovoid coriaceous striated follicle that opens along the ventral suture.

A small genus of 8 species in western United States.

1. Petiole with a swollen reddish base that usually produces obvious stipules; leafy branchlets typically erect, straight and elongated . . . 1. *F. planitierum*.
1. Petiole not as above, at most somewhat narrowly keeled, without obvious stipules; branchlets sparsely leafy, typically spreading or recurved-arcuate (2)
- 2(1). Plant with numerous short branchlets that are spinescent at tips; leaves lanceolate to narrowly oblanceolate; petals very narrowly oblanceolate, less than 1 mm. wide; in west and northwest Texas 2. *F. spinescens*.
2. Plant without spinescent branchlets; leaves very broadly oblanceolate; petals lanceolate, about 1.5 mm. wide; endemic in Uvalde and Val Verde cos. 3. *F. texensis*.

1. *Forsellesia planitierum* Ensign. Much-branched spinescent shrubs with numerous straight erect branchlets, 5-12 dm. high; leaves with petioles less than 2 mm. long, narrowly elliptic to oblanceolate, acute, pubescent, prominently venose beneath, 6-12 mm. long, 2.5-4 mm. wide; stipules subulate, to 1 mm. long; pedicels 1-3 mm. long; sepals 5, ovate, 1.5-2 mm. long, 1 mm. wide; petals 5, oblanceolate, 4-6 mm. long, 1.5-2 mm. wide; stamens 8, unequal in length; mature follicles ovoid, 4-5 mm. long. On bluffs, breaks and eroded slopes in the Plains Country, spring; also Okla.

2. *Forsellesia spinescens* (Gray) Greene. Densely and intricately branched shrub to 15 dm. high, the branches angulate, usually glabrous; leaves short-petiolate, oblanceolate, acute, 5-11 mm. long, 1-2.5 mm. wide, glaucous, soon deciduous; flowers subsolitary, axillary, short-pedicellate; sepals usually 5, ovate, 1.5-2 mm. long, hyaline-margined; petals 5, white, oblanceolate to ligulate, 3-7 mm. long, less than 1 mm. wide; stamens 6 to 10; follicles ovoid, coriaceous, asymmetric, acute, about 5 mm. long. *Glossopetalon spinescens* Gray. On rocky hills, ledges, rimrock and in dry washes in the Trans-Pecos, Mar.-July; from Okla. and Tex. to s. Calif. and n. Chih.

3. *Forsellesia texensis* Ensign. Tall closely branched nonspinescent shrub with young flexible branches about 1 mm. in diameter, glabrous, the older branches dark-gray; leaves with petioles about 1 mm. long, very broadly oblanceolate, acute to mucronate, frequently with margins and veins thickened, generally glabrous or with occasional pubescence, 1-2 cm. long, 3-5 mm. wide; pedicels about 5 mm. long, with 4 or 5 scarious bracts at base; sepals 5, entire, ovate, hyaline-margined, about 2 mm. wide; petals lanceolate, 5-7 mm. long, 1.5 mm. wide; stamens 7 to 9, equal; follicles very broadly ovoid, 4-5 mm. long. On chalk bluffs along the Nueces River near Montell, Uvalde Co. and on bluffs of Devils River in Val Verde Co., fall; endemic.

5. SCHAEFFERIA JACQ.

About 16 species from southern United States to the West Indies and South America.

1. *Schaefferia cuneifolia* Gray. DESERT YAUPON, CAPUL, PANALERO. Shrub mostly 1-2 m. high, glabrous, with rigidly and intricately branched somewhat spinescent twigs; bark light-gray; spur branches mere knobs to 2 mm. high; leaves sessile, alternate or fasciculate,

¹²² Based on the treatment by Margaret Ensign in Am. Midl. Nat. 27:501-511. 1942.

exstipulate, cuneate-obovate to oblanceolate, broadly obtuse to shallowly emarginate at apex, 5-23 mm. long, 2-15 mm. wide, glabrous, coriaceous, pale-green to somewhat glaucous; staminate and pistillate flowers on separate plants; flowers solitary or several clustered, unisexual, 4-merous, sessile or with pedicels to 2 mm. long; sepals about 0.5 mm. long; petals greenish, oblong, about 3 mm. long; fruit subglobose, 2-celled, slightly obcompressed, shallowly bisulcate longitudinally between 2 seeds, 3-5 mm. long and wide, 2.5-4 mm. thick, with scanty flesh, orange to bright-red, translucent, shining. On rocky hillsides and breaks and in canyons in the Rio Grande Plains and Valley, and s. Trans-Pecos, Feb.-July; also n. Mex.

6. MORTONIA GRAY

Erect small shrubs; leaves alternate, numerous, persistent, entire, 1-nerved, usually coriaceous with the margins thickened or often revolute; stipules glandlike, caducous; flowers small, white, racemose or cymose with the cymes borne in the upper axils to form a terminal panicle; calyx tube 5-lobed, 10-angled; petals 5, erose-dentate to glandular-ciliolate; stamens 5; ovary imperfectly 5-celled; fruit an achene; seeds oblong, without an aril.

About 8 species in southern United States and Mexico.

1. Leaves oblanceolate, glabrous, leathery, the margins often thickened but not revolute, more than 1 cm. long; in Rio Grande Plains 1. *M. Greggii*.
1. Leaves ovate to oval or suborbicular, scaberulous-hispid to subglabrate, thick-coriaceous, the margins revolute, less than 1 cm. long (2)
- 2(1). Leaves 5-10 mm. long, 2.5-6 mm. wide; flowers many, usually in cymose panicles; widespread in mountains of the Trans-Pecos 2. *M. scabrella*.
2. Leaves 3-5 mm. long, 1.5-2 mm. wide; flowers few, in narrow racemes; rare near and along the Rio Grande in Val Verde Co. 3. *M. sempervirens*.

1. *Mortonia Greggii* Gray. AFINADOR. Erect slender shrub to 2 m. high, the branches puberulent; leaves oblanceolate, tapering at base to short petioles, obtuse-mucronate at apex, 15-25 mm. long, to 5 mm. wide, bright-green, glabrous; flowers about 5 mm. broad, numerous in cymose panicles to 7 cm. long and 5 cm. wide; calyx glabrous, about 3 mm. long, the lobes usually conspicuously scarious-margined; petals white, about 2 mm. long; fruit 4-5 mm. long. In thickets on gravelly hills in Rio Grande Plains, Dec.-May; also n.e. Mex.

2. *Mortonia scabrella* Gray. Yellowish-green shrub to 25 dm. high, usually much lower, densely branched with often elongate brittle rigidly erect branches; leaves short-petiolate, spreading or ascending, ovate to mostly oval or broadly elliptic, sometimes suborbicular, 5-10 mm. long, 2.5-6 mm. wide, rounded to bluntly acute at apex, scaberulous-hispidulous, very thick with the margins revolute; flowers about 5 mm. broad, mostly in terminal cymes 2-4 cm. long; calyx hirtellous, about 2 mm. long, the lobes rounded-deltoid; petals creamy-white, obovate-oblong, about 2 mm. long; fruit short-cylindroid, 4-5 mm. long, about 2 mm. thick. On rocky slopes, ridges, ledges and about rimrock in the Trans-Pecos, Feb.-Sept.; from Tex. to Ariz. and n. Mex.

3. *Mortonia sempervirens* Gray. Stiff intricately branched shrub about 6 dm. high; leaves bright grass-green, oblong-elliptic, usually recurved-ascending, shortly petiolate and mucronate at the subobtusate to acute apex, 3-5 mm. long, 1.5-2 mm. wide, glabrous (*fide* Gray) to more commonly minutely and sparsely hispidulous; flowers in narrow racemes about 1 cm. long, otherwise similar to those of *M. scabrella* but slightly smaller. On rocky hills and ledges near and along the Rio Grande in Val Verde Co., Apr.-May; undoubtedly also in adj. Mex.

FAM. 108. ACERACEAE JUSS.

MAPLE FAMILY

Trees and shrubs with watery saccharine sap, polygamo-dioecious; leaves opposite, simple and palmately lobed or pinnately divided; flowers small, regular, with or without petals; ovary 2-celled, 2-lobed; ovules 2 in each cell.

Three genera comprising about 200 species in the North Temperate Zone and tropical mountains.

I. ACER L. MAPLE

Deciduous trees or rarely shrubs; flowers mostly 5-merous, in racemes, panicles or corymbs; calyx colored, 5 (rarely 4 to 12)-lobed or -parted; petals either none or as many as the lobes of the calyx, equal, usually with short claws, inserted on the margin of a perigynous or hypogynous disk; stamens 3 to 12; ovary 2-celled, with a pair of ovules in each cell; styles 2, long and slender, united only below, stigmatic down the inner side; back of each carpel bearing a wing, converting the fruit into two 1-seeded eventually separable samaras or "keys."

Nearly 200 species in the Northern Hemisphere.

- 1. Leaves compound, with 3 to 9 pinnately veined leaflets 1. *A. Negundo*.
- 1. Leaves simple, palmately veined and mostly palmately lobed (2)
- 2(1). Distribution in canyons of the Edwards Plateau and of Trans-Pecos Texas 2. *A. grandidentatum*.
- 2. Distribution in the forests of east Texas (3)
- 3(2). Uncommon on forested hills and ravines of northeast Texas; leaf margins smooth; samaras 25-40 mm. long 3. *A. saccharum*.
- 3. Widespread in swamps and along streams in alluvial or flat woods in southeast Texas, rarely extending into northeast Texas; samaras very rarely more than 25 mm. long (4)
- 4(3). Leaf margins smooth, not closely serrate; terminal and upper lateral lobes of leaf with straight or concave sides, the lobes somewhat quadrate or squarish; base of sinus between lobes forming a rounded or obtuse angle; the yellowish flowers and fruits produced along with the leaves or after they develop; calyx bearded; fruit more or less pubescent 4. *A. barbatum*.
- 4. Leaf margins more or less closely serrate; terminal and/or at least the upper lateral lobes of the leaf with gradually rounded or tapering sides, the lobes triangular; base of sinus between lobes forming an acute angle; the reddish flowers and fruits produced before leaves develop; calyx and fruit glabrous 5. *A. rubrum*.

1. *Acer Negundo* L. BOXELDER, ASH-LEAVED MAPLE, ARCE, FRESNO DE GUAJUCO. Small tree with green pubescent to glabrous twigs and branchlets; leaves pinnate, with 3 to 9 petiolulate very veiny and more or less pubescent leaflets, when mature pubescent to glabrate beneath; leaflets 5-10 cm. long and 5-7.5 cm. wide; terminal leaflet elliptic to obovate; lateral leaflets narrower and coarsely few-toothed or entire; leaves of vigorous tips and sprouts with more numerous often lobed leaflets; flowers greenish, unisexual, produced just before the leaves, the staminate flowers fascicled and pendulous on filiform pedicels, the pistillate flowers racemose; petals and disk absent; samaras 25-35 mm. long, yellowish, strongly ascending, the seed prolonged. *Rulac Negundo* (L.) Hitchc. River banks, floodplain woods, waste places, fencerows mainly in the e. half of Tex., Feb.-Apr.; from Fla. to Tex., n. to w. N.E., N.Y., s. Ont. and s.e. Minn.; much cult. and naturalized e. to Maritime Provinces and e. Que.

Those trees with the branchlets more or less permanently puberulent are usually segregated as var. *texanum* Pax.

2. *Acer grandidentatum* Nutt. SUGAR MAPLE, BIGTOOTH MAPLE, PALO DE AZÚCAR. Tree to 15 m. high, with dark-brown scaly bark; branchlets glabrous; thickish leaves with stout petioles 3-5 cm. long, 3- to 5-lobed, with broad sinuses, 5-9 cm. wide, cordate to truncate at base, the lobes obtuse to acute and somewhat lobulate or very rarely entire, glaucescent and pubescent beneath mainly along the veins; flowers on slender drooping

villous pedicels in several-flowered short-stalked or nearly sessile corymbs; calyx often persistent under the fruit; corolla absent; wings spreading, often rose-colored in mid-summer, the wings to 25 mm. long, with the nutlets about 8 mm. long. *A. saccharum* var. *grandidentatum* (Nutt.) Sarg. In canyons of the Edwards Plateau and of the mts. in the Trans-Pecos, Mar.-Apr.; from Tex. to Wyo., Ut., N.M. and n. Mex.

Those plants with wings of the samara 15 mm. long or less and with smaller, less toothed leaves are usually referred to var. *brachypterum* (Woot. & Standl.) E. J. Palm. Although typical *A. grandidentatum* is found in the Sabinal Canyon, most of the material found in the canyons of the Edwards Plateau falls into var. *sinuosum* (Rehd.) Little, characterized by having the leaf divided into 3 large usually entire lobes.

Acer nigrum Michx. has been reported as occurring in west Texas but no specimens of this species have been seen from the state. This report might have been based on a misdetermination of *A. grandidentatum* which it superficially resembles.

3. *Acer saccharum* Marsh. SUGAR MAPLE, ROCK MAPLE. Large tree to 40 m. high, with spreading branches to form a conical crown and new brown branchlets, the older gray bark becoming deeply furrowed; leaves 3- to 5-lobed, to 15 cm. across, more or less cordate at base, the lobes acuminate, sparingly coarsely toothed with narrow and deep sinuses, dark-green above, glabrous and pale or somewhat glaucous beneath; flowers in subsessile corymbs, expanding with the leaves, campanulate, about 5 mm. long, greenish-yellow, on slender hairy pedicels 3-7 cm. long; corolla absent; stamens exerted in staminate flowers; style branches 5-6 mm. long; samaras 2.5-4 cm. long, the seeds 8-12 mm. long, the ascending wings 6-10 mm. broad. On forested hills and in ravines in n.e. Tex., Mar.-May; from e. Can. to e. Man., s. to Ga., Ala., Miss., Ark. and Tex.

The leaves turn yellow to scarlet in autumn. Its wood is highly valued and, in Canada and northeastern United States, it is one of the chief sources of maple syrup and sugar.

4. *Acer barbatum* Michx. FLORIDA MAPLE, SOUTHERN SUGAR MAPLE. Tree to 20 m. high, with thin whitish-gray smooth bark that becomes furrowed in age, the trunk to 7 dm. in diameter; branchlets grayish and purple-tinged, glabrous to short-pilose; leaves with glabrous to pilose petioles to 75 mm. long, 3- to 5-lobed, minutely pilose to glabrescent and somewhat glaucescent beneath, to 9 cm. long and 11 cm. broad, truncate to subcordate at base, with entire or slightly lobulate obtuse to acute lobes; flowers yellowish-green, with pedicels elongating to 5 cm., in many-flowered nearly sessile corymbs; calyx to 2.5 mm. long, with a conspicuous long white beard projecting from throat; corolla absent; ovary long-setose; samaras 1.5-3 cm. long, fruit body to 1 cm. long, sparingly villous while young, the wings to 9 mm. wide. *A. floridanum* (Chapm.) Pax, *A. saccharum* var. *floridanum* (Chapm.) Small & Heller. Along streams and in flat woodlands in s.e. Tex., Mar.-Apr.; from Fla. to s.e. Tex., n. to e. Va. and s.e. Mo.

This species might be considered as a small edition of *A. saccharum* since the two are undoubtedly closely related.

5. *Acer rubrum* L. RED MAPLE, SCARLET MAPLE. Tree to about 35 m. high, with spreading to ascending smoothish branches to form a globular crown, the trunk to about 1 m. in diameter; branchlets red; leaves with mostly reddish petioles to 1 dm. long, 3- to 5-lobed, to 1 dm. long and wide, the margins coarsely serrate, broadly cuneate to rounded or subcordate at base, the lobes triangular-ovate and short-acuminate, herbaceous to somewhat coriaceous, dark-green and lustrous above, glaucous and subglabrous to densely whitish- or tawny-pubescent beneath, mostly always pubescent on veins beneath; flowers appearing before the leaves, usually reddish, on slender stalks; petals linear-oblong, about 2 mm. long; samaras 15-25 mm. long, on pendulous stalks to 1 dm. long, glabrous, the fruit body about 8 mm. long, the wings to about 12 mm. wide. Usually in swamps, along streams or in alluvial woods in e. Tex., Feb.-Apr.; from Fla. to Tex., n. to Man. and e. Can.

The var. *rubrum* has, at most, hairs along the nerves on the lower surface of the leaves, whereas the var. *Drummondii* (H.&A.) Sarg. and var. *trilobum* K.Koch have the lower surface of their leaves densely and usually permanently hairy. In addition, the leaves of var. *trilobum* have only three well-developed lobes, with the smaller lateral basal lobes being suppressed.

FAM. 109. HIPPOCASTANACEAE DC.

BUCKEYE FAMILY

Trees or shrubs with exstipulate opposite palmately divided leaves, the leaflets pinnately straight-veined; perfect and unisexual flowers on same plant, in a large terminal panicle, irregular, showy; petals 5 or sometimes 4, brightly colored or whitish, unguiculate; fruit a leathery capsule, 3-celled and 2- or 3-seeded or (by abortion) 1-seeded, smooth or warty to spiny.

A family of two genera, *Billia* of Latin America, and the present Temperate Zone genus.

I. AESCULUS L.¹²³

BUCKEYE. HORSE-CHESTNUT

Shrubs to large trees; leaves deciduous, with 5 to 11 leaflets; flowers mostly with imperfect pistils and sterile; pedicels jointed; calyx campanulate to tubular, somewhat irregularly 5-lobed, often oblique or gibbous at base; petals more or less unequal, with claws, nearly hypogynous; stamens usually 7 or rarely 5, 6 or 8; filaments long, slender, often unequal in length; anthers elliptical, glandular-apiculate, 2-celled, opening longitudinally; style one; ovary 3-celled; seeds large, with a dull or shining thick coat and a large round pale scar.

About a dozen species in Eurasia and North America.

- 1. Calyx about 6 mm. long; petals subequal, villous-ciliate or dorsally glandular but not on margins; stamens exerted to almost twice the corolla length; flowers pale-yellow to greenish-yellow; fruit spiny or rarely smooth (2)
- 1. Calyx rarely less than 8 mm. long; petals unequal, the upper pair longer and narrower with minute spatulate blade and the claw often equaling the lateral petals; lateral petals with a wide and nearly rounded blade, with stipitate glands on margins; stamens included or only slightly exerted beyond the uppermost petals; flowers red or yellow, sometimes with these colors mixed; fruit smooth; leaflets 5 or rarely 7 (3)
- 2(1). Leaflets 7 to 111. *A. arguta*.
- 2. Leaflets 5 or very rarely some leaves with 6 or 72. *A. glabra*.
- 3(1). Flowers scarlet or yellow-red; primarily in the eastern half of Texas3. *A. Pavia* var. *Pavia*.
- 3. Flowers yellow throughout; confined to the Edwards Plateau3. *A. Pavia* var. *flavescens*.

1. *Aesculus arguta* Buckl. WHITE BUCKEYE. Large shrub or small tree to 7 m. tall, with a trunk to 15 cm. in diameter; bark smooth, gray, somewhat scaly with thin plates; leaves with a petiole to 1 dm. long; leaflets 7 to 11, sessile or shortly petiolulate, lanceolate to elliptic-lanceolate, tapering at base, acute to long-acuminate at apex, glabrous on upper surface, subglabrous to tomentose on lower surface, the margins sharply and unequally serrate, to 12 cm. long and 4 cm. wide; calyx campanulate, rarely more than 6 mm. long, the short lobes rounded to acute; corolla to 15 mm. long. *A. glabra* Willd. var. *arguta* (Buckl.) Robins., *A. glabra* var. *Buckleyi* Sarg., *A. Buckleyi* (Sarg.) Bush. Commonly in sandy soils in woods, thickets, along streams and in fencerows in n.e. and cen. Tex., Mar.-Apr.; from n.e. Kan., s. to cen. Tex.

Plants are occasionally found that are apparently hybrids of this species and *A. pavia*. This is evidenced by their intermediate leaflet size and floral coloration.

2. *Aesculus glabra* Willd. OHIO BUCKEYE. Tree to 10 m. tall; bark gray, much-furrowed and broken into scaly plates; leaves compound, with petioles 10-15 cm. long; leaflets usually 5, elliptic to obovate, more or less abruptly acuminate, narrowed at base, 7.5-13 cm. long, finely toothed; flowers in branched clusters 10-15 cm. long, showy, to about 3 cm. long, pale greenish-yellow, with villous-ciliate petals nearly equal in length; capsule to 5 cm. in diameter, prickly, with 1 or 2 poisonous seeds that are to

¹²³ Ref.: J. W. Hardin in Brittonia 9:173-195. 1957.

35 mm. wide. In woodlands and bottomlands in n.e. Tex. (*vide* Small), Mar.-May; primarily in the Ohio and Miss. Valley.

3. *Aesculus Pavia* L. Large shrub or tree to 10 m. tall; with a trunk to 5 dm. in diameter; bark smooth, gray or brownish; leaves with a petiole to 15 cm. long; leaflets essentially sessile or with a petiolule to 1 cm. long, lanceolate to elliptic or oblanceolate, tapering at base, more or less abruptly acuminate at apex, glabrous or sometimes tomentose on lower surface, the margins irregularly serrate or crenate-serrate, to 17 cm. long and 7 cm. wide; calyx 8-16 mm. long, very rarely shorter tubular or sometimes tubular-campanulate, with a gibbous base, the short lobes rounded; corolla to 3 cm. long. Incl. var. *discolor* (Pursh) T.&G., *A. discolor* Pursh, *A. austrina* Small, *A. discolor* var. *mollis* (Raf.) Sarg. Commonly in forests, along streams, in thickets and on rocky hills in the e. half of Tex., Mar.-May; from e. N.C., s. to n. Fla., w. to s. Ill., s.e. Mo., Ark. and Tex. We have two varieties.

The red-flowered var. *Pavia* (RED BUCKEYE) occurs frequently in east Texas but is rare south to Victoria County and on the eastern edge of the Edwards Plateau. The calyx is typically elongated and narrowly tubular but rarely it is rather short and somewhat campanulate. The margin of the orifice is glandular-ciliate but these adornments are sometimes obscured by long silky hairs.

Var. *flavescens* (Sarg.) Correll. This yellow-flowered plant is the representative of this species throughout most of the Edwards Plateau. It has been found as far west as Edwards and Kinney counties. Although flower color, in itself, is not sufficient reason for segregating a plant, the apparent geographic separation of the yellow-flowered plant from the red-flowered var. *Pavia* would seem to justify this distinction: We have not seen the yellow-flowered plant in Texas other than on the Edwards Plateau. On the eastern edge of the Edwards Plateau, especially in Hays, Kendall, Comal and Bexar counties, where var. *Pavia* and var. *flavescens* come together, plants are frequently found that have yellow flowers that are deeply tinged or marked with red.

FAM. 110. SAPINDACEAE JUSS.

SOAP-BERRY FAMILY

Trees, shrubs or vines; leaves always alternate (in ours), with or without stipules, simple or palmate to pinnate or odd-pinnate; staminate and pistillate flowers on separate plants or often some flowers appearing perfect; flowers regular or irregular, usually borne in racemes, panicles or cymes; sepals 4 or 5; petals commonly 4 or 5, often with scaly or hair-tufted nectaries on lower inner side; stamens usually more numerous than petals, typically 8 or 10 in 2 whorls; anthers 2-celled; fruit a berry or capsule, sometimes a schizocarp of samaralike mericarps.

About 150 genera and about 2,000 species, mostly in tropical Asia and America. Species of *Koelreuteria*, or China Tree, are cultivated in south Texas but they apparently do not escape from cultivation.

- 1. Flowers regular; leaves pinnate, the terminal leaflet absent 1. *Sapindus*, p. 1006.
- 1. Flowers irregular; leaves odd-pinnate with a terminal leaflet (2)
 - 2(1). Erect shrubs or small trees; flowers with 4 or 5 petals and 2 ovules in each cell 2. *Ungnadia*, p. 1006.
 - 2. Shrubby or herbaceous climbers; flowers with 4 petals and solitary ovules in each cell (3)
 - 3(2). Inflorescence umbelliform, with branches mostly about 1 cm. long; fruits 3-lobed and inflated, membranaceous, dehiscent, more or less acute at apex 3. *Cardiospermum*, p. 1006.
 - 3. Inflorescence racemose or paniculate, the branches longer than above; fruit consisting of 3 indehiscent samaras or 3-winged capsules, often notched at apex (4)
 - 4(3). Samaras seed-bearing in the middle; leaves minutely stipulate, trifoliolate 4. *Urvillea*, p. 1007.
 - 4. Samaras seed-bearing at apex; stipules obsolescent; leaves more dissected than above 5. *Serjania*, p. 1007.

I. SAPINDUS L. SOAP-BERRY

About 13 species in America and Asia.

1. *Sapindus Saponaria* L. var. *Drummondii* (H. & A.) L. Benson. JABONCILLO. Trees to about 15 m. high under optimum conditions, usually less than 10 m. high, with rough grayish or tan bark and yellow wood; leaves alternate, exstipulate, pinnate; leaflets as many as 18, elliptic-lanceolate to narrowly lanceolate-attenuate, acuminate, falcate, strongly veined on upper surface, to 1 dm. long and 4 cm. wide, entire; flowers 4-5 mm. broad, regular, white, in large dense terminal panicles; sepals and petals 4 or 5, with ciliate margins; petals usually 5, appendaged; stamens 8 or 10, with long hairs on the filaments; fruits globose, about 13 mm. in diameter, consisting of amber or yellowish translucent flesh surrounding the seed. *S. Drummondii* H. & A., *S. marginatus* of Coult. Commonly forming groves in fields and on the edge of woods, along streams and fencerows, scattered throughout Tex., Mar.-July; from La., n. to Kan., w. to N.M. and Mex.

2. UNGNADIA ENDL. TEXAS BUCKEYE. MEXICAN BUCKEYE

A monotypic genus.

1. *Ungnadia speciosa* Endl. MONILLA. Shrub or small tree, rarely to 10 m. high, with a trunk to 2 dm. in diameter, the thin bark light-gray; leaves alternate, odd-pinnate, exstipulate; leaflets 3 to 7, ovate to ovate-lanceolate, acuminate, serrate, to 12 cm. long and 4 cm. wide, pubescent beneath when young but soon glabrate; flowers in lateral fascicles, appearing before or with the leaves from the axils of the preceding season, pink to purplish-pink, fragrant; calyx deeply 5-lobed; petals 4 or 5, obovate, with a pilose claw, fimbriate-crested at apex of claw on inner side, to 1 cm. long; stamens 7 to 10; anthers cherry-red in color; fruit a large somewhat woody stipitate 3-lobed smoothish pod, pale-green, often suffused with red, 3.5-5 cm. thick; seeds spherical, 1-1.5 cm. in diameter, dark-brown to blackish, poisonous. Commonly in rocky areas in canyons and on slopes and ridges in s., cen. and w. Tex., e. to Dallas Co., Mar-June; also N.M. and adj. Mex.

3. CARDIOSPERMUM L. HEARTSEED. BALLOON-VINE

Mostly herbaceous climbers, with alternate twice-ternate to variously decompound leaves; leaflets entire to toothed or incised; flowers small, yellowish or whitish, in axillary racemose-paniculate or corymbose clusters on a slender peduncle and with 2 tendrils at the apex of the rachis; sepals 4 or 5, the 2 outer ones smaller than the inner ones; petals 4, stamens 8; fruit a membranaceous 3-lobed 3-celled inflated pod.

About 14 species, mostly in tropical America.

1. Leaflets dissected into linear-oblong segments that are to 1 cm. long and 4 mm. wide; sepals 5 1. *C. dissectum*.
1. Leaflets ovate-lanceolate to narrowly lanceolate, coarsely dentate and incised, the complete blade much more than 1 cm. long and 4 mm. wide; sepals 4 (2)
- 2(1). Vegetative parts sparsely pilose to subglabrous; peduncle, tendrils and the 3 verticillate floral branchlets all filiform; seed scar lunate, about 5 mm. long or the diameter of the seed 2. *C. Halicacabum*.
2. Vegetative parts (especially lower surface of leaflets) densely villose; peduncle, tendrils and the several floral branchlets all stout; seed scar suborbicular, at most notched, 2-3 mm. in diameter 3. *C. corindum* f. *villosum*.

1. *Cardiospermum dissectum* (Wats.) Radlk. Stems wiry, herbaceous, several-ribbed, sparsely hirsute to essentially glabrous; leaves to 1 dm. long, decompound and much-dissected, thinly hispidulous and ciliate, the rachis and petiolules winged or margined throughout; flowers several in a short contracted panicle; calyx puberulent, the elliptic-obovate inner sepals about 6.5 mm. long and conspicuously long-ciliate on the lower half; petals elliptic, about 5 mm. long; fruit somewhat quadrangular-obovate in outline,

glabrous, lustrous, about 15 mm. long and twice as wide. In gravelly soil on open-brushy hills in extreme s. Tex., July-Sept.; also Chih.

2. *Cardiospermum Halicacabum* L. COMMON BALLOON-VINE, FAROLITOS. Vine, sparsely pilose to subglabrous throughout; stem wiry, several-ribbed; leaves usually biternate; leaflets ovate-lanceolate to rhombic-lanceolate or narrowly lanceolate, acuminate at apex, decurrent on petiolules, incisely lobed and toothed, to about 8 cm. long and 3 cm. wide; flowers about 4 mm. long; petals obovate; fruit 3-4.5 cm. in diameter; seeds black, 5 mm. in diameter. Sprawling on ground and trailing over weeds and bushes in open waste ground or brushy areas in n.e., cen. and s. Tex., June-Nov.; widespread in warmer regions of the W. Hemis.

3. *Cardiospermum corindum* L. f. *villosum* (Mill.) Radlk. TROPICAL HEARTSEED. Vine, very similar to *C. Halicacabum* except for its typically smaller leaf segments, villous vestiture, difference in the inflorescence, somewhat larger (4-6 mm. long) flowers and different seed scar. *C. molle* of Coult. Uncommon in waste lands, brushlands and open woods in w. and s. Tex., Apr.-Aug.; throughout warmer regions in the W. Hemis.

4. URVILLEA H.B.K.

About 13 species primarily in tropical America.

1. *Urvillea ulmacea* H.B.K. APAAC. Shrubby climber, with alternate stipulate 3-foliolate leaves; stems wiry, hirsute with white incurved hairs; leaflets petiolulate, ovate to ovate-lanceolate, acuminate at apex, at base slightly decurrent on the petiolule and rounded to broadly cuneate or subcordate, to 1 dm. long and 5 cm. wide, coarsely dentate and somewhat incised, softly pubescent beneath; flowers whitish or yellowish-green, in axillary racemose panicles on a more or less elongated peduncle and with 2 coiled tendrils at the apex of the rachis; sepals 5, the 2 outer rounded ones smaller than the inner elliptic ones; petals 4, obovate, about 1.5 mm. long, twice as long as the hair-tufted clublike nectary at the base of each petal; stamens 8; fruit composed of 3 broadly winged membranaceous samaras that are seed-bearing in the middle, elliptic-oval in outline, 2-3 cm. long at maturity, narrowed at base, pubescent to glabrate; seed one in each cell. *U. mexicana* Gray. In woodlands and waste places in extreme s. Tex., May-Oct.; also adj. Mex., s. to Peru and Arg.

5. SERJANIA MILL.

Woody vines with alternate exstipulate ternate or odd-pinnate leaves and axillary racemes or panicles of small yellowish or whitish flowers, commonly with 2 tendrils at the apex of the floral rachis; sepals 5, imbricated, concave, the outer 2 smaller than the inner ones; petals 5; stamens 8; fruit composed of 3 broadly winged dorsally attached membranaceous samaralike mericarps that are seed-bearing at their apex, the wings usually produced beyond the axis to make the fruit notched at the apex.

About 215 species mainly in tropical America.

1. Fruits broadest below middle, about 10 mm. long, the wings lenticular; petals oblanceolate to spatulate, 2-2.5 mm. long, scarcely exceeding the nectary; sepals white-pubescent1. *S. brachycarpa*.

1. Fruits broadest above middle, to about 35 mm. long, the wings inflated; petals obovate, about 4 mm. long, twice as long as the nectary; sepals glabrate or puberulent2. *S. incisa*.

1. *Serjania brachycarpa* Gray. Stems wiry, several-ribbed, hirsute, often high-climbing; leaflets ovate to ovate-lanceolate, mucronulate, remotely and coarsely serrate, more or less shortly hirsute above and softly pubescent beneath, 1.5-5 cm. long, to 25 mm. wide, the terminal leaflet cuneate-tapering into a petiolule, the lateral leaflets essentially sessile; flowers greenish-yellow, in a thyrse; petals oblanceolate to spatulate, 2-2.5 mm. long, only slightly longer than the conspicuous platelike hairy nectary at the base of each petal; fruit 1-1.3 cm. long, puberulent to glabrate, cordate-ovate on outline, the wings 3.5 mm. wide. In thickets and scrub forests along and near the coast in s. and s.w. Tex. winter and spring; also adj. Mex.

2. *Serjania incisa* Torr. Stem hirtellous or glabrate; leaflets ovate-rhombic, incised-serrate or coarsely dentate, noticeably darker green on upper surface, pubescent or puberulent on both surfaces, acute at each end, 25-35 mm. long; flowers in racemiform panicles; outer sepals glabrate, the inner ones puberulent; petals obovate, 4 mm. long, about twice as long as the basally attached nectary; fruit to 35 mm. long and 2 cm. wide, at first pubescent, at length nearly smooth, from obovate-oblong to cuneate in outline, the seed-bearing portion reticulately veined, the wings 6-10 mm. wide. In the Rio Grande Plains and w. Edwards Plateau; also Coah.

FAM. 111. BALSAMINACEAE A. RICH. TOUCH-ME-NOT FAMILY

Herbs or undershrubs with bland watery juice; leaves alternate, opposite or rarely whorled, simple, exstipulate; flowers irregular, perfect, hypogynous; calyx petaloid, imbricated, spurred; stamens 5, with short flat filaments and introrse more or less connivent obconic anthers; ovary 5-celled; fruit a capsule or berry; seeds without albumen.

About 500 species in 4 genera, mostly in the tropics of Asia and Africa.

1. IMPATIENS L. TOUCH-ME-NOT. JEWEL-WEED. BALSAM

About 650 species, nearly all of which are in the Old World.

1. *Impatiens capensis* Meerb. SPOTTED TOUCH-ME-NOT. Succulent annual, glabrous, bright-green, to 15 dm. high, the stems simple or freely branched; leaves with petioles to 1 dm. long, broadly ovate to ovate-elliptic, obtuse-mucronate at apex, broadly cuneate to rounded at base, pale or glaucous beneath, to 12 cm. long and 8 cm. wide, coarsely crenate-mucronate; flowers axillary or paniced, often both normal and cleistogamous flowers produced; bracts of inflorescence linear-subulate; flowers 2-3 cm. long, pendulous on filamentous pedicels to about 2 cm. long, usually orange-color with crimson spots; sepals apparently 4, the anterior sepal notched at the apex, the large posterior saccate sepal longer than broad and its spur one third to half its length and bent back parallel with it; petals 3, bilobed; filaments appendaged with a scale on the inner side, the 5 scales connivent over the stigma; capsules about 2 cm. long, the 5 valves coiling elastically and dehiscing explosively when touched or shaken. *I. biflora* Walt. In moist woods, along streams and in springy places in open or shade in e. Tex., May-July; from Nfld. and Que. to Alas., s. to Fla. and Tex.

The yellow-flowered *I. pallida* Nutt. occurs in east-central Oklahoma. It should be looked for in northeast Texas.

FAM. 112. RHAMNACEAE JUSS.* BUCKTHORN FAMILY

Shrubs or small trees or woody vines or lianes; leaves opposite or alternate, seasonally deciduous, petiolate; stipules present, minute, caducous; flowers perfect except in a few species of *Rhamnus*, in cymes or small thyrses or umbels, or reduced to solitary flowers or appearing glomerate on short shoots, perigynous (or in a few species at early anthesis appearing epigynous because of the almost complete covering of the ovary by the disk), small, inconspicuous (except in *Ceanothus*), usually greenish or yellowish-green, with a hemispherical or campanulate floral cup at whose margins are borne (4 or) 5 triangular sepals, usually (4 or) 5 clawed or spatulate delicate often cucullate petals (these absent in some species) and (4 or) 5 stamens that are opposite the petals and alternate with the sepals and whose anthers are often partly hooded by the ends of the spatulate petals; disk usually present, fleshy or thin or firm, either annular and attached near the rim of the cup or lining the cup or in some species nearly filling the cup and often nearly hiding the ovary in the early stages of its development but not adhering to the ovary or adhering only to the basal portion of it at maturity; style solitary; ovary 1- to 4-celled, each cell

* Cf. M. C. Johnston in C. L. Lundell, *Flora of Texas* II: 357-392. 1969 for a more detailed treatment.

with one anatropous ovule; ovule attached at the base of the cell near the axis; fruit a drupe with 1, 2 or 3 stones or a schizocarpous capsule, in one genus (*Colubrina*) a partially spurious fruit in which the remains of the cup and disk (adherent to the base of the capsule) also partake of the dehiscence.

A family of more than 45 genera and about 600 species, widespread in the warmer parts of the world; easily distinguished as woody plants with the stamens alternate with the sepals.

1. Leaves opposite (2)
1. Leaves alternate or often fasciculate, when opposite (in *Ceanothus Greggii*) without spinescent twigs and with leathery leaves less than 1 cm. wide (3)
- 2(1). Unarmed shrubs; fruits drupaceous9. *Karwinskia*, p. 1015.
2. Twigs thorn-tipped; fruits capsular3. *Adolphia*, p. 1011.
- 3(1). Woody vine or liane, unarmed; fruits about twice as long as broad5. *Berchemia*, p. 1012.
3. Shrubs or small trees; fruits usually about as long as broad (4)
- 4(3). Fruit a 1- to 3-stoned indehiscent drupe (5)
4. Fruit capsular, essentially dry at maturity (8)
- 5(4). Fruit with 2 or 3 stones (6)
5. Fruit with solitary stone (7)
- 6(5). Flowers aggregated in more or less elaborate inflorescences terminating branches6. *Sageretia*, p. 1012.
6. Flowers in few-flowered axillary cymes4. *Rhamnus*, p. 1011.
- 7(5). Petals present; disk thickened around the ovary and partly hiding it in the early stages of anthesis7. *Ziziphus*, p. 1012.
7. Petals absent (except in *C. ericoides*); disk thin, if thickened at all then slightly near the rim of the floral cup8. *Condalia*, p. 1013.
- 8(4). Remains of cup and disk adhering to the base of the ovary at maturity and partaking of the more or less irregular dehiscence of the exo- and mesocarp1. *Colubrina*, p. 1009.
8. Cup and disk persistent on the pedicels at maturity, neatly separating from the parts of the fruit when they fall2. *Ceanothus*, p. 1010.

1. COLUBRINA BRONGN. SNAKEWOOD

Unarmed shrubs or small trees; leaves alternate, ovate, thinly tomentose (sparsely so above), usually with 3 principal nerves (only 1 in *C. texensis*); disk copious, overflowing the cup and essentially hiding the ovary at early stages of anthesis; petals present; ovary cells 3, rarely 4; fruit a slow-maturing hard capsule, the stony endocarp eventually dehiscing both septicidally and at least partly loculicidally releasing the seeds, this accompanied by more or less regular breaking up of the meso- and endocarp and of the remains of the postantheically accrescent disk and cup which adhere to the exocarp of approximately the lower third of the fruit, the entire process of dehiscence delayed for as much as 14 months after anthesis.

About 30 species, 21 of which occur in the New World, one in Hawaii, the remainder in Madagascar and southeast Asia.

1. Flowers appearing solitary or usually glomerate at short twiglike spur-shoots (the latter with numerous crowded nodes; flowers appearing in spring, each one in the axil of one of the nodes, thus glomeruled)3. *C. texensis*.
1. Flowers in axillary cymes or thyrses (2)
- 2(1). Inflorescence (including peduncle) at anthesis about 10 mm. long; leaves 3-6 cm. long, 2-4 cm. broad2. *C. stricta*.
2. Inflorescence (including peduncles) at anthesis 15-30 mm. long; leaves 5-23 cm. long, 3-11 cm. broad1. *C. Greggii*.
1. *Colubrina Greggii* Wats. MANZANITA. Shrub or small tree; leaves 5-23 cm. long, ovate, usually long-tapered to the acute apex, marginally serrate; cymes or thyrses usually

relatively elaborate, 15-30 mm. long, with 15 to 40 flowers; peduncles 5-20 mm. long. Rare in groves of sabal palms s.e. of Brownsville on the Rio Grande delta, summer-fall. Our plants are of the typical variety which otherwise occurs from Coah., s. to Hgo. and Ver. The var. *yucatanensis* M. C. Johnst. occurs in the Yuc. peninsula and Petén.

2. *Colubrina stricta* M. C. Johnst. Shrub; leaves 3-6 cm. long, 2-4 cm. broad, about 1 to 1.5 times as long as broad, apically rounded to acute; cymes or thyrses 10-13 mm. long, with 6 to 15 flowers; peduncles 2-8 mm. long. Rare near a spring in Comal Co., Edwards Plateau, not collected in the U.S. since 1851, late spring or early summer; otherwise known from one locality in N.L. (Lampazos in 1937) and one in Coah. (Muzquiz in 1935).

3. *Colubrina texensis* (T.&G.) Gray. Rounded shrub 1-2 m. tall; leaves the smallest of our Colubrinas, both the lateral veins and the marginal serrations suppressed to some extent; flowers solitary or few in glomerules, never in cymes. Locally abundant in Rio Grande Plains, infrequent n. to s. part of n.-cen. Tex. and s. part of Plains Country, rare in e. part of Trans-Pecos, late spring to early summer. Our plants are of the typical variety that occurs from Tex. s. to Coah., N.L. and Tam. The var. *pedunculata* M. C. Johnst., in which the flowers are in minute cymes, occurs in Coah. and Dgo.

2. CEANOTHUS L.

Armed or unarmed shrubs, sometimes weak, spindly, almost suffruticose; leaves opposite or alternate, 1- to 3-nerved basally, usually serrate; flowers relatively showy for the family, white, in elaborate sometimes umbelliform inflorescences either terminal on leafy branches or terminal on long nearly leafless axillary peduncles, often not only the petals white but also the whole exterior of the flower including portions of the peduncle; ovary 3- (4-) celled; fruit a capsule that dehisces septicidally and also partly loculicidally (along the ventral-axial angles of the 3 parts), the parts abscising from the post-anthetically accrescent cup and disk in which they are borne, the cup and disk persistent on the pedicel as a subtriangular pedestal.

A genus of about 55 species confined to North America and Central America. Some of the Mexican and Californian species have been extensively cultivated, and are usually known as French lilacs.

1. Leaves and branches opposite; much-branched low shrubs of Trans-Pecos mountains
.....1. *C. Greggii*.

1. Leaves alternate (2)

2(1). Low shrubs of Trans-Pecos mountains, with at least some of the branches thorn-tipped
.....2. *C. Fendleri*.

2. Branchlets never thorn-tipped; nearly suffruticose low shrubs of prairies, scrub or forests (3)

3(2). Leaves ovate to occasionally broadly elliptic, acute or rarely not, pilose above; peduncles elongate, mostly axillary, naked or few-bracted at summit
.....3. *C. americanus* var.

Pitcheri.

3. Leaves narrowly elliptic or elliptic-lanceolate, obtuse to barely acute, glabrous or nearly glabrous above; peduncles short, mostly terminating regular leafy branches
.....4. *C. herbaceus*.

1. *Ceanothus Greggii* Gray. Shrub 1-2 m. tall, with small leathery opposite leaves and showy vernal masses of white flowers. Arid mt. slopes in the Trans-Pecos, spring; from Oax. to Tex.

2. *Ceanothus Fendleri* Gray. Low shrub mostly not surpassing 1 m. in height; leaves alternate, small, with some close glandular serrations; branches often bluish-gray or glaucous, with some ordinarily thorn-tipped; flowers in showy masses. High elevations in the Trans-Pecos, Apr.-Aug.; from S.D. and Colo. to Chih. and Coah.

3. *Ceanothus americanus* L. var. *Pitcheri* T.&G. REDROOT, NEW JERSEY TEA. Low shrub, the flowering branches being vernal innovations of the same season (thus plants approaching suffruticose in habit); leaves more or less pilose above and below, rarely

glabrous, the apex usually pointed; peduncles long, axillary, naked below. Usually sandy soil, forests and forest-openings and prairies, e., s.e., n.-cen. and s.-cen. Tex., spring; in e. U.S. and s. Can. (This var. confined from n. Ga. to Ind., Ill., Ia., Kan. and Tex.).

In the Midwest the enormously enlarged burl-like "rootstocks" are known as "grubs." Before the pioneers could cultivate the land the grubs had to be laboriously "grubbed" out; they were too tough for the plows then in use. In colonial times the dried leaves were used as a substitute for tea.

4. *Ceanothus herbaceus* Raf. REDROOT. Much like *C. americanus* but nearly glabrous; leaves narrower, elliptic-oblong and usually not pointed; peduncles terminal and shorter. Incl. var. *pubescens* (T. & G.) Shinners, *C. ovatus* Desf. Mostly well-drained clays and loams in prairies or open brush, or in crevices of limestone bluffs, n.-cen. and s.-cen. Tex., the Panhandle and Edwards Plateau; s. Can. and e. U.S. This species, like *C. americanus*, produces large grubs near the ground surface.

3. ADOLPHIA MEISN. JUNCO

The genus consists of two species that are confined to North America.

1. *Adolphia infesta* (H.B.K.) Meisn. Low nearly glabrous much-branched shrub with greenish thorn-tipped branchlets; leaves opposite or nearly so, small, entire, linear-lanceolate, deciduous; flowers solitary or fasciculate at the axils, the pedicels often white, slender and longer than the cup; cup and disk loosely coherent to the base of the mature ovary, at anthesis often white; sepals 5, white and petaloid, broadly triangular; petals white, sometimes with yellow tips, very small, clasping the anther; fruit dry at maturity, of three 1-seeded carpels that fall from the floral cup and release the seed loculicidally. Arid slopes in the Trans-Pecos, late spring-summer; from Oax. to Tex.

The roots have an anise- or licorice-like odor.

4. RHAMNUS L. BUCKTHORN

Unarmed shrubs or small trees; leaves alternate, unlobed, often with some serrulation on the margin, usually glabrous or nearly so; cup and disk small, quite free from the ovary; sepals 5, small, not colored; petals small, wrapped around the filament; flowers perfect or in 2 of our species unisexual, either solitary in the axils or in axillary pedunculate cymes far-surpassed by the leaves; fruit (when immature) appearing dry and 2- or 3-celled, upon maturity becoming black and juicy and containing 2 or 3 seedlike stonelets that become free from each other but remain in the indehiscent drupe.

Nearly 100 species in temperate and tropical regions. The powerful cathartic, *cascara sagrada*, is obtained from some species of *Rhamnus*.

1. Leaves 15-30 (-40) mm. long, 2 to 2.5 times as long as broad; fruit about 5 mm. long; flowers solitary in the axils; shrub of Trans-Pecos mountains 1. *R. Smithii* subsp. *fasciculata*.
1. Leaves mostly more than 50 mm. long, commonly much longer; fruit commonly at least 5 mm. long; shrubs or small trees (2)
- 2(1). Flowers (or some of them) unisexual, appearing in spring before the leaves or with them, solitary in the axils of the lowest nodes of the emerging vernal innovations; leaves elliptic, 5-7 cm. long, 2 to 3 times as long as broad, with a terminal acuminate apiculation 3-5 mm. long, thin, with inconspicuous (not raised) venation beneath 2. *R. lanceolata*.
2. Flowers perfect, appearing in the late spring with or after the leaves, in axillary pedunculate several-flowered cymes; leaves membranous but not thin, rarely apiculate, with fairly conspicuous usually yellowish and slightly raised venation beneath (3)
- 3(2). Leaves 1.3 to 1.7 (to 2) times as long as broad, with considerable soft pubescence beneath, velvety or felty to the touch 3. *R. betulaeifolia*.
3. Leaves 1.7 to 2.5 times as long as broad, the undersurfaces nearly glabrous or somewhat pubescent but not velvety or felty 4. *R. caroliniana*.

1. *Rhamnus Smithii* Greene subsp. *fasciculata* (Greene) C. B. Wolf. Shrub 1-2 m. tall; leaves numerous, elliptic, 1.5-3 (-4) cm. long; flowers solitary or few fascicled in the axils on short pedicels, some or all of them unisexual. *R. fasciculata* Greene. Arid slopes in Trans-Pecos mts., July-Aug. The species, with several infraspecific members, occurs from Hgo. to Colo. The present subsp. is nearly confined to Texas.

2. *Rhamnus lanceolata* Pursh. Large shrub or small tree; leaves lanceolate-elliptic, 4-7 cm. long; flowers axillary, solitary, at the lowest nodes of the emerging vernal innovation, the concomitant vernal leaves only about 1 cm. long, some of the flowers unisexual. Bottomland hardwood forests in e. Tex., spring; from Pa. to Wisc., s. to Ala. and Tex.

3. *Rhamnus betulaeifolia* Greene. Large shrub or small tree; leaves ovate to obovate, 6-9 (-12) cm. long; flowers in small pedunculate axillary inflorescences. *R. californica* Eschs. var. *betulaeifolia* (Greene) Trel., *R. Purshiana* DC. var. *betulaeifolia* (Greene) Cory, *Frangula betulaeifolia* (Greene) Grub. Moist canyons in Trans-Pecos mts., late spring-early summer; from s.e. Ariz. and N.M. to Coah.

Extremely similar to, and probably conspecific with, the next species.

4. *Rhamnus caroliniana* Walt. INDIAN-CHERRY, YELLOW-WOOD, POLECAT TREE. Large shrub or small tree to 6 m. tall; leaves narrowly ovate to narrowly obovate, 7-14 cm. long. *Frangula caroliniana* (Walt.) Gray. Bottomlands in e. and s.e. Tex., w. near streams into n.-cen. and s.-cen. Tex. and Edwards Plateau, late spring-early summer; from Va. to Neb., s. to Fla. and Tex.

5. BERCHEMIA DC.

SUPPLE-JACK. RATTAN-VINE

About 20 species occur in southeastern Asia and 2 in Africa and Madagascar; another in North America.

1. *Berchemia scandens* (Hill) K. Koch. Glabrous unarmed woody climber and liane; leaves alternate, ovate, 3-6 (-8) cm. long, with numerous conspicuous parallel lateral or secondary veins beneath; cup and disk very small and completely free from the ovary; flowers in small panicles at the ends of lateral branches, mostly overtopped or equaled by the foliage; sepals and petals 5, inconspicuous; fruit when mature juicy, ellipsoidal, about 8 mm. long, with 2-celled and 1- or 2-seeded stone. Forests and forest-edges, e., s.e., n.-cen. and s.-cen. Tex., w. to ravines in s. portion of Edwards Plateau, spring; from Va. to Mo., and s. to Fla. and Tex.; also Chis. and Guat.

6. SAGERETIA BRONGN.

More than 30 species have been proposed, mostly from China; 2 occur in North America and 1 from Mexico to Andean South America, the rest in the warmer parts of the Old World but not in Australia or Africa.

1. *Sageretia Wrightii* Wats. Low shrub; leaves opposite or subopposite, small, shiny; flowers nearly sessile, in ample terminal panicles overtopping the foliage; cup small, quite free from the ovary; sepals and petals 5, inconspicuous; fruit at maturity juicy, black, containing 3 one-seeded stonelets, not dehiscent. Arid slopes in the Trans-Pecos, July-Aug.; from s. Ariz. and Chih. to Coah. and Tex.

7. ZIZIPHUS MILL.

Usually armed and nearly glabrous shrubs or small trees; leaves alternate, usually approaching an ovate or oblong shape, petioled; flowers in axillary cymes; cup nearly filled with a massive disk thickened around but not adherent to the ovary; petals present, falling early; ovary 2-celled, usually biovulate; drupe with a solitary woody 2-celled stone.

The name is often incorrectly spelled "Zizyphus." About 150 species in the warmer parts of the Old World and New World.

- 1. When plants armed the spines axillary, much shorter than the leaves and hooked or curved, the branches never thorn-tipped1. *Z. Jujuba*.
- 1. Plants armed with rather straight stout thorn-tipped branches
.....2. *Z. obtusifolia*.

1. *Ziziphus Jujuba* Mill. JUJUBE. Leaves glossy, usually 2-5 cm. long, usually with 2 small unequally hooked stipular (?) spines at each node (at least on some branches); branches usually zigzag. Infrequent in n.-cen. Tex., rare in e. and s.e. Tex. and in Edwards Plateau and Rio Grande Plains, summer; nat. of the warmer, drier parts of the Old World, widely cult. and now widely escaped and naturalized.

The flesh of the fruits is edible. It is used fresh, dried or preserved, and is useful in cooking and candymaking.

2. *Ziziphus obtusifolia* (T.&G.) Gray. LOTE BUSH, GUMDROP TREE, CLEPE. Branches often covered with a grayish or whitish waxlike bloom, usually terminating in stout thorn-tips; leaves often grayish-green, very variable in shape from deltoid to ovate or oblong to nearly linear, when deltoid or ovate then usually serrate in the upper half. *Z. lycioides* Gray. Locally abundant in much of Tex. except in the e. and the higher parts of the Plains Country, summer; from Okla., Tex., N.M. and Ariz., s. to S.L.P. and Ver.

Our plants pertain to the var. *obtusifolia*. The var. *canescens* (Gray) M. C. Johnst. occurs in Ariz., Nev., Calif., Son. and Baja Calif. The thorn-tipped branches give a superficial resemblance to *Condalia Hookeri* and other *Condalia* species, but the latter are easily distinguished by the bright-green, entire leaves that are broadest in the distal extremity and the branches not whitish.

8. CONDALIA Cav.

Shrubs or small trees, most of the branches ending in stout thorns; leaves alternate, often fascicled on short spur-shoots in which the internodes are suppressed; petioles very short or absent; blades bright-green to sordid-green, either linear or usually obovate or spatulate, entire; flowers solitary or seemingly fascicled at the short shoots; disk seemingly absent or forming a slight annular thickening near the rim of the cup; petals absent except in *C. ericoides*; ovary completely 2-celled at least early in its development, each cell with an ovule, often one of the cells and one of the ovules suppressed early in development and not evident at maturity; fruit a roundish, small drupe.

A genus of 18 species in warm temperate and tropical arid America.

1. Leaves sessile, linear, with no obvious venation pattern; petals present 5. *C. ericoides*.
1. Leaves often short-petiolate, not linear; petals absent (2)
 - 2(1). Leaves very small, spatulate, 4-12 (-14) mm. long, (0.5-) 1.6-3 (-5) mm. broad, the veins slightly prominent and broad and occupying at least 30 per cent of the undersurface of the leaf (3)
 2. Leaves larger, obovate to elliptic, most of them more than 5 mm. long and 3 mm. broad, with inconspicuous venation beneath occupying much less than 30 per cent of the surface (4)
 - 3(2). Leaves (and young branches) entirely glabrous, intervein surfaces beneath with rounded transverse ridges, the undersurface appearing as if molded in wax 4. *C. spathulata*.
 3. Leaves hispidulous, intervein surfaces merely microvesiculate, undersurface not appearing waxy 3. *C. Warnockii*.
 - 4(2). Leaves apically commonly weakly acute, less commonly rounded, 5-8 (-18) mm. long, 2.3-4 (-10) mm. broad 2. *C. viridis*.
 4. Leaves usually rounded apically, rarely slightly acute, (10-) 15-20 (-31) mm. long, (5-) 9-12 (-19) mm. broad 1. *C. Hookeri*.

1. *Condalia Hookeri* M. C. Johnst. BRASIL, CAPUL NEGRO. Leaves obovate, (10-) 15-20 (-31) mm. long, (5-) 9-12 (-19) mm. broad, broadest about a third the distance from the apex, apically mucronate and usually rounded or sometimes truncate and emarginate or rarely slightly acute (minimum angle about 100°), basally acuminate, entire or very rarely with 2 to 4 inconspicuous small introrse teeth in the distal half, membranous, above rather smooth and flavescent buffy-green or occasionally flavescent brownish-green, glabrous or occasionally hispidulous, beneath paler flavescent olive-green with inconspicuous flush venation including the midrib and 3 or 4 pairs of lateral veins; fruit globose, 5-6 mm. thick. *C. obovata* Hook., an illegit. name. Locally abundant, Rio Grande

Plains and margins of adj. regions, n. to Val Verde, Edwards, Kerr, Travis, Austin and Matagorda cos., rare above 2,000 ft. elev., summer; Tam., N.L. and Tex.

There are 2 varieties, the common and widespread var. *Hookeri*, not occurring above 2,000 ft. elev., with blades 1 to 2.5 times as long as broad, and the endemic var. *edwardsiana* (Cory) M. C. Johnst., with blades 2.5 to 3 times as long as broad, known only from one thicket in Edwards Co., at an elevation slightly above 2,000 ft.

2. *Condalia viridis* I. M. Johnst. Leaves elliptic-obovate, 5-8 (-19) mm. long, 2.3-4 (-10) mm. broad, broadest a third to two fifths the length from the apex, apically rounded and apiculate or truncate and emarginate or usually acute (minimum angle about 85°), basally cuneate, marginally entire and very minutely hispidulous at least basally or glabrous, firm, above yellowish-green or grayish-green and microvesiculate and sparsely and very minutely hispidulous or glabrous, beneath usually slightly more flavescent or even glaucous and vesicular and sparsely and very minutely hispidulous or glabrous and with inconspicuous concolorous flush or very slightly raised pinnate venation including the midrib and 3 or 4 pairs of lateral veins; fruit black and globose or even slightly oblate when mature, 5-6 mm. thick. *C. viridis* var. *Reedii* Cory. Locally abundant in dry limy uplands, Edwards Plateau and Trans-Pecos, s.e. to Kinney and Uvalde cos., summer; also Coah., N.L. and S.L.P.

3. *Condalia Warnockii* M. C. Johnst. Leaves usually in fascicles of 2 to 5 at the short shoots, spatulate, 3-7 (-10) mm. long, 1-2.6 (-5) mm. broad, broadest about a third the length from the apex, apically usually acute (minimum angle about 85°), basally acuminate, marginally entire and hispidulous, firm above and sordid-yellowish or brownish-olive or grayish-green and hispidulous, beneath dark olive-green or sordid gray-green and hispidulous with somewhat paler raised venation including the midvein and 2 to 4 pairs of flat-topped or sulcate lateral veins, the venation altogether occupying 30 to 70 percent of the surface; fruit when mature nearly globose, black to reddish-black, 4-6 mm. long, 3-4.5 mm. thick when dry, larger when moist. Locally abundant in deserts in the Trans-Pecos, infrequent e. to w. part of Edwards Plateau and s. part of Plains Country, summer.

Our plants are referable to the var. *Warnockii*, which occurs in Tex., N.M., Chih., Coah. and Zac. The var. *Kearneyana* M. C. Johnst. occurs in Ariz. and Son.

4. *Condalia spathulata* Gray. SQUAW-BUSH. Rounded shrub usually less than 1 m. tall; leaves mostly in fascicles of 2 to 7 at short shoots, entire, spatulate, 4-12 (-14) mm. long, 1.6-3 mm. broad, broadest about a fourth to a third the length from the apex, apically mostly rounded or less commonly emarginate or acute (minimum angle 90°), basally acuminate, marginally slightly thickened and often a little revolute when dry, firm, above grayish-olive to tawny or brownish-grayish-olive, entirely glabrous and often wrinkled when dry, beneath slightly paler and entirely glabrous and with slightly raised, broad, flattened dark veins that occupy more than 40 per cent of the surface, intervein surfaces beneath with some transverse rounded wrinkles, the whole undersurface appearing as if molded in wax; petioles 1 (-2) mm. long; fruit slightly prolate when dry or immature, or nearly globose when mature, black, 3.5-4 mm. long, 2.9-3.5 mm. thick (larger when moist). Locally abundant in dry open brushy areas, Rio Grande Plains, rare in s. part of Edwards Plateau, summer-fall; also Coah., Tam. and N.L.

5. *Condalia ericoides* (Gray) M. C. Johnst. JAVELINA BUSH, TECOMBLATE. Shrub 3-10 (-13) dm. tall; leaves mostly in fascicles of 2 to 9 at short shoots, essentially sessile, linear, 2-13 mm. long, about 1 mm. broad, apically shortly acute, marginally entire, coriaceous, grayish with a waxy texture, above rounded or with a slight median sulcus, beneath with a flat median portion (midvein) occupying most of the width along which are grooves as if the vestigial lateral portions of the blade were revolute, no venation visible; petals shorter than the sepals, spatulate, emarginate, yellowish, membranous, reflexed, caducous; fruit pronouncedly prolate, 7-12 mm. long, 1.5 to 2 times as long as thick, when unripe or abortive dry and yellowish-brown, when fully mature and juicy reddish-black or purplish-black with a thin pulp and a very thick-walled apiculate stone. *Microrhamnus ericoides* Gray. Locally abundant, Trans-Pecos deserts, infrequent in the Plains Country, rare e. to w. part of Edwards Plateau, spring-summer; Ariz., N.M., Tex., Chih., Coah., S.L.P. and Zac.

9. KARWINSKIA Zucc.

One of the 12 species occurs in Texas, the rest in the West Indies, Mexico and Central America, one reaching northern Colombia.

1. *Karwinskia Humboldtiana* (R. & S.) Zucc. COYOTILLO. Unarmed usually glabrous shrub 1-2 m. tall, rarely more; leaves opposite, short-petiolate, usually 3-7 (-8) cm. long, oblong or elliptic-oblong, rounded or acute at both ends, entire, rarely gently crenate, with numerous close and elegantly parallel secondary veins, often each vein beneath with an alternating pattern of lighter and darker coloration; flowers in few-flowered axillary cymes; disk thin; petals present; ovary 2- to 4-celled; fruit a globose drupe, black when ripe. Frequent in Rio Grande Plains, n. to s. part of s.e. Tex. and Edwards Plateau, and extreme s.e. part of Trans-Pecos, summer-fall; Baja Calif., Son., Chih., Tex., Tam., N.L., Coah., S.L.P., Ver., Qro., Gto., Hgo., Jal., Mex., Gro., Pue. and Oax.

The flesh of the fruit is insipid-sweet and edible, but the stones are reported to contain a substance toxic to the nervous system of vertebrates.

FAM. 113. VITACEAE JUSS.

GRAPE FAMILY

Shrubs or woody vines with watery acid juice, usually climbing by tendrils opposite the leaves or on the peduncles; leaves alternate, essentially entire to palmately 3- or 5-lobed or compound; stipules deciduous; inflorescences opposite the leaves; flowers often unisexual and perfect on the same plant, small, regular, greenish, 4- or 5-merous, with a minute or truncated calyx (its limb mostly obsolete) and stamens as many as the valvate petals and opposite them; filaments slender; anthers introrse; style short or none; stigma slightly 2-lobed; grape 2-celled, 1- to 4-seeded; seeds bony, with a minute embryo at the base of the hard albumen.

More than 600 species in about 20 genera widespread in tropical and temperate regions.

1. Bark loosening and freely exfoliating in shreds and without lenticels (excepting in *V. rotundifolia*); pith brownish; leaves simple; inflorescence a compound thyrse; petals separating only at base, falling without expanding; seeds mostly pyriform1. *Vitis*, p. 1015.
1. Bark tight, covered with lenticels; pith white; leaves rarely simple; inflorescence a dichotomous or umbelliform cyme; petals expanding, free from one another, dropping singly; seeds trigonous (2)
- 2(1). Leaves (at least some of them) digitate; some or all tendrils with adhesive disks; ovary adnate to the obscure disk2. *Parthenocissus*, p. 1021.
2. Leaves pinnately compound or sometimes simple; tendrils all with slender tips; ovary surrounded by a free nectariferous or glanduliferous disk (3)
- 3(2). Cyme dichotomous; flowers 5-merous; disk with entire or crenulate margins3. *Ampelopsis*, p. 1022.
3. Cyme umbelliform; flowers 4-merous; disk deeply 4-lobed4. *Cissus*, p. 1022.

I. VITIS L.¹²⁴

GRAPE

Deciduous rarely evergreen polygamo-dioecious viny shrubs, climbing by tendrils; pith brown, interrupted at the nodes by a diaphragm (except in *V. rotundifolia*); leaves simple, dentate, mostly rounded and cordate, usually lobed, rarely palmately compound; flowers fragrant, 5-merous, in a compound thyrse opposite a leaf; sepals minute or obsolete; petals cohering at the apex and falling as a whole at anthesis; disk hypogynous, consisting of 5 nectariferous glands alternate with the stamens; ovary 2-celled; cells

¹²⁴ Ref.: L. H. Bailey in *Gent. Herb.* 3:149-244; T. V. Munson, *Foundations of American Grape Culture.* 1909; W. H. Duncan in *Sida* 3:1-76. 1967.

2-ovuled; style conical, short; fruit a pulpy 2- to 4-seeded berry; seeds usually pyriform, with a contracted beaklike base, with 2 grooves on the ventral side.

About 60 species in the Northern Hemisphere, mainly in temperate regions.

1. Lower surface of fully grown leaves more or less covered with a permanent indument or (if somewhat naked) either whitened to silvery-bluish-green, covered with long cobwebby hairs continuous or in patches (floccose) lying parallel to the surface or with a close continuous felt of hairs completely hiding the surface; younger shoots, petioles and peduncles thinly to densely woolly or pubescent (2)
1. Lower surface of fully grown leaves (except usually the veins) green and glabrous or rarely with short straight hairs erect-spreading from surface; younger shoots, petioles and peduncles glabrous or thinly woolly or with short erect-spreading hairs (6)
- 2(1). Lower surface of leaves with a close continuous felt of white to cream-color hairs that are matted so as to completely and permanently conceal the surface 1. *V. mustangensis*.
2. Lower surface of leaves visible through the indument, with long cobwebby hairs that are either close and forming a continuous covering or commonly occurring in patches of tufts or (if essentially glabrous) the surface whitish or bluish-green, sometimes with some intermixed short straight hairs (3)
- 3(2). Leaves with coarse uneven acute or acuminate teeth that are usually longer than wide, the pubescence gray or whitish; distribution in the Panhandle and Trans-Pecos, east to the northwestern part of north-central Texas 2. *V. acerifolia*.
3. Leaves with shallow acute or rounded and abruptly pointed teeth that are usually about as wide as long or wider, the pubescence yellowish to rust-color or sometimes grayish; distribution east of the Panhandle and Trans-Pecos (4)
- 4(3). Leaves of flowering shoots unlobed or shallowly lobed with the lobes toothed to the base; lower surface of leaves dull-green with a more or less uniform continuous (though often thin) covering of grayish cobwebby hairs 3. *V. cinerea*.
4. Leaves of flowering shoots shallowly or deeply lobed, the deeply lobed ones with entire sinuses; lower surface of leaves usually with grayish or reddish-brown cobwebby hairs, sometimes blue-glaucous and thinly hairy (5)
- 5(4). Lower leaves on flowering branchlets obtuse to acute; axis of inflorescence with brownish or grayish crisped hairs; mound-forming shrubby vines or low-climbers 4. *V. Lincecumii*.
5. Lower leaves on flowering branchlets acute to acuminate; axis of inflorescence with whitish or stramineous (sometimes ferruginous) cobwebby hairs; low- to high-climbing vines 5. *V. aestivalis*.
- 6(1). Tendrils simple, not forked; bark tight, not shredding; pith continuous through the nodes; confined to forests of east Texas 6. *V. rotundifolia*.
6. Tendrils on vegetative parts forked; bark loosening and shredding; pith interrupted at the nodes by cross partitions (7)
- 7(6). Leaves (at least some) deeply lobed (8)
7. Leaves entire or (at most) shallowly lobed (9)
- 8(7). Axis of inflorescence sparsely and loosely long-pubescent or glabrous; fruit gray-bluish and glaucous; margins of leaves often ciliolate . 7. *V. riparia*.
8. Axis of inflorescence densely short-pubescent; fruit black, not glaucous; margins of leaves scarcely or not at all ciliolate 8. *V. palmata*.
- 9(7). Distribution in mountains of Trans-Pecos Texas ... 9. *V. arizonica*.
9. Distribution east of Trans-Pecos Texas or *V. acerifolia* very rare in Presidio County (10)

- 10(9). Leaves with coarse uneven acute or acuminate teeth that are usually longer than wide; distribution almost solely in the Panhandle (an isolated locality in Tierra Vieja Mts.), rare east to the northwestern part of north-central Texas 2. *V. acerifolia*.
- 10. Leaves with shallow acute or rounded and often abruptly pointed teeth that are usually about as wide as long or wider; distribution south of the Panhandle (11)
- 11(10). Leaves rarely more than 8 cm. long; inflorescences rarely more than 6 cm. long; tendrils absent or only opposite uppermost leaves or at tips of flowering or fruiting branches (12)
- 11. Leaves rarely less than 8 cm. long; inflorescences usually much more than 6 cm. long; tendrils present and often on peduncles (13)
- 12(11). Leaves typically reniform and wider than long, commonly conduplicate; a viny shrub or low vine10. *V. rupestris*.
- 12. Leaves typically broadly ovate to triangular-ovate, mostly about as long as wide, not conduplicate; vine climbing over trees and shrubs ..11. *V. monticola*.
- 13(11). Petioles and veins (especially in axils) on lower surface of leaves either with short erect-spreading hairs or glabrous; distribution in eastern third of Texas 12. *V. vulpina*.
- 13. Petioles and veins on lower surface of leaves with cobwebby or flocculent hairs, rarely with some short erect-spreading hairs intermixed, sometimes glabrescent (14)
- 14(13). Endemic to Edwards Plateau; leaves developing fully along with growth of new branchlets13. *V. Berlandieri*.
- 14. In extreme northern part of north-central Texas; rapidly produced new growth of branchlets slender-elongate with very immature leaves 14. *V. cordifolia*.

1. *Vitis mustangensis* Buckl. **MUSTANG GRAPE**. Vigorous high-climbing vine; young growth white-tomentose; diaphragm 3-5 mm. thick; leaves broadly triangular-ovate to ovate-reniform, subacute to obtuse at apex, 6-14 cm. long from top of petiole, about as wide as or wider than long, the basal sinus broad and open to subtruncate at base of leaves, sinuately and shallowly toothed, essentially entire to indistinctly lobed or angled, on vigorous shoots deeply 3- or 5-lobed, white-tomentose on both sides when young, later dark-green and glabrous or somewhat floccose on upper side and permanently white-tomentose (felty) on lower surface; petiole 3-6 cm. long, white-woolly; thyse 5-12 cm. long, the short peduncle and axis woolly and floccose; grape 1.5-2 cm. thick, purple-black to light-colored, without bloom, persistent, with tough skin and of a fiery disagreeable taste; seeds 6-7 mm. long and about as thick. *V. candicans* Engelm. and var. *diversa* Bailey. Along stream bottoms, thickets, fencerows, edge of woods and sandy slopes, especially in disturbed grounds in the e. half of Tex., fruiting Aug.-Sept.; from Tex. to La., Okla. and Ark.

The fruit of some populations is very pungent or fiery in flavor, especially if the skin is chewed, and it is irritating to the mouth and even to the hands. It is frequently used in the making of domestic wine. Fruits of the var. *diversa* (Bailey) Shinnery are very sweet and agreeable.

2. *Vitis acerifolia* Raf. **PANHANDLE GRAPE, BUSH GRAPE**. Stocky erect much-branched short-jointed vines, rarely climbing but often covering rocks and shrubs, early-fruited; younger parts short and leafy, pubescent or tomentose and floccose, whitish or grayish; bark shredding tardily; diaphragm 1-3 mm. thick; tendrils short; stipules conspicuous but shedding early, 5-7 mm. long; leaves light-grayish-green, thick-textured to subcoriaceous, suborbicular to broadly triangular-ovate, abruptly acute to long-acuminate at apex, 7-12 cm. long above the petiole and often broader than long, the basal sinus almost closed to very broad, irregularly and very sharply and coarsely toothed, indistinctly or shallowly lobed or often only shouldered, with age becoming free of cobwebby hairs and tomentum above but usually retaining some cobwebby pubescence especially along the

veins on the lower surface, variously pubescent beneath until midseason or later; petiole short, pubescent or becoming glabrous; thyrses 3-7 cm. long, almost simple, the rachis and very short peduncle at first floccose but becoming glabrous; grapes 8-12 mm. thick, black with a heavy bloom, persisting, with a thin skin, becoming sweet at maturity; seeds 5-6 mm. long, 4-5 mm. broad, rather abruptly short-beaked. *V. Doaniana* Munson, *V. Longii* Price and var. *microsperma* Munson. In low open woods in stream bottoms, and on dunes and rocky slopes in Tex. Panhandle, s.e. to n.w. part of n.-cen. Tex., with an apparently isolated locality in Tierra Vieja Mts., Presidio Co., fruiting July-Aug.; from Tex., n. to Kan. and Colo.

3. *Vitis cinerea* Engelm. GRAYBARK GRAPE, SWEET GRAPE, PARRA SILVESTRE. Lax high-climbing vine; growing tips and branchlets angled, permanently close-pubescent with ashy-white or gray hairs; diaphragm 3-5 mm. thick; stipules 2-4 mm. long; leaves of fertile branches suborbicular to broadly ovate, with a prolonged and tapering triangular apex, 1-2 dm. long above petiole, slightly less wide, the basal sinus either narrow or broad, with irregular usually smallish and shallow apiculate or short-mucronate teeth, either unlobed or with short shoulders or (more rarely) with 2 or 4 prolonged lobes, the upper surface floccose but becoming glabrate, the pale-green or somewhat glaucous lower surface canescent-pilose or grayish-floccose with cobwebby hairs, the looser hairs somewhat deciduous; petiole shorter than the blade, canescent or floccose; thyrses slender, 6-15 cm. long, canescent or gray-floccose, rather open; grapes 4-9 mm. in diameter, blackish or purplish, with a slight bloom, finally sweet; seeds 4-5 mm. long. River and creek banks, bottomlands and pond margins in n.-cen. and e. Tex., fruiting Sept.-Nov.; from Fla. to Tex., n. to Va., O., Ind., Ill., Ia. and Neb.

Those plants with suborbicular-cordate very shallowly toothed leaves that lack the triangular or 3-lobed aspect of var. *cinerea* and whose lower surface is prominently soft-pubescent or densely canescent instead of being cobwebby and/or floccose are referred to var. *canescens* Bailey.

4. *Vitis Linceumii* Buckl. POST OAK GRAPE. Stout moderately climbing vine on low trees but making bushy clumps when standing alone; young shoots densely whitish or light-brownish tomentose, the old wood eventually becoming glabrous; tendrils often twice-forked; diaphragm 2-3 mm. thick; leaves of fertile branches quadrate-rotund to broadly cordate-ovate, thick-textured, 8-15 cm. long from top of petiole and usually or at least frequently broader than long, with a broad basal sinus, coarsely and shallowly toothed, sometimes continuous in outline with obscure shoulders but more often shallowly 3-lobed and frequently deeply 3- or 5-lobed with open rounded smooth sinuses, densely floccose- or webby-tomentose and rarely glaucous on lower surface; petioles tomentose; thyrses 8-15 cm. long, shorter than the leaves, commonly forked, the short peduncle and rachis more or less tomentose or woolly; grapes 1-2 cm. in diameter, black or dark-purple, with a thin bloom, falling at maturity, variable in quality and taste; seeds 7-8 mm. long, 5-6 mm. broad. Incl. var. *glauca* Munson, (?) *V. aestivalis* var. *argentifolia* (Munson) Fern. In sandy open woods, thickets and glades in e. and s.-cen. Tex., w. to Bastrop Co., fruiting June-Sept.; from Miss. to Tex., n. to Ind. and Mo.

5. *Vitis aestivalis* Michx. SUMMER GRAPE, PIGEON GRAPE. High-climbing vine; young branchlets and petioles with rusty or reddish persistent to flocculent-deciduous tomentum or velutinous pilosity; diaphragm 3-4 mm. thick; leaves of fertile branches suborbicular-ovate, cordate, 7-20 cm. long from top of petiole, about as broad as long, the basal sinus mostly deep and prominent, the margins irregularly and not deeply sinuate-toothed and the teeth often sharp, unlobed or merely shouldered to deeply 3- or 5-lobed, upper surface dull-green and essentially glabrous, lower surface with subsistent but loose and flocculent tomentum of cobwebby hairs, the prominent ribs and veins tomentose to velutinous-hispid; thyrses 5-18 cm. long, the axis with cobwebby hairs; grapes 5-12 mm. in diameter, dark-purple or blackish, with a thin bloom, persistent, variable in quality and taste, sometimes sweet and pleasant-tasting; seeds 5-7 mm. long, 4-5 mm. broad. In sandy soils mostly along rivers and streams in the e. third of Tex., fruiting Sept.-Oct.; from Ga. to Tex., n. to Mass., N.Y., O., Mich. and Wisc.

6. *Vitis rotundifolia* Michx. MUSCADINE, BULLACE-GRAPE, SCUPPERNONG. Great vigorous vines, climbing to 30 m. or more over trees and shrubs; bark tight, nonshredding, abundantly dotted with small lenticels; pith continuous through the nodes; tendrils simple,

unbranched; stipules 1-2 mm. long; leaves orbicular to deltoid-ovate, obtuse to acute at apex, the sinus broadly open or the base of leaf nearly truncate, 5-12 cm. long above the petiole, about as wide as long, glabrous but usually somewhat hairy-tufted in axils of veins on lower surface, lustrous, with broad blunt teeth, rarely slightly lobed; petiole slender and about equaling the blade, usually retaining slight pubescence or floccosity; thyse 2-4 cm. long; grapes promptly falling, 12-25 mm. in diameter, purple-black to bronze, without bloom, the skin tough, the flesh musky; seeds oblong, 7-8 mm. long, 4-5 mm. thick. *Muscadinia rotundifolia* (Michx.) Small. Frequent in forests of e. Tex., fruiting Sept.-Oct.; from Fla. to Tex., n. to Del., Va., W.Va., Ind., Mo. and Okla.

The fruits of this species make excellent jelly. Included here is the famous Scuppernong of the Atlantic Coast, with silvery amber-green grapes.

7. *Vitis riparia* Michx. RIVERBANK GRAPE, FROST GRAPE. Vigorous high-climbing vine; new branchlets green or dull-red, glabrous or pubescent and glabrate; diaphragm 0.8-2 mm. thick; leaves of fertile branches with glabrous petioles, 8-18 cm. long from petiole, about as broad as long, cordate-ovate, with a prolonged acuminate apex, with a broad open basal sinus, the margins with coarse acuminate teeth and usually conspicuously ciliate, glabrous or glabrate, with 2 or more erect and prolonged lobes 1-4 cm. long; leaves of vegetative sprouts similar or more deeply palmate-lobed; thyse 4-15 cm. long, its axis and branches sparsely and loosely long-pubescent to glabrous or essentially so; grapes crowded, 8-12 mm. in diameter, purple-black, with heavy bloom, acid; seeds about 5 mm. long. *V. vulpina* of auth. On trees and cliffs in open woodlands, along streams and in canyons in the Trans-Pecos, e. to n.-cen. Tex., fruiting Aug.-Oct.; from Que. to Man. and Mont., s. to Tenn., Mo., Tex. and N.M.

8. *Vitis palmata* Vahl. MISSOURI GRAPE, RED GRAPE, CATBIRD GRAPE. Slender high-climbing vine; shoots and flowering branchlets herbaceous, angled, bright-red when fresh; diaphragm 4-5 mm. thick; stipules 3-4 mm. long; tendrils red when young; leaves of fertile branches thin, ovate, long-acuminate, 7-12 cm. long above petiole, about as broad as long, with a broad open sinus to almost truncate at base of leaf, with little or no cilia on the margins, unevenly large-toothed with sharp or mucronate points, with 2 prolonged acuminate erect lateral lobes; leaves of vegetative shoots larger and with 3 or 5 long-acuminate lobes with broad rounded sinuses; upper leaf surfaces shining dark-green and glabrous except on veins, the lower surface pale and usually retaining pubescence on veins with tufts in the axils; petioles red; thyse 5-15 cm. long, long-stalked, rather open, its rachis and branches copiously hirtellous; grapes 5-10 mm. in diameter, black or bluish-black, without bloom, the skin thick, finally sweet; seeds 4.5-6 mm. long. On margins of ponds or sloughs, or in low woods in e. Tex., fruiting Sept.-Oct.; from La. and Tex., n. to Ind., Ill. and Ia.

9. *Vitis arizonica* Engelm. CANYON GRAPE, GULCH GRAPE, PARRA DEL MONTE. Grayish more or less shrubby vine, mostly small and weak, much-branched, usually not high-climbing; young parts ashy-gray from a tomentum to essentially glabrous; diaphragm 2-4 mm. thick; stipules 2-3 mm. long; tendrils soon deciduous if not attached; leaves broadly cordate-ovate to nearly reniform, with a triangular apex, 5-12 cm. long above the petiole and mostly slightly broader than long, the basal sinus from narrowly inverted U-shaped to broad and open, the margins with rather small or rarely large sharp and mucronate uneven teeth, commonly obscurely lobed or shouldered, rarely deeply 3-lobed, at first both sides cottony, with age the upper surface becoming indifferently floccose and the lower surface more or less permanently covered with grayish-white short erect hairs, the lower surface also commonly becoming glabrous and somewhat glossy except for a usual tuft of erect hairs in the vein axils; petioles often pink-tinged and either slightly floccose or glabrous; thyse 5-10 cm. long, slender-stalked, the short peduncle and rachis more or less floccose to subglabrous; grapes 6-10 mm. thick, black and sometimes with a thin bloom, the skin thin, the pulp juicy and sweet; seeds 4-6 mm. long, 3-4 mm. broad, short-beaked. Climbing on trees, shrubs and over boulders in canyons of mts. in the Trans-Pecos, fruiting Aug.-Oct.; from Tex. to Ariz. and n. Mex.

The leaves of var. *arizonica* are usually smaller and their lower surface is more or less permanently covered with short straight whitish hairs, whereas the var. *glabra* Munson (*V. Treleasei* Munson) has leaves to 12 cm. long and their lower surface is essentially glabrous or the vein axils are provided with small tufts of short straight hairs.

10. *Vitis rupestris* Scheele. SAND GRAPE, SUGAR GRAPE. Low bushy plant to about 25 dm. high or less, with early fruit, seldom climbing, either ascending or prostrate, sometimes trailing over rocks and bushes, bark tardily shredding, young shoots leafy to the tip; diaphragm 2-3 mm. thick; tendrils red, wanting or only at tips of fertile branches; stipules 4-5 mm. long; leaves thick, reniform to reniform-ovate, mostly abruptly short-pointed at apex, the blade folded upward (conduplicate) to form a trough so that the light-colored lower surface is exposed, 5-10 cm. long above the petiole and usually considerably broader, sometimes as much as 2 dm. wide, the base with a broad open sinus to nearly truncate, the margins with few coarse apiculate teeth and often shallowly lobed, glabrous and somewhat shiny on both surfaces, often tinted light-glaucous above; petiole short, angled, glabrous; ground shoots sometimes bearing slightly lobed leaves; thyrses 2-5 cm. long, on a peduncle of equal or less length; rachis and peduncle usually somewhat floccose at anthesis; grapes globose to depressed, 6-12 mm. in diameter, black and somewhat glaucous, soon dropping, the skin thin, pulp sweet and pleasant; seeds 4-5 mm. long and nearly as broad, abruptly short-beaked. On rocky limestone slopes and stream beds on the Edwards Plateau, fruiting July-Sept.; from Tex. and Okla., n. to Mo., W.Va. and Tenn.

11. *Vitis monticola* Buckl. SWEET MOUNTAIN GRAPE. Rather slender small-leaved climber, to about 10 m. high; young growth gray- or white-tomentose or floccose but becoming glabrous, the canes eventually terete; diaphragm 2-3 mm. thick; stipules 3-4 mm. long; leaves suborbicular-reniform to cordate-ovate or deltoid-ovate, obtuse to short-acuminate at apex, 5-10 cm. long above petiole and usually about as broad as long, the basal sinus from almost oblique-truncate to commonly inverted U-shaped, marginal teeth broad-angled and mostly short and ending in a sharp or bluntish mucro or apex, occasionally slightly lobed on the shoulders, eventually becoming glabrous and glossy though a little cotton may remain on the veins of the lower surface; thyrses 4-7 cm. long, forked, compact, the rachis and short peduncle glabrous or only slightly floccose; grapes 6-12 mm. in diameter, black or rarely red or pinkish, roughish, thinly glaucous, sweet; seeds 5-7 mm. long and about as broad, mostly with a short abrupt beak. *V. texana* Munson, ? *V. Champinii* Planch. On limestone hills and ridges of the Edwards Plateau, fruiting Sept.-Oct.; endemic.

The small glossy leaves with squared notches resemble the east Texas *V. rotundifolia*. The more prolonged leaf apices, the branched, not simple, tendrils and shredding, not tight lenticellate, bark, as well as a diaphragm at the nodes, readily separate this species from *V. rotundifolia*.

12. *Vitis vulpina* L. FOX GRAPE, WINTER GRAPE, FROST GRAPE, CHICKEN GRAPE. Vigorous high-climbing vine with stout trunk; young growth glabrous or soon glabrate, the branchlets terete; diaphragm 2-6 mm. thick; stipules 5-8 mm. long; leaves of fertile branches thick-herbaceous, broadly cordate-ovate, usually with a long sharp apex, 8-18 cm. long from petiole, longer than wide, the basal sinus prevalingly broadly inverted U-shaped, coarsely and sharply irregularly toothed, unlobed or merely with angled shoulders, upper surface bright-green and lustrous, lower surface lighter-green and usually glabrous except for short straight hairs on veins and as tufts in the axils of veins; petiole shorter than blade, usually with short straight erect or spreading hairs; thyrses loose and open, to 2 dm. long; fruiting pedicels about 5 mm. long; peduncles sometimes with an early-deciduous tendril; grapes black and shining, often glaucous, 5-10 mm. in diameter, persistent, edible after frost; seeds 5-6 mm. long, 4-5 mm. thick. Edge of woods and in woods, fields, along roadsides and on trees along rivers and streams in e. third of Tex., fruiting Oct.-Nov.; from Fla. to Tex., n. to N.J., Wisc. and Neb.

13. *Vitis Berlandieri* Planch. SPANISH GRAPE, WINTER GRAPE, UVA CIMARRONA. Stocky or stout vine, moderately climbing or in moist favorable situations reaching tops of trees to 12 m. or more high; young growth striate or angled, the tips gray-cottony or -tomentose; diaphragm 3-4 mm. thick; stipules 3-4 mm. long; leaves suborbicular-cordate to cordate-ovate, abruptly acute to short-acuminate at the deltoid apex, 8-12 cm. long above the petiole, commonly broader than long, marginal teeth of different sizes and commonly broad or bluntish although short-apiculate, with short lobes or indications of them toward apex, the basal sinus narrow or broad, upper surface at first with thin cobwebby hairs but soon becoming glabrous and shining dark-green, lower surface somewhat cottony

when young but eventually glossy although retaining cobwebby or somewhat floccose pubescence on ribs and nerves; petioles somewhat shorter than blades, cottony pubescent or floccose; thyse 7-20 cm. long, the stout peduncle and rachis cottony, often strongly forked; grapes 4-8 mm. thick, purple to black or reddish, with light or heavy bloom, pleasant tasting, on pedicels 4-5 mm. long; seeds variable, the largest about 5 mm. long and 4 mm. broad, with a short abrupt beak. *V. Helleri* (Bailey) Small. Climbing on shrubs and trees and over boulders in canyons and on limestone slopes on the Edwards Plateau, fruiting Aug.-Oct.; also adj. Mex.

Those plants that have more rounded leaves with very glossy lower surface and have been designated *V. Helleri* are referred here. On the Edwards Plateau this species is somewhat a counterpart of the more eastern *V. vulpina*.

14. *Vitis cordifolia* Michx. FROST GRAPE, CHICKEN GRAPE. Tall and vigorous vine reaching the tops of the tallest trees and the large trunks to about 8 cm. in diameter; tips slender and rapid-growing, nearly smooth or grayish- to tawny-pubescent but soon becoming glabrous; diaphragm 2-6 mm. thick; stipules 3-5 mm. long; leaves cordate-ovate or sometimes more or less triangular in shape, the apex usually long-pointed and sharp, basal sinus mostly broad, 5-15 cm. long or more above the petiole and about two thirds as wide, the margins variously simply but not deeply apiculate-toothed, mostly unlobed but frequently shouldered or angled and sometimes with a distinct lobe on either side, the upper surface glabrous and glossy, the lower surface light-green and glabrous with tufts in vein axils and usually with some cobwebby hairs along the veins, varying to puberulent and then mostly glabrescent to occasionally distinctly pubescent; petioles slender, sometimes nearly as long as the blade, with cobwebby or flocculose hairs; thyse slender and open, 6-15 cm. long, frequently forked at or near base, the peduncle slender but short, the fruiting pedicels about 5 mm. long; grapes 3-10 mm. in diameter, black and only slightly if at all glaucous, persistent, sweet after frost; seeds about 5 mm. long, 3-4 mm. broad. In thickets and open woods in n.-cen. Tex., fruiting Oct.-Nov.; from Tex. and Okla. to Fla., n. to Pa. and Kan.

2. PARTHENOCISSUS PLANCH. VIRGINIA CREEPER. WOODBINE

Woody vines, trailing or climbing by branched tendrils that affix themselves by twining tips or by enlarged terminal adhesive disks; leaves digitate or palmately lobed; leaflets 3 to 7, rather coarsely serrate; inflorescence cymosely compound; flowers perfect or unisexual; calyx slightly 5-toothed; petals free, concave, thick, expanding before they fall; disk none; berries with thin flesh; seeds 1 to 4.

About 10 species in North America and eastern Asia.

- 1. Leaflets fleshy-thickened, mostly 7, 3-5 cm. long, to about 2 cm. wide; endemic to the Edwards Plateau1. *P. heptaphylla*.
- 1. Leaflets thin-herbaceous, usually 5 or 6, typically much more than 5 cm. long and 2 cm. wide (2)
- 2(1). Tendrils with 3 to 8 branches that terminate in adhesive disks; leaves dull on upper surface; inflorescence with a pronounced central axis; in the eastern half of Texas2. *P. quinquefolia*.
- 2. Tendrils with 3 to 5 diskless branches; leaves glossy on upper surface; inflorescence dichotomously forked; in west Texas3. *P. vitacea*.

1. *Parthenocissus heptaphylla* (Buckl.) Small. Vine, sometimes climbing to 10 m., glabrous, with long forking tendrils; leaflets mostly 7 but occasionally 5 or 6, sessile or short-petiololed, oblanceolate to oblong-oblanceolate or sometimes the lateral oblong-lanceolate, acuminate, fleshy-thickened, 3-5 cm. long, to about 2 cm. wide above the middle, coarsely few-toothed above the middle or somewhat incised, glossy on upper surface, often cuneately narrowed at base; corymbs 4-8 cm. broad, pendulous; berries subglobose, to 1 cm. in diameter, dark-blue to nearly blackish, glaucous; seeds as many as 4, to 6 mm. long. *Ampelopsis heptaphylla* Buckl., *Parthenocissus texana* Rehd., *Psedera texana* (Rehd.) Greene. Climbing over small trees and shrubs in rocky or sandy soils, endemic on the Edwards Plateau.

Besides their smallness, the leaves of this species are quite fleshy-thickened, resembling somewhat those of *Cissus* in texture.

2. *Parthenocissus quinquefolia* (L.) Planch. VIRGINIA CREEPER, HIEDRA, PARRA. High-climbing vine by means of adhesive disks of the 3 to 8 tendril branches; leaflets distinctly petiolulate, to about 15 cm. long and 5 cm. wide, oblong-obovate to elliptic, acuminate, coarsely toothed, pale-green and dull above, glaucescent beneath, glabrous or pubescent in f. *hirsuta* (Donn) Fern. [*P. hirsuta* (Donn) Small]; cymes usually approximate and with a prolonged central axis, forming a paniculate inflorescence with a solitary ascending to divergent lower branch and as many as 200 or more flowers; berries 5-7 mm. in diameter; seeds 1 to 3. In woods and on rocky banks, in open woodlands, on fences and edge of forests in the e. half of Tex., May-July; from Fla. to Tex., n. to N.E., Ind., Ill. and Minn.

3. *Parthenocissus vitacea* (Knerr) Hitchc. THICKET CREEPER. Plant loosely climbing or trailing; tendrils with 3 to 5 slender-tipped twining branches without disks; leaves lustrous above, green and glabrous to thinly pubescent beneath; leaflets mostly 5-12 cm. long; inflorescences mostly scattered in elongate panicles or solitary, without a prolonged central axis, consisting of a pair of subequal divergent few-flowered branches; berries 8-10 mm. long; seeds 3 or 4. *P. inserta* (Kern.) Fritsch. In woods, thickets and on banks in w. Tex., May-July; from Que. to Man. and Mont., s.w. to Wyo. and Tex.

3. AMPELOPSIS MICHX.

Climbing or erect shrubs with tight bark and lenticels, the pith white, with or without tendrils opposite the leaves; leaves thin, deciduous; inflorescence a dichotomous cyme; flowers small, greenish, mostly 5-merous and perfect; calyx scarious, saucer-shaped; petals free, spreading; disk cup-shaped, free from ovary except at base, the margins entire or scarcely crenate; berry dry or pulpy; seeds 1 to several, trigonous-obovoid.

About 25 species in North America and Asia.

1. Leaves simple or rarely only shallowly lobed, cordate to truncate at base 1. *A. cordata*.
 1. Leaves twice-pinnate or ternate, the leaflets small 2. *A. arborea*.

1. *Ampelopsis cordata* Michx. Plant nearly glabrous, high-climbing; leaves petiolate, broadly ovate to suborbicular-ovate, cordate to truncate at base, acuminate at apex, to about 15 cm. long and wide, typically smaller, coarsely and sharply toothed, unlobed or very rarely with some shallowly 3-lobed, dark-green above, pale-green beneath; paniculate cymes lax; style slender; berries oblate, less than 1 cm. in diameter, bluish-purple or greenish. *Cissus Ampelopsis* Pers. In rich woodlands and bottomlands along rivers and streams in the e. half and the Panhandle of Tex., Apr.-June; from Fla. to Tex. and Mex., n. to Va., O., Ind., Ill. and Neb.

2. *Ampelopsis arborea* (L.) Koehne. PEPPER-VINE. Plant nearly glabrous, bushy or high-climbing; leaves petiolate, triangular-ovate in outline, twice-pinnate or ternate, 15 cm. long or more; leaflets ovate to rhombic-ovate, acute to acuminate at apex, rounded to cuneate at base, the larger ones 3-7 cm. long, coarsely cut-toothed, dark-green above, pale-green beneath; cymes rather short, mostly less than 8 cm. long; disk very thick, adherent to the ovary; berries black, pulpy, subglobose to obovoid, 1-1.5 cm. in diameter. *Cissus arborea* (L.) Des Moul. Along streams, in and on edge of swamp forests, in fencerows and waste places, mostly in s. and e. Tex., June-Aug.; from Fla. to Tex. and n.e. Mex., n. to Md., Ill., Mo. and Okla.

The Mexican *A. mexicana* Rose has been reported as being in southwest Texas where it might occur as an escape from cultivation. No material from Texas has been seen. Its distinctive 3-foliolate leaves readily separate it from our two indigenous species.

4. CISSUS L. POSSUM-GRAPE

A mostly pantropical genus with several hundred species.

1. *Cissus incisa* (Nutt.) Des Moul. MARINE-IVY IVY TREEBINE, COW-ITCH, HERBA DEL BUEY. A stout heavy vine with warty tight-barked stems to at least 10 m. long from

tuberous roots; pith white; leaves petiolate, fleshy-thickened and succulent, to 8 cm. long and about as wide, deciduous or semievergreen, extremely variable, from simple and broadly ovate or ovate-reniform to more or less trilobed or trifoliolate, the margins coarsely and irregularly toothed; leaflets ovate to obovate, cuneate; peduncle at first usually exceeding the subtending leaf, supporting an umbelliform cyme; flowers 4-merous, perfect or unisexual; petals free, spreading; disk a deeply 4-lobed cup that is free from the ovary except at its base; berry obovoid, black, 6-8 mm. long, dry, beaked by the persistent style, on recurved pedicels, 1- to 4-seeded; seeds trigonous-obovoid. Sprawling or climbing over rocks, trees and shrubs in chaparral, salt marshes and open woodlands, throughout most of the state, rare or absent in the extreme e. part and in the Panhandle, May-Sept.; from Fla. to Tex. and adj. Mex., n. to Mo. and Kan.

Plants with simple undivided leaves are frequent in the Rio Grande Plains and Valley. There seems to be no other difference, however, that would separate these plants from the typical plants with trilobed or trifoliolate leaves.

The tropical American *C. sicyoides* L. (WATERWITHE TREEBINE or BEJUCO LOCO) has been reported as being in southwest Texas. Although the species is known from Tamaulipas State, Mexico, no material has been seen from Texas. It is easily distinguished by its entire, ovate-cordate succulent leaves whose margins are finely bristle-toothed.

FAM. 114. TILIACEAE JUSS. LINDEN FAMILY

Trees or shrubs, the pubescence mainly of stellate or branched hairs; leaves alternate or rarely opposite, simple or sometimes lobate, usually serrate, stipulate; flowers usually perfect, regular, solitary or in cymes or panicles; sepals 5 or rarely 3 or 4, free or coherent, deciduous, commonly valvate; petals as many as the sepals, mostly imbricated in the bud; stamens usually numerous and indefinite in number, distinct or mostly united into 5 or 10 bundles, some often staminodes; anthers 2-celled; fruit 2- to 10-celled or (by abortion) 1-celled, dry or drupaceous, dehiscent or indehiscent.

About 450 species in 50 or more genera, mostly tropical and subtropical.

- 1. Trees; peduncle adnate to a bract; fruit nutlike, globose, indehiscent 1. *Tilia*, p. 1023.
- 1. Shrubs or herbaceous; peduncle free, not adnate to a bract; fruit capsular, linear-oblong, dehiscent 2. *Corchorus*, p. 1024.

1. TILIA L. BASSWOOD. LINDEN

Trees with soft white wood and fibrous tough inner bark, the pubescence of simple or stellate hairs; leaves petiolate, the broad blade very oblique at base and palmately veined, serrate; stipules deciduous; flowers fragrant, white or yellowish, 5-merous, in axillary cymes; peduncle adnate about to the middle of a narrow short-petioled foliaceous membranous bract; sepals distinct; petals spatulate-oblong; stamens numerous, distinct or united into 5 bundles each of which is in front of a petal; staminodes lacking or present with one in front of each petal; fruit globose, nutlike, tomentose, dry and woody, indehiscent, 1- or 2-seeded.

A genus of about 50 polymorphic species mainly of Asia with a few in eastern North America and Mexico.

In regard to *Tilia*, the recent tendency of some workers is to consider the basswoods of southern United States as one extremely polymorphic species; namely, *T. americana* L. Other researchers tend to recognize as many as 16 species in this part of the country. Any present treatment must be tentative and, consequently, unsatisfactory. It is, of course, less frustrating to "lump" all of the basswoods into one polyglot species.

- 1. Expanding and mature leaves glabrous or sparsely pubescent with simple hairs; peduncles and pedicels glabrous 1. *T. americana*.
- 1. Expanding leaves stellate-pubescent; mature leaves stellate-tomentose or glabrescent with stellate and simple hairs (2)

- 2(1). Mature leaves somewhat rusty-brown stellate-tomentose to sparsely stellate-pubescent; peduncles and pedicels glabrous or glabrescent 2. *T. caroliniana*.
2. Mature leaves glabrous or glabrescent with stellate and simple hairs; peduncles and pedicels pubescent 3. *T. floridana*.

1. *Tilia americana* L. AMERICAN BASSWOOD. Tree to 40 m. high; branchlets green, glabrous; leaves with a glabrous petiole 3-5 cm. long, broadly ovate, obliquely cordate to truncate at base, abruptly acuminate at apex, to 2 dm. long, coarsely serrate with long-pointed teeth, glabrous from the first, light-green beneath, commonly with tufts of hairs in the axils of the lateral veins; flowers about 15 mm. across, in pendulous 6- to 15-flowered slender-branched cymes, with staminodia; pedicels glabrous; inflorescence bract usually stalked, glabrous, tapering toward the base; stamens shorter than the petals; fruit ellipsoid to subglobose, thick-shelled, without ribs. In rich moist soils of woods and bottomlands in n.e. Tex., spring-summer; from Can., s. to Va. and Ala., w. to N.D., Kan. and Tex.

2. *Tilia caroliniana* Mill. CAROLINA BASSWOOD. Large tree to about 30 m. high; leaves with stout glabrous to slightly pubescent petioles to 35 mm. long, broadly ovate, obliquely truncate to cordate at base, abruptly acuminate at apex, to 13 cm. long, with coarsely dentate margins, the upper surface dark-green, clothed with rusty-brown woolly hairs on the lower surface; cymes 8- to 15-flowered; inflorescence bracts essentially glabrous; fruit subglobose to ellipsoid, pubescent, about 6 mm. in diameter. *T. phanera* Sarg. In open woodlands, along forested streams and lowlands in e. and cen. Tex., spring-summer; from N.C., s. to cen. Fla., w. to s.w. Ark. and Tex.

3. *Tilia floridana* Small. FLORIDA BASSWOOD. Tree to 20 m. or more high, with furrowed bark; twigs yellowish to reddish-brown; leaves thin, broadly ovate to ovate-oval, obliquely truncate to subcordate at base, abruptly short-acuminate at apex, to 12 cm. long, coarsely serrate with conspicuously gland-tipped teeth, deep-green above, white-villous to white-tomentose and often glaucous beneath (especially when young), soon glabrate; inflorescence bracts relatively small, spatulate or scythe-shaped, 10-15 cm. long, mostly much less than 2 cm. wide, somewhat rounded at base and decurrent to within 5-15 mm. of the base of the peduncle, somewhat pubescent; cymes few-flowered; peduncle pubescent, the free portion 5-15 mm. long; pedicels pubescent; sepals lanceolate to linear-lanceolate, 3-3.5 mm. long; petals about 5 mm. long; staminodia nearly linear to linear-spatulate, slightly shorter than the petals; fruit globular. *T. nuda* Sarg., *T. leucocarpa* Ashe. In rich woods in e. and cen. Tex., Apr.-June; from Fla. to Tex., n. to s.e. Va., s. Ind., s. Ill. and Mo.; also n.e. Mex.

2. CORCHORUS L.

About 100 species in warm regions of the world. The fiber, jute, is obtained from two Old World species.

1. *Corchorus hirtus* L. ORINOCO JUTE, MORALIA. Plant herbaceous or subshrubby, usually much less than 1 m. high, minutely pubescent to glabrate throughout, the stems simple or sparingly branched; leaves alternate, with short pilosulous petioles, ovate to oblong-elliptic or narrowly lanceolate, subobtuse to acuminate, serrate, to 6 cm. long; flowers solitary or in clusters of 2 or 3 opposite the leaves; pedicels to 5 mm. long; sepals and petals 5 or rarely 4; sepals linear-lanceolate, acuminate, to 8 mm. long; petals obovate to linear-spatulate, a little shorter than the sepals; stamens 10 (in ours); filaments filiform, simple; anthers introrse; capsule slender, siliquelike, to 6 cm. long, 4-celled, ascending or spreading, flattened contrary to the septum, appressed-puberulent, short-beaked, longitudinally dehiscent. Incl. var. *orinocensis* (H.B.K.) K. Schum. *C. orinocensis* H.B.K. In waste places and along roadsides in s. Tex., throughout year; from Fla. to Tex. and Ariz., s. through Latin Am.

FAM. 115. MALVACEAE JUSS.¹²⁵

MALLOW FAMILY

Plants herbaceous or shrubby, rarely arborescent, with more or less mucilaginous sap, usually pubescent with simple, stellate or forked hairs; leaves simple, alternate, petioled, stipulate; flowers regular, perfect; calyx often subtended by a calyxlike involucre; petals 5, hypogynous, convolute in the bud, asymmetric, more or less united at base to the stamen column; stamens numerous, monadelphous; anthers 1-celled, reniform; pollen grains large, spiny; carpels 3 or more, 1-celled; style usually several-branched; fruit a loculicidal capsule or (in most of the genera) the mature carpels separating from one another and from the receptacle; seeds often pubescent.

About 1,000 species in about 75 genera in tropical and temperate regions throughout the world. A family of highly ornamental plants, with numerous species of *Hibiscus*, *Malva*, *Abutilon* and *Althaea* under cultivation. It includes the cotton plants (*Gossypium* spp.), the vegetable okra (*Hibiscus esculentus* L.) and the marsh-mallow (*Althaea officinalis* L.), of Europe, whose mucilaginous root is used in making the popular confection.

1. Style branches and stigmas twice the number of the carpels; stamen tube not filamentiferous at the apex, this usually dentate; stigmas capitate or discoid; fruit a schizocarp; carpels normally 5, often indehiscent or tardily dehiscent; ovule solitary, ascending (2)
1. Style branches and stigmas of the same number as the carpels or the style unbranched and the stigmas entire or nearly so (4)
- 2(1). Petals auriculate on one side of the claw; fruit berrylike until fully mature, with a fleshy outer envelope; plants shrubby or arborescent; flowers solitary in the axils or in terminal or subterminal clusters; involucre of 5 to 16 narrow bractlets; corolla funnelform, the petals connivent or spreading only at apex; column usually long-exserted; carpels indehiscent, unappendaged, becoming dry and stony, usually finally separating1. *Malvaviscus*, p. 1028.
2. Petals not auriculate; fruit not berrylike or fleshy (3)
- 3(2). Inflorescence subtended by an involucre of conspicuously veined foliaceous bracts, these often whitish and scarious toward base; flowers often attached to the bracts; involucre none and the inner flowers subtended only by narrow stipules; plants herbaceous2. *Malachra*, p. 1029.
3. Inflorescence not foliaceous-involucrate or the bracts wholly foliaceous; flowers free from the subtending bracts; involucels always present, the bractlets various; plants shrubby or suffrutescent3. *Pavonia*, p. 1029.
- 4(1). Fruit capsular or baccate, the carpels remaining attached to one another and to the axis; stamen tube usually not filamentiferous at the apex, usually dentate or lobed; involucre usually present but sometimes much-reduced; fruit loculicidally dehiscent or indehiscent, the cells 5 or fewer (5)
4. Fruit usually a schizocarp, the carpels separating finally from one another and from the axis; stamen tube filamentiferous at and often also below the apex (8)
- 5(4). Style branches becoming more or less divergent, the stigmas more or less capitate or discoid; seeds usually reniform (6)
5. Style branches short and erect or the style unbranched and clavate; seeds usually angulate or obovoid (7)
- 6(5). Ovules solitary, ascending; capsule depressed, saliently 5-angled; involucre of 5 to 10 narrow bractlets, rarely obsolete; plants herbaceous or somewhat shrubby4. *Kosteletzkya*, p. 1029.
6. Ovules 2 or more in each cell; capsule not depressed or (if lightly so) not saliently angled5. *Hibiscus*, p. 1029.

¹²⁵ Parts of this treatment adapted from various publications of T. H. Kearney; generic key adapted from Am. Midl. Nat. 46:93-131. 1951.

- 7(5). Plants herbaceous or suffrutescent; bractlets of the involucl more than 3, small and narrow, or the involucl wanting; calyx deeply 5-cleft, the oil glands (when present) in definite longitudinal rows; cotyledons not black-dotted 6. *Cienfuegosia*, p. 1033.
7. Plants with a somewhat ligneous stem; bractlets 3, persistent and foliaceous to small, subulate and caducous; calyx dentate to nearly entire, with oil glands usually scattered but sometimes in rather definite longitudinal rows; cotyledons black-dotted 7. *Gossypium*, p. 1033.
- 8(4). Stigmas decurrent on the style branches, the latter filiform to clavate but usually not noticeably expanded at the very apex (9)
8. Stigmas apical or very nearly so, capitate to discoid or obliquely truncate, usually distinctly larger than the apices of the style branches (12)
- 9(8). Bractlets of the involucl distinct, 1 to 3 or sometimes wanting; herbs with lobed or parted leaves (10)
9. Bractlets more or less united; herbs or shrubs (11)
- 10(9). Carpels usually with an inflexed or incurved beak, this often with its cavity partly separated from the larger seed-containing cavity by an endoglossum (transverse projection from the dorsal wall); petals broadly truncate, usually erose or fimbriate at apex; taproot often much-thickened 8. *Callirhoe*, p. 1033.
10. Carpels beakless, the cavity not divided; petals often deeply notched; taproot not thickened 9. *Malva*, p. 1035.
- 11(9). Involucl with 6 or more (rarely only 5) lobes; receptacle (columella) not enlarged at apex or projecting above the carpels; plants herbaceous 10. *Althaea*, p. 1036.
11. Involucl with 3 to 6 lobes; receptacle enlarged (conical or discoid) at apex, often projecting above the tip of the carpels; plants herbaceous to shrubby or arborescent 11. *Lavatera*, p. 1037.
- 12(8). Ovules normally 2 or more in each carpel (13)
12. Ovules normally solitary in each carpel (18)
- 13(12). Involucl none (14)
13. Involucl present (17)
- 14(13). Carpels more or less completely divided into 2 superposed cavities; herbs or shrubs (15)
14. Carpels 1-celled, the cavity undivided (16)
- 15(14). Carpels 5 (rarely 3, 4 or 6), 2-celled by horizontal or oblique constriction of the lateral walls, with no internal projection from the dorsal wall 12. *Wissadula*, p. 1037.
15. Carpels 5 to 11, 2-celled by a horizontal projection (endoglossum) from the dorsal wall 13. *Pseudabutilon*, p. 1038.
- 16(14). Carpels greatly inflated, rounded and mucicous at apex, the walls thin and papery; plant herbaceous or merely suffrutescent, the stems often weak and vine-like; flowers relatively small, on slender axillary peduncles; carpels promptly loculicidal and tardily septicidal, normally hirsute with long hairs 14. *Herissantia*, p. 1038.
16. Carpels not or only moderately inflated, commonly more or less pointed at apex and mucronate to rostrate or aristate, the walls firm-membranous to coriaceous; plants herbaceous to shrubby or arborescent; flowers often large and showy 15. *Abutilon*, p. 1038.

- 17(13). Carpels almost completely septate by a transverse projection (endoglossum) from the dorsal wall, with 1 ovule in each compartment; stamen tube filamentiferous at apex; plants herbaceous; bractlets 3, more or less persistent, often foliaceous; carpels deeply incised, often bicuspidate or biaristate on the dorsal angle, rugose below, hirsute, septicidal and partly loculicidal . . . 16. *Modiola*, p. 1042.
17. Carpels not septate but the dorsal wall sometimes bearing a palatolike internal fold (endoglossum) at base of the dehiscent section of the carpel, this projecting a short way into the cavity; stamen tube usually filamentiferous below as well as at the apex; nectary of 5 segments; carpels often remaining attached to the axis long after maturity by a threadlike branch of the midrib . . 17. *Sphaeralcea*, p. 1042.
- 18(12). Involucel present; ovule (except in *Sida*) erect or ascending (19)
18. Involucel absent or (rarely in *Sida*) a false involucel of several narrow bracts borne on the peduncle shortly below the calyx (22)
- 19(18). Cavity of the carpel more or less completely divided into 2 compartments by a transverse septum (endoglossum), the lower compartment holding the seed; annual or perennial herbs; bractlets 3, adnate to or borne below the calyx; carpels dehiscent to about the middle . . . 16. *Modiola*, p. 1042.
19. Cavity of the carpel not divided but sometimes (in *Sphaeralcea*) with a palatolike fold (endoglossum) of the dorsal wall at base of the dehiscent section, this projecting a short way into the cavity (20)
- 20(19). Carpels sharply differentiated into a smooth dehiscent empty apical section and a reticulate indehiscent basal section, the latter containing the seed; annual or perennial herbs; bractlets small and narrow, usually caducous . . . 17. *Sphaeralcea*, p. 1042.
20. Carpels not sharply differentiated apically and basally, usually without reticulation (21)
- 21(20). Ovules erect or ascending; plants annual or perennial, herbaceous to shrubby; carpels incurved-rostrate to muticous, usually more or less rugose, sometimes appendaged externally on the back, the lateral walls firm and persistent to thin and soon disintegrating . . . 18. *Malvastrum*, p. 1047.
21. Ovules pendulous; plants perennial, herbaceous; stems decumbent or prostrate; herbage closely stellate-canescens or lepidote; flowers axillary; mostly solitary; involucel present or absent; fruit discoid to hemispheric; carpels muticous or short-beaked, the lateral walls disintegrating and releasing the seed . . . 21. *Sida*, p. 1049.
- 22(18). Fruit technically a capsule, the 5 carpels loculicidal to the base but not or incompletely septicidal and not (or very tardily) separating from the axis at maturity; leaves entire or dentate, cordate; ovule pendulous . . 19. *Bastardia*, p. 1048.
22. Fruit a schizocarp, septicidally dehiscent, the carpels separating from the axis and usually from one another at maturity (23)
- 23(22). Carpels greatly inflated, much larger than the seed, muticous, the walls thin, papery or membranous (24)
23. Carpels not greatly inflated (25)
- 24(23). Carpel cavity not divided and without an internal appendage; ligaments (attaching threads) usually wanting or poorly developed . . 14. *Herissantia*, p. 1038.
24. Cavity usually partly divided longitudinally by an outgrowth (endoglossum) originating near the base of the dorsal wall but becoming detached and often finally appearing as if attached to the ventral wall, the endoglossum often pectinate and more or less embracing the seed; ligaments present, 2 or 3 per carpel, holding the carpel attached to the columella until maturity . . . 20. *Gaya*, p. 1049.

- 25(23). Carpel cavity partially divided into 2 superposed compartments by a transverse fold or ring at base of the dehiscent portion; plants shrubby or suffrutescent; leaves entire or nearly so; carpels 4 or 5, not reticulate basally 12. *Wissadula*, p. 1037.
25. Carpel cavity not divided as above but an endoglossum (palatelike internal projection from the dorsal wall) sometimes present in *Sphaeralcea* (26)
- 26(25). Carpels differentiated into a smooth ventrally dehiscent apical section and a usually larger rugose-reticulate indehiscent basal section; plants herbaceous 17. *Sphaeralcea*, p. 1042.
26. Carpels not differentiated apically and basally (27)
- 27(26). Ovules erect or ascending 18. *Malvastrum*, p. 1047.
27. Ovules pendulous or resupinate-horizontal (28)
- 28(27). Lateral walls of the carpels firm, persistent; seeds without an aril-like envelope; flowers axillary and solitary or more or less aggregated in racemes, spikes or heads; calyx usually angulate, sometimes much-acrescent, the lobes commonly erect or connivent over the fruit; carpels mucous to birostrate or biaristate, often rugose or muricate, indehiscent or slightly dehiscent at apex 21. *Sida*, p. 1049.
28. Lateral walls of the carpels fragile, soon disappearing or becoming lacerate; seeds usually more or less enveloped by an arilliform often reticulate endocarp, this sometimes closely adherent to the seed coat; fruit discoid to nearly hemispheric, depressed, the carpels incurved and with a dorsal angle, umbo or spur 22. *Anoda*, p. 1054.

1. MALVAVISCUS FABR.

Shrubs with many-branched stems; leaves alternate, petiolate, with caducous stipules, toothed, often lobed or angled; flowers usually red, pedunculate, axillary or racemose; involucre bractlets several to numerous; calyx campanulate, 5-lobed; corolla contorted, tubelike; petals 5, erect-connivent or spreading only above, obovate-cuneate, emarginate, auriculate at base; staminal column exerted, 5-parted at apex, bearing numerous stamens toward the apex; fruit 5-celled; carpels baccate, indehiscent, 1-seeded.

A small American genus of about 20 complex species.

1. Leaves suborbicular-ovate, about as broad as long, deeply cordate at base 1. *M. arboreus* var. *Drummondii*.
1. Leaves ovate-lanceolate, much longer than broad, rounded to broadly cuneate at base (2)
- 2(1). Flowers 23-42 mm. long 1. *M. arboreus* var. *mexicanus*.
2. Flowers more than 42 mm. long 1. *M. arboreus* var. *penduliflorus*.

1. *Malvaviscus arboreus* Cav. var. *Drummondii* (T.&G.) Schery. DRUMMOND WAX-MALLOW, TEXAS MALLOW. Shrub to 3 m. high, tomentulose; leaves rounded-cordate, 4-9 cm. long, fully as broad as long, obtuse to acute at apex, usually 3-angulate or shallow 3-lobate, the margins crenate-dentate; bractlets of involucre linear-spatulate; corolla vermilion-red, 2-3.5 cm. long; fruit red, said to be edible either raw or cooked. *M. Drummondii* T. & G. Limestone slopes and ledges, in wooded arroyos, along streams and in palm groves from s. Edwards Plateau southw. and eastw., flowering throughout the year; from Fla. to Tex.; also adj. Mex. and Cuba.

The var. *mexicanus* Schlecht. is rare in the Rio Grande Valley, thence southw. to Col. and the W.I. The var. *penduliflorus* (DC.) Schery (*M. penduliflorus* DC.) is frequently cult. in the Rio Grande Plains and Valley where it occurs as an escape. It occurs naturally from Mex. to n. S.A.

2. MALACHRA L.

About 6 species mostly in the American tropics.

1. *Malachra capitata* L. MALVA DE CABALLO. Erect perennial herb, usually branched, velvety stellate-pubescent and often with some long whitish hairs, to 15 dm. high; leaves long-petioled, broadly ovate to suborbicular, dentate or obtusely 3- or 5-lobed, the lower leaves to 12 cm. long, the upper leaves smaller; stipules subulate, to 15 mm. long; heads several-flowered, mostly on axillary peduncles; outer bracts broadly ovate, concuplicate, cordate at base, acute at apex, strongly nerved against a whitish background, velvety, 2-2.5 cm. long, the smaller inner bracts ovate; flowers perfect; calyx 6-8 mm. long, its 5 lobes ovate-lanceolate and obtuse; petals 5, inequilateral, yellow or orange-color, about 1 cm. long; stamen tube shorter than the petals, 5-toothed, bearing 15 to 30 filaments at about the middle; carpels 5, obtuse, convex, reticulated, nearly glabrous, 2.5-3 mm. long. Fields, thickets, palm groves, roadsides, waste places and cult. grounds in s. Tex., flowering throughout the year; from Tex. to C.A. and the W.I.

3. PAVONIA Cav.

About 200 species, mostly tropical and subtropical.

1. *Pavonia lasiopetala* Scheele. Plant shrubby, to about 15 dm. high, tomentulose and cinereous; leaves alternate, petioled, stipulate, ovate-cordate or subcordate, obtuse to acutish at apex, the margins coarsely serrate or repand, sometimes slightly angulate-lobed, 25-75 mm. long; flowers perfect, solitary on slender peduncles in the axils; bractlets of involucl 5 to 8, linear, rather longer than the 5 ovate acuminate 3- to 5-nerved calyx lobes; petals 5, rose-color, ciliate on the claw, 12-20 mm. long; stamen column not appendaged; styles 10, the stigmas capitate; carpels 5, 1-celled, smooth or obscurely reticulated, when mature separating from axis. *P. Wrightii* Gray. In rocky woods on the Edwards Plateau and Rio Grande Plains, flowering the year around; also adj. Mex.

4. KOSTELETZKYA PRESL SALT MARSH-MALLOW

About 30 species, mostly in tropical America and Africa.

1. *Kosteletzkya virginica* (L.) Gray. Branched perennial herb closely resembling *Hibiscus*, to about 15 dm. high, rather roughly stellate-hirsute or -tomentose throughout, greenish or somewhat cinereous; leaves gray-green, densely pubescent, the lower ones cordate-suborbicular to -ovate and angulate or coarsely toothed, the upper and bracteal leaves mostly lanceolate and without or with hastately divergent basal lobes; pedicels capillary to coarse and short, frequently equaling or exceeding the bracteal leaves; flowering calyx minutely puberulent to densely pubescent, 5-lobed, 8-13 mm. long, its linear-subulate bracteoles 6-10 mm. long; petals 5, roseate, 3-4.5 cm. long, 2-3 cm. wide; column (including styles) 15-25 mm. long; fruit prominently 5-angled, depressed; carpels copiously villous-hirsute with hairs 1.5-2 mm. long; seeds smooth, one in each carpel. In brackish or nearly fresh marshes and along shores and in swamps, along coastal Tex., June-Oct.; from Fla. to Tex., n. to Va. and Del.; also Cuba.

Our plant is usually referred to var. *althaefolia* Chapm. [*K. althaefolia* (Chapm.) Gray], characterized by having its stems and calyces densely pubescent.

5. HIBISCUS L. ROSE-MALLOW

Plants perennial or rarely annual, often shrubby; leaves merely crenate or dentate, or pedately cleft; flowers axillary, solitary, the petals 2 cm. long or more; involucl usually present; fruit a loculicidal capsule, the carpels 5; seeds several in each cell, essentially glabrous to long-hairy.

About 300 species mainly in tropical and subtropical regions.

1. Leaves and stems glabrous (2)

1. Leaves and stems more or less variously pubescent (4)

- 2(1). Deciduous shrub; leaves typically triangular-ovate to rhombic, the lobes (when present) broad; cultivated species 1. *H. syriacus*.
- 2. Herbaceous perennial; leaves typically lanceolate, the lobes (when present) narrow; indigenous species (3)
- 3(2). Bracteoles and calyx densely hirsute 2. *H. dasycalyx*.
- 3. Bracteoles and calyx glabrous or very sparsely hirsute 3. *H. militaris*.
- 4(1). All leaves 3- or 5-parted, the primary segments oblong-cuneate to linear-elliptic (5)
- 4. Leaves entire or lobate, the lobes triangular-ovate to -lanceolate (6)
- 5(4). Plant a low diffuse annual; calyx strongly veined, papery, with short triangular-ovate lobes above the middle; cultivated species ... 4. *H. trionum*.
- 5. Plant a rigidly erect shrubby perennial; calyx not veiny, herbaceous, with narrow lanceolate lobes extending to near base; indigenous in Trans-Pecos Texas 5. *H. Coulteri*.
- 6(4). Small shrubs of dry soils, rarely to 6 dm. high, mostly in central and west Texas; petals to about 3 cm. long (7)
- 6. Large herbaceous perennials of moist or wet places, more than 10 dm. high, mostly in east and north Texas; petals usually much more than 3 cm. long (8)
- 7(6). Bractlets of involucl lanceolate-spatulate, only slightly shorter than the calyx lobes; leaves conspicuously cordate at base; corolla bright-red; seeds sparsely short-hirsute 6. *H. cardiophyllus*.
- 7. Bractlets of involucl short-setaceous to obsolete, mostly less than half as long as the calyx lobes; leaves broadly cuneate to truncate at base; corolla pinkish or lavender; seeds covered by long silky hairs 7. *H. denudatus*.
- 8(6). Stems usually with prickles; calyx lobes long-attenuate at apex; capsules densely covered with long spreading simple tawny hairs ... 8. *H. cubensis*.
- 8. Stems not prickly; calyx lobes mostly acute-apiculate at apex; capsules short stellate-pubescent to glabrous (9)
- 9(8). Leaves commonly elliptic-lanceolate and broadly cuneate to rounded at base, with age usually becoming glabrous above, gray-pannose beneath; capsules glabrous 9. *H. Moscheutos*.
- 9. Leaves ovate to ovate-lanceolate, rounded to cordate at base, permanently pubescent on both surfaces; capsules more or less pubescent (10)
- 10(9). Upper surface of leaves bearing many simple or subsimple hairs; bractlets of involucl ciliate with long simple hairs in addition to being shortly stellate-tomentose; capsules usually densely villous-hirsute ..10. *H. lasiocarpus*.
- 10. Both surfaces of leaves with a very fine and dense stellate pubescence; bractlets without long simple hairs; capsules eventually glabrescent 11. *H. leucophyllus*.

1. *Hibiscus syriacus* L. **ALTHEA, ROSE-OF-SHARON**. Rather large erect branched essentially glabrous shrub, 3-6 m. high; leaves rather small, triangular-ovate to rhombic, 5-7.5 cm. long, strongly 3-ribbed, most of the lower ones 3-lobed, the margins variously toothed or notched; flowers axillary on short peduncles, 5-7.5 cm. across; bracts linear, about the length of the triangular calyx lobes; corolla variously colored from cream-color to white or bluish, often double; fruit oblong-ovoid, about 25 mm. long. A nat. of e. Asia that is commonly cult., but frequently persists about abandoned homesteads and in waste places.

2. *Hibiscus dasycalyx* Blake & Schiller. Herbaceous perennial to 15 dm. high; stem greenish, terete, glabrous, about 3 mm. thick above; upper nodes mostly 3-5 cm. long; leaves with slender petioles 3-5 cm. long, 3-lobed and hastate at base, 5-9 cm. long, 3-10 cm. wide at base across the lobes, glabrous, the lobes linear-attenuate (3-6 mm. wide) and usually irregularly incised or serrate; flowers 6 or 7, solitary in uppermost axils; peduncles about 15 mm. long, articulate near middle, with spreading hairs above; bracteoles about 12, narrowly linear-attenuate, the inner surface and margins densely

hirsute, hirsute to subglabrous on outside, about 15 mm. long, 1-1.5 mm. wide; calyx about 25 mm. long, campanulate, densely spreading-white-hirsute on outside, densely yellowish-pilose with subappressed hairs on inner surface, the lobes deltoid-apiculate and about 7 mm. long; corolla white with a purple spot, when dry about 6 cm. long, the apex spreading; ovary densely and subappressed yellowish-pilose; styles free above and there pilose; fruit unknown. Rare in Trinity Co. in e. Tex., May-July; endemic.

3. *Hibiscus militaris* Cav. SCARLET ROSE-MALLOW, HALBERD-LEAVED ROSE-MALLOW. Herbaceous perennial, often tinged with red; stems to 25 dm. high, essentially glabrous; leaves with slender petioles to 1 dm. long or more, triangular-hastate in general outline, glabrous, the basal lobes (if developed) widely divergent, the middle lobe long-acuminate and 2 to 6 times as long as the body of the leaf; bractlets linear-setaceous, tapering to a filiform point, to 3 cm. long; calyx glabrous or very nearly so; petals obovate, pink or whitish with a purplish base, 6-8 cm. long; capsule glabrous or nearly so; seeds pubescent with short reddish-brown hairs. In marshes and shallow water in e. and n.-cen. Tex., reported from the Panhandle, May-Nov.; from Fla. to Tex., n. in the interior to O. and Minn.

4. *Hibiscus trionum* L. FLOWER-OF-AN-HOUR. Depressed branching hispid to glabrate annual, to 6 dm. high, with some of the branches becoming prostrate; leaves 3-lobed or most of them 3- to 5-parted, the segments mostly cuneate-oblong to spatulate, with the middle segment much the largest, all coarsely toothed or incised; bracts linear; flowers solitary; pedicel elongating in fruit; calyx setose, papery, dark-striped, becoming inflated; corolla sulphur-yellow or whitish, with a brown-purple center, 5-7.5 cm. across, closing in the shadows; seeds muricate-papillose. A nat. of Cen. Afr., now a weed in N.A.; spontaneous in cen. and n. Tex., summer-fall.

5. *Hibiscus Coulteri* Harv. DESERT ROSE-MALLOW. Suffruticose or even shrubby, to 1 m. high, strigosely hirsute with few-rayed stellular hairs; leaves dimorphous, the lower ones broadly ovate to ovate-oval and dentate, the upper ones mostly divided into 3 narrow coarsely dentate lobes, about 25 mm. in diameter, of rounded or ovate outline; lowest leaves commonly undivided, cordate or ovate, incisely serrate and slightly lobed; upper leaves 3-cleft and the lobes ovate or some 3- to 5-parted into narrower serrate lobes, sometimes all 3- to 5-parted; flowers few, long-peduncled; pedicels usually disarticulating at maturity of the fruit; bractlets of the involucl 10 to 14, linear-setaceous, rigid, 2 cm. or less long, about the length of the attenuate-lanceolate 3-nerved lobes of the 5-parted calyx, both sparsely hispid with simple rigid hairs; petals broadly obovate, 2-4 cm. long, whitish to lemon- or sulphur-yellow and commonly reddish- or purple-tinged; capsule glabrous, shorter than the calyx; seeds covered with long hairs. In desert areas, hills and slopes in the Trans-Pecos, Apr.-Aug.; from Tex. to Ariz. and adj. Mex.

Apparent hybrids between this species and *H. denudatus* have been seen in the Eagle Mts., Hudspeth Co.

6. *Hibiscus cardiophyllus* Gray. TULIPÁN DEL MONTE. Herbaceous from a lignescent perennial base, stellately canescent-tomentose throughout; stems 3-6 dm. high, equally leafy to top; leaves with petioles to 7 cm. long, broadly ovate, cordate at base, obtuse at apex, more or less sinuate-dentate to crenate or sometimes angulate, 3-7 cm. long, slightly less wide, pale beneath and densely stellate-tomentose; peduncles surpassing the leaves; involucl of about 10 spatulate-lanceolate 3-nerved tomentose bractlets, rather shorter than the elliptic-lanceolate calyx lobes; petals crimson to deep rose-red, 2.5-3 cm. long; capsule glabrous, about 15 mm. long; seeds rather few, puberulent. In canyons, on talus slopes, gravelly hills, about boulders and breaks, in chaparral in the Rio Grande Plains, on limestone hills n.w. to Val Verde Co., throughout the year; also adj. Mex.

7. *Hibiscus denudatus* Benth. Suffruticose, 3-6 dm. high, stellately canescent-tomentose, with several to numerous rigidly erect or ascending stems; leaves sessile or with petioles to 1 cm. long, ovate to suborbicular or ovate-oblong, rounded to obtuse at apex, broadly cuneate to truncate or slightly cordate at base, to 35 mm. long, coarsely crenate-serrate, finely stellate-pubescent; flowers short-peduncled in the axils and commonly along the somewhat naked flexuous summit of the branches; involucl of 4 to 7 short setaceous bractlets, sometimes obsolete or as much as half the length of the 5 lanceolate acuminate canescent-tomentose calyx lobes; petals lavender-purple, 2-3 cm. long; capsule glabrous or pubescent at apex; seeds few, densely long silky-pubescent. Incl. var. *involucellatus*

Gray. In canyons, crevices, on rocky slopes and clayey hillsides in the Trans-Pecos, Mar.-Oct.; from Tex. to Calif. and adj. Mex.

8. *Hibiscus cubensis* A. Rich. Herbaceous perennial, to 3 m. high, densely gray-velutinous throughout (except on corolla) with short stellate hairs; stem (sometimes also the petioles and peduncles) remotely or rather densely aculeate with straight spreading (at length) corky-based prickles 3 mm. long or less, the prickles apparently sometimes lacking; leaves with petiole 2-6 cm. long, triangular-lanceolate to oblong-lanceolate or ovate-oblong, 8-11 cm. long, 3.5-5 cm. wide, acute to acuminate, subtruncate to shallowly cordate at base, the margin crenate-serrate throughout, not at all or only obscurely greener above than below; peduncles solitary in the upper axils, to 35 mm. long, jointed almost to the base; bractlets about 12, narrowly linear or (in age) somewhat involucremargined and linear-filiform, 12-15 mm. long, to 1.5 mm. wide, sometimes sparsely hispid as well as densely velutinous, in age reflexed; calyx (in flower) about 28 mm. and at maturity about 32 mm. high, sometimes more or less hispid outside (especially on the nerves), the broadly triangular acuminate teeth about equaling the tube; corolla 8-9 cm. long, purplish-pink with dark-reddish basal blotch, the petals with spreading tips; capsule subglobose, abruptly apiculate, densely spreading-hispid outside with ochroleucous hairs and between them minutely hispidulous, glabrous inside; seeds densely and shortly rufescent-velvety 2.5 mm. long; styles united to apex; stigmas oblong. In marshes and along canals in s.e. Tex., May-Oct.; in temp. and trop. Am.

9. *Hibiscus Moscheutos* L. SWAMP ROSE-MALLOW, MALLOW-ROSE. Plants erect, to about 25 dm. high, the stems minutely stellate-pubescent to glabrescent; leaves with slender petioles to about 5 cm. long, ovate to elliptic-lanceolate or lanceolate, canescent-pannose beneath with minute and close down, less so to glabrate and green above, broadly cuneate to rounded or subcordate at base, acuminate at apex, to about 22 cm. long and 9 cm. wide, the margins coarsely incised-dentate, unlobed or with the middle and lower leaves tricuspidate; with one to several peduncles usually fused for as much as three fourths their length to the subtending petiole; bractlets and calyx canescent but not hairy; petals 5-10 cm. long, light creamy-yellow or white with a crimson-purple base; style branches glabrous or remotely hispid; capsule conic-ovoid, tapering to an erect beak, glabrous, 2.5-3 cm. long. *H. incanus* Wendl. In low wet areas on edge of woods, swamps and wet meadows in e. Tex., June-Oct.; from Fla. to Tex., n. to Md., Va., W.Va., O. and Ind.

10. *Hibiscus lasiocarpus* Cav. WOOLLY ROSE-MALLOW. Plants erect, to about 2 m. high, the stems pubescent; leaves with petioles to 1 dm. long, broadly to narrowly ovate, cordate to subcordate at base, acute to acuminate at apex, the margins crenately dentate, occasionally some leaves angulate or somewhat 3-lobed, 1-2 dm. long, more or less velvety-tomentose on both sides with the upper surface bearing many simple or subsimple hairs, the uppermost leaves often ovate-lanceolate; bractlets more or less ciliate with villous or hirsute cover; calyx lobes at maturity prominently 5- or 7-nerved; corolla white or pale rose-color with a crimson or deep-purplish-red blotch at base, the petals 7.5-10 cm. long; capsule short-cylindric, subtruncate, usually densely villous-hirsute. In marshes, floodplains, ditches and along streams and rivers from e. to n.w. Tex., June-Sept.; from Ga. to Tex., n. in the Miss. basin to Ky., Ind., Ill. and Mo.

11. *Hibiscus leucophyllus* Shiller. Roots perennial, succulent; stems to 8 dm. high, somewhat branched upwardly, densely puberulous with minute many-branched sessile stellate hairs; leaves numerous, with petioles to 4 cm. long, densely puberulous like the stems, narrowly ovate, to 14 cm. long and 6 cm. wide, rounded or the larger leaves subcordate at base, sharply long-acuminate at apex, coarsely and bluntly serrate except at very base and at apex, 7-nerved at base, the nerves raised beneath and impressed above, light olive-green above, paler and ashy beneath, densely stellate-pubescent on both sides, the hairs beneath conspicuously whitish; peduncles axillary, one-flowered, shorter than the pedicels; involucre of numerous linear free bractlets that are much shorter than the calyces, densely tomentulose, lacking long simple bristly hairs on the margins; calyx 2-2.5 cm. long, the ovate lobes longer than the tube, densely stellate-tomentulose externally; petals 7-8 cm. long, white with a purple blotch at the base; capsule short-beaked, 2-2.3 cm. long, densely and minutely stellate-tomentose when young, finally glabrescent although with some persistent hairs along the margins of the valves; seeds glabrous. In sandy moist soils in s.e. Tex., May-July; also La. and Miss.

6. CIENFUEGOSIA CAY.

About 20 species of tropical and subtropical regions.

1. *Cienfuegosia Drummondii* (Gray) Lewton. YELLOW FUGOSIA. Perennial somewhat woody herb, essentially glabrous throughout, with dark dots; stems rather stout, rigidly ascending, to about 5 dm. high; leaves with petioles to 3 cm. long, oval, to 6 cm. long, the margins coarsely repand-dentate; stipules caducous; peduncles stout, dilated upward, equaling or exceeding the subtending leaves; flowers perfect, solitary on long peduncles in axils; involucl of 7 to 9 linear or spatulate-oblong bractlets that are little shorter than the deeply 5-cleft calyx; petals 5, convolute, short-clawed, rounded or obcordate, greenish-yellow or sulphur-yellow, about 25 mm. long; stamen tube shorter than the petals; stigmas 4 or 5; capsule globular, glabrous, loculicidally 3- or 4-valved; seed 2 in each cell, tomentulose. *C. sulphurea* (H.B.K.) Hassl. var. *glabra* Gke. In clayey soils in fields and open thickets along the coast and in s. Tex., Feb.-June; also S.A.

7. GOSSYPIUM L. COTTON

Herbs, shrubs or trees in tropical regions, cultivated as an annual in warm-temperate regions, the herbage commonly glandular-dotted and punctate; leaves palmately-ribbed or -lobed; flowers axillary, large; involucre or "square" of 3 to 7 united or separated entire to more or less lacerated bracts; calyx entire or somewhat 5-lobed; petals large, convolute, white, yellow or purple, often changing color after opening; fruit a dehiscing 3- to 5-celled capsule or "boll," each cell containing several fuzzy or smooth seeds whose epidermis produces the lint or "cotton" of commerce.

About 20 species in both hemispheres, several of which are of great economic importance.

1. *Gossypium hirsutum* L. UPLAND COTTON, ALGODÓN. This, our commonly cultivated cotton, is occasionally found as a waif. It is distinguished by its coarsely toothed or serrated involucl bracts and short staminal column with anthers loosely arranged on filaments of varying length.

8. CALLIRHOË NUTT.¹²⁶ POPPY-MALLOW

Plants hirsute or hispid with both simple and branched hairs; leaves palmately parted, the lobes toothed or pinnatifid; flowers large and showy, solitary on long axillary peduncles; without or with an involucl of 3 bractlets; petals cuneate, erose-denticulate at the truncate apex; carpels numerous, deeply reticulate, with a short inflexed beak.

About 7 species in the United States and northern Mexico.

1. Calyx subtended by an involucl of 3 bracts (2)

1. Calyx not subtended by an involucl (6)

2(1). Involucl bracts separated from the calyx, at least one of them usually 1-3 mm. removed; upper leaves with lobes mostly entire (3)

2. Involucl bracts not noticeably separated from the calyx; upper leaves with segments having teeth on secondary lobes (4)

3(2). Backs of carpels yellowish sericeous-pubescent; stem densely rough-pubescent with ascending mostly 8-rayed hairs; fruiting peduncles 4-7 cm. long, about 2 mm. thick; central Texas 1. *C. scabriuscula*.

3. Backs of carpels glabrous; stems slightly pubescent with appressed mostly 4-rayed hairs; peduncles 10-19 cm. long, about 1 mm. thick; east Texas 2. *C. Papaver*.

¹²⁶ Treatment based on U. T. Waterfall in Field & Lab. 19:107-119. 1951.

- 4(2). Sinuses between leaf lobes extending to within 2-4 mm. of the petiole; stipules 20-70 or rarely to 100 mm. long and 1.5-4 or rarely to 5 mm. wide; carpels glabrous or with varying amounts of strigose pubescence 3. *C. involucrata* var. *lineariloba*.
4. Sinuses between leaf lobes extending to within 5-15 mm. of the petiole; stipules 7-15 mm. long and 6-14 mm. wide; carpels strigose (5)
- 5(4). Sinuses extending to within 5-10 mm. of the petiole 3. *C. involucrata* var. *involucrata*.
5. Sinuses extending to within 10-15 mm. of the petiole, the lobes few-toothed 3. *C. involucrata* f. *novomexicana*.
- 6(1). Carpels strigose-pubescent, at least on the beaks; carpel beaks protruding above the body, forming the upper one-third to one-fourth of the compound fruit (as seen from the side) 4. *C. alcaeoides*.
6. Carpels glabrous (7)
- 7(6). Carpel beaks not or only slightly elevated above the body of the mature carpel, scarcely visible above the body of the compound fruit when viewed from the side; back of the mature carpel body not or only slightly prolonged over the base of the beak; plant perennial 5. *C. digitata*.
7. Carpel beaks usually protruding above the body of the mature carpel to form about one-third of the upper part of the fruit; back of the carpel body prolonged about 1 mm. into a conspicuous whitish chartaceous "collar" covering the base of the beak; plant annual 6. *C. leiocarpa*.

1. *Callirhoë scabriuscula* Robins. TEXAS POPPY-MALLOW. Plant annual, erect, to about 45 cm. high, covered throughout with a fine close slightly rough mostly 8-rayed stellate tomentum; leaves suborbicular in outline, to 4 cm. long and 55 mm. wide, deeply and palmately 3- or 5-cleft; leaf lobes oblong to oblanceolate or linear-oblanceolate, entire to few-toothed, obtuse; petioles of the lower leaves 7.5-10 cm. long and channeled above, the upper leaves shortly petioled to subsessile; stipules lance-linear, about 1 cm. long; peduncles rather rigid, much-exceeding the subtending sessile foliaceous 3- or 5-parted bracts; the 3 involucre bracts linear, about 1 cm. long, 1-2 mm. below the calyx; calyx lobes lanceolate, acuminate, 3-nerved, 8-10 mm. long; petals obovate, subtruncate, red or purple, 25 mm. long or more; carpels 14 to 16, to 5 mm. high and 3.5 mm. wide, the backs and exposed side-margins densely pubescent, the sides thin and reticulated. A rare Tex. endemic found along the Colorado River.

2. *Callirhoë Papaver* (Cav.) Gray. Perennial from a long narrow woody root; stems 3-6 dm. long, ascending to decumbent, sparsely appressed-pubescent with mostly 4-rayed hairs, sometimes glabrate, rarely with the lower part of the stem pilose; leaves with petioles equal to or many times longer than the blade, hastate, cordate, triangular or ovate in outline, 3-8 cm. long and 4-9 cm. wide, deeply palmately or pedately 3- or 5-cleft into almost entire (sometimes sinuate-toothed or -lobed) linear-falcate to lance-falcate divisions, the uppermost leaves sometimes reduced to a single lobe; stipules ovate to rhombic-ovate or oblong, to 12 mm. long and 7 mm. wide; peduncles long and slender, commonly 2 or 3 times as long as the subtending leaf; the 3 involucre bracts mostly 1-3 mm. below the calyx, usually linear and about one half as long as the calyx; calyx 1-1.5 cm. long, the united basal portion varying from slightly to densely hispid with simple hairs to 3 mm. long, the lobes lanceolate and their tips somewhat attenuate; petals 25-35 mm. long, red, erose-denticulate at the broad apex; carpels about 20, 4 mm. high, with reticulate sides. In pine-oak flatwoods, on caliche outcrops and grassy banks in e. Tex., Mar.-July; from Fla. to Tex., n. to Ga. and Mo.

3. *Callirhoë involucrata* (Torr.) Gray. Perennial, the stems mostly decumbent from an elongate to napiform root, to about 6 dm. long, hirsute or even hispid; principal cauline leaves 2.5-5 cm. long, 3-6 cm. wide, usually 5- or 7-parted or -cleft to within 5-10 mm. of petiole; leaf segments mostly cuneate at base and variously toothed or incised to

lobed or parted above the central segment, 5-10 mm. wide at base; stipules to 15 mm. long and about as wide, ovate to rhombic-ovate or ovate-lanceolate, cordate; peduncles surpassing the leaves; involucler contiguous with the calyx or very rarely slightly removed, each of the bracts (6-12 mm. long) linear or linear-lanceolate to narrowly ovate-rhombic; calyx 1-2.3 cm. long, divided to near base into mostly lanceolate lobes, sometimes varying to ovate-rhombic with attenuate tips; corolla 4-6 cm. in diameter; petals reddish-purple, cuneate to obovate-cuneate, truncate to somewhat rounded at the slightly fimbriate apex; carpels 16 to 25, strigose. In sandy or gravelly soils in open woods, on rocky hills, in scrubland and thickets, throughout Tex. except in the Trans-Pecos, Feb.-June; from N.D. to Wyo., s. to Mo., Okla., Tex. and Ut.

The variations in this species are denoted in the key. *C. geranioides* Small is referable to var. *lineariloba* (T.&G.) Gray. The f. *novomexicana* (E.G.Baker) Waterfall is very close to var. *involutrata*.

4. *Callirhoë alcaeoides* (Michx.) Gray. PLAINS POPPY-MALLOW. Perennial from an oblong or napiform root; stems several, erect or ascending, to about 45 cm. high, appressed-pubescent with 4-rayed hairs or sometimes glabrate; leaf blades 5-9 cm. long, 4-10 cm. wide, mostly cordate or triangular-cordate; blades of basal leaves crenate or incised to palmately parted, their petioles equal to or twice as long as the blade, the segments mostly lancinate-cleft, the ultimate leaf divisions mostly oblong to linear; petioles of cauline leaves mostly as long as blade, essentially lacking in uppermost leaves; inflorescence corymbose at anthesis, later elongating; peduncles to 8 cm. long; calyx lobes united below middle, lanceolate, sometimes attenuate, about 1 cm. long, the pubescence of short strigose mostly appressed simple hairs; petals 15-22 mm. long, pink or white; carpels 10, strigose-pubescent, 4-5 mm. high. *C. triangulata* of auth. In prairies of n.-cen. Tex., Mar.-May; from Ill. to Neb., s. to Ala., Tenn., Mo., Okla. and Tex.

5. *Callirhoë digitata* Nutt. Plant perennial, erect or reclining, to about 10 dm. high, the stems glabrous and glaucous to pilose-strigose; lower petioles usually 15-25 cm. long, often with a trace of pilose-strigose hairs; leaf blades mostly cordate or ovate, palmately or pedately 5- or 7-parted, with some of the divisions sometimes again parted into segments that are narrowly linear to linear-lanceolate and to 11 cm. long; stipules linear-lanceolate to ovate-lanceolate, to 12 mm. long, persistent or early-deciduous, commonly absent at flowering time; peduncles to 15 cm. long; involucler absent; calyx lobes strongly veined and lanceolate-acuminate; petals 1-2 cm. long, red or purple, the apex irregularly fimbriate; carpels 12 to 14, glabrous, dorsally rugose, 4-5 mm. high. In open woods and on plains, prairies and grassy slopes in cen. and n.-cen. Tex., Mar.-June; from Tex., n. to Ark., Mo. and Kan.

Our plant is usually referred to var. *stipulata* Waterfall with smaller stems and leaves, and larger and nondeciduous stipules than in var. *digitata*. Flowers with white petals are referred to f. *alba* Waterfall.

6. *Callirhoë leiocarpa* Martin. Plant annual, with several slender stems from a slender taproot, erect, to about 85 cm. high, glabrous or slightly pubescent with small 4-rayed hairs; leaves with petioles shorter than to about 3 times as long as the blade, reniform-cordate to ovate in outline, to 6 cm. long and about as wide, crenate to palmately or pedately 3- to 6-parted; leaf segments cuneate or oblong to lanceolate or falcate, to linear, entire to lobed; upper leaves usually more deeply parted and with narrower lobes than the lower ones; peduncles many, in fruit diverging from the upper part of the stem; fruiting calyx 9-15 mm. long and 5-8 mm. wide, united below the middle, the lobes lanceolate to linear-lanceolate and somewhat attenuate; petals to about 23 mm. long, red-purple to light-pink, finely and regularly erose at the broad summit; carpels 10 to 12, glabrous, 4-5 mm. high, smooth to slightly wrinkled dorsally, the beak large and hollow, the back of carpel body prolonged about 1 mm. into a white chartaceous collar that subtends the base of the beak. *C. pedata* Gray. In woods, mesquite groves, prairies and plains in cen. and s. Tex., Mar.-Aug.; also Okla.

9. MALVA L. MALLOW. CHEESE-WEED

Plants annual, biennial or perennial, sparsely pubescent or glabrate; leaves orbicular or reniform; flowers small, axillary, solitary or in small cymules, short-pedicelled,

involucellate; petals white or pink; style branches filiform, introrsely papillate; fruit depressed, disklike, the carpels numerous, compressed, reniform, indehiscent.

An Old World genus of about 40 species. The young leaves of several species, especially *M. parviflora*, when boiled as a potherb, are edible and nutritious.

- 1. Flowers mostly in terminal spikelike racemes, only the lowest ones axillary; petals 15-30 mm. long, 4 to 5 times as long as the sepals, purple-red 1. *M. sylvestris*.
- 1. Flowers axillary; petals 4-12 mm. long, less than 2.5 times as long as the sepals, pale-blue to white (2)
- 2(1). Petals about twice as long as the sepals 2. *M. neglecta*.
- 2. Petals (at most) slightly longer than the sepals (3)
- 3(2). Claw of petals pilose; pedicels 10-25 mm. long; calyx not enlarged in age 3. *M. rotundifolia*.
- 3. Claw of petals not noticeably pilose; pedicels 3-15 mm. long; calyx much-enlarged in age 4. *M. parviflora*.

1. *Malva sylvestris* L. HIGH MALLOW. Perennial with erect stems to about 1 m. high, sparsely hirtellous to glabrate; leaves orbicular to reniform in shape, shallowly 3- to 7-lobed, the lobes broadly rounded, serrate, the basal ones 5-10 cm. in diameter; petioles pubescent only or chiefly in a single line on the upper side; bractlets ovate to oblong or obovate; flowers fascicled in the upper axils, on peduncles to 5 cm. long; petals red-purple, 2-2.5 cm. long; carpels about 10, rugose-reticulate on the back, with angled edges, glabrous to sparsely short-pubescent. Nat. of Euras. that has become an escape in the e. third of Tex., May-Aug.

2. *Malva neglecta* Wallr. COMMON MALLOW. Annual or long-lived herb; stems prostrate, procumbent or ascending, to about 1 m. long, usually branched from the base; leaves long-petioled, orbicular to reniform, 3-6 cm. wide, shallowly 5- to 9-lobed, crenate, cordate to subcordate at base; flowers fascicled in the axils, with pedicels to 3 cm. long; bractlets narrow; petals obcordate, 6-12 mm. long, white or slightly tinged with pink or purple; carpels usually 12 to 15, rounded on the back, not rugose or reticulate, usually finely pubescent, the whole ring of carpels presenting a crenate outline, the depressed central portion of the head about a third as wide as the head. A nat. of Euras. and N. Afr. that has become established in various localities throughout Tex., Apr.-July.

3. *Malva rotundifolia* L. COMMON OR DWARF MALLOW. Similar to *M. neglecta* in habit and foliage; stems procumbent from a large and deep firm root; leaves rounded, slightly 5- to 7-lobed, crenate; pedicels often little longer than the calyx; corolla about 13 mm. long, pale, surpassing the calyx; carpels 8 to 15, glabrous or pubescent, conspicuously rugose-reticulate on the back, the margins sharply angled, the whole head of carpels approximately circular in outline, the central depressed area about one fifth the diameter of the whole head. *M. borealis* Wallr. Nat. of Eur. that is established as a weed in n.-cen. and w. Tex., Apr.-June.

4. *Malva parviflora* L. Plant glabrous or sparsely pubescent, usually with several to many stems erect or ascending from an annual root, to about 2 m. high; leaves with long slender petioles, suborbicular to reniform and often somewhat angulate-lobed, to about 6 cm. long and usually wider than long; pedicels usually short; flowers clustered in the axils, whitish or bluish-white, about 5 cm. across; calyx lobes broadly ovate, in fruit much-enlarged and spreading; petal claws glabrous; carpels puberulent or glabrous, sharply and transversely reticulate-rugose on the back, the margins of which are somewhat wavy-winged and denticulate. In thickets, along roadsides, in waste ground and cult. soils throughout much of Tex., Mar.-July; distributed over much of N.A.

10. ALTHAEA L.

About a dozen species native to the Old World; cultivated in gardens for their showy flowers.

1. *Althaea rosea* Cav. HOLLYHOCK, AMAPOLA GRANDE. Biennial, to 25 dm. high; stems strict, hairy; leaves with long petiole, large and rough to touch, rugose, orbicular in

outline, cordate at base, 5- to 7-lobed or wavy-angled, crenate; flowers essentially sessile, 8 cm. wide or more, variously colored, mostly deep rose-color to pink or lavender, arranged at apex of stem in a long wandlike raceme or spike; bracts 6 to 9 below the calyx, connate at base; very similar to *Malva*. A nat. of Asia that is cult. and is occasionally found as a waif along roadsides and about abandoned homesteads, summer-fall.

11. LAVATERA L. TREE-MALLOW

About 30 species in both hemispheres.

1. *Lavatera trimestris* L. Branching herbaceous annual 9-18 dm. high; leaves long-petiolate, irregularly crenate-dentate, finely pubescent or nearly glabrous, the lower suborbicular-cordate, the upper ones angled; stipules caducous; flowers solitary, axillary, 8-10 cm. across; pedicels jointed below the flowers, mostly shorter than the subtending leaves; the 3- to 6-lobate involucre shorter than the 5-lobed calyx; petals 5, rose-pink or red, obtuse to truncate or emarginate, short-clawed; ovary discoid; carpels 5 to 12, verticillate about a prominent axis, beakless, 1-seeded, indehiscent; receptacle or axis of the fruit expanded at apex into a disk to enclose the ovary. A nat. of the Medit. region that escapes from cult. in s. Tex., flowering the year around.

12. WISSADULA MEDIC.

Perennial herbs, somewhat woody; leaves petioled, cordate, mostly entire; flowers perfect, 5-parted, small, without involucre, solitary in the axils or in terminal panicles; calyx deeply lobed; corolla yellow or white; ovary 5-celled, ovules mostly 3 in each cell; style branches 5; carpels typically 5, each 2-celled, constricted laterally so as to produce a horizontal fold, apiculate or aristate; seeds mostly 3 in each carpel, the lower one villous.

About 40 species, mostly in the American tropics.

- 1. Leaves with crenulate to serrate margins, rarely subentire; stems and floral branches with conspicuous simple glandular hairs; calyx and corolla more than 10 mm. long 1. *W. holosericea*.
- 1. Leaves with entire margins; stems and floral branches without simple glandular hairs; calyx and corolla 8 mm. long or less (2)
- 2(1). Leaves typically narrowly ovate to ovate-lanceolate, tapering to the acuminate apex, mostly truncate at base; plant densely brownish stellate-pubescent throughout; corolla white 2. *W. periplocifolia*.
- 2. Leaves typically suborbicular-ovate to broadly triangular-ovate, abruptly long-acuminate at apex, cordate at base; plant puberulent with scattered longer simple or stellate hairs; corolla yellow 3. *W. amplexissima*.

1. *Wissadula holosericea* (Scheele) Gke. Robust branching plant to about 18 dm. high, densely velvety stellate-tomentose throughout, the stems and floral branches with conspicuous simple glandular hairs, soft and white but in age usually tawny and somewhat roughish, heavy-scented; leaves broadly ovate to triangular-ovate, cordate at base, acute to acuminate at apex, to 2 dm. long and often about as broad, irregularly crenate to dentate or rarely subentire, occasionally obscurely trilobed above, conspicuously veined beneath; flowers short-peduncled, at first solitary in the lower axils, the later ones corymbose-paniculate at the summit; calyx campanulate, about 15 mm. long, the lobes ovate and acute to acuminate; petals orange-yellow, 1.2-2 cm. long; carpels tomentose, beaked, not exceeding the calyx; seeds glabrous. *W. insignis* R. E. Fries. In rocky soils on the Edwards Plateau and in the Trans-Pecos, May-Nov.; also adj. Mex.

Very similar in habit to *Pseudabutilon Lozanii* but, in addition to a distributional difference, the stem of upper part of plant and branches of inflorescences have simple glandular hairs, whereas these organs in *Pseudabutilon Lozanii* are densely nonglandular stellate-pubescent.

2. *Wissadula periplocifolia* (L.) Presl. Somewhat woody perennial, branched, densely brownish stellate-pubescent throughout, to about 1 m. high; leaves ovate-lanceolate to

lanceolate, entire, truncate to rounded or rarely subcordate at base, gradually long-acuminate at apex, light-tawny beneath, the lower leaves slender-petioled and 5-15 cm. long, the upper smaller leaves short-petioled; flowers solitary in the axils and in terminal panicle to 2 dm. long; pedicels filiform, to 5 cm. long, usually much shorter; calyx 3-4 mm. long; petals white, obovate, about twice as long as the calyx; carpels dark-brown to blackish, apiculate, 6-8 mm. long. Incl. var. *gracillima* R. E. Fries. In woodlands and sacahuista grasslands in s. Tex., flowering throughout year; from Tex., s. to n. S.A. and the W.I.

3. *Wissadula amplissima* (L.) Fries. Perennial woody plants with erect branches, to about 2 m. high, more or less puberulent throughout and with scattered longer simple or stellate hairs; leaves broadly ovate, thin, very pale beneath, entire, sometimes with short acute lateral lobules above middle, cordate at base, acute to acuminate at apex, the lower leaves slender-petioled and 5-15 cm. long, the upper smaller leaves nearly sessile; flowers forming axillary and terminal panicles; pedicels slender, elongate or short, to 3 cm. long; calyx 3-4 mm. long; petals yellow, 4-6 mm. long; carpels 4 or 5, 7-8 mm. long, short-beaked, puberulent, brownish. In palm groves in the Rio Grande Valley, Sept.-Dec.; from Tex., s. to S.A. and the W.I., also Afr.

13. PSEUDABUTILON R. E. FRIES

About 15 species from Texas to Argentina and the West Indies.

1. *Pseudabutilon Lozanii* (Rose) R. E. Fries. Plant subshrubby, to about 15 dm. high; branches terete, covered with stellate or dendritic hairs; leaves with stoutish petioles, suborbicular-ovate to triangular-ovate, sometimes obscurely 3-lobate above, 5-17 cm. long and often about as wide, obtuse to acute at apex, cordate at base, densely stellate-tomentose (especially beneath), with crenate margins; flowers axillary and in panicles; pedicels stout, to 3 cm. long, usually much shorter; fruiting calyx campanulate, 1-1.2 cm. long, the lobes ovate and acute; petals yellow, obovate-cuneate, about 2 cm. long; carpels 5, about 8 mm. long, short-beaked, falsely 2-celled, the 2 cavities separated by a membranous tongue-like projection (endoglossum) from the dorsal wall; seeds 3. In clay soils in thickets and open grassy areas from e. Edwards Plateau s. to coast and the Rio Grande Valley, flowering throughout year; also n.e. Mex.

The similarity of this species to *Wissadula holosericea* is discussed under that species.

14. HERISSANTIA MEDIC.

A monotypic genus.

1. *Herissantia crispa* (L.) Brizicky. Diffuse perennial with slender vinelike stems and branches to 1 m. long or more, velvety-tomentulose or canescent; leaves thin, with petioles equaling the blades or shorter, ovate, deeply cordate at base, mostly abruptly acuminate at apex, often prominently reticulate-veined, with crenulate margins, 2-7 cm. long, the uppermost leaves becoming nearly sessile; involucels none; peduncles in fruit commonly refracted at the joint; calyx lobes 5, velvety and often villous, ovate to ovate-lanceolate, acute, 4-6 mm. long; petals 5, about twice as long as the calyx, pale-yellow to whitish or sometimes yellowish-orange; fruit globose, 1-2 cm. thick; carpels about 12, rounded and muticous, becoming greatly inflated, the walls thin and papery, normally hirsute with long hairs; ovules 2 to 6 in each carpel; seeds glabrous. *Bogenhardia crispa* (L.) Kearns., *Abutilon crispum* (L.) Sweet, *Gayoides crispum* (L.) Small. In chaparral, brushland, boulder-strewn areas, flats and rocky slopes in cen., s. and w. Tex., flowering throughout the year; from Ariz. to Tex. and Fla., s. through trop. Am.; also trop. Asia.

15. ABUTILON MILL.¹²⁷ INDIAN-MALLOW

Plants herbaceous, suffrutescent or shrubby, canescent or tomentose with short stellate hairs or hirsute with longer simple hairs; leaves crenate or dentate, not or obscurely lobed;

¹²⁷ Key adapted from T. H. Kearney in Leaf. West. Bot. 7:241-254. 1955.

flowers solitary in the axils or in leafy panicles; involucre none; corolla usually orange or yellow; fruit truncate-cylindric or ovoid, the carpels with smooth sides, dehiscent nearly to the base when mature; ovules 2 or more in each carpel.

About 100 species widespread mostly in tropical and subtropical regions.

1. Carpels normally 5 (sometimes 6 in *A. incanum*), usually with few ovules (2)
1. Carpels more than 5 (6)
 - 2(1). Petals about 20 mm. long and 10 mm. wide; herbage whitish-velutinous with stellate hairs; leaves broadly ovate, deeply cordate, acuminate, coarsely dentate; flowers in a small terminal subcorymbose cluster; calyx about 9 mm. long, the lobes ovate-lanceolate and cuspidate 1. *A. Marshii*.
 2. Petals not more than 12 mm. long (3)
 - 3(2). Stems obtusely trigonous and deeply sulcate above; herbage finely stellate-tomentose, also more or less glandular-puberulent and rarely with a few long simple hairs; leaves long-petiolate, cordate, rather abruptly long-acuminate, crenate or subentire; flowers in a very open leafy panicle; calyx less than one half as long as the carpels, spreading or reflexed in fruit; corolla yellow, often with a dark center, the petals about 5 mm. long; fruit truncate, the carpels often slightly constricted at about the middle or above the base, mucronate to cuspidate 2. *A. trisulcatum*.
 3. Stems terete or (if more or less angulate-sulcate) the other characters not combined as above (4)
 - 4(3). Calyx erect in fruit, often almost as long as the carpels; herbage finely tomentose; inflorescence (when well-developed) an elongate leafy many-flowered panicle; carpels 6-9 mm. long, rounded to obtuse at the apex, rather coarsely stellate-pubescent 3. *A. malacum*.
 4. Calyx spreading or reflexed in fruit, much shorter than the carpels; petals usually without basal spots (5)
 - 5(4). Petals 6-9 mm. long, yellow or orange; carpels 6-8 mm. long, mucicous or apiculate, rarely cuspidate, finely stellulate; plant usually suffrutescent; stems erect, minutely tomentose, sometimes triquetous above; leaves often more than 3 (to 7) cm. long, denticulate to coarsely dentate; flowers numerous, often somewhat congested at the ends of the branches 4. *A. incanum*.
 5. Petals 4-6 mm. long, orange-pink or red; carpels 8-9 mm. long, mucronate or cuspidate; plant herbaceous above the crown; stems spreading or decumbent, with spreading hairs, often vinelike; leaves not more (usually less) than 3 cm. long, usually coarsely dentate; flowers few, solitary in the axils 5. *A. parvulum*.
 - 6(1). Corolla typically rose-pink (at least when fresh), rarely white; stems and petioles with long wide-spreading coarse hairs 6. *A. Hulseanum*.
 6. Corolla yellow or orange-color, rarely whitish, with or without a darker center; stems and petioles rarely with long wide-spreading fine hairs (7)
 - 7(6). Plant annual; stems to 1 m. high; herbage more or less tomentose; leaves large, broadly ovate to suborbicular, abruptly acuminate; petals about 1 cm. long, yellow; carpels long-aristate, with many ovules 7. *A. Theophrasti*.
 7. Plants perennial, often more or less woody (8)
 - 8(7). Fruiting calyx not more than two thirds as long as the mature fruit (9)
 8. Fruiting calyx from more than two thirds as long as to longer than the mature fruit (10)
 - 9(8). Carpels mucicous or only shortly cuspidate; flowers in very open panicles 8. *A. sonora*.
 9. Carpels long-beaked or aristate 9. *A. umbellatum*.
 - 10(8). Corolla usually less than 15 mm. long (11)
 10. Corolla usually 15 mm. long or more (12)

- 11(10). Calyx lobes subcordate and overlapping at base (at least in the bud) 10. *A. lignosum*.
11. Calyx lobes not subcordate at base; seeds usually minutely tuberculate or echinate .. 9. *A. umbellatum*.
- 12(10). Stems with few or many long spreading simple hairs in addition to other pubescence 11. *A. Wrightii*.
12. Stems without such hairs (13)
- 13(12). Leaves to 5 cm. long, obtuse to shortly acuminate, crenulate, sometimes obscurely trilobate, moderately discolorous; carpels cuspidate; calyx about one half as long as the corolla, its lobes deltoid and somewhat overlapping at the base; plant shrubby 12. *A. glabriflorum*.
13. Leaves mostly larger than those above, attenuate-acuminate; carpels long-beaked or aristate 13. *A. hypoleucum*.

1. *Abutilon Marshii* Standl. Plant erect, densely whitish-velutinous with stellate hairs; leaves with long slender stellate-pilose petioles 7-9.5 cm. long, broadly ovate, about 13 cm. long and 1 dm. wide, obscurely 3-lobed, deeply cordate at base, long-acuminate at apex, coarsely crenate-dentate, stellate-pilose; flowers few in a small subterminal corymbose cluster, with short thick pedicels; calyx 8-9 mm. long, densely stellate-pilose, deeply lobed, the lobes ovate-lanceolate and shortly subulate-acuminate; petals about 2 cm. long and 1 cm. wide; fruit unknown. In the Chisos Mts. of the Trans-Pecos, Aug., endemic.

2. *Abutilon trisulcatum* (Jacq.) Urban. AMANTILLO. Shrub to about 15 dm. high, with slender ascending densely tomentulose 3-angled branches; leaves ovate, slender-petioled, cordate at base, abruptly acuminate at apex, to 12 cm. long, crenate to crenulate, finely velvety on both sides, the upper leaves smaller than the lower ones; flowers solitary and slender-peduncled in the axils of leaflike bracts or subpaniculate; calyx 4-5 mm. long, its lobes triangular-ovate and acuminate; petals yellow, reddish blotched at the base, 5-7 mm. long; carpels about 5, stellate-puberulent, short-tipped, about 8 mm. long. *A. triquetrum* (L.) Sweet, *A. Nealleyi* Coult. In palm groves and thickets in s. Tex., Jan.-Apr.; from Tex. to Mex. and W.I.

3. *Abutilon malacum* Wats. Plant tall, suffrutescent and branching, the stems rather stout, very finely and closely velvety-pubescent throughout; leaves long-petioled, suborbicular-ovate, cordate at base, acute at apex, irregularly dentate, to about 1 dm. long, about as long as the petiole; panicles axillary and terminal; flowers numerous and short-pedicelled; calyx lobes lanceolate, acute to acuminate, 6-8 mm. long; petals orange-color, about twice as long as the calyx; carpels 5, acutish, coarsely stellate-pubescent, about as long as calyx. On rocky hills, dry slopes and gravelly flats in w. Tex., June-Sept.; also N.M. and adj. Mex.

4. *Abutilon incanum* (Link) Sweet. PELOTAZO. Plant herbaceous, more or less branched above, minutely tomentose, to about 6 dm. high; leaves thickish, mostly ovate-cordate, acute to acuminate, irregularly serrate, to 1 dm. long, smaller on the branchlets; flowers solitary and mostly slender-peduncled in the axils and sometimes loosely and slightly paniculate on the branchlets; calyx 2-4 mm. long, at length usually reflexed under the more or less oblong truncate canescent-puberulent capsule; petals orange-yellow, 6-10 mm. long; carpels 5 (or 6), muticous or nearly so; seeds when young smooth and glabrous, in age minutely cinereous-pubescent. *A. Nuttalli* T. & G., *A. ramosissimum* Presl, *A. texense* T. & G. In dry areas on cliffs, slopes, prairies, and in open woods and chaparral in w. half of Tex., throughout the year; from Tex. to Ariz. and Mex.

5. *Abutilon parvulum* Gray. Stems slender and spreading or trailing, from a woody root, paniculate above, cinereous-tomentose with a lax minute stellate pubescence, the branchlets pilose with spreading hairs; leaves thin, small, to 5 cm. long, broadly ovate, cordate at base, dentate, sometimes obscurely 3-lobed, usually obtuse at apex; peduncles filiform, axillary, 1-flowered, longer than the leaves; calyx lobes ovate, acuminate, reflexed in fruit; petals pink or red, sometimes orange-color or yellowish, 4-6 mm. long, exceeding the calyx; carpels 5, somewhat tomentose, erect and acute, to about 8 mm. long. On limestone hills, dry ledges, mesas and similar areas on the Edwards Plateau

and in the Plains Country and Trans-Pecos, May-Nov.; from Tex. to Colo., Calif. and n. Mex.

6. *Abutilon Hulseanum* (T.&G.) Chapm. Shrub to about 1 m. high, densely velvety-tomentose, the branches and stalks villous or hirsute with spreading hairs; leaves long-petioled, broadly ovate, rather abruptly acute to acuminate, 5-12 cm. long, irregularly crenulate, acute at apex, deeply cordate at base, the lower surface densely canescent; flowers axillary, solitary or short-paniculate; peduncles equal to or surpassing the petioles, 5-10 cm. long; calyx deeply 5-cleft, about 13 mm. long, with reduplicate-angled base, the lobes ovate and acute; petals white, fading to rose-color, 13 mm. long or more, slightly exceeding the calyx; carpels 12 to 14, swollen, black, apiculate. *A. commutatum* K. Schum., *A. leucophaeum* Hochr. Thickets in palm groves in Rio Grande Valley, Feb.-May; also adj. Mex.

7. *Abutilon Theophrasti* Medic. CHINGMA, VELVET-LEAF BUTTERPRINT. Plant annual, tall, velvety and cinereous with very short and fine soft woolliness, annual; leaves sub-orbicular-ovate, to 15 cm. or more in diameter, abruptly acuminate at apex, cordate at base, velvety-pubescent; peduncles shorter than petioles; calyx very deeply 5-parted, about half the length of the awn-beaked capsule; petals yellow, about 6 mm. long; carpels villous, usually more than 10, with long divergent awns, much-surpassing the calyx. A nat. of Euras. that has become weedy in waste and cult. grounds throughout much of N.A.; occasional in the High Plains.

8. *Abutilon sonorae* Gray. Herbaceous or suffrutescent perennial to about 15 dm. high; stems, branches and petioles with simple spreading or reflexed hairs to 3.5 mm. long; stipules linear-lanceolate, 3-5 mm. long, caducous; leaves with petioles 5-15 cm. long, broadly ovate to suborbicular, acuminate, deeply cordate at base, 5-20 cm. long and wide, shallowly trilobate or the margins merely irregularly crenate-dentate, finely and densely stellate-pubescent, dark-green above, canescent and velvety beneath; flowers in axillary and terminal panicles; peduncles 1-3 cm. long in anthesis, 1-flowered; pedicels 3-6 mm. long; calyx finely stellate-puberulent, the ovate acute lobes 3-4 mm. long; petals deep-yellow with orange tinge outside, 6-10 mm. long; carpels 7 to 11, stellate-pubescent, 8-10 mm. long, the spreading-ascending beak 0.5-1 mm. long; seeds usually 3 in each cell, about 2 mm. long, dark-brown, dull, netted with a reticulum of minute conical somewhat curved light-brown hairs that surmount low narrow ridges. In canyons and at base of bluffs in the Trans-Pecos, July-Sept.; from w. Tex. to s. Ariz., s. in Mex. to Gro.

9. *Abutilon umbellatum* (L.) Sweet. Perennial, somewhat woody, erect, usually branched, stellate-tomentose (at least above), to about 9 dm. high; leaves long-petioled, broadly ovate, abruptly acute to acuminate, cordate at base, 4-10 cm. long, stellate-pubescent or puberulent, coarsely crenate-dentate; flowers corymbose or subumbellate, sometimes densely clustered; calyx campanulate, about 6 mm. long in flower; petals yellow, 8-10 mm. long; carpels usually 6 or 7, stellate-hirsute, about 7 mm. long, biaristate. On edge of and in open woods in s. Tex., Sept.-Dec.; also W.I. and Mex. to S.A.

10. *Abutilon lignosum* (Cav.) D. Don. Plant shrubby, branched, densely stellate-tomentose, erect, to 15 dm. high; leaves slender-petioled, orbicular-ovate, stellate-tomentose, dentate or denticulate, acute to acuminate at apex, cordate at base, to about 1 dm. long; flowers axillary, solitary on peduncles mostly longer than the petioles; calyx about 1 cm. long, tomentose, deeply 5-parted, its lobes broadly ovate to ovate-lanceolate and acute to acuminate; petals yellow to orange-color, slightly longer than the calyx; carpels 7 to 10, swollen, beaked, stellate-pubescent, about 15 mm. long. *A. Berlandieri* Gray, *A. abutiloides* (Jacq.) K. Schum., illegit. name, *A. americanum* (L.) Sweet. In waste ground, chaparral and cult. areas in s. Tex.; also n. Mex. and the W.I.

11. *Abutilon Wrightii* Gray. Plant herbaceous from a woody stock, to about 6 dm. high, ascending or decumbent, branching, viscid-pubescent and villous with fine spreading hairs; leaves thin, long-petioled, ovate-cordate, obtuse to acutish at apex, sharply dentate above, to 5 cm. long, greenish and scabrous-velvety above, very soft white-tomentose below; axillary peduncles mostly 1-flowered, equal to the petioles or the upper ones exceeding the leaves; calyx tomentose, 5-parted, angulate at base, about 13 mm. long, with very acuminate divisions that about equal the yellow petals; carpels thin, tomentulose, subulate-beaked, about 12 mm. long; seeds smooth and glabrous. On

talus slopes, rocky hills, ledges and cliffs, and in chaparral, draws and arroyos on the Edwards Plateau and in s. and w. Tex., Mar.-Nov.; from Tex. to Ariz.

12. *Abutilon glabriflorum* Hochr. Shrub with fruticose stems, glabrate in age; leaves broadly cordate, 3.5-7 cm. long, acute to acuminate, shallowly crenate or denticulate, densely stellate-pubescent, whitish beneath; sepals broadly ovate, acute; petals 1.5-2 cm. long; carpels 1-1.2 cm. long. In the Rio Grande Valley of s. Tex.; adj. Mex.

13. *Abutilon hypoleucum* Gray. Shrub with branching stems to 12 dm. high, subglabrous to white-tomentose; leaves slender-petioled, broadly ovate, cordate at base, abruptly narrowed and gradually acuminate at apex, erose-serrate, very soft white-tomentose and veiny beneath, green and scabrous-pubescent to somewhat velvety above, 5-7.5 cm. long; axillary peduncles mostly 1-flowered and exceeding the petioles; calyx white-tomentose, 5-parted and -angled, of seemingly cordate acuminate sepals; petals yellow, slightly exceeding the calyx; carpels numerous, subulately erect-awned and villous-hirsute, 12 mm. long or more. In palm groves and canyons in the Rio Grande Plains and Valley, Mar.-Oct.; adj. Mex.

Distinguished by its seemingly cordate sepals equaling the hirsute erect-awned carpels.

16. MODIOLA MOENCH

A monotypic genus.

1. *Modiola caroliniana* (L.) G. Don. Low creeping diffuse chiefly perennial herb, hirsute with simple or geminate hairs, to 6 dm. long or more; leaves with petioles to 3 cm. long, rounded, palmately 3- or 5-lobed and incised, to 6 cm. long and 4 cm. wide; peduncles commonly filiform and equaling or surpassing the petiole; flowers small, solitary on axillary peduncles, subtended by a persistent involucre of 3 foliaceous bractlets; petals small, salmon-color to purplish-red, obovate, 4-6 mm. long, little-surpassing the calyx; stamens 10 to 20; stigmas capitate; fruit depressed, composed of 15 to 30 thin-coriaceous carpels; carpels reniform, much-compressed, more or less hirsute, with a dorsal bipartite cusp and hispid at summit, eventually falling free from the axis and tardily bivalved at the top, eventually becoming somewhat glabrate. In waste grounds, disturbed soils, edge of salt marshes, lawns and similar places, mostly in s. Tex. but occasionally elsewhere, Mar.-May; from Fla. to Tex., n. to Va. and s. to Arg.

17. SPHAERALCEA ST.-HIL.¹²⁸

FALSE MALLOW. GLOBE MALLOW

Plants herbaceous or suffrutescent, mostly perennial, the herbage stellate-pubescent; leaves subentire to shallowly dentate or pedately dissected; inflorescences racemose or paniculate; calyx nearly always tribracteolate; corolla usually red (grenadine); fruit hemispheric to truncate-conic; carpels often remaining attached to the axis after maturity by a threadlike extension of the dorsal nerve; ovules and seeds 1 to 3 in each carpel.

About 50 species in both hemispheres. Several of the species are browsed to some extent by domestic and wild grazing animals.

1. Indehiscent reticulate part of the carpel conspicuously wider than the dehiscent part, forming two-thirds or more of the carpel (2)
1. Indehiscent reticulate part of the carpel not conspicuously wider than the dehiscent part, forming less than two-thirds of the carpel (4)
- 2(1). Plant sparsely stellate-pubescent; carpels 15 or more, with thin chartaceous walls, very deeply notched; distribution in Rio Grande Plains 1. *S. pedatifida*.
2. Plant canescent or lepidote; carpels fewer than 15, with thick coriaceous walls, not very deeply notched; distribution north and west of Rio Grande Plains (3)
- 3(2). Stems and leaves silvery-lepidote; upper linear leaf blades entire, the lower ones 3-divided or nearly so; calyx closely lepidote; carpels 7 to 9 2. *S. leptophylla*.
3. Stems and leaves canescent or more coarsely pubescent; all leaf blades deeply cleft to parted or divided; calyx villous; carpels 10 to 14 .. 3. *S. coccinea*.

¹²⁸ Adapted from T. H. Kearney in Univ. Calif. Publ. Bot. 19:1-128. 1935.

- 4(1). Stems and leaves copiously pubescent with relatively long soft felted hairs, the hairs of the stem 1-1.5 mm. long 4. *S. Lindheimeri*.
4. Stems and leaves sparsely pubescent to canescent or tomentose with relatively short hairs, the hairs of the stem usually much less than 1 mm. long (5)
- 5(4). Carpels with very thin almost scarious walls, the areolae of the reticulate part transparent; inflorescence an open long-branched panicle 5. *S. laxa*.
5. Carpels with thicker chartaceous walls, the areolae often nearly opaque; inflorescence not as above (6)
- 6(5). Indehiscent part of the carpel usually rugose or muriculate dorsally, the reticulations prominent and usually coarse (7)
6. Indehiscent part of the carpel smooth or nearly so dorsally, the reticulations usually fine and not very prominent (8)
- 7(6). Pedicels slender, the lower ones often exceeding the calyx and 1 cm. long or more; leaves rather thin, the lower surface pubescent with whitish-sericeous hairs; distribution mostly east of Trans-Pecos region 6. *S. hastulata*.
7. Pedicels stout, shorter than the calyx and rarely to 1 cm. long; leaves thickish, the lower surface more densely pubescent than the upper surface; distribution mostly in the Trans-Pecos region 7. *S. subhastata*.
- 8(6). Fruit hemispheric or nearly so; carpels three fifths to fully as wide as long; leaves and stems very sparsely stellate-pubescent ... 8. *S. digitata*.
8. Fruit truncate-conic; carpels one half to three fifths as wide as long; leaves (especially the lower surface) and stems rather copiously pubescent (9)
- 9(8). Leaves pedately cleft or parted 9. *S. Wrightii*.
9. Leaves not pedately divided (10)
- 10(9). Leaves oblong-lanceolate to linear-lanceolate, at most merely angulate or toothed near the base, not more than one third as wide as long; pubescence grayish 10. *S. angustifolia*.
10. Leaves ovate to ovate-oblong, more or less distinctly lobed, more than one third as wide as long (11)
- 11(10). Pubescence yellowish, scurfy; leaves shallowly lobed, the lateral lobes usually broad and rounded; petals 10-17 mm. long; column 6-8 mm. long; hairs of the stem very short, many-rayed 11. *S. incana*.
11. Pubescence grayish or whitish; leaves often deeply cleft, the lateral lobes triangular and often acutish; petals 8-13 mm. long; column 4-6 mm. long or (if the petals and the column longer) the hairs of the stem usually relatively long and few-rayed 12. *S. Fendleri*.

1. *Sphaeralcea pedatifida* Gray. Biennial or short-lived perennial with few slender decumbent or ascending stems from a slender taproot and small crown, green, sparsely to somewhat copiously stellate-pubescent, the stems to 7 dm. long but usually much shorter; leaves with slender petioles somewhat shorter to considerably longer than the blade, thin, sparsely stellate-pubescent, pedately parted or divided, all the divisions pinnately cleft or coarsely toothed with acute often setose-tipped teeth, the midlobe to 2 times the length of the lateral lobes, the larger blades 1.5-3 cm. long and at least equally as wide; inflorescence few-flowered, racemiform or sometimes subthyrsoid below; pedicels slender, shorter than to more than twice as long as the calyx; bractlets of the involucre often denticulate; calyx 6-9 mm. long, stellate-pubescent, with ovate-lanceolate to deltoid more or less acuminate lobes; petals orange-chrome or grenadine-pink, 8-14 mm. long; carpels 15 to 20, with thin chartaceous walls, 3-3.5 mm. long, the dehiscent portion mucous, the indehiscent portion wider than the dehiscent portion, coarsely and prominently reticulate, fenestrate, nigrescent, rugose-tuberculate or muricate dorsally. In sandy soil in scrub brushlands, on rocky-gravelly slopes and in fields on the Rio Grande Plains, Feb.-Aug.; also n. Coah.

2. *Sphaeralcea leptophylla* (Gray) Rydb. SCALY GLOBE-MALLOW. Perennial with several or numerous decumbent to ascending or erect stems from a long stout taproot and a stout woody crown, silvery-lepidote with short many-rayed appressed hairs that

form fringed scales, the stems to 5 dm. long; leaves sometimes fascicled in the lower axils, with slender petioles usually less than one third as long as the blade, rather thick, with midvein prominent beneath, usually conduplicate or with the margins revolute, the upper leaves entire, linear to narrowly oblanceolate, obtuse to acute and usually cartilaginous-apiculate at the apex, the lower leaves 3-divided or very nearly so with the midlobe 1.5-3 mm. wide and 1 to 2 times as long as the lateral divisions, one or more of the divisions sometimes 1- or 2-cleft, the larger blades 15-35 mm. long; inflorescence racemiform, with long internodes, with 12 or fewer flowers, appearing naked throughout or leafy at the base only; pedicels usually slender, much shorter than to twice as long as the calyx; involucre of 3 thick bractlets, often persisting until fruit maturity; calyx 4.5-7 mm. long, with deltoid-ovate to ovate-lanceolate and acute to short-acuminate lobes; petals grenadine, 9-15 mm. long; carpels 7 to 9, very thick, with coriaceous walls, 3-3.5 mm. long, the dehiscent portion obtuse to acute and mucicous or mucronulate at apex, the indehiscent portion much wider than the dehiscent portion, very prominently and usually coarsely reticulate, moderately rugose to slightly tuberculate dorsally. In limestone soil on hills and along roadsides in the Trans-Pecos, Mar.-Aug.; from Tex. and Colo., w. to Ut., Ariz. and n. Mex.

3. *Sphaeralcea coccinea* (Pursh) Rydb. SCARLET GLOBE-MALLOW, RED FALSE MALLOW. Perennial with usually decumbent or ascending stems from a slender or stout taproot, usually rather densely grayish or whitish stellate-pubescent throughout, the stems to 5 dm. long, usually much shorter; leaves with petioles of lowermost ones as long as or longer than the blades, usually thickish and much more pubescent on the lower than on the upper surface, broadly deltoid in outline, pedately parted or divided, the midlobe and often the primary lateral divisions pinnately few-cleft or even parted, the primary lateral divisions not less than two thirds as long as the midlobe with the latter and often the primary lateral divisions long-cuneate at base, all the divisions rounded-truncate to acutish at apex, the larger blades 1-6 cm. long and wider than long; inflorescence racemiform or occasionally subthyrsoid at base, with usually very short internodes, few- to many-flowered; pedicels usually rather stout and shorter than the calyx, the lower ones sometimes more slender and elongate; calyx conspicuously villous, 5-10 mm. long, with lanceolate to deltoid-ovate or usually ovate-lanceolate acuminate lobes; petals grenadine, 1-2 cm. long; carpels 10 to 14, very thick, with coriaceous walls, 3-3.5 mm. long and wide, the dehiscent portion mucicous and with an internal palatelike fold near the base dorsally, the indehiscent portion much wider than the dehiscent portion and very coarsely and prominently reticulate, rugose-tuberculate dorsally. On caliche outcrops and gypsum, and in gravelly-limestone and sandy-clayey soils on breaks, plains and hills in the Plains Country and Trans-Pecos, Apr.-Aug.; from cen. Can. s. to Ia., Tex., N.M. and Ariz. The variants in our region have been segregated as follows:

1. Primary lateral divisions of the leaves less than two thirds as long as the midlobe; dehiscent part of the carpel usually ascending, deltoid and acutish, forming about one-third of the whole var. *elata* (E. G. Baker) Kearn.
1. Primary lateral divisions of the leaves at least two thirds as long as the midlobe; dehiscent part of the carpel usually horizontal, irregularly quadrilateral, forming less than one-third of the whole (2)
- 2(1). Herbage usually densely whitish-canescens; leaves with very narrow divisions var. *dissecta* (Nutt.) Garrett.
2. Herbage usually green and less densely pubescent; leaves with relatively broad divisions var. *coccinea*.

4. *Sphaeralcea Lindheimeri* Gray. Perennial with few decumbent stems from a small crown, densely whitish-pubescent with relatively very long soft felted hairs, the stem to 7 dm. long; leaves with slender or stout petioles about as long as the blade, thin, deltoid-ovate to suborbicular, truncate to cordate at base, rounded to acutish at apex, usually very shallowly but sometimes deeply lobed, the margins shallowly crenate to coarsely and irregularly dentate, the larger blades 25-45 mm. long and wide or wider; inflorescence usually racemiform, at most subthyrsoid, few-flowered; pedicels slender or stout, much shorter than to twice as long as the calyx; calyx 8-15 mm. long, with

lanceolate to ovate-lanceolate attenuate-acuminate lobes; petals grenadine-pink, 13-25 mm. long; carpels about 18, with chartaceous walls, about 4 mm. long, the dehiscent portion rounded and mucicous at apex, the indehiscent portion prominently and rather coarsely reticulate, often nigrescent. In sandy soils in open woods, thickets and plains in s. and s.-coastal Tex., Feb.-June; endemic.

5. *Sphaeralcea laxa* Woot. & Standl. CALICHE GLOBE-MALLOW. Perennial with several erect or ascending stems from a thick woody crown and a stout taproot, usually densely whitish canescent or tomentose with short hairs, to about 9 dm. high; leaves with slender petioles equaling or longer than the blade of the lower leaves, mostly thinnish, broadly ovate to deltoid in outline, subcordate to deeply cordate at base, very obtuse to acutish at apex, shallowly 3-lobed to almost 3-parted, with the lateral lobes sometimes deeply cleft, the lobes usually rounded, the midlobe seldom more than twice as long as the lateral ones, the margins irregularly crenulate to crenate or coarsely dentate, the larger blades 1.5-5 cm. long and about as wide; inflorescence an open lax relatively few-flowered panicle; pedicels slender, usually much shorter than the calyx; bractlets of the involucre often dark-red and conspicuous; calyx 7-11 mm. long, with lanceolate to oblong-lanceolate acuminate lobes; petals grenadine-pink to grenadine-red, 12-18 mm. long; anthers dark-purple; carpels 12 to 14, thin-walled, 4-6 mm. long, the dehiscent portion acute to obtuse and cuspidate to mucronulate at apex, the indehiscent portion rather prominently but finely reticulate, with nearly transparent areolae. In shallow limestone soil in extreme w. Tex., May-Nov.; from Tex. to Ariz. and n. Mex.

6. *Sphaeralcea hastulata* Gray. Perennial with few or several usually decumbent stems from a small crown or from often farther below the soil surface as root-shoots, rather densely canescent to subtriglosely pubescent throughout, the stems to 3 dm. long but usually shorter; leaves with slender petioles one half as long as the blade or less, thin, with veins not very prominent beneath, usually bright-green and rather sparsely pubescent above, paler and densely sericeous-pubescent beneath, oblong-ovate to ovate-lanceolate, subcuneate to strongly cuneate or sometimes truncate or even subcordate at base, acute to short-acuminate at apex, usually merely subhastately toothed or shallowly lobed with rounded teeth or lobules less than one fifth as long as the midlobe (sometimes deeply cleft with much longer lateral lobes), the margins nearly entire to coarsely and irregularly crenate-dentate or the midlobe even pinnately cleft, the larger blades 2-6 cm. long; inflorescence racemiform with usually only one flower at each node and seldom more than 8 per stem; pedicels slender, the lower ones often much longer than the calyx, usually with some more than 1 cm. long; calyx 6-11 mm. long, with lanceolate to ovate-lanceolate acuminate lobes; petals grenadine, 1.5-2 cm. long; carpels thickish, with chartaceous walls, 3-5 mm. long, the obtuse to acute dehiscent portion usually mucicous but sometimes mucronate or cuspidate and sometimes sparsely spinulose dorsally toward apex, the indehiscent portion usually conspicuously wider than the dehiscent portion, coarsely and very prominently reticulate, often nigrescent, conspicuously muricate dorsally. In sandy or rocky soils, caliche or on salt flats mainly in w.-cen. and s. Tex., Feb.-Aug.; also n.e. Mex.

7. *Sphaeralcea subhastata* Coult. Perennial with decumbent to ascending or nearly erect stems from a slender or rather stout taproot, canescent, the stems to 5 dm. long but usually much shorter; leaves with usually slender petioles mostly less than half as long as the blade, usually thickish with veins prominent beneath, oblong-lanceolate to narrowly ovate, cuneate at base, acute to short-acuminate at apex, usually much more sparsely pubescent on the upper than on the lower surface, scarcely lobed but usually subhastately angled or toothed at base with ascending teeth, the margins nearly entire to irregularly crenate or dentate, the larger blades 2-5.5 cm. long; inflorescence racemiform or with 2 flowers at some of the lower nodes, few-flowered (mostly less than 12), usually leafy nearly to the apex; pedicels usually stout and shorter than the calyx, rarely more than 1 cm. long; calyx 4-11 mm. long, with usually ovate-lanceolate to lanceolate and attenuate-acuminate lobes; petals grenadine (rarely pink or drying violet-color), 1-1.8 cm. long; carpels thickish, with chartaceous walls, seldom connate at maturity, 4-6 mm. long, the dehiscent portion usually acute and with cusps to nearly 2 mm. long (rarely mucicous), occasionally sparsely spinulose dorsally toward apex, the indehiscent portion coarsely and very prominently reticulate, often nigrescent, rugose-tuberculate or muricate

dorsally. Incl. var. *pumila* (Woot. & Standl.) Kearn. and var. *Martii* (Cockll.) Kearn. and var. *latifolia* Kearn. In sandy or gravelly soils and on limestone slopes, frequent along roadsides, mainly in the Trans-Pecos, rare eastw., Mar.-Sept.; from Tex., w. to Ariz. and n. Mex.

8. *Sphaeralcea digitata* (Greene) Rydb. JUNIPER GLOBE-MALLOW. Perennial with slender decumbent to ascending or nearly erect stems from a stout or rather slender taproot and woody crown, more or less thinly canescent throughout, the stems to about 55 cm. long, usually much shorter; leaves with slender petioles shorter than the blades, rather thin, pedately divided or nearly so, with the primary lateral divisions so deeply parted as to give the appearance of a 5-parted leaf, all the divisions oblanceolate to narrowly obovate, cuneate at base, obtuse to acute and often mucronulate at apex, the midlobe not more than 5 mm. wide and not much longer than the primary lateral divisions, all the divisions entire or (the midlobe especially) coarsely and irregularly few-toothed or -cleft, the larger blades 1.5-4 cm. long and about as wide; inflorescence usually 10- to 20-flowered, narrowly subthyrsoid with often only the lowest nodes bearing more than 1 flower, the lowest branches not more than 2 cm. long; pedicels mostly stout and usually but not always much shorter than the calyx; calyx 3.5-7 mm. long, with ovate-lanceolate acuminate lobes; petals grenadine, 8-14 mm. long; carpels 9 to 13, thickish, with chartaceous walls, 3-4 mm. long, the acute dehiscent portion muticous to short-cuspidate, the indehiscent portion finely and usually not prominently reticulate. In rock crevices and on rocky hills in limestone and gypsum soils in the Trans-Pecos, Mar.-Nov.; from Tex. to Ut., Ariz. and n. Mex.

Those plants with usually 2 larger flowers at some of the lower nodes, and whose slender elongate pedicels typically exceed the calyx, are segregated as subsp. *tenuipes* (Woot. & Standl.) Kearn.

9. *Sphaeralcea Wrightii* Gray. Perennial with few erect or nearly erect stems from a rather small woody crown, grayish-canescenscent or subtomentose with soft hairs, to 75 cm. high; leaves with rather slender petioles that are usually as long as to much longer than the blade of the lower leaves, thickish, with veins rather prominent beneath, much more densely pubescent below than above, broadly ovate to semiorbicular in outline, truncate to deeply cordate at base, usually obtuse and often mucronulate at apex, all but the lowest leaves pedately deeply cleft or parted, the coarse wedge-shaped divisions irregularly and pinnately few-toothed or -cleft with broad usually obtuse teeth, the midlobe about twice as long as the lateral lobes, the larger blades 2-4 cm. long and wide; inflorescence a narrow few- to many-flowered interrupted thyrses; pedicels rather stout, shorter to considerably longer than the calyx; calyx 6-7 mm. long, with deltoid-ovate to ovate-lanceolate short-acuminate lobes; petals grenadine or pink, often drying lavender or violet-color, 1-1.8 cm. long; carpels 12 to 15, with chartaceous walls, sometimes slightly connate at maturity, 4-5 mm. long, the dehiscent portion very obtuse to acutish and cuspidate at apex, the indehiscent portion prominently and rather coarsely or finely reticulate. On mt. slopes in extreme w. Tex.; rare from Tex. to Ariz. and n. Mex.

10. *Sphaeralcea angustifolia* (Cav.) D. Don. Perennial with erect stout stems from a thick woody crown, more or less stellately canescent throughout, to about 18 dm. high; leaves with petioles rarely more than one fourth as long as the blade, usually thickish, lanceolate to oblong-lanceolate or linear-lanceolate, cuneate at base, obtuse to acuminate at apex, 3-veined from base, to about 15 cm. long, usually much smaller, not lobed but often angulate near the base or subhastately toothed with acutish ascending teeth, the margins usually finely and regularly crenate or crenate-dentate; inflorescence a long narrow interrupted many-flowered thyrses, conspicuously leafy nearly to the apex, the lower branches not more than 4 cm. long; pedicels usually stout and much shorter than the calyx; calyx 5-9 mm. long, the lobes lanceolate to oblong-lanceolate and acuminate; petals usually mauve or lavender (often drying violet-color) but sometimes white or grenadine, 1-2 cm. long; carpels 10 to 15, with chartaceous walls, usually strongly connate at maturity, 3.5-6.5 mm. long, the erect dehiscent portion muticous to mucronulate or sometimes short-cuspidate or spinulose at apex, the indehiscent portion very finely reticulate. In sandy or rocky soils, mostly limestone and gypsum, waste places and along roadsides, mainly in the Trans-Pecos and Rio Grande Plains, less common eastw., throughout the year; from Kan. and Colo., s. to Tex., Ariz. and Mex. The variants in our region have been segregated as follows:

1. Petals usually pink or lavender; carpels usually obtuse, mucicous or mucronulate; leaf blades only angulate or obscurely toothed near the base
.....var. *angustifolia*.
1. Petals usually grenadine; carpels usually acutish, mucronate or cuspidate; leaf blades distinctly toothed or short-lobed near the base (2)
- 2(1). Leaf blades not more than one third as wide as long, with subhastate teeth usually less than one tenth as long as the midlobevar. *cuspidata* Gray.
2. Leaf blades one third to one half as wide as long, with subhastate lobes one tenth to one fifth as long as the midlobevar. *lobata* (Woot.) Kern.

11. *Sphaeralcea incana* Torr. Perennial with several to many erect stems from a stout woody crown and a large taproot, very densely yellowish-canescens with very short scurfy hairs, the stems to 18 dm. high; leaves with stout petioles shorter than the blades, typically yellowish-green, usually rather thick and with veins prominent beneath, deltoid-ovate, usually truncate to subcordate at base, very obtuse to slightly retuse and often mucronulate at apex, scarcely lobed to very shallowly 3- to 5-lobed with broad rounded lobes usually at or near the middle, the midlobe seldom less than 5 times the length of the lateral lobes, the margins usually crenulate but sometimes irregularly and rather coarsely crenate or dentate, the larger blades 3-7 cm. long and about as wide; inflorescence a long narrow interrupted many-flowered thyse, the lower branches seldom more than 3 cm. long; pedicels rather slender but exceptionally tough and persistent, shorter to much longer than the calyx; bractlets of the involucl thickish, not becoming red or purple; calyx 3.5-6.5 mm. long, with deltoid-ovate to ovate-lanceolate acute to short-acuminate lobes; petals grenadine-pink, 1-1.7 cm. long, often well-separated at base; carpels 11 to 14, with chartaceous walls, usually not connate at maturity, 4-5 mm. long, the dehiscent portion obtuse to acutish and cuspidate, the indehiscent portion faintly or rather prominently and usually finely reticulate. On grassy-rocky slopes, sandy soils, among boulders and on gravelly-clay flats in the Trans-Pecos, June-Oct.; from Tex. to Ariz. and n. Mex.

12. *Sphaeralcea Fendleri* Gray. Perennial with several erect or ascending stems from a woody crown, green and sparsely pubescent to densely grayish- or whitish-canescens with usually very short hairs, the stems to 14 dm. high; leaves with slender petioles usually less than one half as long as blade, thin or thickish, grayish-green, usually dark-green above, lighter colored and often densely whitish-canescens beneath, ovate-oblong to very broadly ovate, usually strongly cuneate at base, acute to obtuse and often mucronulate at apex, very shallowly to very deeply 3-lobed below the middle with relatively narrow triangular or nearly rectangular usually ascending acutish lateral lobes about one fourth as long as the midlobe, the midlobe sometimes coarsely and irregularly few-toothed or -cleft, the margins coarsely to finely crenate or crenate-dentate, the larger blades 3-6 cm. long; inflorescence a very narrow interrupted many-flowered thyse, the lower branches not exceeding 3 cm. long and usually much shorter; pedicels slender but very tough and persistent, usually equaling or longer than the calyx; bractlets of the involucl thin, usually green; calyx 4.5-6 mm. long or rarely more, with deltoid to ovate-lanceolate and acute to short-acuminate lobes; petals grenadine or occasionally grenadine-pink, rarely mauve, drying violet-color, 8-13 mm. long; carpels 11 to 15, with chartaceous walls, often somewhat connate at maturity, 4-5 mm. long, the dehiscent portion usually very obtuse and cuspidate, the indehiscent portion usually faintly and very finely reticulate. Uncommon in gravelly soils and about boulders in mts. of the Trans-Pecos, Apr.-Nov.; from s. Colo. and w. Tex. to Ariz. and n. Mex.

18. MALVASTRUM GRAY

Plants annual or perennial, herbaceous or shrubby, sparsely to densely stellate-pubescent or hispid; leaves ovate to orbicular, crenate or palmately cleft; flowers axillary or in terminal bracted inflorescences; calyx subtended by an involucl of narrow or foliaceous bractlets; petals yellow or purple; carpels few, compressed or somewhat turgid, rugose on the sides, sometimes tuberculate or aristate on the back, indehiscent.

About a dozen species that are native to tropics and subtropics of America.

1. Flowers mostly in capitate or spicate terminal inflorescences; carpels blunt
.....1. *M. americanum*.
1. Flowers mostly solitary in the leaf axils, rarely with some capitate (2)
- 2(1). Petals about 10 mm. long; carpels about 3 mm. long, aristate; stems and branches
not lepidote-stellate2. *M. coromandelianum*.
2. Petals 15 mm. long or more; carpels about 5 mm. long, not aristate; stems and
branches shortly lepidote-stellate3. *M. aurantiacum*.

1. *Malvastrum americanum* (L.) Torr. MALVA LOCA. Perennial, erect, stout, branched, usually densely stellate-pubescent, to about 2 m. high; leaves broadly ovate, serrate, stellate-pubescent, acute to acuminate at apex, subtruncate to obtuse at base, the lower leaves long-petioled and to 7 cm. long, the upper leaves smaller; flowers in dense terminal cylindrical spikes 5-12 cm. long and 15-25 mm. thick, with sometimes a few in the upper axils; bractlets 5-7 mm. long; calyx barbately hirsute or hispid, about 5 mm. long, the lobes acuminate; petals yellow to orange-yellow, about 7 mm. long; carpels nearly 2 mm. long, depressed-reniform, beaked, not aristate. *M. spicatum* (L.) Gray. A pantrop. weedy plant in palm groves, thickets, old lake beds and open woods in the Rio Grande Plains and Valley, flowering the year around.

2. *Malvastrum coromandelianum* (L.) Gke. Perennial, freely branched, strigose-pubescent, to about 1 m. high; leaves slender-petioled, ovate to ovate-oblong or lanceolate, 2-8 cm. long, acute, irregularly and sharply serrate, the hairs of the upper surfaces mostly simple; flowers mostly solitary in the axils, on peduncles shorter than the petioles; involuclers of 3 small narrow bractlets; calyx lobes triangular, acute, longer than the tube; petals pale-yellow to orange-color, somewhat longer than the calyx, obliquely truncate; carpels 8 to 12, hirsute on top, with an awn near the inflexed apex and 2 beaks on the back. *M. tricuspidatum* (Ait.) Gray. A pantrop. weedy plant on the Edwards Plateau and in s. Tex., mostly in clay soils, flowering the year around.

3. *Malvastrum aurantiacum* (Scheele) Walp. Plant with rigid stems ascending from a lignescent base, to about 6 dm. high, sparingly branched; leaves slender-petioled, subcordate-oval to oblong, broadly cuneate to truncate at base, obtuse at apex, rather coarsely crenate-serrate; bractlets of the involucler ovate or subcordate, adnate to base of calyx and more or less surpassed by the ovate-acuminate calyx lobes; petals golden-yellow, about 13 mm. long; carpels 15 to 20, firm-coriaceous, much-compressed, brownish-red at maturity, smooth, the narrow back flat with acutish angles, hirsute at top where it is dorsally 2-gibbous and ventrally subulate-aristate or pointed. *M. Wrightii* Gray. Rare in cen. and s. Tex., Apr.-Sept.; undoubtedly also in Mex. adj. to Cameron Co.

19. BASTARDIA KUNTH

About 8 species in tropical or warm temperate America.

1. *Bastardia viscosa* (L.) H.B.K. Perennial herb or subshrub, erect, to about 1 m. high, branched, finely velvety-pubescent and viscid (especially above), sometimes also pilose; leaves with slender petioles about as long as blades or shorter, ovate, cordate at base, acute to abruptly long-acuminate at apex, to 8 cm. long, the margins irregularly sinuate-denticulate, paler beneath and stellate-tomentulose; peduncular pedicels nearly filiform, usually longer than the petioles and often longer than the leaves; flowers small, peduncled, solitary or few in the axils; involucre none; calyx about 4 mm. long, its 5 ovate-lanceolate acuminate lobes about as long as the tube; petals 5, yellow, 4-6 mm. long; stamen column divided into several or many filaments at the apex; ovary 5-celled; style branches 5, the stigmas capitate; capsule depressed-globose, 5-grooved, about twice as long as the calyx, its usually 5 carpel valves beakless; seeds puberulent. *Sida viscosa* L. In clay soils in chaparral, palm groves and thickets in the Rio Grande Valley, flowering throughout the year; from Tex., s. through Mex., C.A. and the W.I. to S.A.

20. GAYA H.B.K.

About 20 species with one in Texas, the others in the American tropics.

1. *Gaya violacea* Rose. Shrub slender, erect, to about 2 m. high, the branches clothed with short soft pubescence together with long spreading hairs; leaves with petioles 4-6 cm. long, ovate to lanceolate, acuminate, 6-9 cm. long, coarsely crenate, cordate at base with the sinus either narrow or closed, green and becoming glabrate above, pale and finely stellate-pubescent beneath; peduncles slender, a little shorter than the petioles, pilose as well as stellate-pubescent; flowers in axils; calyx lobes ovate, acute; petals about 8 mm. long, blue or violet; carpels 9, each 1-seeded, membranaceous, bivalvate, with a longitudinal endoglossum that usually more or less divides the cavity of the carpel. Among boulders and rubble below the "Window" in the Chisos Mts., Oct.-Nov.; also n. Mex.

21. SIDA L.¹²⁹

Plants mostly perennial, herbaceous or suffrutescent, more or less pubescent with forked stellate or scalelike hairs; flowers axillary, solitary or in small cymules, these sometimes assembled in terminal leafy panicles; involucl usually none; carpels indehiscent or dehiscent only part way from the apex, more or less rugose and often reticulate on the sides.

More than 200 species, mostly in warmer regions of the world, especially in Latin America.

1. Peduncles or pedicels adnate to the petiole of the subtending leaf or bract; leaves sparingly serrate toward apex, mostly narrow, linear to narrowly oblong or suborbicular; flowers mostly in dense but few-flowered apical clusters that are closely subtended by the upper leaves and the conspicuously hirsute-ciliate stipules; carpels 5 to 8, with usually short murications 1. *S. ciliaris*.

1. Peduncles or pedicels not so adnate (2)

2(1). Involucl present or the herbage silvery-lepidote or the leaves wider than long; flowers axillary, solitary or very few in the axils; carpels muticous or short-beaked (3)

2. Involucl none; herbage not silvery-lepidote; leaves mostly longer than wide (6)

3(2). Plants herbaceous, the flowering stems from creeping rootstocks; leaves very asymmetric at base; flowers distinctly pedicelled, the pedicels often more or less flexuous and decurved; petals white or whitish; carpels 6 to 10 (4)

3. Plants suffrutescent; leaves not noticeably asymmetric; flowers sessile to shortly pedicellate; petals yellow or copper-colored; carpels normally 5 (5)

4(3). Herbage densely stellate-canescens; leaves wider than long, suborbicular or somewhat flabelliform, rounded at apex, rather regularly denticulate or dentate; involucl of 1 to 3 subulate bractlets, usually present but very caducous; carpels indehiscent 2. *S. hederacea*.

4. Herbage closely silvery-lepidote; leaves mostly longer than wide, acutish to acuminate at apex, often subhastately toothed or lobed at base; involucl rarely (if ever) present; carpels dehiscent at apex 3. *S. leprosa*.

5(3). Leaves flabelliform, more or less cuneate at base; carpels with 2 protracted apical peaks 4. *S. Grayana*.

5. Leaves suborbicular, rounded to truncate at base; carpels bluntly peaked, not protracted 5. *S. Helleri*.

6(2). Calyx greatly accrescent to enclose the fruit, membranous and veiny, the broad lobes overlapping; plants herbaceous above ground; flowers solitary in the axils; petals yellow or whitish 6. *S. physocalyx*.

6. Calyx otherwise, only moderately accrescent (7)

¹²⁹ Based, in part, on I. D. Clement in Contr. Gray Herb. 180:1-91. 1957.

- 7(6). Flowers mostly in open (or sometimes thyrsoid) more or less leafy panicles, numerous, usually long-pedicellate; petals less than 1 cm. long; carpels few 7. *S. paniculata*.
7. Flowers not in many-flowered panicles or (if so) then short-pedicellate and crowded, or if paniculate and long-pedicellate then the flowers few and scattered (8)
- 8(7). Carpels 5 (9)
8. Carpels more than 5 (10)
- 9(8). Herbage usually with both stellate pubescence and long simple hairs; petiole without a tubercle at base; pedicels very slender, usually elongate; calyx more or less angulate-turbinate; petals yellowish to orange 8. *S. filicaulis*.
9. Herbage minutely stellate-puberulent; petiole of largest leaves with a small spine-like tubercle at base; pedicels relatively stout, usually very short, the flowers often subsessile; petals pale-yellow 9. *S. spinosa*.
- 10(8). Corolla violet-purple; stems woody, stellate-pubescent; leaves linear to oblong, mostly 3 or more times as long as wide; flowers solitary; peduncles slender, articulated toward apex, elongate (often surpassing the subtending leaves); carpels 7 to 10, prominently rugose-reticulate 10. *S. filipes*.
10. Corolla whitish to orange or pink, sometimes drying red (11)
- 11(10). Carpels normally long-aristate and the awns retrorsely hispid; leaves not rhombic; stems usually herbaceous, occasionally with long spreading simple hairs in addition to other pubescence 11. *S. cordifolia*.
11. Carpels not long-aristate or (if sometimes so as in *S. rhombifolia*) the awns not retrorsely hispid and the leaves usually more or less rhombic (12)
- 12(11). Peduncles usually equaling or surpassing the subtending leaves, these often much-reduced in the inflorescence; flowers solitary in the axils; leaves not rhombic; carpels about 10 (13)
12. Peduncles usually much shorter than the subtending leaves (sometimes with exceptions in *S. rhombifolia* and *S. tragiaefolia*) (14)
- 13(12). Peduncles to 5 cm. long; carpels cuspidate, puberulent or glabrate, prominently rugose-reticulate 12. *S. Lindheimeri*.
13. Peduncles 7.5-15 cm. long; carpels muticous, glabrous 13. *S. longipes*.
- 14(12). Leaves normally more or less rhombic and cuneate at base, lanceolate to ovate or obovate, finely serrate, discolorous, short-petiolate; plants herbaceous or suffrutescent, rarely shrubby; herbage and calyx finely stellate-pubescent or glabrate; stipules more or less persistent; flowers axillary, solitary or more or less aggregated at ends of the branchlets, the peduncles much shorter than to nearly equaling the leaves; petals somewhat longer than the calyx, yellow or whitish, sometimes purplish at base; carpels mostly 10 to 14, nearly muticous to long-aristate, with glabrous or antrorsely pilosulous awns 14. *S. rhombifolia*.
14. Leaves not rhombic or cuneate, serrate or crenate (15)
- 15(14). Upper leaves often greatly reduced and the inflorescence appearing elongate-racemose; peduncles often longer than the subtending leaves; leaves prevailingly ovate to oblong-lanceolate, truncate to subcordate at base, crenate or crenate-serrate, often coarsely so; plant often suffrutescent; calyx puberulent to villous; petals orange or yellow, 1-1.5 cm. long 15. *S. tragiaefolia*.
15. Upper leaves usually not greatly reduced; peduncles shorter (usually much shorter) than the subtending leaves; leaves narrower, rounded at subcuneate at base, finely serrate or serrulate; plant herbaceous 16. *S. neomexicana*.

1. *Sida ciliaris* L. **BRACTED SIDA**. Diffuse many-stemmed herb or subshrub to about 3 dm. high, mostly spreading-prostrate, stellately strigose-pubescent; leaves long-petioled, linear to suborbicular, obtuse to truncate-retuse and often with a cusp at apex, rounded to cordate at base, serrate above the middle, to 25 mm. long, glabrous above, stellately

appressed-pubescent beneath; stipules filiform- or spatulate-linear, conspicuous, at least the uppermost and the petioles hirsute-ciliate or barbate; calyx 5-7 mm. long, the lobes ovate-triangular; petals white to yellow or various salmon-color to rose-purple, to 15 mm. long; carpels 5 to 8, turgid, very strongly rugose-reticulated and over the back often tuberculate or muricate, the dehiscent apex 1- or 2-aristate. In sandy soils of pastures, scrub oaks, mesquite thickets and along roadsides and on clay flats in s. Tex., throughout the year; from Fla., Tex., the Bah. I. and W.I., s. to S.A. Two variants occur in Texas.

Var. *ciliaris* (*S. muricata* Cav.)—Leaves ovate to suborbicular, obtuse to truncate at apex; carpels shortly biaristate.

Var. *mexicana* (Moric.) Shinnery—Leaves linear to linear-lanceolate; carpels short-aristate.

2. *Sida hederacea* (Hook.) Gray. DOLLAR WEED, ALKALI MALLOW. Plant with decumbent stems and branches, scurfy-canescens with stellate hairs; leaves with petioles about one half as long as blades, obliquely subreniform or triangular-ovate, more or less cordate at base, broadly rounded to bluntly obtuse at apex, to about 4 cm. long and 5 cm. wide, the margins variably and irregularly crenate to acute-serrate; flowers axillary, with pedicels usually slightly longer than the petioles; calyx 4-8 mm. long, the lobes ovate to triangular-lanceolate and short-acuminate; petals whitish to cream-color or pale-brownish-yellow, rose-color in drying, to about 15 mm. long; carpels 6 to 10, acutish, tomentulose to glabrate. *S. leprosa* var. *hederacea* (Dougl.) K. Schum. In rocky or silty soils, along irrigation canals and in depressions in the Panhandle and Trans-Pecos, Mar.-Oct.; from Wash. and Ida., s. to Mex. and e. to Kan., Okla. and Tex.

3. *Sida leprosa* (Ort.) K. Schum. SCURFY SIDA. Low herb with stems commonly prostrate and to about 4 dm. long, scurfy-lepidote throughout, silvery when young; leaves slender-petioled, obliquely deltoid to triangular-lanceolate, commonly semicordate or semisagittate at base, mostly acute at apex, irregularly or incisely dentate, to about 35 mm. long; lower pedicels usually elongated and (in fruit) deflexed with the apex incurved; calyx 3-8 mm. long, deeply divided into ovate acuminate lobes, somewhat ampliate and angulate in age; petals purple to yellow or white with a purple tinge; carpels 8 or 9, thin-walled, mucous, glabrous. In igneous soils, on clay flats and rocky areas from cen. to w. Tex., throughout the year; widespread in s.w. U.S. and Tex.

Two varieties are recognized in Texas.

1. Leaves deltoid, semicordate at base, mostly 1-3 cm. long, the upper margins irregularly notched and toothedvar. *depauperata* (Gray)

I. Clem. (*S. lepidota* Gray).

1. Leaves narrowly elongate-triangular, semisagittate at base, mostly 2-3 cm. long, the upper margins entire and straightvar. *sagittaeifolia* (Gray) I. Clem.

4. *Sida Grayana* I. Clem. Assurgent tomentulose-canescens subshrub, much-branched, the prostrate to ascending stems to 45 cm. long or more; leaves with petioles usually less than 6 mm. long, flabelliform to cuneiform or some rotund with barely cuneate base, repand-dentate or crenulate around the broad summit, to 16 mm. long and wide; stipules linear-oblongate, herbaceous; flowers subsessile; calyx commonly not surpassing the fruit; petals obovate, yellow, becoming orange-yellow with age, 5-6 mm. long; carpels 5, turgid and thin-walled, about 5.5 mm. high, peaked (with dehiscence sharply 2-beaked). *S. cuneifolia* Gray. In saline soils in the Rio Grande Plains and Valley of s. Tex., Apr.-Sept.; also adj. Mex.

This and the following species are extremely close. They may eventually prove to be conspecific.

5. *Sida Helleri* Rose. COPPER SIDA. Suffrutescent, much-branched; branches spreading or procumbent, cinereous, to 3 dm. long or more; leaves suborbicular, crenate, rounded to truncate at the base, to about 16 mm. in diameter, loosely stellate-pubescent on both surfaces; petioles slender, 6-12 mm. long; stipules elliptic-obovate to elliptic; flowers small, subsessile or with pedicels to 4 mm. long, leafy-bracted; sepals ovate-oblong, obtusish, becoming 6 mm. long, surpassing the fruit; corolla pale-copper-colored; carpels 5, obtusely peaked. In sandy or clayey soils of s. coastal Tex., Feb.-May; endemic.

6. *Sida physocalyx* Gray. Plant loosely and coarsely stellate-hirsute, green, partly glabrate; stems spreading or decumbent from a fleshy-ligneous perennial rootstock, to about 4 dm. long; leaves with petioles to 3 cm. long, rather succulent, suborbicular to oblong, obtuse to broadly rounded at apex, cordate at base, to 6 cm. long and 5 cm. wide, crenate or serrate; pedicels solitary in the axils, soon recurved; calyx lobes cordate in appearance, with a small apical ligule, in anthesis about 8 mm. long and pale-green, at length 10-12 mm. long, membranaceous and veiny, together connivent and forming a vesicular globular and wing-angled loose covering over the fruit; petals yellowish or buff-color, scarcely exceeding the calyx; carpels 10 to 14, blackish when mature, ovate with a short beaklike apex, very thin-membranaceous and reticulate-veiny. *S. hastata* St.-Hil. In sandy, gravelly or rocky soils on prairies, in washes and waste ground, mainly in w. two thirds of Tex., May-Oct.; from Tex. to Ariz., s. to S.A.

7. *Sida paniculata* L. Slender erect herb or subshrub, the branches from a woody base and densely stellate-pubescent with coarse appressed fulvous hairs; leaves mostly short-petiolate, rarely with petioles to 6 cm. long, ovate to ovate-lanceolate, mostly densely stellate-pubescent, rounded to cordate at base, obtuse to acuminate at apex, crenate, to about 11 cm. long, usually much smaller; flowers in loose glabrate panicles; pedicels filiform, 2.5-4 cm. long, articulate 2-3 mm. below calyx; calyx nonangulate, 2-3 mm. long, the minute lobes triangular; petals reddish-purple to orange-red, acuminate-apiculate, reflexed at maturity, 3-4 mm. long; carpels 5, not beaked. *S. capillaris* Cav., *S. floribunda* H.B.K. In thickets, open woods and groves in the Rio Grande Plains and Valley, sandy soils, throughout the year; from s. Tex. and the W.I., s. to S.A.

8. *Sida filicaulis* T.&G. Stems branched at base, weak and prostrate-spreading, from a slender woody rootstock, to 5 dm. long or more, stellate-puberulent and with or without long spreading hairs; leaves with slender petioles about as long as the blade, broadly ovate to lanceolate, subtruncate to cordate at base, rounded to bluntly obtuse at apex, stellate-puberulent and sometimes with scattered long hairs, crenate-dentate, to 35 mm. long, usually much smaller; flowers solitary in axils of leaves, with slender pedicels much-exceeding the petioles; calyx somewhat angulate-turbinate, about 5 mm. long; petals orange-yellow or yellow, much-surpassing the calyx; carpels 5, varying from barely apiculate to the dehiscent apex with 2 prominent stout points. *S. diffusa* of auth., *S. procumbens* of auth., *S. filiformis* Moric. On rocky open hills, in sandy or rocky open woodlands, on ledges and in waste areas from n.-cen. to s. Tex., w. to the Trans-Pecos, mostly Mar.-Sept.; from Tex. to Ariz., the W.I. and n. S.A.; also Fla. Keys.

9. *Sida spinosa* L. PRICKLY MALLOW. Annual, finely pubescent, to about 7 dm. high; leaves with petioles to 3 cm. long, ovate to ovate-lanceolate or narrowly lanceolate, to about 55 mm. long and 3 cm. wide, broadly rounded to truncate or subcordate at base, obtuse to subacute at apex, crenate-dentate; stipules linear; petioles of the larger leaves with a small spinelike tubercle at the base dorsally; flowers axillary, with pedicels shorter than the petioles; calyx 5-7 mm. long, the lobes triangular and acute; petals pale-yellow, slightly exceeding the calyx; carpels 5, dehiscent at the apex into 2 prominent beaks. *S. angustifolia* Lam., *S. heterocarpa* Engelm. Mostly in waste lands and disturbed soils in the s. and e. half of Tex., throughout the year; a widespread weedy species mostly in the trop.

10. *Sida filipes* Gray. Subshrub or herbaceous from a perennial rootstock, to about 1 m. high, paniculately branched, rather slender, fulvous-canescens with close stellate pubescence; leaves very short-petioled, lanceolate or the lower ones oblong, coarsely dentate-serrate, obtuse to acute at apex, cordate to truncate at base, 2-7 cm. long, pubescent and dark-green above, canescently stellate-tomentose and pale beneath; pedicels filiform, as long as or longer than the leaves, articulate 3-6 mm. below calyx, the small flower nodding in and after anthesis; calyx lobes about 2 mm. long, ovate, obtuse; petals obovate, deep violet-purple, 4-5 mm. long; carpels 7 or 8, obtusely apiculate at the eventually dehiscent apex, puberulent to glabrate, the sides favose-rugose. In rocky ravines, on dryish limestone hills and flats on the Edwards Plateau and Rio Grande Plains of s. Tex., Mar.-Aug.; also n. Mex.

11. *Sida cordifolia* L. Perennial or somewhat woody annual, densely stellate-velvety-tomentose throughout, to 15 dm. high, the stems erect and rather stout; leaves ovate to ovate-orbicular or ovate-oblong, cordate at base, acute to obtuse at apex, irregularly

crenate-dentate, to 1 dm. long and 5 cm. wide, the lower leaves long-petioled; flowers terminal and axillary, corymbose or subglomerate, with pedicels to 15 mm. long; calyx canescent-tomentose, 5-angled, 6-8 mm. long, the triangular lobes acute; petals yellow or salmon-pink, nearly twice as long as the calyx; carpels 7 to 12, biaristate when dehiscent or merely bimucronate, their sides reticulated. *S. althaeifolia* Sw., *S. hamulosa* Salzm., *S. herbacea* Cav., *S. micans* Cav. Uncommon in sandy soils on plains and along roadsides in the Rio Grande Valley and Trans-Pecos, July-Nov.; from Fla. to Tex., the W.I. and trop. Am.; also Old World trop.

12. *Sida Lindheimeri* Engelm. & Gray. Plant stellately cinereous-puberulent, to about 9 dm. high, the erect or sprawling stems herbaceous from a woody base; leaves with petioles 1 cm. long or less, linear to linear-lanceolate, 1.5-4 cm. long, obtuse to acute at apex, truncate to rounded at base, serrate on the often purplish margins, minutely and densely; stellate-pubescent beneath; pedicels slender, borne mostly in the upper axils, to 5 cm. long, about equaling or frequently exceeding the subtending leaves; calyx 8-10 mm. long, the lobes broadly ovate and acute, the margins often purplish; petals yellow to salmon-color, 12-15 mm. long; carpels about 10, dorsally puberulent or glabrate, cuspidately bidentate. *S. texana* Small. In sandy soils in open woodlands, scrub and thickets, and in beach areas in s. and coastal Tex., Apr.-Oct.; from La. to Mex.

13. *Sida longipes* Gray. Stems herbaceous from a woody rootstock, strictly erect, branched from the base, somewhat scabrous-puberulent, not cinereous, to about 4 dm. high; leaves with petioles to about 25 mm. long, linear-elongate to linear-lanceolate, narrowly obtuse at apex, truncate to broadly cuneate at base, serrulate or crenulate on the often purplish margins, to about 6 cm. long, much-surpassed by the erect elongate pedicels that are to 15 cm. long; calyx about 7 mm. long, the lobes triangular-ovate and acute; petals orange-color, about 15 mm. long; carpels 8 to 10, puberulent to glabrous, muticous or only slightly obtuse. On limestone hills and mt. slopes in the Edwards Plateau and Trans-Pecos, rare in the Rio Grande Plains, Apr.-Sept.; also probably adj. Mex.

14. *Sida rhombifolia* L. AXOCATZIN. Plant herbaceous or shrubby, to about 2 m. high, the stems minutely stellate-pubescent; leaves short-petiolate, varying from rhombic-oblong to ovate-cuneate or oblanceolate, obtuse to rounded or subacute at apex, cuneate to rounded at base and usually minutely cordate at the very base, to 8 cm. long and 4 cm. wide, pale and cinereous-puberulent beneath, green and subglabrous above, serrate or serrulate; stipules setaceous, caducous; pedicels more or less elongated; calyx 5-7 mm. long, minutely cinereous-puberulent, the base (at maturity) with 5 to 10 callous-thickened nerves, the lobes broadly ovate and acuminate; petals pale-yellow to orange-yellow, about 6 mm. long, sometimes red at base; carpels 10, smoothish, subulately 2-awned or merely acute. *S. alba* Cav. In sandy-clayey soils in brushlands, meadows, low open woods and alluvial soils in e. third of Tex., throughout the year; from N.C. to Fla. and Tex.; widespread, mostly in the trop.

15. *Sida tragiaefolia* Gray. Herbaceous perennial to about 6 dm. high, stellar-pubescent or puberulent and with scattered long hairs throughout; leaves with petioles to 15 mm. long, ovate-oblong to linear-oblong, cordate to truncate at base, mostly obtuse at apex to about 5 cm. long, coarsely dentate, stellate-pilose beneath, glabrate above; flowers mostly solitary in the axils, with slender pedicels; calyx 7-8 mm. long, with a somewhat 10-angled base, densely stellate-tomentose and usually profusely adorned with long silvery hairs, the lobes triangular and acuminate; petals orange-yellow, to 14 mm. long; carpels 9 to 12, with thin sides rugose-reticulated below, smooth towards the obtuse bimucronate apex. Uncommon on limestone hills in the Rio Grande Plains and Big Bend region of the Trans-Pecos, May-Nov.; from Tex. to Ariz. and n. Mex.

16. *Sida neomexicana* Gray. Stems usually herbaceous, rather numerous from a woody rootstock, to about 4 dm. high, minutely stellate-pubescent; leaves with petioles 1 cm. long or less, linear-elongate to linear-oblong, to 6 cm. long, obtuse to acute at apex, rounded to truncate at base, serrate on the often purplish margins, finely stellate-pubescent (especially beneath) but green; flowers sessile or with pedicels to about 1 cm. long, borne mainly and somewhat clustered at the ends of the branches; calyx about 8 mm. long, the lobes broadly ovate and subacuminate; petals orange-color, turning purplish or reddish with age, about 1 cm. long; carpels 10, muticous or scarcely bimucronulate. In

rocky soils in mts. and plains of the Trans-Pecos, July-Nov.; from w. Tex. to s. Ariz. and n. Mex.

22. ANODA CAV.

Plants sparsely hirsute to densely puberulent or tomentose; leaves (especially the upper ones) often hastate at base; involucre none; fruit depressed, hemispheric or disklike; carpels usually umbonate or spurred on the back, with fragile lateral walls, these usually breaking up before maturity, the inner layer forming a saclike envelope of the seed or becoming closely adherent to the seedcoat, the dorsal wall more persistent.

About 10 species that are confined to the Western Hemisphere.

1. Fruit hemispheric or somewhat lower but not flat and disklike; carpels puberulent to short-hirsute, rounded to umbonate or angled to short-spurred on the back; calyx more or less conforming with the fruit 1. *A. pentaschista*.
1. Fruit a flattened disk of radiating carpels, these conspicuously long-hirsute to hispid, with an elongated dorsal spur; calyx spreading in fruit (2)
- 2(1). Essentially acaulescent plant to about 5 cm. high; leaves in rosette, ovate 2. *A. pygmaea*.
2. Stem well-developed, typically 30 cm. high or more; leaves scattered on stem, somewhat triangular (3)
- 3(2). Petals purple; herbage sparsely hirsute with long mostly simple spreading or retrorse hairs, sometimes slightly puberulent or glabrate; carpels 9 to 20, hispid, not reticulate on the back; leaves truncate or broadly cuneate at base 3. *A. cristata*.
3. Petals orange-yellow, purplish at base; herbage densely stellately puberulent or short-pilose, a few long simple hairs often also present, the pubescence slightly viscid; carpels 10 to 12, hirsute, strongly reticulate on the back with black veins; lower leaves cordate or subcordate at base 4. *A. Wrightii*.

1. *Anoda pentaschista* Gray. Plant very slender, to about 6 dm. high, paniculately branched, puberulent and more or less cinereous throughout; leaves to 7 cm. long, usually much smaller, pale beneath, the slender-petioled lower ones ovate to subcordate and somewhat 3-lobed, the upper short-petioled leaves hastate to lanceolate or with some linear; flowers with slender pedicels to 25 mm. long that are noticeably articulated above the middle, arranged in panicles; calyx about 4 mm. long, rounded and apiculate, a little shorter than the bright-yellow corolla; carpels usually 5, sometimes 6 to 9, dehiscent dorsal portion closely applied to and half covering the puberulent seed, membranous with an inflexed thickish apex. Incl. var. *obtusior* Robins. In open woods and thickets in the Rio Grande Plains and Valley, and in the Trans-Pecos, Aug.-Dec.; from Tex. to Ariz. and adj. Mex.

2. *Anoda pygmaea* Correll. Plant about 5 cm. high, essentially acaulescent, consisting of a rosette of leaves and one or more pedunculate flowers that are large for the plant, densely covered with stellate hairs; petioles stout, to 3 cm. long; blades thickish, ovate to ovate-elliptic, usually slightly longer than petioles, to about 2 cm. wide, rounded to slightly cordate at base, obtuse at apex, coarsely crenate-serrate, the primary veins prominent; peduncle slender in flower, becoming stout in fruit, to about 2 cm. long; sepals 5, united for about half their length to form a concave disk 2.5-3 cm. wide, the spreading lobes broadly triangular and acute, with simple hairs on the inner surface; petals probably (?) yellowish, obovate-oblongate, about 15 mm. long and 8 mm. wide above middle; fruit a flattened disk of 12 radiating carpels; carpels about 5 mm. long, conspicuously beaked and dorsally spurred, the outer surface stellately pubescent, the sides or partitions coarsely reticulate-honeycombed; seeds reddish-brown, glabrous except for several cilia about the hilum. Definite locality unknown. "Texas, Pope" (Capt. John Pope explored Texas in 1854 from Preston, Grayson Co., on the Red River southwest to El Paso on the Rio Grande.)

3. *Anoda cristata* (L.) Schlecht. Plant branched from near base, erect, to about 8 dm. high, sparsely hirsute with mostly simple hairs; leaves petiolate, deltoid to triangular-

ovate or -lanceolate, truncate to broadly cuneate at base, acute to acuminate at apex, occasionally hastate or subtrilobate at the base, the margins either irregularly dentate or entire; flowers solitary on long peduncles in the axils; calyx with triangular-lanceolate acuminate spreading lobes to 15 mm. long, often purplish-red; petals purple, commonly cuneiform and retuse, 1-2.5 cm. long; carpels 15 to 20, rather conspicuously beaked, hispid, the dorso-basal portion wholly thin-scarious and veinless and with slender mid-nerve, the sides or partitions wholly obliterated in the breaking up of the fruit; seeds naked, puberulent. *A. lavaterioides* Medic., *A. hastata* of auth. On gravelly banks and in open woods along streams in the Trans-Pecos, July-Nov.; from Tex. to Ariz., s. to S.A.

The leaves of this species are exceedingly variable, even upon the same individual. Our plant usually has the upper leaves elongated and conspicuously hastate.

4. *Anoda Wrightii* Gray. Plant erect, to 15 dm. high, viscidulous-puberulent and above more or less villous-hirsute; lower leaves deltoid-ovate, the upper ones hastate-lanceolate; peduncles about equaling or exceeding the subtending leaves, or the upper ones in a naked raceme and subtended by linear or filiform deciduous bracts; calyx canescently pubescent; petals dull-yellow, 1-1.3 cm. long, changing to brown-purple at base; carpels 10 to 12, beaked, the dorsal portion bilamellar at maturity, the tardily separable endocarpial layer of firm texture, clathrate-reticulate, loosely half-enveloping the minutely or sparsely puberulent seed. Rare in shrubby growth in the Trans-Pecos, July-Sept.; from Tex. to Ariz. and adj. Mex.

FAM. 116. STERCULIACEAE BARTL.

CACAO FAMILY

Trees, shrubs or herbs, sometimes scandent, the pubescence chiefly of stellate hairs; leaves alternate, simple or rarely compound, usually stipulate; flowers large or small, mostly in axillary cymes, perfect or unisexual, regular or sometimes irregular; calyx persistent, gamosepalous, usually 5-parted; petals 5 or none, hypogynous, free or united with the stamen tube; stamens 5, connate at least at the base, the tube commonly with 5 staminodia, the 2- or 3-celled anthers borne in the sinuses; fruit dry or rarely baccate, usually 5-celled, variously dehiscent.

About 700 species in 60 genera, mainly tropical and Old World. The seeds of the important tropical American tree, *Theobroma cacao* L., are the source of cocoa and chocolate. The Chinese parasol-tree, *Firmiana simplex* W. Wight, is cultivated in central and south Texas, but it apparently does not occur as an escape.

1. Petals concave or cucullate (2)

1. Petals flat (3)

2(1). Petals mostly rhomboidal, united at the apex with the stamen tube, with or without a dorsal gland1. *Ayenia*, p. 1055.

2. Petals reniform, free from the stamen tube, without a dorsal gland
.....2. *Nephropetalum*, p. 1057.

3(1). Fruit with numerous pubescent processes; seeds numerous in each cell
.....3. *Hermannia*, p. 1057.

3. Fruit without pubescent processes; seeds 2 in each cell or (by abortion) only one (4)

4(3). Capsule 1-celled, 2.5-3 mm. long4. *Waltheria*, p. 1058.

4. Capsule 5-celled, 4-9 mm. long5. *Melochia*, p. 1058.

1. AYENIA L.¹³⁰

Shrubs or herbs; leaves simple, serrate, crenate or dentate; flowers small, perfect, long-pedicellate, axillary, solitary, fasciculate or in cymes or umbels; calyx 5-lobate; petals 5, with slender claws, cucullate, the apex inflexed and adnate to the stamen tube, often with an elongate gland; stamens 5, alternating with staminodes; anthers 2- or 3-celled, solitary

¹³⁰ Adapted from Carmen L. Cristóbal in *Opera Lilloana IV* (Argentina): 1-230. 1960.

in the sinuses of the stamen tube; fruit a 5-celled warty or spinescent globose capsule that separates into five 1-seeded bivalvate carpels.

About 70 species in warmer regions of America.

1. Flowers 2 or more on a common peduncle from leaf axils; some of the leaves to 35 mm. wide; localized in Brownsville region1. *A. limitaris*.
1. Flowers borne singly or in fascicles in leaf axils; leaves rarely more than 15 mm. wide; apparently usually north of the Brownsville region (2)
- 2(1). Stems stiffly erect; flowers mostly in fascicles; leaf blades typically lanceolate, often narrowly so; fruit on slender stipe 2-3 mm. long or sometimes more; petals with an appendage on the inner face2. *A. filiformis*.
2. Stems with spreading branches; flowers usually solitary or as many as 3; leaf blades typically broadly ovate to ovate-elliptic; fruit on stout stipe about 1.5 mm. long or less; petals with or without an appendage on the inner face (3)
- 3(2). Blade of petals notched at apex and with a somewhat clavellate appendage on the upper part of the inner surface and 2 teeth on the lower part; leaves typically ovate-elliptic, their lower surface sparsely coarsely pubescent with simple or once-branched hairs, rarely subglabrous or with scattered stellate hairs3. *A. pilosa*.
3. Blade of petals not notched and without an appendage or teeth; leaves typically suborbicular-ovate, their lower surface felty with a dense covering of short stellate hairs4. *A. microphylla*.

1. *Ayenia limitaris* Cristóbal. Shrub to about 15 dm. high, with hoary young branches; stipules 4-5 mm. long, subulate, pubescent; leaves with pubescent petioles to about 25 mm. long, ovate, to about 75 mm. long and 35 mm. wide, subacute to subacuminate at apex, rounded to more or less cordate at base, irregularly dentate to dentate-crenate on margins, lightly pubescent above, with long silvery-stellate hairs below but the epidermis not entirely covered; peduncles 1 to 4 at each node, axillary, about 1 cm. long, each supporting 3 flowers; pedicels 3-7 mm. long, pubescent; sepals about 3 mm. long and 1 mm. wide, oval-lanceolate, pubescent; petal with claw 2.5 mm. long, the lamina 1 mm. long and 1.5 mm. wide, lobules rounded with the margins nearly entire; stamen tube 1 mm. long, the external border of the staminodes with a small orifice at each side; style and stigma 0.5 mm. long, the stigma exerted with the lobules slightly notched; fruit 8 mm. long, covered with very short hairs, the prickles 1 mm. long and uniformly pubescent; seeds 4-5 mm. long, wrinkled, tuberculate. *A. Berlandieri* of auth. In clay soil on the edge of thickets and in chaparral in the Brownsville region in the Rio Grande Valley, throughout the year; also Coah.

2. *Ayenia filiformis* Wats. Subshrub to 9 dm. high, erect, very much branched from base, the woody stem to 2 cm. thick, the branches covered with short appressed hairs; stipules subulate, 3-5 mm. long, pubescent; leaves with petioles 5 (to 15) mm. long, orbicular to oval on lower part of branches and to 35 mm. long and 5-18 mm. wide, ovate-lanceolate to lanceolate toward end of branches and 25-55 mm. long and 5-10 mm. wide, rounded at base, subacute at apex, the margins serrated, pubescent with short hairs; the compact inflorescence composed of about 11 rose-color or red flowers; pedicels 3-4 mm. long; sepals 2-3 mm. long, 1-1.5 mm. wide, oval-lanceolate, pubescent; petal with claw 3-6 mm. long, subtriangular to rhomboidal, 1-2 mm. long, 1-2.5 mm. wide, the posterior side concave, straight or convex, the outer surface pubescent, appendage about one third as long as lamina; stamen tube 1 mm. long, free portion of filaments reaching middle of tube, the internal margin of the staminode not reaching the style; style 0.5 mm. long, partially exerted; stigma with small globose lobes; fruit 3-4 mm. long, densely pubescent, the prickles 0.5 mm. long; seed 2.5-3 mm. long, tuberculate. On limestone and granite soils on hills, bluffs and in canyons in mts. of the Trans-Pecos, May-Dec.; from Tex. to Ariz. and n. Mex.

3. *Ayenia pilosa* Cristóbal, Subshrub, decumbent, 1-2 dm. high, very much branched from the base, the branches covered with appressed hairs; stipules 0.5-1 mm. long, pubescent, subulate; petiole 5 (to 10) mm. long, pubescent; leaf blade 15 (to 30) mm. long, 8 (to 10) mm. wide, orbicular on lower part of branches, ovate-elliptic to suborbicular

toward end of branches, the margin dentate to dentate-crenate, mostly adorned with long branched or simple hairs; flowers 2 or 3 in axils, reddish, with pubescent pedicels 1.5-2 mm. long; sepals oval, pubescent, about 2 mm. long and 1 mm. wide; petal with claw 4 mm. long, rhomboidal, about 1 mm. long and wide, with the upper side somewhat concave, the outer surface lightly pubescent, the appendage about half as long as the lamina, the lower teeth a little larger than the upper ones; stamen tube 1 mm. long, the free portion of filaments reaching to middle of tube; internal margin of staminodes not reaching the style; style 0.5 mm. long, partially exerted; stigma with small globose lobules; fruit 3-3.5 mm. long, covered with hairs, the prickles 0.5 mm. long; seeds 2-2.5 mm. long, lightly tuberculate, irregularly wrinkled. *A. pusilla* of auth. In rocky soils or sandy loam in mesquite-chaparral, on slopes and about rimrock in Rio Grande Plains, w. Edwards Plateau and Trans-Pecos, throughout most of year; from Tex. and N.M., s. to S.L.P. and Tam.

4. *Ayenia microphylla* Gray. Erect or spreading shrub to 6 dm. high; stem woody, to 17 mm. thick, the principal axis branched from the ground; young branches gray, with short appressed hairs; stipules 1.5-2.5 mm. long, subulate, persistent, pubescent; petiole to 12 mm. long, usually much shorter, hoary; leaf blade orbicular to suborbicular on lower part of stem, ovate on upper part, to 3 cm. long and 18 mm. wide, usually about 12 mm. long and 7 mm. wide, subacute at apex, marginally serrated, the nerves prominent, the lower surface (especially in young leaves) densely hoary-felty beneath with short stellate hairs; 1 or 2 flowers in axils, on pubescent pedicels about 4 mm. long; sepals 3 mm. long, 1.5 mm. wide, oval-lanceolate, stellately pubescent; stamen tube 1 mm. long, campanulate, lobed for one third its length, cucullate, the external margin waved, apiculate; filaments free at apex; style 5 mm. long, scarcely exerted; stigma capitate, globular, the lobes small; fruit 5 mm. long, pendulous, hoary, prickles 0.5 mm. long, obscure, pubescent; seed 3 mm. long, wrinkled, with small scattered tubercles. Among boulders and on limestone hills and slopes of arroyos in the Trans-Pecos and w. Edwards Plateau, throughout most of the year; from Tex. to Ariz. and Coah.

2. NEPHROPETALUM ROBINS. & GREENM.

A monotypic genus.

1. *Nephropetalum Pringlei* Robins. & Greenm. Stellate-tomentose unarmed shrub; stem terete, nearly glabrate; leaves simple, alternate, ovate, cordate with a narrow sinus, acuminate to an obtusish apex, crenate-dentate, palmately 7-nerved from the base, finely stellate-pubescent above, paler and tomentulose beneath, 9-12.5 cm. long, 4-7.5 cm. wide; petioles canescent-tomentulose, about 4 cm. long; stipules setaceous, deciduous, nearly 4 mm. long; axillary umbelliform cymes 2- or 3-flowered, about 25 mm. long, the peduncles about equaling the pedicels; flowers greenish, only about 2 mm. in diameter; calyx deeply 5-parted, the segments ovate; petals 5, unguiculate, slightly adnate at base to the staminal cup, free at the apex, the blade reniform with a deep sinus at the attachment of the claw, concave and neither appendaged nor glandular; stamens 5, united into a short cup; anthers 3-locular, sessile or nearly so, extrorse, the cells parallel and longitudinally dehiscent; staminodes 5, alternate with the stamens and opposite the sepals, rounded and cucullate at the summit; ovary sessile, globose, 5-celled; ovules 2 in each ovary-cell, superposed on axial placentae; style short, terete; stigma capitate; young fruit globose, covered with numerous pubescent processes; seeds by abortion solitary in the cells. Known only from Hidalgo Co. where it was collected once in August 1888; to be expected elsewhere in Tex. and in Tam.

3. HERMANNIA L.

About 300 species, mainly African.

1. *Hermannia texana* Gray. Plant suffrutescent or with herbaceous stems from a woody rootstock, to about 5 dm. high, more or less densely stellate-pubescent throughout; leaves thick-herbaceous, with petioles to 2 cm. long, suborbicular to broadly ovate-elliptic, mostly broadly rounded at apex, rounded to truncate or cordate at base, to about 6 cm.

wide, dentate to sinuate-dentate; flowers perfect, axillary, pendulous, 5-merous, several in a cyme, the peduncles to about 25 mm. long to exceed the recurved pedicels; calyx lobes triangular-lanceolate, acuminate, to 5 mm. long; petals deep-orange-yellow to orange-red, erect, persistent, 8-12 mm. long, the long claw with inrolled edges, the blade obliquely suborbicular, pandurate when spread out; stamens 5, connate below the middle to form a tube; anthers linear, about 3.5 mm. long, pubescent; capsule subglobose to oblong-quadrate, loculicidally 5-valvate, covered with hairy filiform processes to 3.5 mm. long; seeds several in each cell, dark-brown or blackish, crescentiform, pitted. In dry rocky calcareous or gypseous soils on slopes and prairies, in red sands, and rarely on the edge of salt marshes and on dunes along the coast from s. Edwards Plateau to the coast in Tex., Apr.-Nov.; also adj. Mex.

4. WALTHERIA L.

About 50 species widely distributed in the warmer regions of the world, mainly tropical America.

1. *Waltheria indica* L. *HIERBA DEL SOLDADO*. Shrub or somewhat herbaceous, from a woody rootstock, to about 2 m. high, more or less stellately velvety-tomentose throughout, erect or the branches sometimes decumbent; leaves with a petiole to 2 cm. long, broadly ovate to oblong-elliptic, obtuse to rounded at apex, rounded to subcordate at base, to 8 cm. long, crenate-dentate; flowers fragrant, perfect, 5-merous, in sessile or pedunculate glomerules to 1 cm. long; calyx strongly ribbed, the triangular-lanceolate acuminate lobes about as long as the tube; petals yellow, spatulate, obtuse, 4-6 mm. long, persistent in fruit, usually slightly longer than the calyx; stamens 5, the filaments more or less connate; anthers about 1 mm. long; style bearded; capsule obliquely globose, pubescent, 2.5-3 mm. long, 1-seeded. *W. americana* L. In rocky or sandy soil in extreme s. Tex., winter and spring; from s. Fla., s. Tex. and s. Ariz., s. throughout trop. Am.

5. MELOCHIA L.* BROOM-WOOD

Shrubs or herbs, with pubescence of simple or stellate hairs; leaves dentate; flowers mostly small, in cymes or dense axillary glomerules; involucrel present or wanting; calyx 5-lobate; petals 5, spatulate, marcescent; stamens 5, the filaments connate at the base or higher; capsule 5-celled, loculicidally 5-valvate, the cells 1-seeded; carpels easily separating, sometimes indehiscent.

About 75 species in warm regions of both hemispheres.

1. Involucrel of 3 or more bractlets; capsule subglobose, scarcely beaked, 5 mm. or less wide 1. *M. corchorifolia*.
1. Involucrel wanting; capsule angular or pyramidal, long-beaked, much more than 5 mm. wide (2)
- 2(1). Leaves glabrous or nearly so, green; capsule glabrous or glabrate, with sharp acute angles, short-stipitate 2. *M. pyramidata*.
2. Leaves densely stellate-tomentose, usually whitish beneath; capsule densely pubescent, with somewhat rounded angles, on a relatively long stipe 3. *M. tomentosa*.

1. *Melochia corchorifolia* L. Stem to 15 dm. high, glabrous or sparingly pubescent, virgately branched; leaves with petioles to about 2 cm. long, ovate to ovate-lanceolate, to 6 cm. long and 3 cm. wide, irregularly serrate and sometimes lobate, usually entirely glabrous; flowers cluster dense; calyx lobes acute; petals purple or with the claw yellowish, 4-7 mm. long; capsule subglobose, strigose with simple hairs, 4-4.5 mm. in diameter. Old fields, cult. grounds and waste places in s.e. Tex., Aug.-Oct.; from Fla. to Tex. and S.C., s. to Braz.; also Old World tropics, where native.

2. *Melochia pyramidata* L. Slender shrub to 2 m. high, often herbaceous, lightly pubescent to glabrate throughout; leaves with slender petioles to 12 mm. long, rounded-ovate to lanceolate, obtuse to short-acuminate at apex, rounded to broadly cuneate at base, to 35 mm. long and 2 cm. wide, serrate, thin, green, glabrous or frequently sparsely

* Cf. Aaron Goldberg in *Contr. U. S. Nat. Herb.* 34: 191-363. 1967.

pubescent; flowers solitary or in axillary cymes, mostly pedicellate; calyx lobes long-acuminate; petals pink or violet, about 7 mm. long; capsule broadly triangular in outline, glabrate or sparsely puberulent, 5-6 mm. long and somewhat broader, the lobes truncate or broadly rounded at base, acute and spreading; seeds dull-brown to black. In sandy or rocky soil in mesquite thickets, palm groves, dry stream beds, ditches and waste places in the Edwards Plateau and Trans-Pecos, s. to the coast in Tex., Apr.-Nov.; widely distributed in the warmer regions of both hemispheres. We have only var. *pyramidata*.

3. *Melochia tomentosa* L. Shrub to 2 m. high, the branches herbaceous, more or less pale stellate-tomentose throughout; leaves with petioles to 25 mm. long, broadly rhombic-ovate to elliptic-lanceolate or oblong-elliptic, rounded to acute at apex, rounded to subcordate at base, to 7 cm. long and 4 cm. wide, crenate or dentate, thick, usually densely and finely tomentose on both surfaces; flowers in loose cymes, mostly pedicellate; calyx lobes lanceolate to linear-lanceolate, acuminate, pubescent; petals pink to violet, to 15 mm. long; capsule rhombic in outline, stellate-tomentose, 6-9 mm. long, long-beaked, the lobes rounded to acutish at base. In open woodlands and brushlands in s. Fla. and s. Tex., summer-fall; widely distributed in the warmer parts of the W. Hemis.

We have only var. *tomentosa*.

FAM. 117. THEACEAE D. DON

CAMELLIA FAMILY

Shrubs or small trees with simple alternate exstipulate deciduous leaves; flowers perfect, showy, borne singly in the axils of leaves; sepals 5 or rarely 6, somewhat unequal, persistent, subtended by one or more caducous bracteoles; petals 5 or rarely as many as 8, white, imbricate, silky pubescent on the outer surface, the outermost ones usually smallest and somewhat concave, connate at base; stamens numerous, the filaments united at their base and adnate to base of corolla; styles 5, distinct or united; ovary 5-celled, superior; capsule globose to ovoid, loculicidally dehiscent, woody, pubescent; seeds 1 to 4, compressed.

Several hundred species in about 25 genera mainly in the tropics of both hemispheres.

1. STEWARTIA L.

WILD-CAMELLIA. STEWARTIA

Characters of the family. A genus of about 10 species in eastern Asia and southern United States.

1. *Stewartia Malacodendron* L. SILKY CAMELLIA. Shrub or small tree to 6 m. tall; leaves shortly petioled, ovate to elliptic or somewhat obovate, cuneate at base, acute to shortly acuminate at apex, to 1 dm. long, the margins serrulate and ciliate, the lower surface light green and pubescent; sepals ovate, about 1 cm. long; petals white, obovate, spreading, 2.5-5 cm. long, the margins somewhat crimped; stamens with dark purple filaments and bluish anthers; styles united as one, stout, the stigma 5-toothed; capsule globular-depressed, beakless, about 15 mm. thick; seeds lustrous, angled but wingless. On wooded banks, hillsides and along streams in e. Tex., Apr.-May; from w. Fla. to La. and Tex., n. to Va., Tenn. and Ark.

FAM. 118. HYPERICACEAE JUSS.

ST. JOHN'S-WORT FAMILY

Herbs or shrubs; leaves with or without a basal articulation, opposite, entire, glandular-dotted as seen under a lens with transmitted light, mostly sessile, exstipulate; flowers perfect, usually regular and hypogynous; sepals 4 or 5, imbricated in the bud, herbaceous, with or without a basal articulation, persistent; petals 4 or 5, mostly deciduous, oblique and mostly convolute in the bud; stamens many or few, sometimes grouped in 3 or more clusters or bundles; capsule 1-celled, with 2 to 5 parietal placentae and as many usually persistent styles, sometimes 3- to 7-celled by the union of the placentae in the center, mostly septicidally dehiscent; seeds numerous, usually areolate or reticulate.

Approximately 1,000 species in about 50 genera, primarily tropical in distribution.

1. Sepals 4, in 2 very unequal pairs; petals 4; stamens many, distinct 1. *Ascyrum*, p. 1060.
 1. Sepals 5; petals 5; stamens many to few, often in 3 to 5 clusters 2. *Hypericum*, p. 1061.

1. ASCYRUM L.

ST. PETER'S-WORT

Low smooth pale essentially evergreen shrubs; stems simple or sparsely branched, when young 2-edged or winged; leaves usually numerous, small; flowers solitary or in small cymules, pedicellate, each subtended by a pair of bractlets; sepals 4, herbaceous, the 2 outer ones broad and leaflike, compressed and persistent, the 2 inner ones usually much smaller; petals 4, pale-yellow, oblique, fugacious, cruciate, spreading, convolute in the bud; stamens numerous, the filaments distinct and not noticeably in clusters, marcescent; capsule 1-celled, ovoid, 2- to 4-valved, enclosed by the sepals; seeds numerous, black, reticulate.

Five species, mainly in southeastern United States; merged with *Hypericum* by some authors.

1. Styles 3 or 4; inner sepals only slightly smaller than the outer ones that are to 2 cm. long and 15 mm. wide; leaves oblong-elliptic, the upper ones somewhat cordate and clasping 1. *A. stans*.
 1. Styles 2; inner sepals minute or obsolete; leaves mostly linear- to oblong-oblancoelate, narrowed at base 2. *A. hypericoides*.

1. *Ascyrum stans* Michx. ST. PETER'S-WORT. Plant with stems erect or suberect, mostly 3-8 dm. high; leaves oblong-elliptic, rounded to somewhat acute at apex, the upper ones somewhat cordate and clasping, coriaceous, to about 3 cm. long and 15 mm. wide; pedicels to 1 cm. long, with lanceolate bractlets 3-5 mm. below the calyx; outer 2 sepals broadly ovate to suborbicular, cordate at base, acute at apex, 1-1.5 cm. long, about as wide; inner 2 sepals lanceolate, 7-14 mm. long, to 4 mm. wide; petals showy, obliquely obovate, commonly exceeding the sepals, to 15 mm. wide; styles 3 or 4; capsule exerted at maturity. *Hypericum stans* (Michx.) Adams & Robson. In sandy bogs, swamp woods and moist grasslands in e. Tex., June-Sept.; from Fla. to Tex., n. to N.Y., N.J., e. Pa., Ky., Tenn., Ark. and Okla.

2. *Ascyrum hypericoides* L. ST. ANDREW'S CROSS. Plant with reddish-brown stems that are erect-ascending to decumbent and somewhat diffuse, simple or more or less branched from the base or above the base, to 1 m. or more high or long, the bark exfoliating in shreds; leaves linear to oblanceolate, more or less narrowed at the sessile base, rounded to obtuse at apex, to about 3 cm. long and 8 mm. wide, the margin somewhat revolute; pedicels 3-6 mm. long, the bractlets borne near apex; outer 2 sepals ovate to elliptic, rounded-cuneate to subcordate at base, obtuse to acute at apex, to 12 mm. long and about as wide; inner 2 sepals minute or obsolete; petals narrowly oblong-elliptic, about equaling the outer sepals, to 4 mm. wide; styles 2; capsule included or exerted at maturity. *Hypericum hypericoides* (L.) Crantz. Mostly in light sandy soils in open pine-hardwood and hardwood forests, thickets, grasslands and in bogs in the e. third of Tex., May-Nov.; from Fla. to Tex. and e. Mex., s. to Hond. and the W.I., n. to N.E., Ky., Mo. and Okla.

This species is highly variable in the size and shape of its leaves and outer calyx lobes, and some of our coastal material might eventually be segregated as a small narrow-leaved variant. Not only decumbent plants with several basal stems and oblanceolate leaves, segregated as var. *multicaule* (Michx.) Fern. [*Hypericum hypericoides* var. *multicaule* (Michx.) Fosb.], are to be found in Texas but also the erect plant, segregated as var. *oblongifolium* (Spach) Fern., with rather broadly oblanceolate leaves and prominent basally cordate outer calyx lobes that are up to 15 mm. long and 1 cm. wide. Var. *hypericoides*, our most common plant, is erect and freely branched above the ground level and has linear to linear-elliptic leaves.

2. HYPERICUM L.¹³¹

ST. JOHN'S-WORT

Herbs or shrubs; leaves opposite, sometimes verticillate; flowers solitary or in cymes; sepals 5, usually subequal, persistent; petals 5, oblique, usually convolute in the bud, yellow, flesh-colored or sometimes reddish or purplish; stamens usually numerous, mostly united or clustered in 3 to 5 fascicles, the filaments elongate; styles abbreviated or elongate, separate or (at first) connate for most or part of their lengths, more or less united below the middle, mostly persistent on the capsules, the stigmas minute or capitate; capsules mostly 1-celled or sometimes 3- to 5-celled; seeds short-cylindric, mostly reticulate.

About 300 species that are cosmopolitan in their distribution.

1. Stems woody throughout or at least on lower part; styles typically closely appressed their entire length at maturity, the stigmas minute; translucent or pellucid-punctate glands present (2)
1. Stems herbaceous or rarely slightly woody at very base; styles either appressed or separate (11)
- 2(1). Mature leaves and sepals linear-subulate or needlelike, the leaf margins essentially parallel 7. *H. fasciculatum*.
2. Mature leaves and sepals with expanded non-needlelike blades, the leaves somewhat wider above the middle (3)
- 3(2). Flowers terminal and solitary, sometimes in 3-flowered dichasia 5. *H. frondosum*.
3. Flowers in a 3- to many-flowered terminal and/or subterminal dichasia (4)
- 4(3). Perennial herb, usually less than 1 m. tall 11. *H. sphaerocarpon*.
4. Shrubs; stems mostly 1 m. or more tall (5)
- 5(4). Leaves and sepals without a basal articulation or groove; inflorescence appearing naked due to the much-reduced bracts (6)
5. Leaves and sepals with a basal articulation or groove; inflorescence appearing leafy due to the foliaceous bracts (8)
- 6(5). Leaves linear-oblong to linear-lanceolate, less than 1 cm. wide, midnerve beneath prominently keeled and running into a stem wing ... 10. *H. cistifolium*.
6. Leaves ovate-lanceolate to elliptic, usually well over 1 cm. wide (7)
- 7(6). Inflorescence usually a many-flowered (rarely 3) dichasium; mature capsules 3.5-7 mm. long, 3-4.5 mm. wide; raphe of seed well-developed, forming a conspicuous keel 8. *H. nudiflorum*.
7. Inflorescence a 3-flowered dichasium, sometimes 6- or 1-flowered; mature capsules 6-14 mm. long, 4.5-7 mm. wide; raphe of seeds only slightly developed, forming a low ridge but not a conspicuous keel 9. *H. apocynifolium*.
- 8(5). Largest leaves 1.5-3 cm. long; seeds 0.7-0.8 mm. long 6. *H. galioides*.
8. Largest leaves 3-7.5 cm. long; seeds 0.9-1.6 mm. long (9)
- 9(8). Mature capsules exceeding 7 mm. in length and 3.5 mm. in width, lance-ovoid; flowers in 1- to 7-flowered terminal and subterminal dichasia, the inflorescence usually narrow and compactly thyrsoid; seeds dark-brown or black, 1-1.7 mm. long 4. *H. prolificum*.
9. Mature capsules 6 mm. or less long and 3 mm. wide, slender-conic; flowers in 7- to many-flowered terminal and subterminal compound dichasia, the inflorescence presenting an obpyramidal aspect; seeds reddish-brown, 0.8-1.3 mm. long (10)

¹³¹ Adapted mainly from William P. Adams in Contr. Gray Herb. 189:3-51. 1962.

- 10(9). All flowers with only 3 styles present 3. *H. densiflorum* var. *densiflorum*.
10. Some flowers with 4 or 5 styles present 3. *H. densiflorum* var. *lobocarpum*.
- 11(1). Petals yellow or orange-color, convolute in bud; stamens numerous or few, distinct or united at base into 3 to 5 clusters without intervening glands; flowers terminal or in terminal cymes (12)
11. Petals flesh-color to mauve-purple, imbricated in bud; stamens mostly 9, strongly triadelphous, with 3 large orange glands alternating with the 3 bundles of stamens; flowers clustered in the axils and at summit of stem (19)
- 12(11). Stamens numerous, usually 20 or more; roots perennial (13)
12. Stamens usually less than 20; annuals or rarely perennials (15)
- 13(12). Stems and leaves copiously pilose; sepals ciliate; petals clear yellow 12. *H. setosum*.
13. Stems and leaves glabrous; sepals glabrous; petals streaked with dark lines (14)
- 14(13). Main stem mostly simple, with branches only near summit; sepals 2.5-4 mm. long; petals 4-7.5 mm. long; styles 2-4 mm. long, mostly persistent 1. *H. punctatum*.
14. Main stem mostly with small axillary branches throughout; sepals 4-7 mm. long; petals 8-14 mm. long; styles 6-10 mm. long, fugacious or seldom persistent 2. *H. pseudomaculatum*.
- 15(12). Leaves flat, varying from suborbicular-ovate to linear-lanceolate, spreading; stem simple or loosely branched, from a slightly woody base (16)
15. Leaves subulate or subulate-linear, appressed or strongly ascending; stem fastigate-branched; root annual (18)
- 16(15). Leaves linear-lanceolate, all sessile and clasping the stem; styles 3 mm. long, the stigma conspicuously capitate 15. *H. pauciflorum*.
16. Leaves orbicular to ovate-deltoid or elliptic-oblong, the upper ones cordate at base or clasping; styles 1 mm. or less long, the stigmas minute (17)
- 17(16). Diffusely branched; leaves ovate-oblong to shortly elliptic, rounded at apex; capsule short-ellipsoid 13. *H. mutilum*.
17. Simple or nearly so, virgate, the cymes with ascending branches; middle and upper leaves ovate-deltoid, tapering to apex; capsule slender-conical 14. *H. gymnanthum*.
- 18(15). Leaves linear, 6 mm. or more long; capsules ovoid, slightly exceeding calyx 16. *H. Drummondii*.
18. Leaves scalelike, less than 4 mm. long; capsules lance-subulate, much-exceeding the calyx 17. *H. gentianoides*.
- 19(11). Leaves tapering below middle to a distinctly slender petiole 19. *H. Walteri*.
19. Leaves sessile at the rounded to cordate-clasping base (20)
- 20(19). Leaves with translucent glands and dark-punctate on lower surface; styles 2-3 mm. long 18. *H. virginicum*.
20. Leaves without translucent glands or superficial dots on lower surface; styles 1 mm. long 20. *H. tubulosum*.

1. *Hypericum punctatum* Lam. Plant erect, to about 1 m. high, conspicuously marked with black and pellucid dots, the main stems mostly simple and with few to no branches below the inflorescence; leaves sessile or somewhat clasping at the base, typically oblong to oblong-elliptic but sometimes narrowly ovate-oblong, to 7 cm. long and 2 cm. wide, rounded to obtuse or even retuse at apex; flowers crowded in small clusters that terminate short branches at summit of plant; sepals heavily dotted and lined with black, ovate-oblong to triangular-lanceolate, obtuse to subacute at apex, 2.5-4 mm. long; petals pale yellow, copiously black-dotted, 4-7.5 mm. long; styles 2-4 mm. long, mostly persistent;

capsules ovoid, 4-6 mm. long, conspicuously beset with amber-colored glands; seeds less than 1 mm. long. On open-wooded hills and on edge of woods and fields in n.-cen. and n.e. Tex., June-July; from Fla. to Tex., n. to Que. and Minn.

2. *Hypericum pseudomaculatum* Bush. Plant erect, to 8 dm. high, the main stems mostly with small axillary branches throughout; leaves closely sessile and somewhat clasping at base, ovate-lanceolate to triangular-lanceolate or linear-lanceolate, narrowly obtuse to acute at apex, the margins often revolute in drying, to about 4 cm. long and 12 mm. wide; flowers numerous, in terminal clusters that are more open than in *H. punctatum*; sepals lanceolate, acute to acuminate, 4-7 mm. long, conspicuously black-dotted; petals 8-14 mm. long, conspicuously black-dotted; styles 6-10 mm. long, fugacious or seldom persistent; capsules 5-7 mm. long, somewhat glandular. *H. punctatum* var. *pseudomaculatum* (Bush) Fern. In moist or dry soil in fields in e. Tex., May-June; from Fla. to Tex., n. to Okla. and Ill.

3. *Hypericum densiflorum* Pursh. Shrub to 2 m. high, much-branched above, the upright branches slender; leaves linear to linear-elliptic or oblanceolate, obtuse-apiculate to acute at apex, tapering at base to a short petiole, to 75 mm. long and 15 mm. wide, with smaller leaves in axillary fascicles; flowers numerous in crowded compound cymes; sepals firm, linear-lanceolate to elliptic, 2-5 mm. long; styles 3 to 5, persistent, somewhat connate at base, either completely separate from the beginning or tardily separating, 2-3 mm. long; capsules lance-ovoid to slender-conic, more or less deeply lobed or sulcate, the body to 6 mm. long and 3 mm. thick, composed of 3 to 5 distinct carpels; seeds reddish-brown, 0.8-1.3 mm. long. On pinewood slopes and in and on the edge of swamps and marshes, and along wooded streams, in s.e. Tex., May-Aug.; from Fla. to Tex., n. to N.Y., N.J., W.Va., s. Ind. and s. Mo.

The usually 4 or 5 styles and the deeply lobed capsules of the more southern var. *lobocarpum* (Gatt.) Svens. (*H. lobocarpum* Gatt.) set it apart from var. *densiflorum* and *H. prolificum*. The leaves are also usually larger than those of var. *densiflorum* whose leaves are usually less than 5 cm. long and 8 mm. wide. In our material, where there is a preponderance of flowers with 4 or 5 styles these are early separated in flower. However, in var. *densiflorum* and in those plants having only a few flowers with 4 or 5 styles, the styles often remain tightly coherent or even twisted together until the fruit is well-developed.

4. *Hypericum prolificum* L. SHRUBBY ST. JOHN'S-WORT. Rather coarse diffusely branched shrub to 2 m. high, with sharply 2-edged twigs; leaves typically narrowly oblong, 3-7.5 cm. long and to 15 mm. wide, narrowed at base to a short petiole, obtuse at apex; cymes both terminal and in the upper axils, contracted, the inflorescence thus interruptedly cylindrical; sepals elliptic, 5-7 mm. long; petals obovate, 7-10 mm. long; styles 3 (rarely 4); capsules lance-ovoid to subcylindric-conic, 3-carpellate, 8-15 mm. long, 3-5 mm. thick. *H. spathulatum* (Spach) Steud. In dry or damp sandy or rocky thickets, along wooded streams and on slopes in s.e. Tex., June-Aug.; from Ga. to Tex. and Ark., n. to s.e. N.Y., Ont. and Minn.

5. *Hypericum frondosum* Michx. GOLDEN ST. JOHN'S-WORT. Shrub to 1 m. high, widely branching; leaves narrowly oblong to elliptic, narrowed at base, obtuse to acute at apex, to 75 mm. long and 18 mm. wide; flowers large and showy, 1 to 3 terminating the branches or in the upper axils; sepals foliaceous, very unequal, often enclosing the capsule, some of them ovate to broadly elliptic and 2-3 cm. long; petals orange-yellow, firm, to 2 cm. long, becoming reflexed; stamens very numerous; capsules narrowly conic-ovoid, thick-walled, unlobed, about 1 cm. long. In barrens and openings in e. Tex., Apr.-July; from Ala. to Tex., n. to S.C., Ky. and s. Ind.

An ornamental shrub that is frequently cultivated, from which it has a tendency to escape.

6. *Hypericum galioides* Lam. Shrub 3-18 dm. high; leaves narrowly linear to linear-oblanceolate, narrowed to the base, obtuse to acute at apex, to 3 cm. long and 5 mm. wide, usually noticeably verticillate and marginally revolute in drying; flowers numerous, terminal or axillary; sepals linear to linear-spatulate, 3-4 mm. long; petals bright-yellow, narrowly cuneate, obliquely or almost laterally pointed, 4-7 mm. long; capsules triangular-conic, subtruncate-rounded at base, tapering to the acute apex, deeply sulcate, 5-6 mm. long, the persistent 3 styles about 2 mm. long. In wet pinelands, swamps and depressions,

about ponds and lakes, and along ditches in s.e. Tex., May-Aug.; from Fla. to Tex., n. to Tenn. and N.C.

7. *Hypericum fasciculatum* Lam. SAND-WEED. Shrub to about 1 m. high; bark dark-brown, spongy-thickened, exfoliating in tissue-thin sheets; leaves verticillate, numerous, crowded, typically linear-filiform or very narrowly linear, coriaceous, revolute, 1-2 cm. long, mostly about 1 mm. wide, with a cluster of smaller leaves in the axils of the larger ones; flowers several terminating the upper branches; sepals linear, 3-4 mm. long, about 1 mm. wide; petals bright-yellow, obliquely apiculate, 7-8 mm. long; capsules ovoid to ovoid-conic, 4-5 mm. long, 3-lobed. *H. galioides* var. *fasciculatum* (Lam.) Svens. In wet places about ponds and lakes, in low pinelands and along forested streams, in s.e. Tex., June-Aug.; from Fla. to Tex., n. to N.C.

This species is closely allied to *H. galioides*. The juvenile leaves found on seedlings and sometimes on adult plants are very similar to the leaves found on that species.

8. *Hypericum nudiflorum* Michx. Shrub to 2 m. high, usually much smaller, the stems ligneous below, sending up long subherbaceous brown-barked 4-angled flowering branches; leaves ovate-lanceolate to linear-oblong, obtuse, thin, to about 7 cm. long, pale-green, minutely punctate beneath, revolute in drying, usually without axillary fascicles; flowers numerous, in open terminal dichotomous cymes; bracts lance-subulate, 2-3 mm. long; sepals firm, linear to oblong, 2-5 mm. long; petals to 1 cm. long; styles 3; capsules ovoid, to 7 mm. long, with 3 inwardly projecting placentae. In moist sandy woods, thickets or swamps in e. Tex., June-Aug.; from Fla. to Tex., n. to Va. and Tenn.

9. *Hypericum apocynifolium* Small. Shrub 4-7 dm. high, the stems with red somewhat shreddy bark and the branchlets narrowly 4-winged; leaves essentially sessile, oblong to oblong-elliptic, more or less cuneate at the base, rounded to emarginate at apex, 2-4 cm. long, thin, bright-green, pale beneath, minutely punctate, rarely revolute; flowers 3 to 5 in terminal cymes; sepals spatulate to elliptic or oval, obtuse, persistent, 3-5 mm. long, at least one half as long as the petals; petals yellow, oblong, 8-9 mm. long; capsules oblong-conic, thick-walled, to 14 mm. long, acute. In swamps and marshes in n.e. Tex., June-Aug.; from Ga. and Fla. to Tex. and Ark.

10. *Hypericum cistifolium* Lam. Slender subherbaceous perennial; stem somewhat woody, reddish-brown, prominently 2-winged and simple or very sparingly branched, to 9 dm. high; leaves firm, linear-oblong to linear-lanceolate, to 3 cm. long and 6 mm. wide, obtuse to subacute at apex, the margins strongly revolute, sessile, subauriculate and clasping at the base, the solitary midnerve beneath keeled and continuous into the wing on the stem, with fascicles of smaller leaves in their axils; flowers numerous in terminal or axillary dichotomous cymes, the bracts subulate and about 3 mm. long; sepals ovate to elliptic or oval, to 3 mm. long and 1.5 mm. wide; petals yellow, convolute in bud, obliquely cuneate to obovate, 5-10 mm. long; filaments elongate; styles 3, coherent, somewhat persistent, the stigmas minute; capsule globose to globose-ovoid, to 7 mm. long, 3-lobed, 1-celled; seeds wrinkled. In sandy soils, rare in extreme s.e. Tex., June-Aug.; from Fla. to Tex., n. to N.C.

The peculiar thin-tissued, somewhat auriculate-clasping base of the leaves, and the keeled midnerve that continues into a stem-wing, distinguish this species.

11. *Hypericum sphaerocarpon* Michx. Plant with usually simple herbaceous stems from a somewhat woody base, 3-5 dm. high, the stems angled with 4 narrow salient lines; leaves sessile, nearly linear to narrowly oblong, with a somewhat clasping base, obtuse to acute at apex, 3-7 cm. long, to 15 mm. wide; cymes naked, compound, usually many-flowered; sepals ovate to elliptic-lanceolate, acute, 3-5 mm. long, about equal in length and size, the larger ones 1.5-3 mm. wide; petals elliptic to elliptic-oblong, 5-9 mm. long; capsule depressed-globose to broadly ovoid, firm, 5-7 mm. long at maturity, 1-celled; seeds large, oblong, very rough-pitted. On barren embankments and in prairies in n.e. Tex., May-July; from Ala. to Tex., n. to O., Ind., s. Wisc., Ia. and e. Kan.

12. *Hypericum setosum* L. Plant herbaceous, scabrous-tomentose to -pilose throughout, the stem simple or sometimes virgately branched, to 75 cm. high; leaves sessile, numerous, erect-appressed, ovate to linear-oblong or lanceolate, acute at apex, the margins somewhat revolute, to 15 mm. long and 4 mm. wide, gradually reduced up the stem; flowers few in cymes; sepals ovate to ovate-lanceolate or elliptic, acute to acuminate, to 4 mm. long, conspicuously ciliate; petals yellow, 5-6 mm. long, obliquely oblong-elliptic, obtuse;

styles 3, subsistent; capsule ovoid-oval, 4-5 mm. long. In bogs and wet pinelands in s.e. Tex., June-Sept.; from Fla. to Tex., n. to Va.

13. *Hypericum mutilum* L. Plant annual or perennial; 3-9 dm. high, with weak slender erect to ascending stems, widely branching above, sometimes forming extensive colonies, often with leafy-bracted decumbent bases; leaves ovate to lanceolate or narrowly oblong, sessile and partly clasping at base, rounded to broadly obtuse at apex, mostly 5-nerved, to 35 mm. long and 15 mm. wide; cyme in well-developed plants diffuse and somewhat leafy-bracted, the ultimate bracts setaceous; flowers light-yellow, about 4 mm. across; sepals variable in length and size, linear to linear-lanceolate or elliptic-oblong, equal to or much-exceeding the capsules; stamens 6 to 12; capsules subglobose to short-ellipsoid, the rounded summit capped by the short persistent styles that are about 1 mm. long. On the edge of and in water of streams, ponds, swamps and other wet situations in cen. and e. Tex., May-Oct.; from Fla. to Tex., n. to s. N.E., cen. N.Y., O., Ill., Mo. and Kan.

Those plants with sepals broadly lanceolate to oblong and foliaceous have been segregated as var. *latisepalum* Fern.

14. *Hypericum gymnanthum* Engelm. & Gray. Plant herbaceous, almost simple, with strict stem and branches, to 9 dm. high, usually much smaller; leaves firm, clasping, 5- to 7-nerved, deltoid-cordate, acute to obtuse at apex, about 15 mm. long and 1 cm. wide below middle; cymes naked, elongated, the floral leaves reduced to small subulate bracts 3-4 mm. long; sepals thickish, erect, lanceolate, acuminate, 3-5 mm. long; petals 3-6 mm. long; stamens 10 to 12; styles 3, persistent, about 0.75 mm. long, the stigmas only slightly dilated; capsule ellipsoid-conical, pointed, about 4 mm. long. In sandy soils in barrens or low ground in s.-cen. and s.e. Tex., June-July; from Fla. to Tex., n. locally to N.Y., N.J., Pa., W.Va., O., Ill., Mo. and e. Kan.

15. *Hypericum pauciflorum* H.B.K. Plant somewhat succulent, to 7 dm. high, usually with several herbaceous stems arising from a somewhat woody base, rarely simple, the individual stems then much-branched above the middle, the floral branches strongly 2-edged and somewhat flattened; leaves bluish-green, all sessile and more or less clasping, coriaceous, with conspicuously revolute margins, those on the lower and middle part of the stem lanceolate to linear and more or less spreading, to 3 cm. long and 7 mm. wide, gradually reduced above into the flowering branches; flowers distant, in the axils of the uppermost nodes; sepals linear-lanceolate to elliptic-lanceolate, acute, 5-6 mm. long; petals orange-yellow, 8-10 mm. long; capsules ovoid-conic, dark-brown, 4.5-6 mm. long, usually about as long as sepals, the 3 persistent styles 3 mm. long, with conspicuously discoid-capitate stigmas; seeds oblong, light-brown, pitted, about 0.5 mm. long. On dunes and in grassy sandy fields along the coast and in the Rio Grande Plains in s. Tex., Mar.-Oct.; also in adj. and cen. Mex.

16. *Hypericum Drummondii* (Grev. & Hook.) T & G. NITS-AND-LICE. Plant annual, to 8 dm. high, the stem and the alternate bushy branches rigidly erect, mostly densely punctate throughout; leaves numerous, linear to linear-subulate, ascending to nearly erect, not appressed, 1-nerved, 6-20 mm. long; flowers short-pedicelled, mostly solitary in the axils along the upper part of the leafy branches; sepals narrowly lanceolate, acute, 3-5 mm. long; petals orange-yellow, withering before noon; stamens 10 to 20; capsules ovoid, 4-5 mm. long, reddish-brown, barely as long as or but slightly exceeding the sepals; seeds oval, dark-brown, strongly ribbed and rugose, about 1 mm. long. *Sarothra Drummondii* Grev. & Hook. In dry sandy or gravelly soils in fallow fields, open scrub oak and cedar-oak flatwoods in cen. and e. Tex., July-Sept.; from Fla. to Tex., n. to Md., W.Va., O., Ind. s. Ill., Ia. and s.e. Kan.

17. *Hypericum gentianoides* (L.) B.S.P. ORANGE GRASS, PINEWEEED. Plant an erect annual, to 6 dm. high, the stem and erect bushy branches threadlike and wiry; leaves minute subulate scales, appressed, 1-3 mm. long; flowers minute, mostly sessile and at the nodes along the branches; sepals linear to linear-lanceolate, about 2 mm. long; capsules lance-subulate, acute, 5-7 mm. long; seeds about 0.5 mm. long, pale-brown, somewhat areolate. *Sarothra gentianoides* L. In dry gravelly or sun-baked sandy soil in cen. and e. Tex., May-Sept.; from Fla. to Tex., n. to s. Me., s. Ont., O., Ind. and Wisc.

18. *Hypericum virginicum* L. MARSH ST. JOHN'S-WORT. Plants stoloniferous, the stem simple or bushy-branched (especially above), to 7 dm. high; leaves sessile and cordate or clasping at base, oblong-elliptic to ovate-oblong, rounded at the retuse to apiculate

apex, the principal leaves to 7 cm. long and 3 cm. wide, dark-punctate beneath, dotted with translucent glands, often purplish; flowers in small clusters in the upper axils and terminal; sepals linear-elliptic to lanceolate, obtuse to acute, 4-7 mm. long; petals flesh-color or mauve, 7-10 mm. long; filaments free except near the base, the 3 fascicles alternating with 3 large orange-colored glands; capsule ellipsoid, tapering to the apex, about 1 cm. long, the mature styles 2-3 mm. long; seeds tan-color, oblong, pitted, about 1 mm. long. *Triadenum virginicum* (L.) Raf. In or on the edge of water along streams, in bogs and swamps, and about lakes and ponds in e. Tex., Aug.-Oct.; from Fla. to Tex., n. to N.S., s. N.E., N.Y., O., Ind. and Ill.

19. *Hypericum Walteri* Gmel. Similar in habit to *H. virginicum* but usually larger and more branched; leaves oblong to oblong-oblancheolate, obtuse to rounded at the apex, tapering into the slender petiole, to 15 cm. long and 35 mm. wide, yellowish-green above, pale-glaucous and translucent-dotted beneath, often reddish-tinged; flowers in small axillary and terminal clusters; sepals linear-elliptic, obtuse, 3-4 mm. long; petals reddish, 5-7 mm. long; filaments united to about or above the middle; capsules ellipsoid-cylindric, rounded or tapered at apex, 7-11 mm. long, the styles about 1 mm. long; seeds oblong, dark-brown at maturity, about 0.75 mm. long. *H. petiolatum* Walt., *H. tubulosum* Walt. var. *Walteri* (Gmel.) Lott, *Triadenum petiolatum* (Walt.) Britt., *T. Walteri* (Gmel.) Gl. In or on the edge of water along streams, in bogs and swamps, and about ponds and lakes, sometimes on cypress knees and trunks, logs and occasionally on moist sandy wooded slopes, in e. Tex., Aug.-Oct.; from Fla. to Tex., n. to Md., W.Va., s. Ind. and s.e. Mo.

20. *Hypericum tubulosum* Walt. Erect rhizomatous plant with stem simple or branched above, 3-8 dm. tall, glabrous throughout; leaves sessile, ample, lacking translucent glands or superficial dots on lower surface, oblong to elliptic-oblong or elliptic-oblancheolate, 5-15 cm. long, 2-5 cm. wide, scarcely tapered to a broadly rounded to truncate or somewhat cordate base, obtuse to broadly rounded at apex; cymes axillary, few-flowered, on peduncles to 3 cm. long; sepals oblong-lanceolate, acute, 4-6 mm. long; petals pink, 5-8 mm. long; fruit 9-11 mm. long; styles 3, about 1 mm. long. *Triadenum tubulosum* (Walt.) Gl. In wet soil of wooded swamps, open floodplain woods and on lake shores in s.e. Tex. where recently found in Newton Co., Sept.-Oct.; mainly on Coastal Plain from s.e. Va. to s.e. Tex., n.w. in the interior to s. Mo. and s. O.

FAM. 119. ELATINACEAE DUM.

WATERWORT FAMILY

Low annual or perennial herbs with opposite simple leaves with membranous paired stipules between them and small regular axillary flowers; the persistent or marcescent sepals and petals imbricated in the bud; stamens as many as the petals and alternate with them or twice as many; ovary 2- to 5-celled, the placentae axile; valves of capsule alternate with dissepiments; seeds several to many, oblong-cylindric, straight or curved, usually with a reticulate surface pattern.

A family of the following two genera and about 40 species of cosmopolitan distribution.

1. Plants less than 1 dm. tall, creeping, glabrous; flowers 2- or 3-merous; sepals obtuse, not scarious-margined1. *Elatine*, p. 1066.
1. Plants 1 dm. or more tall, erect-ascending, glandular-puberulent; flowers 5-merous; sepals cuspidate, scarious-margined2. *Bergia*, p. 1067.

1. ELATINE L.

WATERWORT

Dwarf more or less prostrate plants of wet places, often rooting at the nodes; flowers 1 or 2 to a node; sepals and petals each 2 or 3; petals membranous, hypogynous, usually orbicular; styles or sessile capitate stigmas 2 to 4; capsule membranous, 2- to 4-celled, several- to many-seeded, 2- to 4-valved, the partitions left attached to the axis or evanescent.

A genus of about 20 species in fresh-water habitats in temperate and warm regions.

- 1. Leaves linear to narrowly spatulate, often emarginate at tip; largest seeds with 16 to 25 pits in each row1. *E. triandra*.
- 1. Leaves obovate to narrowly oblong-obovate or rarely linear-spatulate, not emarginate at tip; largest seeds with 9 to 15 pits in each row ..2. *E. brachysperma*.

1. *Elatine triandra* Schkuhr. Matted creeping plant; leaves mostly truncate or emarginate, to 7 mm. or more long and 3 mm. wide; flowers sessile, 3-merous; seeds borne along entire length of thickened central axis, horizontally divergent, slender-cylindric and curved, with meandering obscure longitudinal ridges and somewhat angular pits in each row, the larger seeds with 16 to 25 pits in each row. In mud and shallow water in cen. Tex., Mar.-Oct.; from Wisc. to Alta. and Wash., s. to Tex. and n. Mex.; also Euras.

2. *Elatine brachysperma* Gray. Plant forming tiny low spreading mats to 5 cm. across, the branches somewhat ascending; leaves to 6 mm. long and 2 mm. wide; flowers sessile, 3-merous; sepals 2 or with a third greatly reduced; petals 3, pinkish; capsule depressed, 3-celled; seeds shortly oblong-ellipsoid, with 9 to 15 pits in each irregular row, the pits separated by acute cross-ribs. *E. triandra* var. *brachysperma* (Gray) Fassett. Rare on mud or in shallow water in cen. Tex., Mar.-Oct.; O. and Ill. w. to Ore., s. to Tex., Ariz. and Calif.

2. BERGIA L.

A small essentially tropical or subtropical genus of about 20 species.

1. *Bergia texana* (Hook.) Walp. Diffuse or ascending plant that is branched from the base, to 4 dm. tall, more or less glandular-puberulent throughout; flowers shortly pedicelled, 1 to 3 in the axils of the leaves; leaves elliptic-oblong to oblong-ob lanceolate, tapering at base, serrulate, to 3 cm. long; stipules lanceolate, deeply serrate; sepals 5, to 3.5 mm. long, acuminate, with thickened greenish midnerve and wide scarious margins, roughened on the keeled midnerve; petals 5, white, oblong, shorter than the sepals; stamens 5 or 10; fruit subglobose, 2-3 mm. in diameter, firm-textured, 5-carpellate; seeds glossy, light-brown, elliptic-oblong, curved, obscurely reticulate. In ditches, swamps, marshes, and on mud about ponds and on wet banks in s. Tex., June-Oct.; from Ark. to Tex. and s. Calif., n. to s. Ill., Mo., S.D. and Wash.

FAM. 120. FRANKENIACEAE S. F. GRAY
FRANKENIA FAMILY

Low perennial herbs or small shrubs; leaves opposite, subsessile or shortly petiolate, entire, exstipulate, the pairs jointed at base by a ciliated line; flowers perfect, 4- to 7-merous, solitary or in cymes; sepals united to form a tube; petals free, imbricate; stamens usually 6; ovary 1-celled, the style 2- to 4-cleft; fruit a 1-celled capsule included in the persistent calyx; seeds 2 to several, oval to oblong, with parietal placentation.

About 90 species in 4 genera, mostly in the Mediterranean region.

1. FRANKENIA L.

Characters of the family. About 80 species of saline habitats.

- 1. Leaves sessile, linear, when mature 3-5 mm. long, dorsally sulcate, glabrous beneath; calyx lobes less than 1 mm. long1. *F. Jamesii*.
- 1. Leaves with petioles 1-2 mm. long, when mature about 10 mm. long, plane above, densely farinose beneath; calyx lobes about 2 mm. long2. *F. Johnstonii*.

1. *Frankenia Jamesii* Torr. Small much-branched shrub with jointed stems from a woody base, to about 3 dm. tall, the leafy portion more or less hispidulous; leaves small, linear, pointed, dorsally sulcate, with strongly revolute margins, 3-5 mm. long and 1

mm. wide, the fascicled leaves shorter; flowers sessile, solitary at end of branchlets or becoming cymose-clustered on the branches; calyx tube strongly ribbed, 4-5 mm. long, the 5 toothlike lobes less than 1 mm. long; petals 5, clawed, white, erose-denticulate at the truncated apex, about twice as long as the calyx tube; capsule linear, angled, about 5 mm. long. On dunes about salt flats and lakes in the Trans-Pecos and Plains Country, usually associated with gypsum, Apr.-Aug.; in w. Tex., N.M. and Colo.

2. *Frankenia Johnstonii* Correll. Shrub to 3 dm. high, the woody base supported by dark-brown wiry roots and giving rise to several or many elongated arching or strongly recurved willowy stems, the entire plant grayish- or bluish-green; stems subherbaceous, about 1 mm. thick, sparsely pilose with short whitish appressed or incurved hairs; internodes mostly 1-1.5 cm. long; leaves distinctly petioled, oblanceolate to oblong-elliptic, rounded at base, minutely apiculate at the rounded apex, to 13 mm. long and 4 mm. wide, the margins somewhat revolute, the upper surface sparsely short-pilose with appressed hairs, the lower surface farinaceous and hoary; petioles brownish-green, 1-2 mm. long, slightly winged with the membranous pubescent wings united around the node; flowers sessile and solitary at the apex of short axillary branchlets; calyx tube strongly ribbed, about 4 mm. long, the 5 triangular lobes about 2 mm. long; petals 5, clawed, white, elliptic-oblanceolate, erose at the apex, about twice as long as the calyx; stamens 6, of various lengths, included; styles 3-cleft. Rare on saline flats and rocky gypseous hillsides in the Rio Grande Plains of s. Tex., Nov.-Apr.; endemic.

FAM. 121. TAMARICACEAE LINK.¹³²

TAMARISK FAMILY

Shrubs or small trees; leaves alternate, exstipulate, sessile, small and scalelike, entire, commonly imbricated; flowers mainly perfect, regular, in spicate racemes that are usually collected to form a panicle; sepals 4 or 5, imbricated; petals 4 or 5, distinct, somewhat imbricated; disk 5- or 10-lobed or obsolete; stamens 4, 5, 8 or 10, the distinct filaments free, the anthers opening lengthwise; ovary 1-celled, superior, with 3 to 5 basal placentae; stigmas 2 to 5, distinct; ovules 2 to many on each placenta; fruit a capsule; seeds erect, terminating in a sessile tuft of hairs.

More than 60 species in four genera, all natives of the Old World.

1. TAMARIX L. TAMARISK. SALT CEDAR

Deciduous shrubs or small trees with irregularly and widely spreading slender terete stems; the ultimate small branchlets deciduous with the leaves; leaves clasping or sheathing; flowers small, short-pedicel or sessile; petals pink or white, inserted under the disk; capsule dehiscent into 3 to 5 valves; seeds numerous.

About 50 species in the Old World, many of which are cultivated for their feathery foliage and profuse pink or white flowers. Occasionally planted for windbreaks and for sand binding. Most have become naturalized in such places as along streams (especially if saline), in and about salt flats and in waste places generally. They flower periodically throughout the year.

1. Flowers 4-merous, occasionally with more than 4 stamens 5. *T. parviflora*.
1. Flowers 5-merous, occasionally with more than 5 stamens (2)
- 2(1). Staminal filaments arising from the alternating disk-lobes (3)
2. Staminal filaments not as above (4)
- 3(2). Racemes mostly on last year's branches, 6-9 mm. broad (in dried material); petals ovate to broadly trulliform-ovate, more than 2 mm. long 1. *T. africana*.
3. Racemes mostly on green branches, 4-5 mm. broad; petals elliptic to somewhat ovate-elliptic, less than 2 mm. long 4. *T. gallica*.

¹³² Adapted from Bernard R. Baum in *Baileya* 15(1):19-25. 1967.

- 4(2). Staminal filaments inserted between the more or less retuse lobes of the disk; petals caducous (sometimes 1 or 2 persisting) 2. *T. aphylla*.
4. Staminal filaments as above but with at least 3 of them inserted under the disk near the margin; petals persistent after maturity (5)
- 5(4). Sepals more or less entire; petals ovate to elliptic; flowers of those racemes that occur on green branches with 1 or 2 of the filaments inserted between lobes of disk 3. *T. chinensis*.
5. Sepals denticulate; petals obovate; all filaments of all flowers inserted below disk near margins 6. *T. ramosissima*.

1. *Tamarix africana* Poir. Bark black to dark-purple; leaves sessile; racemes 3-7 cm. long, 6-9 mm. broad (in dry material), those occurring on green branches of the current year somewhat smaller; bracts longer than pedicels; flowers pentamerous; sepals subentire, the outer 2 slightly keeled and longer than the inner more obtuse ones; petals ovate to broadly trulliform-ovate, about 2.5-3 mm. long in vernal flowers, 3 mm. long or more in aestival; staminal filaments inserted on gradually tapering lobes of disk. Nat. of Eur. and the Medit. region; introd. in Calif., Ariz., Tex. and S.C.

2. *Tamarix aphylla* (L.) Karst. Bark reddish-brown to gray; leaves vaginate; racemes 3-6 cm. long, 4-5 mm. broad; bracts longer than pedicels; flowers pentamerous; sepals entire, the inner somewhat larger; petals elliptic-oblong to ovate-elliptic, 2-2.25 mm. long, caducous, sometimes 1 or 2 persisting after maturity; staminal filaments inserted between the more or less retuse disk-lobes. Nat. of Afr. and the Middle East; introd. in Tex., Ariz. and Calif.

3. *Tamarix chinensis* Lour. Bark brown to black-purple; leaves sessile; vernal inflorescences of many dense racemes, aestival ones loose and of slender racemes; racemes 2-6 cm. long, 5-7 mm. broad; bracts equaling to slightly longer than pedicels; flowers pentamerous; sepals subentire, acute; petals elliptic to ovate, persistent after maturity, about 1.5-2.25 mm. long; filaments inserted between lobes of disk but from its lower part near the margin; in aestival flowers 1 or 2 filaments are inserted in the sinuses between the lobes and the other 3 or 4 under the disk near the margin. Nat. of the Far East; introd. and widespread in Can. and the U.S.

4. *Tamarix gallica* L. TAMARISCO, ROMPEVIENTOS. Bark blackish-brown to deep-purple; leaves sessile; racemes 2-5 cm. long, 4-5 mm. broad; bracts longer than pedicels, not exceeding the calyx; flowers pentamerous; sepals acute, entire or subentire; petals caducous, elliptic to slightly ovate-elliptic, 1.5-1.75 mm. long; staminal filaments inserted on apices of the gradually attenuating lobes of disk. Nat. of s. Eur.; introd. and rare in s. U.S.

5. *Tamarix parviflora* DC. Bark brown to deep-purple; leaves sessile; racemes more often on last year's branches, 1.5-4 cm. long, 3-5 mm. broad; bracts diaphanous, longer than pedicels; flowers tetramerous; sepals eroded-denticulate, the outer 2 trulliform-ovate, acute and keeled, the inner 2 ovate and obtuse; petals parabolic or ovate, 2 mm. long; staminal filaments emerging gradually from the disk-lobes. Nat. of the Medit. region; introd. and widespread in Can. and the U.S.

6. *Tamarix ramosissima* Ledeb. Bark reddish-brown; leaves sessile; racemes 1.5-7 cm. long, 3-4 mm. broad; bracts longer than pedicels; flowers pentamerous; sepals more or less acute, eroded to irregularly denticulate, the inner 3 broader than the outer; petals 1-1.75 mm. long, obovate to broadly elliptic-obovate; filaments inserted under the disk near the margin between the usually emarginate lobes. Nat. of Euras.; introd. and widespread mainly in s. U.S.

FAM. 122. FOUQUIERIACEAE DC.

OCOTILLO FAMILY

Shrubs with wandlike branches or (in *Idria*) small trees with a massive trunk and relatively small branches; spines numerous, each formed by hardening of the persistent petiole and midrib of the leaf of the first season of growth; leaves of succeeding seasons produced in clusters in the axils of the spines; flowers showy, in terminal panicles; sepals 5, imbricated, unequal, persistent; petals united to form a 5-lobed tube; stamens 10 to

19, attached to base of corolla tube, the filaments thickened at base; fruit a capsule, incompletely 3- or 4-celled; seeds several, winged or copiously fringed on the angles.

A family of two genera, the following and *Idria* of Baja California.

1. FOUQUIERIA H.B.K. OCOTILLO. CANDLEWOOD

Characters of the family. About 7 species centered in Mexico with one in southwestern United States.

1. *Fouquieria splendens* Engelm. Shrub with several slender wandlike branches from a root crown; branches erect- or sinuously-ascending, to 9 m. tall and 6 cm. in diameter, strongly grooved and ridged by decurrent base of spines, the bark grayish; spines to 2 cm. long; leaves sessile or nearly so, obovate to spatulate, to 5 cm. long and 3 cm. wide, entire, glabrous, early-deciduous; inflorescence to 25 cm. long; pedicels to 8 mm. long; sepals suborbicular, scarious, 4-6 mm. long; corolla scarlet, to about 15 mm. long, the rounded lobes strongly revolute; stamens red, protruding well beyond the corolla; style divided into 3 or 4 elongated filiform branches; capsule about 15 mm. long, 3-valved, persistent; seeds fringed with long whitish hairs. On rocky exposed slopes, along rocky draws and on sandy plains in w. Edwards Plateau and Trans-Pecos, Mar.-June; from Tex. to Calif. and n. Mex.

The periodic, not seasonal, appearance of the leaves of this species is dependent upon rainfall; their appearance is a sure indication that rain has only recently fallen in that particular region.

FAM. 123. CISTACEAE JUSS.¹³³ ROCKROSE FAMILY

Herbs or low shrubs; leaves simple, alternate, opposite or whorled, stipulate or exstipulate, entire; flowers hypogynous, regular, perfect, variously arranged; sepals 5 with the 2 outer smaller, distinct or with the outer 2 attached to the inner; petals 3, 5 or absent in cleistogamous flowers; stamens few to numerous; pistil 1, of (2 or) 3 to (5 to 10) united carpels; ovary 1-celled or imperfectly (2- or) 3- to (5- to 10-) celled; fruit a capsule.

About 180 species in 5 or 6 genera in temperate and subtropical regions of both hemispheres.

- 1. Petals 5 (rudimentary or lacking in cleistogamous flowers), yellow; stigma capitate; capsule 1-celled with filiform placentae; pubescence completely or in part stellate1. *Helianthemum*, p. 1070.
- 1. Petals 3, reddish; stigma fimbriate-plumose; capsule incompletely 3-celled from the broad shieldlike placentae; pubescence of only simple trichomes2. *Lechea*, p. 1072.

1. HELIANTHEMUM MILL. ROCKROSE. FROSTWEED

Annual or perennial herbs or shrubs with alternate (all American species) or opposite (some Eurasian) exstipulate (all American) or stipulate (some Eurasian) leaves and dimorphic (petaliferous or apetalous) or monomorphic flowers; sepals (3) 5 with the 2 outer attached to the inner 3; petals (when present) 5, usually yellow (as in all American), fugacious; stamens 3 to 8 in the cleistogamous and 10 to 50 (to 100) in the chasmogamous flowers; pistils (2-) or 3-carpellate; stigma capitate; style short to elongate; capsule 1-celled with 2 or 3 parietal placentae bearing few to numerous seeds.

A genus of approximately 100 species principally of the Northern Hemisphere and largely centered about the Mediterranean.

¹³³ Contributed by Robert L. Wilbur. Cf. his more detailed treatment in C. L. Lundell, *Flora of Texas II*: 1-17. 1969.

1. Lower epidermis of cauline leaves clearly visible and not completely masked by the dense pubescence; lower stem with spreading pilose trichomes to 2.5 mm. long; seed coat papillate, not readily separable when wetted 1. *H. carolinianum*.
1. Lower epidermis of cauline leaves completely masked by the dense stellate pubescence; lower portion of stems variously pubescent but never with pilose trichomes; seed coat smooth or indistinctly pebbled, gelatinous and readily separable when wetted (2)
 - 2(1). Leaves densely stellate-tomentose above, ash-gray, their epidermis masked from view; Chisos Mts. of Trans-Pecos Texas 2. *H. glomeratum*.
 2. Leaves sparingly to moderately stellate-tomentose above but still green and with a clearly visible epidermis; central and eastern Texas (3)
 - 3(2). Inner cleistogamous sepals 4 mm. long or longer; outer cleistogamous sepals 1.4 mm. long or longer; cleistogamous capsules 3 mm. long or more, with 12 to 20 seeds; petals 6-12 mm. long; chasmogamous capsules 3.8 mm. long or more, 20- to 35-seeded; cleistogamous flowers loosely racemose 3. *H. georgianum*.
 3. Inner cleistogamous sepals less than 2 mm. long; cleistogamous capsules less than 2 mm. long, 1- (2-) seeded; petals 4-6.4 mm. long; chasmogamous capsules 3 mm. long or less, 1- to 6-seeded; cleistogamous flowers glomerate 4. *H. rosmarinifolium*.

1. *Helianthemum carolinianum* (Walt.) Michx. Perennial herb with ascendent stems to 38 cm. tall, densely beset below with trichomes to 2.5 mm. long; basal leaves rosulate with blades mostly 1-4 cm. long; cauline leaves few and remote, sparsely stellate-pubescent beneath; flowers few in a loose scorpioid cyme, almost all petaliferous; pedicels and calyces with spreading trichomes to 1.5 mm. long; free portion of outer chasmogamous (= petaliferous) sepals (2.5-) 4-5.5 (-7.5) mm. long; inner sepals 6-14 mm. long; petals 8-18 mm. long; capsule 6-10.5 mm. long with 80 to 135 papillate seeds. Sandy fields and roadsides or open woods of e. Tex., Mar.-May; from Fla. to Tex., n. to s.e. N.C. and s. Ark.

2. *Helianthemum glomeratum* (Lag.) Dun. Plant suffrutescent with ascendent stellate-pubescent to glabrate stems 1-5.5 (-8) dm. tall; cauline leaves 1-3.5 cm. long, usually oblanceolate, densely stellate-tomentose on both surfaces; flowers dimorphic but occasionally predominately or even exclusively either chasmogamous (= petaliferous) or cleistogamous (= apetalous); pedicels and calyces densely stellate-tomentulose; chasmogamous flowers mostly solitary at tips of the branches on filiform pedicels 7-20 mm. long and overtopping the subsessile or short-pedicellate cleistogamous flowers; *chasmogamous flowers*: free portion of outer sepals 0.6-4 mm. long and with inner sepals 3-7 mm. long; petals 4-9 mm. long; capsule 3.5-4.5 mm. long with 6 to 20 slightly pebbled seeds with a separable membrane when wetted; *cleistogamous flowers*: free portion of outer sepals 0.6-3 mm. long and the inner sepals 2.4-5 mm. long; capsule 1.6-3.6 mm. long with (1 or) 2 to 7 (to 11) seeds similar in pattern to the chasmogamous. Dry open woods of the Chisos Mts. of the Trans-Pecos, June-Aug.; s. to Guat.

3. *Helianthemum georgianum* Chapm. Perennial herb with ascendent stellate-tomentose stems 1-4 dm. tall; basal leaves (when present) rosulate with blades 1-2.8 cm. long; cauline leaves greenish but stellate-pubescent above while hoary and stellate-tomentose beneath with both the midvein and the secondary veins prominently elevated beneath; flowers dimorphic, in loose racemose cluster of 2 to 7; pedicels and calyces densely short stellate-canescens; *chasmogamous flowers*: pedicels 5-15 mm. long; free portion of outer sepals 1.5-3.5 mm. long; inner sepals 3.6-6.6 mm. long; petals 6-12 mm. long; stamens 15 to 36; capsule 3.8-5.8 mm. long; seeds 20 to 35, smooth and (when moistened) the membrane separable; *cleistogamous flowers*: pedicels 0.6-3(-6) mm. long; free portion of outer sepals 1.4-2.2 mm. long; inner sepals 3-4.2 mm. long; stamens 3 to 8; capsule 4-5.4 mm. long; seeds 12 to 20. *H. Bicknellii* of Tex. auth., not Fern. Dry open sandy fields or woods of e. Tex., Apr.-June; from Fla. to Tex., n. to s.e. N.C. and s. Okla.

4. *Helianthemum rosmarinifolium* Pursh. Perennial herb with ascendent stellate-tomentose stems 1.3-5 dm. tall; cauline leaves 5 to 14 times as long as wide, green and stellate-pubescent above, hoary and densely stellate-tomentose beneath with the midvein strongly elevated and the secondary veins only slightly elevated; flowers dimorphic; pedicels and calyces stellate-tomentose; chasmogamous flowers solitary at the tips of the branches on filiform pedicels 1-2.2 cm. long overtopping the subsessile glomerate cleistogamous flowers; *chasmogamous flowers*: free portion of outer sepals 1.3-2.5 mm. long; inner sepals 2.5-4.3 mm. long; petals 4-6.4 mm. long; stamens 15 to 24; capsule 2-3 mm. long; seeds 1 to 6, smooth and with a thin separable membrane when moistened; *cleistogamous flowers*: pedicels in fruit 0.5-3 mm. long; free portion of the outer sepals 0.5-1 mm. long; inner sepals 1.5-1.8 mm. long; stamens 3 to 5; capsule 1.3-1.7 mm. long; seeds 1 (or 2). Sandy fields, roadsides and open woods of e. Tex., Apr.-June; from Fla. to Tex., n. to s.e. N.C. and Ark.

2. LECHEA L. PIN-WEED

Perennial herbs or somewhat suffruticose; leaves alternate, opposite or whorled, exstipulate; flowers small, variously arranged; sepals 5, the 2 outer very unlike and much shorter to somewhat longer than the inner; petals 3, reddish; stamens (3 to) 6 to 15 (to 25); pistil 3-carpellate; stigmas 3, fimbriate; style lacking; capsule incompletely 3-celled by the shieldlike partitions; seeds 1 to 6.

A primarily eastern North American genus of 17 species ranging from Nova Scotia to Hispaniola and Guatemala.

1. Mid-cauline leaves wider than 3 mm.; pubescence of aerial stems and inflorescence branches spreading-pilose 1. *L. mucronata*.
1. Mid-cauline leaves less than 3 mm. wide; pubescence of aerial stems and inflorescence branches closely appressed-pubescent (2)
 - 2(1). Fruiting pedicels 3-5 mm. long and both strikingly secund and bending away from the stem at an angle of 90° or more; calyx more than 3 mm. in diameter; incomplete partitions within capsules firm and bony; seeds 6 2. *L. san-sabeana*.
 2. Fruiting pedicels less than 3 mm. long and not both conspicuously secund and deflexed, more or less ascendent; calyx less than 3 mm. in diameter; incomplete partitions with capsules delicate to thin-chartaceous but never rigid and bony; seeds typically 3 or less (3)
 - 3(2). External sepals usually equaling or longer than the internal; capsules 1.3-1.5 mm. wide, usually 3-seeded; eastern Texas 3. *L. tenuifolia*.
 3. External sepals usually shorter than the inner sepals or equaling them; capsules 1.2-1.3 mm. wide, usually 1- or 2-seeded; western Texas 4. *L. mensalis*.

1. *Lechea mucronata* Raf. Perennial herb with aerial stems (1.5-) 3-9 dm. tall, bearing villous or spreading-pilose trichomes and with mid-cauline leaves 3 mm. wide or more; flowers few to several together forming a compact glomerule; pedicels mostly 0.5-1 (-1.5) mm. long; calyx subglobose; inner sepals deeply concave, scariously-margined, 1.3-2.2 mm. long; outer sepals slightly shorter to somewhat longer than the inner, 1.9-2.2 mm. long; capsule 1.4-2.1 mm. long, (2 or) 3 (or 4)-seeded. *L. villosa* Ell. and its var. *macrotheca* Hodg., *L. divaricata* of auth., not Britt. Sandy fields and roadsides or open woods and hillsides principally from the e. half of Tex., June-Nov.; from Fla. to Tex., n. to s. N.H. and Neb.

2. *Lechea san-sabeana* (Buckl.) Hodg. Perennial herb with aerial stems 1.5-3.5 dm. tall, bearing strigillose or strongly ascendent trichomes and with narrowly linear cauline leaves less than 2 mm. wide; flowers distantly spaced and secund with strongly deflexed pedicels 3-5 mm. long; calyx conspicuously triangular in cross section and subglobose in general outline; inner sepals conspicuously keeled at maturity, about 2 mm. long and 3 mm. wide, scariously margined; outer sepals equaling to somewhat longer than the inner sepals in flower but usually somewhat shorter in fruit, mostly 1-2 mm. long; capsule

1.2-2.2 mm. long, 6-seeded and incompletely partitioned by a crustaceous yellowish dissepiment. *L. Drummondii* (Spach) T. & G. Roadsides, fields or open woods of e.-cen. Tex., Apr.-June; endemic.

3. *Lechea tenuifolia* Michx. Perennial herb with aerial stems 1.2-2.5 (-4) dm. tall, with strigose or strongly ascendent hyaline trichomes and with mid-cauline leaves about 1.5 mm. wide or less; flowers racemose and frequently secund on appressed pedicels 1-1.5 mm. long; calyx subglobose; inner sepals occasionally noticeably keeled at maturity, 1.6-2.2 mm. long; outer sepals equaling to conspicuously longer than the inner but rarely slightly shorter, (1.6-) 2-3 mm. long; capsule depressed-globose, 1.4-2.1 mm. long, (2-) or 3- (to 5-) seeded. Incl. var. *occidentalis* Hodg. Roadsides, fields and open woods of e. Tex., May-July; Ga. to Tex. and n. to s. Me., Minn. and Neb.

4. *Lechea mensalis* Hodg. Perennial herb with aerial stems about 1.5-2.7 dm. tall, with strigillose to appressed-pilose trichomes and linear median cauline leaves less than 1.5 mm. wide; flowers racemose and borne on closely appressed pedicels 1-2 mm. long; calyx ovoid; inner sepals 1.8-2 mm. long and at maturity obscurely keeled; outer sepals usually shorter than the inner but occasionally equaling them, 1.2-2 mm. long; capsule asymmetrically ovoid, 1.6-1.8 mm. long, 1- or 2-seeded. Apparently restricted to the wooded summit of the Chisos Mts., June-Aug.; endemic.

FAM. 124. COCHLOSPERMACEAE PLANCH.

COCHLOSPERMUM FAMILY

Low-growing herbaceous or subshrubby plants (in ours) with simple or slightly branched erect stems that arise from a thick tuberous rootstock; leaves alternate, stipulate, long-petioled, palmately divided with the more or less cuneate lobes serrate; flowers large, perfect, several in a terminal raceme, occasionally solitary by abortion, sometimes slightly irregular; sepals and petals 5 each, distinct, imbricated, deciduous; petals of unequal width; stamens numerous, distinct, dimorphic, in 2 sets on opposite sides of the flower (one with long and the other with shorter filaments); filaments filiform; anthers 2-celled, linear, basifixed, opening by two terminal porelike slits; pistil 1, the subglobose ovary superior and 3-celled, the placentae parietal and sometimes intruding; capsule large, ellipsoid, with thick outer wall and thin inner wall that separate at maturity.

A small family of several genera and about 25 species, mostly in tropical America.

1. AMOREUXIA DC.

Characters of the family. A small American genus of 7 species.

1. *Amoreuxia Wrightii* Gray. Plants to about 5 dm. tall, glandular-puberulent throughout except the glabrous leaf blades; leaves on a petiole to 8 cm. long, 5-parted with the basal pair of segments sometimes shallowly lobed again, to 6 cm. long and 8 cm. wide; leaf segments obovate, cuneate at base, serrate above; flowers rather large; sepals oblong-elliptic, about 2 cm. long, with red broken striations; petals pinkish to orange-color, with a purplish blotch at base, about 35 mm. long; fruit oblong-ovoid, to 5 cm. long; seeds oblong-obovoid, flattened on one side in profile, the loose arilliform integument smooth. In limestone soils and on silty flats in Rio Grande Plains to w. Edward Plateau, May-July; also adj. Mex.

FAM. 125. KOEBERLINIACEAE ENGL.

ALLTHORN FAMILY

Intricately branched very thorny shrubs or small trees with green bark; branches short, stiff, divergent, terminating in a spine, somewhat hairy, becoming glabrate with age, neither glandular nor aromatic; leaves alternate, reduced to scales, ephemeral; inflorescence lateral, few-flowered, umbel-like or short-racemose; flowers perfect, regular; sepals

and petals 4; stamens 8, the filaments thickened at the middle; ovary 2-celled, stipitate; fruit a globose beaked berry; seeds 2 to 4, cochleate.

A monotypic family; included by some authors in the Capparidaceae.

1. KOEBERLINIA ZUCC. JUNCO. ALLTHORN

Characters of the family. Monotypic.

1. *Koerberlinia spinosa* Zucc. Plant globose, to 15 dm. tall, with a short trunk or branched from the base; spine-tipped branches to 1 dm. long and 3 mm. in diameter, yellow-green; pedicels slender, about 5 mm. long; sepals 1-2 mm. long; petals greenish-white or cream-color, to 6 mm. long; berry tan-color or black when ripe, shining, 3-4 mm. in diameter. On rocky open slopes, clay mounds, brushlands, and about arroyos along the lower Rio Grande and in the Trans-Pecos, Mar.-Oct.; from Tex. to s.e. Ariz. and n. Mex.

Plants that flower in the spring instead of late summer and have dark green spine-tipped branches 5-10 cm. long and 1.5-2 mm. in diameter, sepals 1.5-2 mm. long, and petals 4-6 mm. long have been segregated as var. *tenuispina* Kearn. & Peeb.

Besides the above variety, we have two strikingly distinct forms, if not species, of *Koerberlinia* in Texas. Typical plants have stout, simple branches that form a less compact shrub than the intricate atypical plants that have slender branches with slender, spreading secondary branches that, in turn, have minute branchlets mostly less than 1 cm. long. Further study may reveal that these plants comprise two separate entities.

FAM. 126. VIOLACEAE BATSCH¹³⁴ VIOLET FAMILY

Herbs, vines, shrubs or small trees with lobed or unlobed stipulate leaves; flowers irregular, perfect, 5-merous, polypetalous, axillary; calyx with separate sepals, often the two lowermost spurred; corolla bilaterally symmetrical, the lowermost petal spurred or gibbous; stamens hypogynous, with adnate introrse anthers, the filaments continued beyond the anther locules; ovary 1-celled, 3-carpellate, with parietal placentation, free from calyx; fruit a 3-valved capsule. Reduced cleistogamous flowers produced in most species during summer; with 5 sepals, 2 rudimentary petals that are not exposed and two stamens; pollen tubes grow directly from anthers into ovary.

About 800 species in 15 genera; cosmopolitan.

- 1. Sepals with auricles; lower petal spurred; stamens distinct, the lower two spurred 1. *Viola*, p. 1074.
- 1. Sepals without auricles; lower petals merely gibbous, not spurred; stamens united, the lower two not spurred 2. *Hybanthus*, p. 1078.

1. VIOLA L. VIOLET

Herbs (in Texas) with large stipules; petals unequal, the lowermost spurred; 5 stamens closely surrounding ovary but not fused, two lower ones bearing spurs that are housed in spur of basal petal; cleistogamous flowers produced by all species except *V. pedata*.

About 450 species, cosmopolitan, but chiefly in temperate North America and northern South America.

- 1. Plants with leafy aerial stems (2)
- 1. Plants without leafy aerial stems (4)
- 2(1). Plants annual 1. *V. Rafinesquii*.
- 2. Plants perennial, with underground rhizomes (3)
- 3(2). Flowers yellow; plants erect 2. *V. pubescens* var. *eriocarpa*.
- 3. Flowers blue; plants prostrate 3. *V. Walteri*.

¹³⁴ Contributed by Norman H. Russell.

3 to 5 leafy aerial stems; leaves cordate, uncut, smooth to sparingly hairy on all surfaces; stipules small and entire; flowers yellow; capsule glabrous to soft-tomentose; seeds 2-2.5 mm. long. Rich moist forests, often by streams, n.e. Tex., Mar.-May; n.e. Tex. to N.C., n. to Que. and Ont.

3. *Viola Walteri* House. Creeping perennial with slender underground rhizome and sometimes much-branching with leafy prostrate above-ground stems; leaves orbicular to reniform, entire, often purple-tinged on lower surface, pubescent on upper surfaces with short stiff hairs; stipules deeply cut; flowers blue-violet; cleistogenes on long axillary peduncles; fruits subglobose; seeds brown, 0.2 mm. long. Moist to somewhat dry rich deciduous forests in s.e. Tex., Mar.-Apr.; Tex. to Fla., n. to Va., O. and Ark.

4. *Viola primulifolia* L. Acaulescent perennial with cordlike rhizomes, producing runners throughout growing season (these take root at the nodes and form new crowns); leaves ovate-lanceolate to broadly ovate, variously pubescent, the blade tapering to a petiole as long as or longer than blade; flowers white with light-blue veins (especially on lower petal), small; capsules green, borne on erect peduncles; seeds 1.5-1.7 mm. long. Roadside ditches and open marshy fields, moderately abundant in e. Tex., Mar.-May; Tex. to Fla., n. to N.S., n. Ind. and Okla.

5. *Viola lanceolata* L. subsp. *lanceolata*. LANCE-LEAVED VIOLET. Acaulescent perennial with cordlike rhizomes, producing runners through growing season (these root at the nodes and form new crowns); leaves lanceolate, glabrous, about 3.5 to 5 times as long as broad; flowers white with bluish veins; capsules green, on erect peduncles; seeds light-brown, 1.4-1.5 mm. long. Roadside ditches and wet open fields, rare in n.e. Tex., Mar.-Apr.; Tex. to Ga., n. to Que. and Minn.

6. *Viola lanceolata* subsp. *vittata* (Greene) Russell. Acaulescent perennial, similar to subsp. *lanceolata* in most respects, differing in having vittate leaves often 3-5 dm. long and 5 to 14 times as long as broad. Drainage ditches and other wet open habitats, moderately frequent in e. Tex., Mar.-Apr.; Tex. to Fla., n. to s. Va. and s.e. Okla.

7. *Viola pedata* L. BIRD-FOOT VIOLET. Acaulescent perennial with thick vertical rootstock, not reproducing vegetatively; leaves deeply pedately divided into 3 or 5 major divisions and these lobed or divided further, the ultimate lobes spatulate; flowers large, 1.5-3 cm. broad, with flattened pansylike appearance; petals either uniformly pigmented whitish to dark-purple or the 2 upper petals dark-purple and the 3 lower petals pale-lilac or bluish; cleistogenes not produced; capsules on erect peduncles about equal in length to leaves. Open woods or fields, usually in sandy soil, in e. Tex., Mar.-Apr.; Tex. to Ga., n. to N.H. and Minn.

8. *Viola sagittata* Ait. ARROW-LEAVED VIOLET. Acaulescent perennial with thick horizontal or vertical rootstock which may occasionally fragment and form new crowns; leaves erect or slightly spreading, narrow, about 2 or 3 times as long as broad, sagittate, with 4 to 6 lobes or large teeth at the cordate base, moderately to densely pubescent; flowers blue to violet-purple; sepals with short auricles; cleistogenes abundantly produced during summer. Rather dry sandy woods and edges of woods in e. Tex., Mar.-Apr.; Tex. to Ga., n. to N.H. and Minn.

9. *Viola Lovelliana* Brainerd. Acaulescent perennial, reproducing vegetatively by fragmentation of the horizontal rhizome; leaves similar to those of *V. sagittata* but wider, with 3 to 5 broad lobes at base, from 2 times as long as broad to nearly as broad as long, moderately to densely pubescent, the central leaf lobe elongate and obovate; flowers deep-violet; sepal auricles short and ciliate; cleistogenes abundantly produced during summer. Rather dry deciduous woods in s. and e. Tex., also reported from w. Tex., Mar.-Apr.; Tex., La., Ark. and s.e. Okla.

10. *Viola triloba* Schwein. var. *triloba*. Acaulescent perennial, reproducing vegetatively by fragmentation of the horizontal rhizome; leaves spreading, as broad as or broader than long, with 4 to 6 broad lobes in lower half of blades, moderately to densely pubescent on both upper and lower surfaces; flowers violet-purple. Rich bottomland woods, sparingly in e. Tex., Mar.-Apr.; Tex. to Fla., n. to Vt., Ill. and e. Okla.

11. *Viola triloba* var. *dilatata* (Ell.) Brainerd. Similar to var. *triloba*, differing in having leaves deeply cut (almost to midrib) into 5 to 7 narrow lobes; similar habitats but not occurring with typical variety, more frequent, e. Tex., Mar.-Apr.; Tex. to Fla., n. to Pa., Ill. and Okla.

12. *Viola septemloba* LeConte. Acaulescent perennial, reproducing vegetatively by fragmentation of the horizontal rhizome; leaves spreading, with 3 to 6 narrow somewhat oblanceolate lateral lobes, thin, sometimes purple-tinged in spring, overall leaf shape orbicular to ovate; flowers blue-violet, on peduncles exceeding the leaves; lateral petals villous at base; fruits green, on erect peduncles; seed with inconspicuous caruncle. Wet lowland forests, often by streams, rare in extreme e. Tex., Mar.-Apr.; e. Tex. to s. Fla., n. to Va. and Tenn.

13. *Viola esculenta* Ell. Acaulescent perennial, reproducing vegetatively by fragmentation of the fleshy horizontal rhizome; leaves spreading, somewhat fleshy, with 4 to 6 broad palmately cut basal lobes; leaf lobes with parallel margins, not oblanceolate or obovate as in *V. septemloba*; flowers pale-violet; sepals with emarginate auricles; spurred petal slightly hairy; capsules cylindrical, green, borne on spreading peduncles. Wet open land in s.e. corner of Tex., Mar.-Apr.; Tex. to s. Fla., n. to s. Va. and n. Miss.

14. *Viola sororia* Willd. Acaulescent perennial, reproducing vegetatively by fragmentation of the thick horizontal rhizome; leaves spreading, broadly ovate to reniform, entire, pubescent on both surfaces with long hairs, sometimes villous; flowers varying in color from light-lilac to reddish-purple or dark-violet-purple; sepals with short broad ciliate auricles; peduncles of open flowers equaling or shorter than petioles; capsules large, ovoid, purple or purple-spotted, prostrate or buried in leaves; seeds buff to brown, ovoid, 1.75-2.5 mm. long. Woodland habitats of all sorts, sometimes a weed in cities, e. half of Tex., Mar.-Apr.; Tex. to n. Fla., n. to Que. and N.D.

15. *Viola villosa* Walt. Small acaulescent perennial, spreading from horizontal somewhat woody rhizomes; leaves forming flattened rosettes or nearly so, small, thick, from ovate to orbicular in shape, entire, heavily pubescent with long interwoven hairs (pilose); petioles short, about length of laminas; flowers violet or blue-violet; sepals short-auricled and ciliate; lower petals bearded; fruits green, on short prostrate or ascending peduncles; capsules to 1 cm. long; seeds blackish. Occasional in open rather dry deciduous forest in e. Tex., Mar.-Apr.; Tex. to n. Fla., n. to N.C., O., Ark. and s.e. Okla.

16. *Viola nephrophylla* Greene. Acaulescent perennial, spreading from horizontal somewhat fleshy rootstocks; leaves erect or ascending, orbicular to slightly reniform, entire, glabrous except for a scattering of tiny hairs on the upper surfaces of the lobes; petioles about 2 cm. long in summer; laminas of young leaves often purple on lower surface; flowers light-blue; sepals with short blunt glabrous auricles; spurred petal villous; capsules green, slightly ovoid, borne on erect peduncles above the leaves; seeds with pronounced caruncles. Open wet fields, rare in n.e. Tex., Mar.-May; n.e. Tex. to Que. and Ont., w. to N.D. and throughout Rocky Mts.

17. *Viola pratincola* Greene. Acaulescent perennial, reproducing vegetatively by fragmentation of the horizontal rhizome; leaves spreading, broadly ovate to cordate with acute apex, uniformly crenate from basal lobes to apex, completely glabrous; flowers blue-violet; sepals with marked auricles extending back about half the length of attached portion; lateral petals often with clusters of clavate hairs; cleistogenes on erect peduncles, sagittate in shape; capsules cylindrical, green. Occasional in open prairie, often beside railroads, sometimes a weed in towns and cities, e. half of Tex., reported from the Panhandle, Mar.-May; Tex. n. to Wisc., N.D. and w. to Colo.

18. *Viola Langloisii* Greene. Acaulescent perennial, reproducing vegetatively by fragmentation of the horizontal rhizome; leaves small, short, spreading, ovate, with cordate bases and slightly attenuate apices, with 10 to 14 teeth in upper third of each margin, completely glabrous; flowers blue-violet, borne on erect peduncles above the leaves; sepals narrow, slightly sagittate. River forests in e. Tex., especially in the s.e., Mar.-Apr.; cen. Tex., e. to cen. Fla., n. to n. Miss.

19. *Viola missouriensis* Greene. Acaulescent perennial, reproducing vegetatively by fragmentation of the thick horizontal rhizome; leaves large and numerous, often 20 to 30 produced from one crown, ovate to orbicular, with cordate bases, triangular at apex, with 0 to 6 widely spaced crenations, glabrous; flowers light-blue, borne on erect peduncles about same length as petioles; sepals broad, the auricles not pronounced; grading into *V. Langloisii*. Common in cen. and n.e. Tex. in river forests, Mar.-May; s. Tex. e. to Ark., n. to Minn. and Neb., w. to N.M.

groves on the Norias Division of the King Ranch in Kenedy Co. It possibly represents another species of *Xylosma*.

FAM. 128. TURNERACEAE DC.

TURNERA FAMILY

Herbs, shrubs or rarely trees; leaves alternate, petiolate, simple, toothed or serrate, often biglandular at base; stipules small or none; flowers perfect, axillary, solitary or fasciculate, often bibracteolate, calyx borne on hypanthium, 5-lobulate, the lobes imbricate, deciduous; petals 5, inserted on hypanthium, distinct, clawed, contorted; stamens 5, inserted on the hypanthium, the filaments free; styles 3, apically fringed; fruit a 1-celled 3-valvate many-seeded capsule.

About 120 species in 7 genera in tropical and subtropical America.

1. TURNERA L.

About 60 species mainly in tropical and subtropical America.

1. *Turnera diffusa* Willd. var. *aphrodisiaca* (Ward) Urban. DAMIANA, HIERBA DEL VENADO. Shrub to 2 m. tall, usually much smaller, the herbage aromatic; leaves alternate, petiolate, oblong-elliptic to elliptic-oblong, to 35 mm. long and 15 mm. wide, usually much smaller, cuneate at base, obtuse to subacute at apex, coarsely crenate-dentate to serrate, tomentose or merely pilose beneath, often glabrate above; flowers usually solitary, sessile, 8-12 mm. long; peduncle often adnate to the petiole; calyx with 5 narrow lobes, tomentose; petals yellow, obovate to spatulate, thin; capsule thin-walled, 4-5 mm. long; seeds with a membranaceous aril. On dry brushy hillsides along the Rio Grande in s. Tex., throughout the year; from throughout most of trop. Am.

Although long considered to be an aphrodisiac, its efficacy is dubious. In Mexico, according to Standley, the plant is used as a flavoring substance in liquors and for the making of Chinese tea.

FAM. 129. PASSIFLORACEAE JUSS.

PASSION-FLOWER FAMILY

Herbaceous or woody plants that climb by axillary simple tendrils; leaves alternate, simple (in ours), stipulate, lobed or unlobed, often with petiolar glands; peduncles axillary, jointed, commonly bracteate; flowers regular, bisexual, commonly 5-merous, often highly colored; sepals and petals imbricate, perigynous; floral cup usually with a corona; stamens monadelphous, the anthers versatile and 2-celled at anthesis; ovary mostly stipitate, 1-celled; styles usually 3; stigmas capitate to clavate or discoid; fruit a capsular berry; seeds arillate with straight embryo and fleshy endosperm.

An economically important tropical family composed of 12 genera with over 600 species.

1. PASSIFLORA L.¹³⁵

PASSION-FLOWER

Characters of the family; leaves usually palmately lobed; calyx tube campanulate to cylindrical; sepals fleshy or membranous, united at base; petals membranous, alternate with the sepals; corona of 1 to several series of distinct or more or less united filaments, rarely tubular; operculum various, borne within or below the corona; filaments of stamens united below to form a tube to sheath the long stalk of the ovary, distinct above; fruit baccate, indehiscent, globose to ovoid or rarely fusiform, containing a mucilaginous pulp that is often edible; seeds numerous, more or less compressed, variously reticulate, punctate or grooved.

About 500 species, mostly in the American tropics. Many produce edible fruits.

¹³⁵ Adapted mainly from E. P. Killip in Publ. Field Mus. Bot. 19:1-613. 1938.

1. Operculum plicate; bracts (when present) linear-subulate or setaceous, not involucrate (2)
1. Operculum not plicate, of various forms; bracts setaceous or foliaceous, scattered along the peduncle or involucrate (6)
- 2(1). Petiolar glands present; seeds reticulate (3)
2. Petiolar glands none; seeds with rugulose transverse ridges (4)
- 3(2). Petiolar glands sessile, more than 0.5 mm. in diameter; leaves much broader than long, the lobes narrow1. *P. tenuiloba*.
3. Petiolar glands usually stalked and less than 0.5 mm. in diameter; leaves usually longer than broad, the lobes broad2. *P. suberosa*.
- 4(2). Peduncles rather stout, provided with bracts that are often early-deciduous
.....5. *P. affinis*.
4. Peduncles very slender, bractless (5)
- 5(4). Outer corona filaments narrowly linear; lower leaf surface with raised reticulate veins, the apical leaf lobe usually triangular-ovate and mucronate; north of the Brownsville area3. *P. lutea*.
5. Outer corona filaments filiform; lower leaf surface without raised veins, the apical leaf lobe usually broadly rounded and retuse; confined to the Brownsville region4. *P. filipes*.
- 6(1). Bracts entire or only serrulate, forming an involucre near the base of the flower6. *P. incarnata*.
6. Bracts lacerate-dentate to bipinnatisect, the ultimate divisions usually gland-tipped7. *P. foetida* var.
gossypifolia.

1. *Passiflora tenuiloba* Engelm. Stem slender, subterete, glabrous or slightly pilosulous; stipules linear-setaceous, about 3 mm. long; petioles to 8 mm. long, bearing 2 sessile saucer-shaped glands at the extreme apex of the petiole or occasionally one on each of the lowermost lateral nerves close to their base, the glands sessile and 1-1.2 mm. in diameter; leaves deeply 3-lobed, subcordate at base, 3- to 5-nerved, strongly reticulate-veined, few-ocellate, coriaceous, sparsely or densely pilosulous above, glabrous beneath; leaf lobes linear to cuneate or oblong, often aristulate, the lateral lobes once- or twice-lobed and to 8 cm. long and 2 cm. wide, the middle lobe from one third to two thirds as long as the lateral lobes and entire to 3-lobed; peduncles solitary or in pairs, 3-7 mm. long, very slender, articulate at middle, finely pilosulous, at length glabrous; bracts none or early-deciduous; flowers about 2 cm. wide, greenish; sepals linear-lanceolate, 6-8 mm. long, 2 mm. wide, obtuse, hyaline-margined; petals none; corona filaments in 2 series, those of the outer narrowly linear and 3-4 mm. long, the inner ones filiform and 2 mm. long; operculum membranous, closely plicate, minutely denticulate at margin; limen annular, borne within 1 mm. of operculum; fruit globose, glabrous, black, 8-10 mm. in diameter; seeds ovate-oblong, 3-4 mm. long, 2-2.5 mm. wide, acute at both ends, reticulate at middle of each face, 5-sulcate at margin, the axis slightly curved. Prostrate or climbing on shrubs on limestone hills in s.w. Tex., Apr.-Oct.; from Tex., s. N.M. and n. Mex.

2. *Passiflora suberosa* L. Plant glabrous to densely pubescent, the lower portion of the stem corky; stipules linear-subulate, 6-8 mm. long; petioles 0.5-4 cm. long, biglandular, the glands usually less than 0.5 mm. in diameter and distinctly stipitate, rarely larger and subsessile, borne above middle of petiole; leaves highly variable in outline, entire to deeply 3-lobed, rounded or occasionally peltate at base, membranous or subcoriaceous, sometimes ocellate beneath; leaf lobes narrowly linear to broadly ovate, suberect or widely divergent, acute or obtuse; flowers 1-3 cm. wide, solitary or in pairs in the axils of the leaves, occasionally in leafy axillary racemes; bracts minute, setaceous, soon deciduous; sepals ovate-lanceolate, subobtuse, greenish-yellow; petals none; corona filaments in 2 series, filiform, the outer recurved, white, yellow at apex and purple below, those of the inner series capitellate; operculum membranous, plicate, minutely fimbriate, white, the margin incurved; limen annular; fruit globose to ovoid, dark-purple or black, glaucous

when young, 6-15 mm. in diameter; seeds flattened, slightly curved, abruptly acuminate at apex, tapering at base, 3-4 mm. long, 2 mm. wide, coarsely reticulate. In palm groves and thickets in extreme s. Tex., June-Oct.; from s. Fla. and s. Tex. to n. S.A. and W.I., introd. into Old World.

3. *Passiflora lutea* L. Plant glabrous or sparingly pilosulous; stipules setaceous, 3-5 mm. long, deciduous; petioles to 5 cm. long, glandless; leaves usually much wider than long, 3-7 cm. long, 4-10 cm. wide, 3-lobed usually from one quarter to one third their length, rounded to subcordate or subtruncate at base, 3-nerved, closely and usually inconspicuously reticulate-veined, membranous, rarely subcoriaceous; leaf lobes broadly triangular-ovate, rounded or obtuse, rarely acutish, often mucronulate; peduncles solitary or in pairs, 1.5-4 cm. long, very slender; bracts none; flowers 1-2 cm. wide; calyx tube patelliform; sepals linear-oblong, 5-10 mm. long, 2-3 mm. wide, obtuse, pale-green; petals linear, 3-5 mm. long, about 1 mm. wide, acutish, white; corona filaments in 2 series, the outer ones about 30, narrowly linear or almost filiform, 5-10 mm. long, radiate, greenish-white, the inner narrowly liguliform, 1.5-2.5 mm. long, slightly thickened toward apex, white above, pink-tinged at base; operculum membranous, plicate, erect, white at margin, pale-pink at base; nectar ring a low ridge; limen cupuliform, fleshy; fruit globose-ovoid, glabrous, about 15 mm. long and 1 cm. in diameter; seeds broadly obcordate to suborbicular, 4.5-5 mm. long, 3 mm. wide, transversely sulcate with 6 or 7 grooves, the ridges strongly rugulose. In shade of low moist woods mainly in cen. and e. Tex., May-Aug.; from Pa. to Ill. and Kan., s. to Fla. and Tex.

This species is distinguished from *P. filipes* by the thicker filaments of the outer corona, and by thicker, more deeply lobed leaves, the reticulate venation of which is quite evident. Most of our material is referable to var. *glabriflora* Fern., characterized by having the calyx, leaves and stems quite glabrous.

4. *Passiflora filipes* Benth. Plant slender, glabrous throughout; stem terete; stipules linear-lanceolate, 2-4 mm. long, falcate, acuminate; petioles 1-2 cm. long, glandless; leaves 1-4 cm. long, 2-6 cm. wide, 3-lobed at apex, rounded at base, 3-nerved, dark-green above, slightly glaucescent beneath; leaf lobes nearly equal, obtuse or slightly acuminate; peduncles very slender, 4-6 cm. long, diverging at nearly right angles to the stem; bracts none; flowers small, 8-15 mm. wide, yellowish-green or greenish-white; sepals lanceolate to linear-lanceolate, 6-9 mm. long, 2 mm. wide, acutish; petals narrowly linear, 3-4 mm. long, 1.5 mm. wide; corona filaments in 2 series, filiform, the outer equaling the petals, the inner shorter; operculum membranous, plicate, incurved; limen annular, close to the gynophore; fruit globose, glabrous, 5-7 mm. in diameter; seeds slightly flattened, obovate to obcordate, 4 mm. long, 2.5-3 mm. wide, transversely sulcate with 3 or 4 broken ridges. In palm groves and thickets in extreme s. Tex., Mar.-Oct.; from Tex. to Nic.; also Venez.

5. *Passiflora affinis* Engelm. Plant glabrous throughout; stipules linear-subulate, 1.5-2 mm. long, falcate, deciduous; petioles 1-3.5 cm. long, slender, glandless; leaves 2-10 cm. long, 3-14 cm. wide, usually lobed from a half to two thirds their length, rarely about one third, cordulate or subtruncate at base, 3-nerved, minutely ocellate beneath, membranous or subcoriaceous; leaf lobes variable, oblanceolate to oblong or ovate, rounded or obtuse, mucronulate, the middle lobe slightly longer than the lateral lobes, the latter sometimes bilobulate; peduncles solitary or in pairs, 1-3 cm. long; bracts setaceous, 1-3 mm. long, remote in upper half of peduncle, subpersistent; flowers 2-2.5 cm. wide, greenish-yellow; sepals oblong-lanceolate, 1-1.2 cm. long, 2-3 mm. wide, obtuse; petals linear, 6-8 mm. long, 1.5-2 mm. wide; corona filaments in 2 series, the outer filiform, 7-9 mm. long, knobbed at apex, the inner filiform, 1.5-2.5 mm. long; operculum membranous, closely plicate, incurved; limen annular; fruit subglobose, glabrous, 8-10 mm. long, purplish-black; seeds obcordate, about 3 mm. long and 2 mm. wide, transversely sulcate, the grooves 6 or 7. On limestone on the Edwards Plateau, June-Aug.; also n. Mex.

This species differs from *P. lutea*, which it closely resembles, in having bracts on the peduncles and in the presence of distinct knobs at the tips of the outer corona filaments.

6. *Passiflora incarnata* L. MAYPOW, PASIONARIA. Plant glabrous or usually finely pilosulous; stem terete, the younger portion angular; stipules setaceous, 2-3 mm. long, very early-deciduous; petioles to 8 cm. long, biglandular at apex, the sessile glands suborbicular; leaves 6-15 cm. along midnerve, 5-12 cm. along lateral nerves, 7-15 cm. between apices of lateral lobes, 3-lobed from three quarters to four fifths their length, cordulate,

finely serrate, 3-nerved, membranous, dark-green above, glaucescent beneath; leaf lobes ovate-lanceolate or oblong-lanceolate, 2-5 cm. wide, acute or acuminate, the middle lobe narrowed at base, rarely with the lateral lobes bilobate; peduncles to 1 dm. long, stout; bracts spatulate to oblong, 4-7 mm. long, 2.5-4 mm. wide, obtuse to acute, minutely glandular-serrulate toward apex, conspicuously biglandular at base, borne about 5 mm. below flower; flowers to 7 cm. wide; calyx tube short-campanulate; sepals lanceolate-oblong, 2-3 cm. long, about 1 cm. wide, white or pale-lavender, obtuse, cucullate at apex, slightly carinate, the keel terminating in an awn 2-3 mm. long; petals subequal to sepals, obtuse, white or pale-lavender; corona filaments in several series, purple or pink, rarely pure white, those of the outer 2 series filiform, 1.5-2 cm. long, crispate at apex, slightly enlarged at base, radiate, those of the succeeding 3 series capillary, about 2 mm. long, radiate or suberect, the innermost series membranous at base, filamentose, the filaments about 4 mm. long, capitellate; operculum membranous, about 2 mm. long, incurved, fimbriate; nectar ring a low ridge halfway between the operculum and gynophore; limen cupuliform, closely surrounding base of gynophore, crenulate; ovary ovoid, densely brownish or whitish-velutinous-tomentose; fruit ovoid to subglobose, to 5 cm. long, orange-yellow when ripe, edible; seeds obovate to nearly orbiculate, 4-5 mm. long, 3-4 mm. wide, truncate at apex, reticulate. In old fields, along roadsides and streams, and in and on the edge of open woods in the e. third of Tex., Apr.-Aug.; from Va. to Mo., s. to Fla. and Tex.; also in Berm.; introd. farther n. in U.S.

This is our only species with edible fruit.

7. *Passiflora foetida* L. var. *gossypifolia* (Hamilt.) Mast. CORONA DE CRISTO. Plant villosulous or hirsutulous throughout, often viscous, the indument grayish, brownish or yellowish-brown, averaging not more than 1.5 mm. long; leaves hastate, averaging 5 cm. long and 5 cm. at greatest width, undulate or crenate-serrulate, the basal lobes usually semicircular in outline and sometimes abruptly narrowed to an obtuse point; bracts 2-3 cm. long, bipinnatisect or tripinnatisect, the ultimate filiform segments gland-tipped, straight or nearly so, not closely interwoven; flowers 2-5 cm. wide, white to purplish; sepals ovate-oblong to ovate-lanceolate, awned dorsally just below apex; petals oblong to oblong-lanceolate or oblong-spatulate, slightly shorter than sepals; corona filaments in several series, those of the 2 outer series filiform, about 1 cm. long, the others capillary, 1-2 mm. long; operculum membranous, erect, denticulate; ovary sparingly to densely pilosulous, the hairs persisting in fruit; fruit 2-2.5 cm. in diameter, yellow or greenish-yellow, red-spotted; seeds ovate-cuneiform, about 5 mm. long and 2.5 mm. wide, obscurely tridentate at apex, coarsely reticulate at the center of each face. In thickets and among weeds in sand, saline depressions and along ditches in s. Tex., Apr.-Oct.; from Tex. through Mex. and C.A. to n. S.A.; also W.I.

FAM. 130. LOASACEAE DUM.¹³⁶

STICK-LEAF FAMILY

Annual or perennial herbs (to woody) with barbed or sometimes stinging hairs; leaves alternate (or opposite), entire or lobed; flowers regular, bisexual; sepals persistent; corolla apetalous to sympetalous, sometimes with petaloid staminodia alternate with the petals; stamens 5 to many (sometimes fascicled); filaments narrow to petaloid; style 1, usually persistent; ovary inferior, 1-locular with 1 to 5 placentae; ovules 1 to many; fruit dry, dehiscent and many-seeded (capsule) or indehiscent and 1-seeded (achene); seeds variable; embryo straight or somewhat hooked.

About 200 species in 14 genera in temperate and tropical America and 1 genus of 2 species in the Old World.

1. Stamens 5; connective inflated and exceeding the pollen sacs; fruit indehiscent, 1-seeded; suffrutescent; hairs stinging 1. *Cevallia*, p. 1083.
1. Stamens numerous; anthers with inconspicuous connective; fruit dehiscent, 2- to many-seeded; annual or perennial; hairs scabrous, not stinging (2)

¹³⁶ Contributed by Henry J. Thompson and Joyce Roberts Zavortink.

- 2(1). Leaf blades orbicular, mostly cordate, with the petioles at least as long as the blade; pedicels elongating in fruit; seeds minute2. *Eucnide*, p. 1083.
2. Leaf blades ovate to oblanceolate, never cordate, sessile or with a petiole much shorter than the blade; pedicels not elongating in fruit; seeds 1.5-4 mm. long ...3. *Mentzelia*, p. 1083.

1. CEVALLIA LAG.

A monotypic genus with the characteristics of the species.

1. *Cevallia sinuata* Lag. Plants suffrutescent, to 6 dm. tall; leaves and stems tomentose and armed with long stinging hairs; leaves sinuate to pinnatifid, sessile or nearly so; flowers in tight heads on long peduncles borne opposite the leaves, opening in the morning; sepals and petals similar, 5-8 mm. long, plumose, yellow on the inner surface; stamens 5; filaments short, thick, the connective extending beyond the anthers as a hollow inflated appendage; fruit indehiscent, with only one seed; chromosomes $n=13$. Open areas, often along roadsides, on various coarse substrates, in w. half of the state and common along the Rio Grande, June-Oct.; w. to s.e. Ariz. and n. Mex.

2. EUCNIDE ZUCC. ROCK-NETTLE

Eleven species in southwestern United States, Mexico and Guatemala.

1. *Eucnide bartonioides* Zucc. Annual or herbaceous perennial, more or less woody at base; leaves alternate, with petioles 4-14 cm. long, orbicular to cordate, with crenate or dentate margins; flowers 5-merous, opening in late afternoon; calyx lobes lanceolate, 5-20 mm. long; corolla sympetalous; petals obovate, light-yellow, 1-4 cm. long; stamens numerous, filiform, (15-) 25-50 mm. long; ovary inferior, 1-celled with 5 placentae; style (13-) 30-55 mm. long; capsules globular to obovoid, 5-13 mm. long, 5-8 mm. wide; pedicels elongating to 15 cm. or more in fruit; seeds numerous, minute, less than 0.5 mm. long, oblong, grooved or ribbed longitudinally; chromosomes $n=21$. On limestone bluffs or gravelly slopes in w. Edwards Plateau and the Trans-Pecos, May-Aug.; s. in Mex. to S.L.P.

3. MENTZELIA L.

Perennial or annual; hairs barbed but not stinging; leaves lobed or entire, petiolate or sessile; flowers solitary and axillary or in terminal bracteate more or less cymose inflorescences; perianth 5-merous, usually 2-seriate; stamens few to many; filaments filiform or dilated; staminodes present or absent; style filiform; ovary with 3 to 5 placentae; ovules few to many; capsules variable in size and shape, sessile to short-pedicellate; seeds irregularly angled, flattened or oblong, the surface smooth, tuberculate or wrinkled, sometimes striate.

About 60 species in temperate and tropical America, mostly in southwestern United States and Mexico. *Mentzelia pumila* (Nutt.) T.&G. has been reported from Texas but we have seen no material from the state. It is very dubious that this far-western species would occur in Texas.

1. Seeds pendulous, not winged; petals 5 (2)
1. Seeds horizontal, winged; petals more than 5 (Sect. *Bartonia*) (7)
- 2(1). Seeds irregularly angled or somewhat prismatic; petals less than 5 mm. long (Sect. *Trachyphytum*) (3)
2. Seeds oblong or flattened and pyriform; flowers with petals longer than 5 mm. (Sect. *Mentzelia*) (4)

- 3(2). Bracts usually entire, not white at base; axillary capsules usually recurved to be at least 90°; seed surface with large pointed papillae . . . 1. *M. albicaulis*.
3. Bracts usually lobed, white at base; axillary capsules usually erect or only slightly curved to 45°; seed surface with minute pointed papillae 2. *M. montana*.
- 4(2). Seeds oblong, more or less 3-sided; capsules becoming hard and woody 3. *M. oligosperma*.
4. Seeds flattened and pyriform; capsules never hard and woody (5)
- 5(4). Petals 10-16 mm. long; styles 10-12 mm. long; stamens of 2 distinct lengths, inner 5-9 mm. long, outer 10-14 mm. long 4. *M. incisa*.
5. Petals less than 12 mm. long; stamens more or less equal in length (6)
- 6(5). Petals 6-8 mm. long; styles and stamens 4-5 mm. long 5. *M. texana*.
6. Petals 9-12 mm. long; styles 7-10 mm. long; stamens 7-9 mm. long 6. *M. Lindheimeri*.
- 7(1). Petals over 4 cm. long; styles 5-6 cm. long; stamens 3-5 cm. long, forming a loose cylindrical cluster around style at anthesis 7. *M. decapetala*.
7. Not as above (8)
- 8(7). Petals 6-11 mm. long; sepals 3-6 mm. long; capsules long-cylindrical, 20-30 mm. long 8. *M. albescens*.
8. Flowers large or small but not with above combination; if sepals and petals are small then capsules are less than 13 mm. long (9)
- 9(8). Leaves with very narrow rachis, entire or pectinately lobed (10)
9. Leaves with medium to broad rachis, dentate or with short lobes, never entire or pectinate (11)
- 10(9). Petals white, linear; leaves pectinately lobed 9. *M. humilis*.
10. Petals yellow, broader; leaves mostly entire; Hudspeth County only 10. *M. saxicola*.
- 11(9). Some fertile stamens with broad filaments (12)
11. All fertile stamens with narrow filaments (13)
- 12(11). Plants usually taller than 3 dm., open, not compact; leaf rachis less than 6 mm. wide, the margins lobed with lobes as long as or longer than the width of the rachis 11. *M. multiflora*.
12. Plants low and much-branched from base, compact, 1-2 dm. tall; leaf rachis broad, 6-12 mm. wide, the margins dentate or with short round lobes that are shorter than width of the rachis 12. *M. mexicana*.
- 13(11). Petals yellow; cauline leaves broad-based, sessile and more or less clasping 13. *M. Reverchonii*.
13. Petals white; cauline leaves narrow, base not broad or clasping (14)
- 14(13). Petals 25-40 mm. long; styles 12-20 mm. long; bracts linear-lanceolate, lacinate 14. *M. nuda*.
14. Petals 11-25 mm. long; styles 7-12 mm. long; bracts linear, entire or sometimes few-toothed 15. *M. strictissima*.

1. *Mentzelia albicaulis* (Hook.) T.&G. Rosette-forming annual, erect or spreading; lower leaves linear, usually deeply lobed; upper leaves linear to ovate-lanceolate, usually lobed, uppermost sometimes entire; floral bracts usually linear-lanceolate, entire or somewhat angular; flowers opening in early morning; calyx lobes 2-4 mm. long; petals ovate, yellow, 3-5 mm. long; stamens many, 3-5 mm. long; style 3-5 mm. long; capsules cylindrical, narrowed at base, erect or the first-formed capsule sometimes recurved, 15-30 mm. long; seeds 20 to 30 per capsule, irregularly angled, slightly tessellate, the surface with large pointed papillae; chromosomes $n=36$. On gravelly slopes and along roadsides, in extreme w. Tex., Apr.-May; from Neb., w. to Calif., n. to B.C., s. into Baja Calif. and n. Mex.

2. *Mentzelia montana* (Davids.) Davids. Rosette-forming annual, erect or somewhat spreading; lower leaves linear, lobed or entire; upper leaves linear to ovate-lanceolate, entire or few-lobed; floral bracts narrow and linear, lobed or angular, with a white spot at base; flowers opening in early morning; calyx lobes 2-4 mm. long; petals yellow, obovate, 2-5 mm. long; stamens 20 to 40, 2-4 mm. long; style 2-4 mm. long; capsules cylindrical, narrowed at base, erect or occasionally slightly curved, 8-20 mm. long; seeds irregularly angled or somewhat prismatic, tan or sometimes slightly tessellate, about 35 per capsule, the surface with very small pointed papillae; chromosomes $n=18$. Under evergreen oaks or mesquite, or in dry streambeds with cottonwoods, only in Culberson Co., Apr.-May; w. to Calif.

3. *Mentzelia oligosperma* Sims. STICK-LEAF, CHICKEN-THIEF, PEGAJOSA. Rounded to matted semiwoody perennial with enlarged roots; leaves sessile or short-petiolate, ovate to distinctly trilobed with irregularly toothed margins; flowers opening in early morning; calyx lobes lanceolate, 6-8 mm. long; petals orange (salmon), ovate, 9-13 mm. long; stamens 25 to 35, subequal, 6-10 mm. long; filaments all narrow; style 7-10 mm. long; capsules woody, sessile, cylindrical, often curved, 7-13 mm. long; seeds oblong, more or less 3-sided, 2 or 3 per capsule; chromosomes $n=11$. On limestone bluffs in wooded areas but also on shell debris as in Aransas Co., and on sandy or clay soils and occasionally in ruderal areas, generally throughout Tex., late May-Sept.; from n. Ark., Mo. and S.D. to Colo.

4. *Mentzelia incisa* Urban & Gilg. Perennial, to 6 dm. tall, with several semiwoody stems from an enlarged root; leaves petiolate or subsessile, ovate to more or less trilobed, margins irregularly dentate or crenate; time of flower-opening unknown; calyx lobes lanceolate, 8-11 mm. long; petals yellow to orange, obovate, 10-16 mm. long; stamens 30 to 40, the outer 5 to 10 about 10-14 mm. long and with filaments slightly dilated at base, inner whorl 5-9 mm. long with filaments all narrow; style 10-12 mm. long; capsules subcylindrical to obconical, 10-15 mm. long, usually pedicellate and attenuated at base; seeds flattened, pyriform, about 5 to 8 per capsule. On gravelly slopes, igneous soil along streams in s. Tex., Mar.-Nov.; also Mex.

5. *Mentzelia texana* Urban & Gilg. Perennial to 12 dm. tall; leaves petiolate, ovate to trilobed, width irregularly dentate margins; flowers opening in early morning; calyx lobes 4-5 mm. long; petals yellow, obovate, 6-8 mm. long; stamens about 25; filaments all narrow, 4-5 mm. long; styles 4-5 mm. long; capsules conical to cylindrical, sessile or somewhat attenuated at base to a very short pedicel, 10-20 mm. long; seeds flattened, pyriform, 6 to 8 per capsule. *M. asperula* Woot. & Standl. On canyon slopes and edges of oak woodland in s. and s.w. Tex., Sept.-Nov.; also Mex. (Pue.)

6. *Mentzelia Lindheimeri* Urban & Gilg. Perennial to 6 dm. tall, with several semiwoody stems from an enlarged root; leaves petiolate or subsessile, ovate to more or less trilobed, margins irregularly dentate or crenate; time of flower-opening unknown; calyx lobes lanceolate, 6-9 mm. long; petals yellow to orange, obovate, 8-12 mm. long; stamens 30 to 45, subequal, 7-9 mm. long; style 7-10 mm. long; capsules subcylindrical, 10-14 mm. long, usually pedicellate and attenuated at base; seeds flattened, pyriform, about 4 to 8 per capsule. Gravelly slopes in s. Tex., Mar.-Nov.; also Mex.

7. *Mentzelia decapetala* (Pursh) Urban & Gilg. Herbaceous perennial with stems often 1 m. tall; rosette leaves oblanceolate, sinuate; cauline leaves oblanceolate, coarsely toothed; bracts sessile, lacinate, the uppermost borne on the side of the capsule; flowers large, opening about 1 hour after sunset; calyx lobes 2.5-4 cm. long; petals 10, white, 4-8 cm. long; stamens numerous, 3-5 cm. long, at anthesis forming a loose cylindrical cluster around the style; style 5-6 cm. long; capsules 3-4.5 cm. long; seeds flattened, oval in outline, 3 mm. long, with a wing 0.5 mm. wide; chromosomes $n=11$. *M. ornata* T. & G., *Bartonia decapetala* Pursh. Disturbed places in prairies, gravel slopes and roadbanks, in n.w. Tex., mostly in the Panhandle, June-Aug.; northw. e. of the Rockies into s. Alta. and Sask.

8. *Mentzelia albescens* (Gill. & Arn.) Griseb. Herbaceous perennial, the stems strictly branched, erect, 3-6 dm. tall; lower leaves linear-lanceolate to oblanceolate, coarsely dentate to lobed; cauline leaves linear-lanceolate to ovate-lanceolate, toothed or lobed; bracts linear to lanceolate, entire or slightly toothed or more or less lobed at base; flowers opening in late afternoon; calyx lobes 3-6 mm. long; petals light-yellow, more or less

ovate, 6-11 mm. long; stamens numerous, most fertile anthers with narrow filaments, few outer ones with broadened filaments, 3-6 mm. long; style 4-6 mm. long; capsules cylindrical, 20-30 mm. long; seeds flattened, oval, 2.5-3.5 mm. long, with a wing to 1 mm. wide; chromosomes $n=11$. On open disturbed sites, often ruderal, in cen. and w. Tex., May-Aug.; Colo., Kan., Mo., Okla., s. into Chih.; also Chile and Arg.

9. *Mentzelia humilis* (Urban & Gilg) Darl. Herbaceous perennial with stem 2-6 dm. tall; leaves linear to linear-lanceolate, with very narrow rachis, pectinately lobed, the lobes usually long but sometimes short; bracts linear and entire; flowers opening in late afternoon; calyx lobes 6-11 mm. long; petals white, linear, 9-23 mm. long; stamens numerous, most fertile stamens with narrow filaments, occasionally a few with somewhat broadened filaments, 9-15 mm. long; style 6-13 mm.; capsules globular or cup-shaped, 6-13 mm. long, 4-6 mm. wide; seeds flattened, oval, 3-4 mm. long, with a wing about 1 mm. wide; chromosomes $n=10$. On gypsum soils in w. Tex. (Culberson, Loving and Ward cos.), June-Oct.; also N.M.

10. *Mentzelia saxicola* Thomps. & Zavortink. Herbaceous perennial, to 4 dm. tall; rosette leaves linear, entire or with very short lobes; cauline leaves linear, usually entire or with short lobes or toothed; bracts linear, entire; flowers opening in late afternoon; calyx lobes 5-8 mm. long; petals yellow, ovate, 9-12 mm. long; stamens numerous, most fertile stamens with narrow filaments, a few with dilated filaments, 6-8 mm. long; style 6-8 mm. long; capsules globular or cup-shaped, 7-10 mm. long; seeds flattened, oval, 1.5-2 mm. long, with a wing 1 mm. wide; chromosomes $n=10$. On gypsum soils and rocky hills in Presidio, Hudspeth and El Paso cos. only, July-Oct.; endemic.

11. *Mentzelia multiflora* (Nutt.) Gray. Herbaceous perennial; stems 2-8 dm. tall, several- to many-branched; leaves linear-lanceolate, with narrow to medium rachis, usually with long lobes; bracts linear, entire to somewhat lobed; flowers opening in late afternoon; calyx lobes 6-9 mm. long; petals yellow, obovate, 7-25 mm. long; stamens numerous, 5-10 mm. long, outer fertile stamens with broad filaments grading to inner stamens with narrow filaments; style 6-10 mm. long; capsules cylindrical to cup-shaped, 8-24 mm. long; seeds flattened, oval, 1.5-3 mm. long, with a wing 0.5-1 mm. wide; chromosomes $n=9$. On disturbed sites of various substrates, w. Tex., Mar.-Sept.; in most of w. U.S. and Mex.

12. *Mentzelia mexicana* Thomps. & Zavortink. Herbaceous perennial with stems 1-2 dm. tall, compact and much-branched from the base; lower leaves more or less lanceolate, with broad rachis 6-12 mm. wide, margins dentate or with short round lobes shorter than the width of the rachis, upper leaves similar but smaller; bracts linear and entire; time of flower-opening not known; calyx lobes triangular to lanceolate, 6-8 mm. long; petals yellow, ovate-lanceolate, 8-15 mm. long and 2-5 mm. wide; stamens numerous, 5 mm. (inner) to 10 mm. (outer) long, some filaments dilated to 2 mm. wide; style 6-10 mm. long; capsules cup-shaped, 5-15 mm. long; seeds flattened, oval, 1.8-2 mm. long, with a wing to 1.2 mm. wide; chromosome number not known. On clay soils or rocky slopes, 2,000-4,000 ft. alt., known in Tex. from Brewster Co. only, Mar.-Sept.; also Coah. and e. Chih.

13. *Mentzelia Reverchonii* (Urban & Gilg) Thomps. & Zavortink. Herbaceous perennial with stems to 1 m. tall; rosette leaves linear-lanceolate, with broad rachis and short blunt lobes; cauline leaves lanceolate to ovate-lanceolate, shallowly lobed to coarsely or finely toothed; uppermost leaves with broad somewhat clasping base; bracts linear to lanceolate, entire to toothed or lacinate; time of flower-opening unknown; calyx lobes 10-12 mm. long; petals yellow, spatulate, 15-30 mm. long; stamens numerous, fertile stamens with narrow filaments, some narrow staminodes present, from 4 mm. (inner) to 20 mm. (outer) long; style 11-17 mm. long; capsules cylindrical, 15-30 mm. long; seeds flattened, oval, 2-3 mm. long, with a wing 0.5-1 mm. wide. *M. nuda* of auth., *M. Wrightii* of auth. On gravelly and limestone soils, throughout most of Tex. except the extreme e. portion, May-Sept.; s.e. Colo., s.w. Okla., e. N.M. into n. Mex.

14. *Mentzelia nuda* (Pursh) T.&G. Herbaceous perennial, strictly branched, to 1 m. tall; leaves linear-lanceolate, bluntly dentate to sharply toothed, very scabrous; bracts linear-lanceolate, lacinate; flowers opening in late afternoon; calyx lobes 10-19 mm. long; petals white, linear-oblongate, 25-40 mm. long; stamens numerous, fertile stamens

with narrow filaments, most staminodia narrow or a few slightly dilated but not broad, from 4 mm. (inner) to 25 mm. (outer) long; style 12-20 mm. long; capsules cylindrical, 18-30 mm. long; seeds flattened, oval, 1.5-2.5 long, with a wing about 1 mm. wide; chromosomes $n=10$. *M. stricta* (Osterh.) Jeffs & Little. On open sites in grassland and prairies usually on sandy soils, throughout cen. Tex., from the Panhandle to the Rio Grande Valley, June-Oct.; e. of the Rocky Mts. from Mont. and S.D., s. into n. N.M.

15. *Mentzelia strictissima* (Woot. & Standl.) Darl. Herbaceous perennial, strictly branched, to 9 dm. tall; leaves linear-lanceolate, irregularly dentate to finely toothed, scabrous; bracts linear, entire or somewhat toothed at base; flowers opening in late afternoon; calyx lobes 8-12 mm. long; petals white, linear-oblongate, 11-25 mm. long; stamens numerous, from 4 mm. (inner) to 20 mm. (outer) long; fertile stamens with narrow filaments, most staminodia narrow, a few slightly dilated; style 7-12 mm. long; capsules cylindrical or subcylindrical, 13-18 mm. long; seeds flattened, oval, 1.5-2.5 mm. long, with a wing to 1 mm. wide; chromosomes $n=10$. On open sites in grassland and prairies usually on sandy soils, in w. Tex., May-Sept.; also e. N.M.

FAM. 131. CACTACEAE JUSS.¹³⁷

CACTUS FAMILY

Stems succulent, 0 to many ribs; tubercles separate to coalescent; leaves exceedingly small, usually none in adult plants; areoles usually bearing spines; flowers epigynous; floral tube bearing usually areoles and often scale leaves, the part above the inferior ovary from almost obsolete to elongate and tubular; scale leaves of the tube shading upward into sepaloid structures and these into petaloid structures; stamens numerous; carpels cyclic, 3 to 20; stigmas separate; style 1; ovary 1-chambered; ovules numerous, on laminar placentae that are as numerous as the carpels or stigmas and which protrude from the walls, usually campylotropous; hilum basal or appearing "lateral."

1,000 or more species from Canada to southern South America.

1. Areoles bearing glochids (barbed bristles) as well as spines; young stem with a slender fleshy leaf below each areole; floral tube barely developed above the ovary; stems composed of series of cylindroid or flattened joints, not ribbed; flower within or on the edge of the areole1. *Opuntia*, p. 1088.
1. Areoles *not* bearing glochids; stem leafless; floral tube often developed into a deep cup or a tube above the ovary (2)
 - 2(1). Flowers nearly always on stem areas 1 to several years old, usually clearly below the apex of the stem or branch; seed longer than broad; hilum obviously basal or rarely oblique (3)
 2. Flowers on the new growth of the season at the apex of the stem or branch in a felted area merging directly or through an isthmus with the new spiniferous areole; cotyledons accumbent (5).
 - 3(2). Stems *not* ribbed, with independent tubercles; flower bud in a special areole between tubercles, *not* associated with the spiniferous areole on the tubercle; cotyledons accumbent4. *Mammillaria*, p. 1100.
 3. Stems ribbed; flower bud *either* within the spiniferous areole *or* bursting through the epidermis just above it; ovary bearing scale leaves or spines; cotyledons incumbent (4)

¹³⁷ Contributed by Lyman Benson. Most of the voluminous synonymy is omitted here, but it may be found in *The Cacti of the United States and Canada* by Lyman Benson, ined., and by him in an abridged form in C. L. Lundell, *Flora of Texas II*: 221-317. 1969. The research underlying preparation of the manuscript on the Cactaceae was supported by several research grants from the Claremont Graduate School, by one for 1950 from the Society of Sigma Xi, and by three grants from the National Science Foundation covering the periods from 1956-1959, 1960-1964, 1965-1967. This aid is acknowledged with gratitude.

- 4(3). Flower within at least the edge of a mature spine-bearing areole; stem length 15 to 100 times the diameter; embryo curved 2. *Cereus*, p. 1094.
4. Flower bud bursting through the epidermis just above a mature spine-bearing areole; stem length 1 to 5 or 10 times the diameter; embryo nearly straight 3. *Echinocereus*, p. 1095.
- 5(2). Areoles of the mature plant bearing spines (6)
5. Areoles of the *mature* plant *not* bearing spines, with tufts of hair; hilum obviously basal except in the single species of *Echinocactus* appearing under this lead (12)
- 6(5). Flower-bearing portion of the areole adjacent to and merging with the spine-bearing portion (7)
6. Flower-bearing portion of the areole (except on juvenile stems) distant from the spine-bearing portion, the flower or fruit standing apart from the spine cluster at the end of a narrow felted and usually linelike groove extending to the base of the tubercle (10)
- 7(6). Flower-bearing portion of the areole narrow, 3 to several times as long as broad, extending along as much as half or more of the tubercle; ovary with a few scale leaves, the areoles *not* bearing axillary hairs; seed longer than broad, the hilum obviously basal 9. *Thelocactus*, p. 1105.
7. Flower-bearing portion of the areole broad, nearly circular to rectangular or irregular (8)
- 8(7). Stems *not* ribbed, the tubercles separate; ovary with few or no scales, the surface never obscured by hairs; seeds broader than long, the hilum appearing "lateral;" fruit thin-walled, bright-red; floral cup deciduous . . 8. *Epithelantha*, p. 1104.
8. Stems strongly ribbed; ovary with numerous scale leaves; fruit thick-walled; floral cup persistent (9)
- 9(8). Fruit fleshy at maturity, the areoles *not* woolly; sepaloid perianth parts *not* spinose or aristate; seed longer than broad, the hilum obviously basal or "sub-basal" or sometimes "diagonal" 6. *Ferocactus*, p. 1102.
9. Fruit (at least in the spiny species) dry at maturity, the areoles bearing long woolly hairs that obscure the fruit; sepaloid perianth parts apically spinose or aristate; seed broader than long, the hilum appearing "lateral" 7. *Echinocactus*, p. 1103.
- 10(6). Spines (either the principal central or the lower radial or both) hooked; tubercles of *mature* plants coalescent basally into ribs; ovary bearing one to many scale leaves; fruit green to red, indehiscent 11. *Ancistrocactus*, p. 1107.
10. Spines all straight or curved, *none* hooked [except in *Coryphantha Scheeri* var. *uncinata* (rare, near El Paso)]; tubercles separate, *not* coalescent (11)
- 11(10). Fruit tan or green, dry, opening *either* lengthwise *or* diagonally at the base; ovary bearing a few (up to 20) membranous scales 10. *Neolloydia*, p. 1106.
11. Fruit green or red, fleshy but very thin-walled, indehiscent; ovary *not* bearing scale leaves (except a few in *Coryphantha macromeris*) . . 12. *Coryphantha*, p. 1108.
- 12(5). Tubercles *not* coalescent, flattened and strongly roughened and fissured on the upper sides; fruit *not* bearing scale leaves; petals pink to magenta or white 13. *Ariocarpus*, p. 1113.
12. Tubercles coalescent into ribs, smooth (13)
- 13(12). Stem ribs *not* scaly; ovary *not* bearing scale leaves; petals pink or tinged with pink 5. *Lophophora*, p. 1102.
13. Stem ribs covered with radiating white hairy scales; ovary bearing brown imbricated scarious scale leaves; petals yellow but the bases red 7. *Echinocactus*, p. 1103.

1. OPUNTIA MILL.

PRICKLY PEAR. CHOLLA

Stems of series composed of cylindroidal or flattened joints; ribs none, the tubercles separate or none; leaves cylindroidal, acicular or subulate, ephemeral; spines commonly

1 to 10 per areole; glochids barbed; flower within the spine-bearing areole; floral tube above the ovary very short, deciduous; fruit fleshy or dry, indehiscent; seeds discoid; cotyledons incumbent, foliaceous.

Many species in the Western Hemisphere, the number uncertain.

1. Joints of the stem cylindroidal; epidermis of the spine separating completely or only apically into a thin paperlike sheath; glochids *usually but not necessarily* (see leads 2 below) small and inconsequential (Subg. 1. *Cylindropuntia*, chollas) (2)
1. Joints of the stem flattened; epidermis of the spine not separating into a sheath; glochids usually but *not* always large, well-developed, barbed and effective (Subg. 2. *Opuntia*, prickly pears) (6)
- 2(1). Spine with the epidermis separating into a sheath at only the extreme apex, at least basally flattened, with rough crossbands of papillae; glochids (especially on underground stems and often on fruits) large and strongly barbed; joints clavate; plant forming a mat 5. *O. Schottii*.
2. Spine with the entire epidermis separating into a thin and paperlike sheath, slender, *not* papillate; glochids usually all small and harmless; joints cylindroidal, usually uniformly spiny; plant shrubby, arborescent or treelike (3)
- 3(2). Terminal joints or at least some of them on each plant at least 15 mm. in diameter (4)
3. Terminal joints not more than 12 mm. in diameter (5)
- 4(3). Longer spines 3.8-5 cm. long; sheaths loose, of much greater diameter than the spines, 3-4 cm. in diameter; petaloid perianth parts yellow or yellowish-green 1. *O. tunicata*.
4. Longer spines 1-3 cm. long; sheaths close-fitting on the spines; petaloid perianth parts reddish-purple 2. *O. imbricata*.
- 5(3). Larger terminal branches 3-4.5 mm. in diameter; fruit bright-red, not tuberculate 3. *O. leptocaulis*.
5. Larger terminal branches 6-12 mm. in diameter; fruit reddish or mostly so, strongly tuberculate 4. *O. Kleiniae*.
- 6(1). Fruit green or reddish, becoming tan and dry as the seeds reach maturity, with at least an apical rim of divaricately-spreading strongly barbed spines; seeds usually 3-7.5 mm. in diameter, rough and irregular (7)
6. Fruit fleshy and juicy at maturity of the seeds, usually red or reddish-purple, nearly always spineless, with glochids (9)
- 7(6). Larger joints 50-125 mm. long, 38-100 mm. broad, broadly obovate to orbiculate, to 12 mm. thick, less than one quarter as thick as broad; spines (except on the fruits) not strongly barbed, the joints not detached readily 6. *O. polyacantha*.
7. Larger joints 25-38 mm. long, 25 mm. broad or less, flattened-obovoid or -ovoid, 12-19 mm. thick, at least one half as thick as broad; spines strongly barbed, the joints readily detached and clinging by the barbed spines (8)
- 8(7). Roots not bearing glochids; stigmas 10, oblong, not apiculate; fruit obovoid, 12-15 mm. long, 10 mm. in diameter 7. *O. fragilis*.
8. Roots bearing areoles and masses of glochids, 3-12 dm. long; stigmas 5, ovate-acute, apiculate; fruit vasselike, constricted above, 25-30 mm. long, 10 mm. in diameter .. 8. *O. arenaria*.
- 9(6). Spines present (10)
9. Spines none (18)
- 10(9). Plant 30-70 dm. high, usually a tree, the trunk commonly 10 dm. high or more; joints 2.25 or 3-6 dm. long; spines nearly white; fruit usually yellowish or tannish-orange; escape from cultivation 18. *O. Ficus-indica*.
10. Plant to only 24 dm. high (usually much less), rarely with a main trunk to 3 dm. long; joints rarely to 2-3 dm. long; fruit red to purple at maturity; native species (11)

- 11(10). Spines acicular (needlelike), elliptic to nearly circular in cross section (sometimes an occasional spine flattened basally), 1 to 3 per areole, not all the spines yellow (12)
11. Spines (at least some of the larger but not necessarily the smaller) subulate, *flattened at least at the bases*, usually 3 or more per areole (15)
- 12(11). Plants low and mat-forming, usually prostrate; largest joints usually 5-7.5 or 11 cm. long, 38-75 cm. broad; spines white, gray or brownish (13)
12. Plants arising the height of several joints, 3-21 dm. high; joints 10-17.5 cm. or 30 cm. long, usually 7.5-15 or 20 cm. broad; spines tan, brown, pink, gray, black, reddish-brown or sometimes white (14)
- 13(12). Seed margin (covering the embryo) smooth and regular, 0.5 mm. broad; joints green; petaloid perianth parts yellow; spines gray or brownish, few on the joint, 1 or rarely 2 per areole, 19-30 mm. long, 0.5-0.7 mm. in diameter, spreading; roots fibrous10. *O. compressa*.
13. Seed margin irregular, 1 mm. broad or more; joints glaucous; petaloid perianth parts yellow, usually with red bases; spines usually white or pale-gray, 1 to 6 per areole, 38-56 mm. long, 0.5 mm. in diameter, mostly deflexed; main root usually tuberous11. *O. macrorrhiza*.
- 14(12). Spines in each of the upper areoles of the joint 3 to 7 or 11; joints green during favorable seasons, sometimes partly lavender to reddish-purple in cold or dry weather; petaloid perianth parts pale-yellow12. *O. atrispina*.
14. Spines in each of the upper areoles of the joint 1 or sometimes 2 or rarely 3 in some areoles; joints strongly tinted with lavender or reddish-purple at all seasons; petaloid perianth parts yellow with red bases and centers13. *O. violacea*.
- 15(11). Spines *all* (1 to 6 or 8 per areole) *deflexed* (except the longest one in each of a few areoles at the top of the joint), one lower spine markedly longer than the others, reddish-brown basally, shading to yellow apically (changing to black in age); fruit red, spheroidal, 1.2-2 cm. in diameter ... 17. *O. Strigil*.
15. Spines not all deflexed, spreading in various directions, no single lower spine in the areole markedly longer than the others (16)
- 16(15). Spines *not all* yellow, at least some of them gray, tan, brown, reddish or white or strongly so basally; joints glaucous14. *O. phaeacantha*.
16. Spines *all* yellow (or slightly colored basally), turning drab-gray or black in age and often so in pressed specimens (17)
- 17(16). Fruit obovoid to elongate-obovoid, sometimes sterile basally in parasitized fruits; seeds 3-4 mm. in diameter; inner sepeloid perianth parts truncate or emarginate15. *O. Lindheimeri*.
17. Fruit elongate-obovoid, the base normally constricted and forming a sterile short stalk; seeds 4-6 mm. in diameter; inner sepeloid perianth parts acute or acuminate16. *O. stricta*.
- 18(9). Plant a tree, 3-6 m. high, the trunk commonly 1 m. high; cultivated, sometimes escaped18. *O. Ficus-indica*.
18. Plant not treelike, *not* with a main trunk; fruits 1.9-5 cm. long (19)
- 19(18). Joints pubescent, gray-green; glochids deciduous, reddish-brown, flying into the air when the plant is disturbed; flowers yellow; fruit bright-red 9. *O. rufida*.
19. Joints glabrous; glochids persistent (20)
- 20(19). Joints green (lavender- or purple-tinged in winter), *not glaucous* (21)
20. Joints glaucous (sometimes lavender- or purple-tinged at least in winter) (22)
- 21(20). Joints orbiculate to obovate, 5-11 cm. long, 4-11 cm. broad 10. *O. compressa*.
21. Joints narrowly obovate to narrowly elliptic or oblong, 10-20 or 35 cm. long, usually 7.5-10 or up to 20 cm. broad16. *O. stricta*.

- 22(20). Joints with a betacyanin pigment (lavender or purple) conspicuous at all seasons (intensified during cold weather or drought)
 13. *O. violacea*.
22. Joints green or (in some hybrids) glaucous (except during extreme cold or drought)
 18. *O. Ficus-indica*
 (hybrids).

1. *Opuntia tunicata* (Lehm.) Link & Otto. ABRJOJO. Bushy or mat-forming cholla 3-6 dm. high; joints 1-2.5 dm. long, 1.5-2 cm. in diameter; tubercles strongly raised, 1.2-3 cm. long, 3-9 mm. high; spines reddish-brown (the conspicuous sheaths lighter colored and papery), 6 to 10 per areole, 3.8-5 cm. long, basally 1-1.5 mm. (sheaths 1.5-4 mm.) broad; flower 3 cm. in diameter; petaloid perianth parts greenish-yellow or tinged with red; fruit fleshy, tuberculate, 3 cm. long, the umbilicus cuplike.

Var. *tunicata*. SHEATHED CHOLLA. Joints not strongly woody, readily detached, 5-25 cm. long, 2.5-3 cm. broad; tubercles 2-3 cm. long; spines 4.4-5 cm. long; sheaths whitish-tan, 2-4 mm. in diameter, remarkably loose. Desert hillsides and fans at 1,500 m., Pecos and Brewster cos.; s. to Mex. and Chile.

Var. *Davisii* (Engelm.) L. Benson. Joints strongly woody, *not* readily detached, 5-15 cm. long, about 1 cm. in diameter; tubercles 12-15 mm. long; spines about 38 mm. long; sheaths golden-tan, 1.5-2 mm. in diameter, loose. Sandy soils at 600-1,500 m. in w. Tex., w. Okla. and e. N.M.

2. *Opuntia imbricata* (Haw.) DC. TREE CHOLLA, COYONOSTLE. Usually a small tree 1-2 m. high; joints cylindroidal, 1.25-3.75 dm. long, 2-3 cm. in diameter; tubercles prominent, very sharply raised, 2-3.5 cm. long; spines usually red or pink (the sheaths dull-tan), 10 to 30 per areole, 12-28 mm. long, basally 0.5 mm. broad, strongly barbed; flower 5-7.5 cm. in diameter; petaloid perianth parts reddish-purple; fruit yellow, fleshy, strongly tuberculate, obovoid, 25-44 mm. long. *O. arborescens* Engelm.

Var. *imbricata*. Arborescent or usually a tree 1-2 or 3 m. high; joints not glaucous, 12.5-37.5 cm. long, 2-3 cm. in diameter; tubercles 2.5-5 cm. long; spines 10 to 30 per areole, these and the sheaths red, pink or brown. Gravelly or sandy soils at 1,200-1,800 m. in Trans-Pecos Tex.; from Colo. to Ariz., N.M., Kan., Okla. to w. Tex., s. to cen. Mex.

Var. *argentea* Anthony. Small shrub to 12 dm. high, often forming thickets; joints glaucous, 1-2 dm. long, 16-38 mm. in diameter, relatively stouter than in var. *imbricata*, the tubercles smaller, being 2 cm. long; spines 10 to 20 per areole, these and the sheaths silvery. Deep soils of desert bottomlands at 600-720 m., Brewster Co.; endemic.

3. *Opuntia leptocaulis* DC. DESERT CHRISTMAS CACTUS, TASAJILLO, TESAJO. Small shrub; joints of the main branches to 3-4 dm. long; larger terminal joints much shorter, cylindroidal, 25-75 mm. long, 3-4.5 mm. in diameter; tubercles almost lacking; spines (sometimes none) gray (the sheaths tan, conspicuous, loose-fitting), 1 per areole, 2.5-5 cm. long, basally 0.5 mm. in diameter, not markedly barbed; flower 1-1.5 cm. in diameter; petaloid perianth parts green to yellow or bronze; fruit bright-red, fleshy, juicy, obovoid, 12 mm. long, persistent. Heavier and bottomland soils at 60-900 or 1,500 m., from Ariz. to N.M., Okla. and w. and s. Tex.; also n. Mex.

4. *Opuntia Kleiniae* DC. KLEIN CHOLLA, TASAJILLO. Bush or shrub 3-20 dm. high; joints cylindroidal, partly purplish-red, 1-3 cm. long, 6-9 mm. in diameter; tubercles prominent, 12-15 or 25 mm. long; spines grayish-pink (the sheaths tan, loose), 1 to 4 per areole, 19-25 or 30 mm. long, basally to 0.5 mm. in diameter, markedly barbed; flower 3-5 cm. in diameter; petaloid perianth parts reddish to purple; fruit red to green and red, fleshy but only slightly juicy, tuberculate, obovoid, 2 cm. long. Rocky soils of desert hillsides from s. N.M. to Tex. w. of the Pecos River.

5. *Opuntia Schottii* Engelm. CLAVELLINA. Mat-forming cholla, the clumps to 7.5-10 cm. high and 1-3 m. in diameter; joints clavate, 38-62 mm. long, 12 or 15-25 mm. in diameter; tubercles mammillate, 4.5-15 mm. long; spines in the uppermost areoles of the joint, brownish or gray tinged with pink or red, sheathed only at the tips, papillate-roughened, 6 to 12 or 15 per areole, 2.5-5 cm. long, 1-1.5 mm. broad; flower 5 cm. in diameter; petaloid perianth parts yellow; fruit yellow, fleshy, expanded upward, 38-56 mm. long, 12-38 mm. in diameter. (?) *O. Stanlyi* of Tex. ref.

Var. *Schottii*. Larger spines flattened, basally 1-1.5 mm. broad, brownish or yellowish, becoming gray, 6 to 10 or 12 per areole, faintly ridged and grooved lengthwise, clearly papillate-roughened. Sandy soils of valleys at 300-1,200 m. in w. Tex. and n. Mex.

Var. *Grahamii* (Engelm.) L. Benson. Larger spines only slightly flattened, basally 1 mm. broad, tan or gray tinged with pink or red, 8 to 12 or 15 per areole, not ridged or grooved, minutely papillate-roughened. Sand of desert dunes and flats at 700-1,500 m. in N.M. and Tex. w. of the Pecos River.

6. *Opuntia polyacantha* Haw. PLAINS PRICKLY PEAR. Clumps 7.5-15 cm. high and 3 dm. to several m. in diameter; joints bluish-green, orbiculate to broadly obovate, 5-10 cm. long, 2.5 or 5-10 cm. broad, not readily detached; spines white to reddish-brown or gray, 6 to 10 per areole, mostly deflexed, 2.5-8 cm. long, basally 0.25-0.5 mm. in diameter, acicular, not strongly barbed; flower 4.4-8 cm. in diameter; petaloid perianth parts usually yellow; fruit tan or brown, dry, obovoid, 2-3.8 cm. long.

Var. *polyacantha*. Spines in the lower areoles rigid, straight, 6-12 mm. long, in the upper 25-38 or 56 mm. long, basally 0.5 mm. in diameter; fruit densely spiny. Sandy soils, Alta. and Sask. to Ida., Colo., w. Okla. and Tex. (Panhandle).

Var. *rufispina* (Engelm.) L. Benson. Spines in the lower areoles rigid, straight, 1.2-3 cm. long, in the upper 4.4-8 cm. long, sometimes reddish-brown, basally 0.5-0.75 mm. in diameter; fruit densely spiny. Calif. to Colo., N.M. and Trans-Pecos Tex.

Var. *trichophora* (Engelm. & Bigel.) Coult. Spines in the lower areoles (especially on basal joints) threadlike, flexible, curving or undulating, white or pale-gray, 38-75 mm. long, in the upper 25 or 38 mm. long, reddish-brown or pale-gray, basally 0.75 mm. in diameter; fruit with few to many weak spines. Panhandle and Trans-Pecos; Colo. to Ariz., w. Okla. and Tex.

7. *Opuntia fragilis* Nutt. LITTLE PRICKLY PEAR. Mat-forming; joints glaucous, flattened-obovoid or -ovoid or elliptic, 2-4.4 cm. long, 12-25 or 38 mm. broad, 1.2-2 cm. thick, at least one half as thick as broad, readily detached and clinging by the barbed spines; spines white or pale-gray, 1 to 6 or 9 per areole, 12-25 mm. long, basally 0.7 mm. in diameter, acicular; flower 3.8-5 cm. in diameter; petaloid perianth parts green edged with yellow; fruit greenish, becoming dry and tan, obovoid, 12-15 mm. long. B. C. to s. Mich., Calif. and Tex. (Panhandle).

8. *Opuntia arenaria* Engelm. Patches 3-9 dm. in diameter; roots (?) or rhizomes 3-12 dm. long, bearing areoles and glochids; joints glaucous, narrowly obovate-oblong, 5-7.5 or 10.6 cm. long, 2-2.5 cm. broad; spines white to gray or reddish-tan, 5 to 7 per areole, the longer ones 25-34 mm. long, basally 0.5 mm. in diameter; flower 38-62 mm. in diameter; petaloid perianth parts yellow; fruit green, changing toward tan, dry, with white spines, vasselike, constricted below the apex, 2.5-3 cm. long, 1 cm. in diameter. Sandy areas near the Rio Grande at 1,120-1,350 m., El Paso Co.; in N.M. and Tex.; also Chih.

9. *Opuntia rufida* Engelm. BLIND PRICKLY PEAR. Shrub 1-1.5 m. high; joints blue-green to gray-green, orbiculate, 7.5-15 or 25 cm. in diameter; spines none; glochids reddish-brown, conspicuous, readily detached; flower 62-75 mm. in diameter; petaloid perianth parts pale-yellow, changing to orange; fruit bright-red, fleshy, 25 mm. long. Rocky desert hillsides at 600-1,050 m. in Tex. in the Big Bend; also Chih. and Coah.

The vernacular name is from the blinding of cattle by glochids.

10. *Opuntia compressa* (Salisb.) Macbr. EASTERN PRICKLY PEAR. Clump- or mat-forming prickly pears 7.5-10 cm. high; roots *not* tuberous; joints green to lead-color or in winter reddish-purple, orbiculate to obovate or elliptic, 5-7.5 or 10 cm. long, 38-62 or 100 mm. broad; spines from the upper areoles of the joint, gray or brownish, 1 per areole, spreading at right angles, 25-38 mm. long, basally 0.5-1 mm. in diameter, acicular; flower 38-62 mm. in diameter; petaloid perianth parts yellow; fruit purple or reddish, obovoid, fleshy, 25-38 mm. long. Sand and rock at mostly 600 m., Mont. (rare) to s. Ont., Mass., Okla., e. Tex. and Fla.

11. *Opuntia macrorhiza* Engelm. PLAINS PRICKLY PEAR. Clump-forming prickly pear, 7.5-12.5 cm. high; main root(s) usually tuberous, the others fibrous; joints glaucous, orbiculate to obovate, 5-10 cm. long, 5-6.2 cm. broad; spines mostly from the uppermost areoles, usually white or gray, 1 to 6 per areole, mostly deflexed, 38-56 mm. long, slender, basally 0.25 or 0.5 mm. in diameter, acicular; flower 5-6.2 cm. in diameter; petaloid

perianth parts yellow or tinged basally with red; fruit reddish-purple, fleshy, obovoid, 25-38 mm. long.

Var. *macrorhiza*. Moderately glaucous; joints 62-75 or 100 mm. long; spines 0.5 mm. in diameter; flowers yellow or the centers reddish. Sandy or rocky soils of plains at 600-2,100 m., Calif. to S.D., s. Mich., w. Mo., w. Ark., w. and s. Tex. and La.

Var. *Pottsii* (Salm-Dyck) L. Benson. Strongly glaucous; joints 5-6.2 cm. long; spines very slender, about 0.25 mm. in diameter; flowers reddish. Sand or loam on plains at mostly 1,200-1,800 m., from Ariz. to N.M. and Tex. in the Panhandle and w. of the Pecos River.

12. *Opuntia atrispina* Griffiths. Sprawling or suberect prickly pears, 4.5-6 dm. high; roots not tuberous; joints green, obovate to nearly orbiculate, 10 or up to 15 cm. long, 7.5 or up to 10 cm. broad; spines on the upper portion of the joint, mostly black but apically shading to yellow, mostly 4 to 7 per areole, the principal one ascending, 25-38 mm. long, basally to 1 mm. in diameter, acicular; flower 5-6.2 cm. in diameter; petaloid perianth parts few, pale-yellow; fruit reddish-purple, fleshy, globose to pyriform, 1.2-2 cm. long. Limestone at 450-700 m. in Tex. from Presidio Co. to Nolan and Uvalde cos.

13. *Opuntia violacea* Engelm. PURPLE PRICKLY PEAR. Shrub or treelike; joints at all seasons tinged by betacyanin pigments (reddish-purple), tending to be orbiculate; flower 75-87 mm. in diameter; petaloid perianth parts few, yellow with bright-red bases and lower middles; fruit red or purplish-red, fleshy, obovoid, 25-38 mm. long. N.A.

Var. *santa-rita* (Griffiths & Hare) L. Benson. Joints orbicular, 15-20 cm. long; spines none or few, often 2 to 4 on the upper margin of the joint, 1 per areole, light reddish-brown, 38-62 mm. long, 0.25-0.3 mm. in diameter. Ariz., N.M. and Tex. w. of the Pecos River.

Var. *macrocentra* (Engelm.) L. Benson. Joints mostly broadly obovate, 15-17.5 cm. long; spines abundant on and just below the upper margin of the joint, 1 or 2 per areole, nearly black, 5 or 7.5-17.5 cm. long, 1 mm. in diameter. In s. N.M. and Tex. w. of the Pecos River; also Chih.

Var. *Castetteri* L. Benson. Joints mostly broadly obovate, 15-17.5 cm. long; spines abundant on and just below the upper margin of the joint, 2 or 3 per areole, white or mostly so, 6.2-12.5 cm. long, 1 mm. in diameter. In s. N.M. and Tex. w. of the Pecos River.

14. *Opuntia phaeacantha* Engelm. Prostrate to suberect prickly pears, in clumps 6-24 or 60 dm. in diameter and 3-6 or 9 dm. high, or sometimes with chains of several joints on edge along the ground; joints bluish-green, in cold weather with some lavender to purple betacyanin pigmentation, obovate to orbiculate, 1-1.5 or 2.5 or rarely 4 dm. long, 7.5-22.5 cm. broad; spines (or some of them) clearly flattened; flower 6.2-8 cm. in diameter; petaloid perianth parts yellow or the bases red; fruit purplish, fleshy, usually obovate, 31-62 mm. long.

Var. *phaeacantha*. Joints obovate, 1-1.5 dm. long, 7.5-10 cm. broad; spines over the upper three fourths of the joint, brown, 38 or 44-62 mm. long, 0.7-1 mm. broad, 3 to 5 or 9 per areole. Ut. to Colo., Ariz., N. M. and Tex. (Big Bend).

Var. *camanchica* (Engelm. & Bigel.) L. Benson. Joints broadly obovate to orbiculate, 14-17.5 cm. long, 11-14 cm. broad; spines over almost the entire joint, dark-brown, 4 or 5-5.7 cm. long, 1-1.5 mm. broad, 5 to 8 per areole. N.M., w. Okla. and Tex. (Panhandle).

Var. *spinosibacca* (Anthony) L. Benson. Joints orbiculate, 14.15 cm. long and the same breadth; spines over almost the entire joint, brownish-red, 75 mm. long, 1 mm. broad, 2 to 6 per areole; fruit spiny at the top (in only this variety). Big Bend area.

Var. *major* Engelm. Joints broadly obovate or sometimes orbiculate, 12.5-25 cm. long, 1-2 dm. broad; spines over the upper one half, one third or less of the joint, dark-brown, 30 or 56-69 mm. long, usually 1-1.5 mm. broad, usually 1 to 3 per areole. Calif. to Ut., Kan. and cen. Tex.

Var. *discata* (Engelm.) L. Benson & Walkington. Joints orbiculate to elliptic, 2.25-3 or 4 dm. long, 1.75-2.25 dm. broad; spines on the entire joint, white or ashy-gray, 2.5-5 cm. long, usually 1 or 1.5 mm. broad, 1 to 4 or rarely 10 per areole. *O. Engelmannii* of auth., not Salm-Dyck. Calif. to Ut. and Tex. (e. hills of Edwards Plateau); also Son. and Chih.

15. *Opuntia Lindheimeri* Engelm. TEXAS PRICKLY PEAR, NOPAL PRICKLY PEAR, CACANAPO. Shrubs 1-3 m. high; joints green or (westward) sometimes blue-green,

obovate to orbiculate or rarely elongate, usually 15-25 or 30 cm. long, usually 1.25-2 or 2.5 dm. broad; spines usually in all but the lower areoles, yellow or sometimes whitish-yellow (or the very base black, brown or red), 1 to 6 per areole, usually one spreading, 12-38 or 50 mm. long, basally 0.7 mm. broad, subulate; flower 5-7.5 or 10.6 cm. in diameter; petaloid perianth parts yellow; fruit purple, fleshy, obovate or elongate, 3.1-7 cm. long.

Var. *Lindheimeri*. Joints determinate, obovate to sometimes orbicular, flat, 15-25 or 30 cm. long, 12.5-20 or 25 cm. broad; spines 1 to 6 per areole, in nearly all the areoles, 12-38 or 50 mm. long. Rare in s. N.M., Tex. and Mex.

Var. *tricolor* (Griffiths) L. Benson. Joints determinate, obovate, flat, 17.5-20 or 25 cm. long, 15-17.5 or 20 cm. broad; spines 1 to 3 or 6 per areole, in nearly all the areoles, 5-7.5 cm. long. In s. Tex.

Var. *Lehmannii* L. Benson. Joints determinate, broader than long, wavy, 22.5-25 cm. long, 22.5 or 25-30 cm. broad; spines 3 or 4 per areole, in all but the lower areoles, 1.9-3 cm. long. Kleberg Co. and s.

Var. *linguiformis* (Griffiths) L. Benson. COW-TONGUE PRICKLY PEAR. Joints apically meristematic, elongate, lanceolate to linear-lanceolate, flat, 4.5-9 or 12 dm. long, 10-12.5 or 17.5 cm. broad; spines 1 to 3 per areole, distributed irregularly or on some joints lacking, 12-19 mm. long. Tex. near San Antonio; widely cult. and sporadically introduced in Tex. and elsewhere.

16. *Opuntia stricta* Haw. Shrub 6-20 dm. high; joints green, narrowly obovate or narrowly elliptic to nearly oblong, 1.75-2.5 or 4 dm. long, 7.5-15 or 25 cm. broad; flower 5-6.2 cm. in diameter; petaloid perianth parts light-yellow; fruit purple, fleshy, obovoid, 38-65 mm. long.

Var. *stricta*. SOUTHERN SPINELESS CACTUS. Joints narrowly elliptic or narrowly obovate, 1.75-2.5 dm. long, 7.5-12.5 cm. broad; spines none or sometimes a few solitary ones in marginal areoles. Sandy soils just above sea level from e. Tex. to Va. and Fla.; also Cuba and Bah. I.

Var. *Dillenii* (Ker) L. Benson. Joints obovate, 1-3 or 4 dm. long, 1.25-1.75 or 2.5 dm. broad; spines 1 to 11 per areole, 12-37 or 62 mm. long. Sandy soils and shell mounds, coastal from Tex. to S.C. and Fla.; also Mex., S.A., W.I. and Berm.

17. *Opuntia Strigil* Engelm. Ascending or sprawling, 6-10 dm. high; joints slightly glaucous, obovate, 10-12.5 cm. long, 8.8-10 cm. broad; spines reddish-brown with yellow tips, 5 to 8 per areole, one much larger, all turned downward or the principal one from each upper marginal areole ascending, the longer ones 12-38 mm. long, basally 0.75 mm. broad, a little flattened; flower 5 cm. in diameter; fruit red, fleshy, spheroidal, 1.2-2 cm. in diameter. Limestone soils at 900-1,350 m. in Tex. from Pecos Co. to Nolan, Crockett and Webb cos.

18. *Opuntia Ficus-indica* (L.) Mill. INDIAN FIG, NOPAL DE CASTILLA. Tree 3-5 m. high; trunk 6-12 dm. long, 2-3 dm. in diameter; joints green, obovate or oblong, 3-6 dm. long, 2-4 dm. broad; spines none, few or abundant, white or on some joints tan or pale-brown, 1 to 6 per areole, 12-25 or 38 mm. long, basally 0.7-0.8 mm. broad, subulate; flower 7.5-10 cm. in diameter; petaloid perianth parts yellow or orange; fruit yellow, orange, red or purplish in various strains, fleshy, edible, 5-10 cm. long, 4-8.7 cm. in diameter. Mex.; common in cult. as *O. Ficus-indica* (spineless) and *O. megacantha* (spiny); often an escape and (as in Austral. and S. Afr.) a pest; occasional escape in Tex. and hybridizing occasionally with *O. phaeacantha* or *O. Lindheimeri*.

2. CEREUS MILL.

Stems branching slightly to freely, elongate, cylindroid to prismatic, 15 to 100 times as long as their diameter; ribs 3 to many; leaves none; spines 1 to many per areole, acicular; flower below the growing apex of the stem, within the edge of the spine-bearing part of the areole; flower 2.5-15 or 22.5 cm. in diameter; floral tube above the ovary almost obsolete to funnelform or tubular; fruit fleshy, indehiscent; seed longer than broad (hilum to opposite side); hilum obviously basal, sometimes oblique; cotyledons minute, incumbent.

Many species from California, Arizona, New Mexico, Texas and Florida to South America.

1. Stems or *most of them* at maturity triangular in cross section, sharply 3-angled, 25-50 mm. thick; roots *not* tuberous; larger spines 25-40 mm. long; flower about 1 dm. in diameter, white1. *C. pentagonus*.
1. Stems at maturity terete or 4- to 6-ribbed, slender, basally 4.5-6 mm. in diameter, enlarging upwards to 6-12 mm., roots forming one or more large tubers; spines slender and weak, to 9 mm. long (2)
- 2(1). Stems strongly 4- to 6-ribbed, the intervening troughs deep; style and stamens not projecting above the perianth parts; tuber one, weighing from 1.5 to 43 pounds; some spines not parallel to the stem surface; superior floral tube 100-150 mm. long; flowers white2. *C. Greggii*.
2. Stems 6- to 10-grooved, the ridges only 1-1.5 mm. high; style and stamens projecting beyond the perianth parts; tubers several; spines all lying parallel to the stem surface; superior floral tube 9-12 mm. long; flowers pink to purple3. *C. Poselgeri*.

1. *Cereus pentagonus* (L.) Haw. BARBED-WIRE CACTUS. Sprawling; stems several m. long, 2.5-5 cm. in diameter; ribs of mature branches 3 (rarely 4 or 5), strongly divergent and sharply angled; spines gray, 7 or 8 per areole, 1 or 2 central, mostly 2.5-4 cm. long; flower 1 dm. in diameter; petaloid perianth parts white; ovary with scale leaves to 12 mm. long; fruit red, shiny, sweet, with many spines each about 12 mm. long; seed 3 mm. long. Coastal thickets and jungles, Tex. along the Rio Grande from Laredo downstream; also Fla. s. to n. S.A.

2. *Cereus Greggii* Engelm. DESERT NIGHT-BLOOMING CEREUS. Inconspicuous plant; stems erect or sprawling, 3-6 or 24 dm. long, to 12 mm. in diameter, very slender below, strongly 4-, 5- or 6-ribbed above, canescent; root turniplike; spines 11 to 13 per areole, to 3 mm. long, mostly parallel to the surface; flower nocturnal, 5-7.5 cm. in diameter; floral tube 10-15 cm. long; petaloid perianth parts white; fruit red, the areoles bearing short spines; seed 3 mm. long. Flats and washes in the desert at 1,200-1,500 m., s. N.M. and Tex. w. of the Pecos River; also Chih. and Zac.

3. *Cereus Poselgeri* Lem. SACASIL. Suberect plant with a cluster of tuberous roots; stem 3-6 dm. high, 6-9 mm. in diameter, slender, cylindroidal; ribs 8 to 10, low; spines tan or brown, 1 central and 12 to 16 radials per areole, appressed; flower diurnal, opening more than one day, 38-44 mm. in diameter; petaloid perianth parts pink to purple; fruit with wool and minute spines; seed 1 mm. long. Semidesert brushlands at low elev. in s. Tex. near the Rio Grande; also Coah., N.L. and Tam.

3. ECHINOCEREUS ENGELM.

HEDGEHOG CACTUS

Stems solitary to profusely branching, up to 500, cylindroidal; ribs 5 to 12; leaves not discernible; central spines 1 mm. to 1 dm. long, acicular or subulate; radial spines 3 to 32; flower on the old growth below the apex of the stem, bursting through the epidermis just above the spine-bearing areole and forming an irregular scar; flower 2-12.5 cm. in diameter; fruit fleshy, with ultimately deciduous areoles bearing spines; seeds black, usually longer than broad (hilum to opposite side); embryo nearly straight; cotyledons minute, incumbent.

Twenty to thirty species from California to South Dakota and Oklahoma, south to Mexico.

1. Petaloid perianth parts red or red and yellow (with no trace of blue); areoles of the mature parts of stems bearing white felt or cobwebby hairs; flowers not closing at night, remaining open for 2 or 3 days1. *E. triglochidiatus*.
1. Petaloid perianth parts *either* (1) lavender to purple *or* (2) yellow, green, brownish or reddish (but then with an admixture of blue); areoles of the *mature vegetative parts of stems not* bearing white or cobwebby hairs, the felt of the young areoles persistent for 1 or rarely 2 years; flowers closing at night and reopening (2)

- 2(1). Flower 38-125 mm. in diameter (3)
 2. Flower 19-25 mm. in diameter (9)
- 3(2). Stem ribs 4 to 6 or rarely 8 (then with prominent tubercles); stems creeping, slender and elongate, 1.9-3 cm. in diameter; spines not obscuring the joints, gray to nearly black or brown (4)
3. Stem ribs 9 to 22 or uncommonly 7 or 8 (vars. of *E. enneacanthus*); stems (if at maturity less than 5 cm. in diameter) *either* (1) with the joints only 1 to 3 times as long as their diameter *or* (2) *not* decumbent *or* (3) *with* at least some straw-colored spines *or* (4) *with* the spines tending to obscure the joints (5)
- 4(3). Petaloid perianth parts narrowly oblong to linear-lanceolate, acute and mucronate, 6-8 mm. broad; stem joints mostly 7.5-15 cm. long, 20-30 mm. in diameter, 5- or 6-ribbed; central spine usually 2-2.5 cm. long, 0.5 mm. in diameter; radial spines shorter than the central, 0.25 mm. in diameter; papillae on the seed coat large 2. *E. Blanckii*.
4. Petaloid perianth parts broadly oblanceolate to cuneate, rounded or truncate, often erose, 8-12 mm. broad; stem joints 5-10 cm. long, 12-16 mm. in diameter, 4- or 5-ribbed; central spines (if any) 1-2 cm. long, absent from many to nearly all areoles, 0.75 mm. in diameter; radial spines about as long as most of the centrals, 0.5 mm. in diameter; papillae on the seed coat small 3. *E. pentalophus*.
- 5(3). Areoles practically circular (6)
5. Areoles vertically elongate, elliptic to linear, close-set, 6-8 mm. apart, the spines dense; stems usually unbranched or with few branches (8)
- 6(5). Central spines 2 to 5, all similar, acicular, the longest central spine shorter than the longest radial; areoles 6-9 mm. apart, the spines obscuring the stem; stems usually unbranched 6. *E. Lloydii*.
6. Central spine(s) dissimilar, the lower one in the areole dominant (7)
- 7(6). Principal central spine *not flattened*, solitary or accompanied by a short upper accessory central; central and radial spines strongly differentiated 4. *E. Fendleri*.
7. Principal central spine basally flattened (that is, narrowly elliptic in cross section), deflexed, the 4 central spines all well-developed; spines not strongly differentiated into types, the centrals similar to the radials 5. *E. enneacanthus*.
- 8(5). Spines of the floral tube (on the ovary and above it) stout and rigid, the associated hairs short; petaloid perianth parts apically rounded; stigmas about 3 mm. long, stout; fruit 20-62 mm. long; seed 1.2-1.3 mm. long; flower 62-125 mm. in diameter 7. *E. pectinatus*.
8. Spines of the floral tube slender and somewhat flexible, the associated hairs long and cobwebby; petaloid perianth parts acuminate; stigmas about 6 mm. long, broad; fruit 15 mm. in diameter 8. *E. Reichenbachii*.
- 9(2). Areoles elliptic or elongate, each with 1 or 2 series of spines; central spines 0 or 1 or sometimes 2 or 3 per areole, 0.5-0.7 mm. in diameter; petaloid perianth parts 3-4 mm. broad 9. *E. viridiflorus*.
9. Areoles circular, each with 3 series of spines (arbitrarily, the innermost central and the other 2 radial); central spines 5 or 6, 0.3-0.4 mm. in diameter; petaloid perianth parts 2-3 mm. broad 10. *E. chloranthus*.

1. *Echinocereus triglochidiatus* Engelm. CLARET-CUP. Plants mostly branching several to many times, forming mounds; joints 5-15 or 30 cm. long, 25-75 or 100 mm. in diameter; ribs 5 to 10 or 12; areoles nearly circular; spines usually gray but sometimes pinkish, straw-color, pale-gray or black, 2 or 3 or commonly 8 to 12 or 16 per areole, exceedingly variable in the varieties; flower 3-5 cm. in diameter; petaloid perianth parts red; fruit red, obovoid to cylindroid, 12-25 mm. long; seed strongly papillate, 1.5-2 mm. long.

Var. *melanacanthus* (Engelm.) L. Benson. Stems up to 500, 38-75 or 150 mm. long, 2.5-5 or 6.25 cm. in diameter; ribs mostly 9 or 10, tuberculate; central spines 1 to 3,

to 0.7 mm. in diameter; radial spines 5 to 11, half to sometimes nearly as long as the central; flower 3.1-5 cm. long; style 1 mm. in diameter. Ut. to s. Colo., Ariz., s.w. and cen. Tex.; also s. to Dgo.

Var. *neomexicanus* (Standl.) L. Benson. Stems 2-3 dm. long, 7.5-10 cm. in diameter; ribs 8 to 12, mostly 10, not markedly tuberculate; central spines 2 to 4, 0.5-1 mm. in diameter; radial spines 9 to 12, about half as long as the central; flower 5-6.9 cm. long; style 1 mm. in diameter. Ariz., N.M., Trans-Pecos Tex. and n.w. Mex.

Var. *Gurneyi* L. Benson. Stems few, 2-3 dm. long, 7.5-10 cm. in diameter; ribs 10 to 12, not markedly tuberculate; central spines 1 (or 2), 0.5 mm. in diameter; radial spines 7 to 9, about equal to the central; flower 5-6.9 cm. long; style 1.5 mm. in diameter. N.M. and Trans-Pecos Tex.

Var. *paucispinus* (Engelm.) L. Benson. Stems few, 15-20 cm. long, 6.2-10 cm. in diameter; ribs 5 to 7, not strongly tuberculate; central spines 0; radial spines 4 to 6; flower 25-38 mm. long; style 1.5 mm. in diameter. S.w. Tex. from Val Verde Co. to Kimble and Uvalde cos.

2. *Echinocereus Blanckii* (Poselger) Palmer. Stems procumbent, forming clumps; joints prismatic or cylindroid, mostly 5-15 or 17.5 cm. long, 19-25 or 31 mm. in diameter; ribs 5 or 6, prominent to indistinct, somewhat to strongly tuberculate; areoles circular; spines gray; central spine usually 1, 6 or 19-25 mm. long, 0.5 mm. in diameter; radial spines 6 to 8 per areole, very slender; flower 62-75 mm. in diameter; petaloid perianth parts oblanceolate; fruit reddish; seed coarsely papillate, 1 mm. long.

Var. *Blanckii*. Stems numerous; joints mostly 5-15 cm. long, 19-25 mm. in diameter; petaloid perianth parts apically rounded, weakly cuspidate, irregularly denticulate, rose-purple or lighter, 3.8-5 cm. long, 9-12 mm. broad; central spine 6-12 mm. long. *E. Berlandieri* (Engelm.) Small. Fine soils in thickets at low elev. in s. Tex. from Webb and Jim Wells cos. to Nueces and Cameron cos.; also n.e. Mex.

Var. *angusticeps* (Link) L. Benson. YELLOW ALICOCHÉ. Stems 1 to 10; joints 1-1.75 dm. long, to 31 mm. in diameter; petaloid perianth parts pale-yellow with red bases, 25 mm. long, 1 cm. broad, acuminate; central spine 6-12 mm. long. Sandy loam or red gravel or limestone at low elev. in s. Tex. from Bexar Co. to the lower Rio Grande.

3. *Echinocereus pentalophus* (DC.) Rümpler. ALICOCHÉ. Procumbent, forming clumps; joints prismatic, to 1 dm. long, 19-25 mm. in diameter; ribs 4 or 5; tubercles about 6 mm. high; areoles nearly circular; central spine (if any) only slightly longer than the radials; radial spines gray or brown to black, 4 to 6 per areole, 1-2 cm. long, 0.5 mm. broad; flower 7.5-10 cm. in diameter; petaloid perianth parts reddish-violet, broadly oblanceolate to cuneate, truncate. Fine soils at low elev. in s. Tex. from Webb Co. to Bexar Co. and Cameron Co.; also n.e. Mex.

4. *Echinocereus Fendleri* Engelm. Stem usually 1 but up to 5, ovoid-cylindroid or cylindroid, 75-62 or 250 mm. long, 38-62 mm. in diameter; ribs 8 or 9 or 10; areoles circular; central spine gray tipped with brown or black, solitary, 12 or 25-38 mm. long, 0.5-0.75 mm. in diameter, acicular; radial spines white or pale-gray, 5 to 7 or 9 per areole; flower 5-6.2 cm. in diameter; petaloid perianth parts magenta; fruit green, turning reddish; seed reticulate-punctate, 1.5 mm. long.

Var. *Fendleri*. Stems usually ovoid to ovoid-cylindroid, 7.5-15 or 25 cm. long; central spine very dark at first but changing to gray in age, curving upward through its entire length, 25-38 mm. long; radial spines 9-12 mm. long. Sandy or gravelly soils at mostly 1,800-2,400 m., Colo., Ut., Ariz., N.M. and Tex. in El Paso and perhaps in Hudspeth and Culberson cos.; also Chih.

Var. *rectispinus* (Peeb.) L. Benson. Stems cylindroid, 10-17.5 or 25 cm. long; central spine pale-gray but at least tipped with brown or black, straight and projecting at right angles to the stem, 12-38 mm. long; radial spines 9-12 mm. long. Sand or gravel at 1,170-1,650 or 2,060 m. in Ariz., s.w. N.M. and Tex. from El Paso Co. to Culberson Co.

5. *Echinocereus enneacanthus* Engelm. Stems to 120 or 350, forming clumps up to several dm. high and 6 or 20 dm. in diameter; stems cylindroidal, 1.5-3 dm. long, 3.8-7 or 10 cm. in diameter; ribs 7 to 13; areoles circular; central spines straw-color or gray at maturity, 1 to 4 per areole, solitary in young plants, straight, 25-94 mm. long, about 1 mm. broad, somewhat flattened; radial spines 7 to 10 or sometimes 12 to 15 per areole; flower 5 or 7.5-12.5 cm. in diameter; petaloid perianth parts magenta to purplish; fruit red; seeds strongly tuberculate to pitted, 1-1.4 mm. long.

The fruit of this species (especially var. *stramineus*) has a fragrant odor and a flavor and texture resembling the strawberry. It is eaten fresh or is used for making preserves.

Var. *enneacanthus*. PITAYA. Stems mostly clustered, decumbent, 3.8-5 cm. in diameter; ribs 7 or mostly 8 to 10; areoles 1-2 cm. apart; spines not obscuring the stem, gray to straw-color, 7 to 12 (mostly 8) per areole; central spine usually 1, 2-3.8 or 5 cm. long; flower 5-8.7 cm. in diameter. Tex. (best-defined from Val Verde to Kimble, Kerr and Cameron cos.); also Chih. and N.L.

Var. *brevispinus* (W. O. Moore) L. Benson. Stems clustered, decumbent, 38-44 mm. in diameter; ribs 7 or 8; areoles 1-2 cm. apart; spines not obscuring the stem, gray or straw-color, 10 to 13 per areole; central spine usually 1, 12-22 mm. long; flower 5-5.6 cm. in diameter. Tex. from Val Verde Co. to Real, Bexar, Jim Wells and Hidalgo cos.; also Coah. and Tam.

Var. *stramineus* (Engelm.) L. Benson. STRAWBERRY CACTUS, SPINE-MOUND. Stems mound-forming, up to 350 or more, mostly erect or suberect, 5-7.5 cm. in diameter; ribs mostly 10 to 12; areoles 1-2 cm. apart; spines obscuring the stem, forming a conspicuous straw-colored mass, 9 to 12 per areole; central spines 2 to 4, 5-8.7 cm. long; flower 10-12.5 cm. in diameter. N.M. and Tex. from El Paso Co. to Brewster and Pecos cos.; also n. Chih.

Var. *dubius* (Engelm.) L. Benson. Stems clustered, decumbent, 5-7 or 10 cm. in diameter, ribs 7 to 9 or 10; areoles 2-4.4 cm. apart; spines not obscuring the stem, gray to straw-color, 6 to 12, mostly few; central spine(s) 1 or sometimes more, 5-9.4 cm. long; flower 7.5-10 cm. in diameter; seed less tuberculate than in the other varieties. Tex. in Hudspeth, Presidio and Brewster cos.; probably also n. Chih.

6. *Echinocereus Lloydii* Britt. & Rose. Stem(s) 1 or several, cylindroidal, 1.5-2 dm. long, 7.5-10 cm. in diameter; ribs 12; areoles circular; central spines red with some gray surface coating, 2 to 5 per areole, shorter than the longest radial spine in the same areole, to 12 mm. long, 0.8 mm. in diameter, acicular; radial spines 8 or 9 per areole, spreading irregularly; flower 5 cm. in diameter; petaloid perianth parts lavender or magenta; fruit green tinged with pink, the spines white, 15 mm. long; seeds strongly papillate, broader than long, 1 mm. long. Sandy or gravelly soils at about 900 m., N.M. and Tex. in Pecos Co.

7. *Echinocereus pectinatus* (Scheidw.) Engelm. Stem(s) solitary or 2 or 3, cylindroid, 1-3 dm. long, 6.2-10 cm. in diameter; ribs 15 to 22; areoles elliptic to narrowly elliptic; spines obscuring the stem, pink to pale-gray or straw-color or brown to white; central spines 0 to 9 per areole, in 1 to 3 vertical series, 1-7.5 mm. long, 0.35-0.5 mm. in diameter; radial spines 12 to 22 per areole, strongly pectinate to spreading rather irregularly, the longer ones 6-15 mm. long, 0.25-0.5 mm. in diameter, acicular; flower 62-125 mm. in diameter; petaloid perianth parts magenta to light-purple or lavender or yellow; fruit green or greenish-purple; seed papillate, 1.2-1.3 mm. long.

Var. *pectinatus*. Central spines 3 to 5 in 1 or sometimes 2 vertical series, 1-3 mm. long; radial spines 12 to 16, pink or pink-and-gray, 6-7.5 mm. long; flowers magenta, 62-87 mm. in diameter. Ariz. and Tex. near the Rio Grande from El Paso to Maverick Co.; also Mex.

Var. *Wenigeri* L. Benson. Central spines 1 to 3, ashy-white, in 1 vertical series, 2-3 mm. long; radial spines 14 to 16, ashy-white, 6 mm. long; flowers magenta, 5-7.5 cm. in diameter. Tex. from Sutton Co. to Terrell and Val Verde cos.; also Coah.

Var. *minor* (Engelm.) L. Benson. Central spines 2 to 5, about equal, in 2 series or irregular, 8-12 mm. long; radial spines 7 to 15, pink or pink-and-gray, 4.5-9 mm. long; flowers magenta, 62-75 mm. in diameter. Near El Paso and in the Big Bend; also N.M. and Chih.

Var. *neomexicanus* (Coul.) L. Benson. Central spines 3 or 7 to 9, in 2 or 3 vertical series, 3-7.5 mm. long; radial spines 18 to 22, pale-brown or pink, 9-12 mm. long; flowers yellow, 75-125 mm. in diameter. *E. dasyacanthus* Engelm. From El Paso Co. to Culberson and Brewster cos.; Chih., Tex., N.M. and Ariz.

8. *Echinocereus Reichenbachii* (Terscheck) Haage f. Stems solitary or branching, cylindroidal, 7.5-15 or 40 cm. long, 2.5-5 cm. in diameter; ribs about 12 to 18; areoles narrowly elliptic to linear; spines obscuring the stem; central spines none or 1 to 3 per areole, much smaller than the radials, 1-3 mm. long; radial spines basally straw-color, pale-gray or pink and distally pink to red, 12 to 32 per areole, 4.5-12 or 14 mm. long, 0.35 mm. in diameter, acicular; flower 5-7.5 cm. in diameter; petaloid perianth parts

pink to light-purple; fruit green, with soft conspicuous long deciduous wool from the areoles; seeds strongly tuberculate, 1.5 mm. long.

Var. *Reichenbachii*. Areole 3 mm. long, very narrow; central spines 0; radial spines 22 to 32, basally straw-color to pale-gray, distally pink, strikingly pectinate, each curving in a low arc, 4.5-6 mm. long. *Echinocereus caespitosus* Engelm. and var. *minor* Engelm. Okla. and n. and cen. Tex.

Var. *perbellus* (Britt. & Rose) L. Benson. Areole 2 mm. long, elliptic; central spines 0 or 1 and minute, 1 mm. long; radial spines 12 to 16 or 20, straw-color to pink, spreading somewhat irregularly at low angles, straight, 4.5-6 mm. long. Colo., Okla., N.M. and n.w. Tex.

Var. *Albertii* L. Benson. Areole 1.5 mm. long, elliptic; central spines 0 or 1, 2-3 mm. long, purple, very dark; radial spines 14 to 16, white with very dark-purple tips, closely pectinate, straight, 3-4 or 6 mm. long. Tex. in Jim Wells Co.

Var. *Fitchii* (Britt. & Rose) L. Benson. Areole 2 mm. long, elliptic; central spines 4 to 7, 2-6 mm. long; radial spines 18 to 22, white or straw-color, distally tan or brownish, spreading rather irregularly, slightly curving downward, 6-7.5 mm. long. From Webb Co. to Jim Hogg and Starr cos.

Var. *chisosensis* (W. T. Marsh.) L. Benson. Areole 2 mm. long, elliptic; central spines 1 to 4, not in a row, 6-12 mm. long; radial spines 12 to 14, the lower elongate, the upper rudimentary, white or ashy, spreading rather irregularly, straight, 6-12 mm. long. Near the Chisos Mts., Brewster Co.

Var. *albispinus* (Lahman) L. Benson. Areole 2 mm. long, narrowly elliptic; central spines 1 to 3, to 3 mm. long; radial spines 12 to 14, commonly dark and basally pink but distally red (or white, yellow or brown), spreading at various low angles, straight, to 12 or 25 mm. long. Okla. and Tex. panhandles.

9. *Echinocereus viridiflorus* Engelm. GREEN PITAYA. Stems usually solitary, ovoid to cylindroid or barrel-shaped, 2.5-20 or 25 cm. long, 25-75 or 100 mm. in diameter; ribs mostly 10 to 14, but sometimes 6 to 9; areoles 2-3 mm. long, elliptic; spines obscuring the stem; central spines red, reddish-brown, white, pale-gray or greenish-yellow, 1 or none or sometimes 2 or 3 or 4 per areole, the longer ones 1.2-2 or 2.8 cm. long, 0.5-0.7 mm. in diameter, acicular or subulate; radial spines 8 to 11 per areole, 0.2 mm. in diameter, flower 2-2.5 cm. in diameter; petaloid perianth parts green to magenta or reddish; fruit green; seeds tuberculate on the reticulate pattern, 1-1.5 mm. long.

Var. *viridiflorus*. Stems small, ovoid or elongate-ovoid, 2.5-5 or 7.5 cm. long, 25-38 mm. in diameter; ribs 10 to 14; spines red, reddish-brown, white or pale-gray; radial spines 3-4.5 mm. long, slender, 0.4 mm. in diameter, acicular, similar in all the mature areoles, the lateral ones in the areole larger; petaloid perianth parts green; anthers 0.7 mm. long, ovoid; fruit 6-9 mm. long. Wyo., S.D., N.M., Okla. and Tex. panhandles.

Var. *Davisii* (Houghton) L. Benson. Stem dwarf, turbinate or turbinate-ovoid, 1.2-2 or 2.5 cm. long, 9-12 or 19 mm. in diameter; ribs 6 to 9; spines gray tipped with red or only gray or white; radial spines about 7 on each side of the areole, pectinate, acicular, the upper ones rudimentary, in the top areoles of older plants the lower spines few, very stout and to 15 mm. long and 0.5 mm. in diameter; petaloid perianth parts yellow-green; anthers 0.7 mm. long, ovoid; fruit 6 mm. long. Tex. in n. Brewster Co.

Var. *Correllii* L. Benson. Stem medium, elongate-ovoid or cylindroid, 75-125 mm. long, 38-50 mm. in diameter; ribs 10 to 14; spines in horizontal bands of greenish-yellow and ashy-white; radial spines to 1 cm. long, slender, 0.4 mm. broad, subulate, similar in all the mature areoles, the lateral ones in the areole larger; petaloid perianth parts yellow-green; anthers 1 mm. long, narrow, lanceolate; fruit unknown. Tex. in Pecos and n. Brewster cos.

Var. *cylindricus* (Engelm.) Engelm. Stems large, cylindroid or some barrel-shaped, 10-20 or 25 cm. long, 5-7.5 cm. in diameter; ribs 10 to 14; spines red, reddish-brown, white or pale-gray; radial spines about 1 cm. long, stout, 0.5-0.75 mm. in diameter, acicular, similar in all the mature areoles, the upper ones in the areole smaller; petaloid perianth parts magenta to nearly red; anthers 1.3 mm. long, narrow; fruit 12 mm. long. N.M. and Tex. w. of the Pecos River.

10. *Echinocereus chloranthus* Engelm. Stems solitary or few, cylindroidal, 7.5-17.5 cm. long, 62-75 mm. in diameter; ribs mostly 14 to 17; areoles nearly circular; spines obscuring the stem; central spines red or red-and-white or brown, 5 or 6 per areole,

shorter than the radials, the longer ones 6-7.5 or 10 mm. long, spreading, slender, acicular; radial spines in two series, 15-20 per areole, to 12 mm. long; flower 25 mm. in diameter; petaloid perianth parts green to brownish-red or red-brown; seed tuberculate and reticulate, 1-1.2 mm. long. Limestone at 900-1,350 m., Tex. w. of the Pecos River; N.M.

4. MAMMILLARIA HAW.

FISH-HOOK OR PIN-CUSHION CACTUS

Stems simple or branching, ovoid to cylindroid, globose or turbinate, 2.5-10 or 30 cm. long, 2.5-7.5 or 15 cm. in diameter; tubercles separate; leaves not discernible; areoles usually circular; spines smooth; central spines 0 to several or sometimes not differentiated, straight, curved or hooked, acicular; radial spines usually smaller and of lighter color, 10 to 80 per areole; flowers on the old growth of preceding seasons below the apex of the stem, between the tubercles and not obviously connected with them or with the areoles upon them, 6-25 or 50 mm. in diameter; floral tube above the ovary funnellform or obconic, green tinged with the perianth color; fruit fleshy, without surface appendages; seed black to brown, rugose-reticulate or reticulate-pitted or smooth and shiny and faintly reticulate-pitted or tuberculate, longer than broad (hilum to opposite side), 1-2 mm. long; hilum obviously basal or oblique; cotyledons accumbent, *not* foliaceous.

Perhaps 100 species from California to Nevada, Utah, New Mexico, Oklahoma and Texas; Mexico and Venezuela.

1. Flower about 50 mm. in diameter; superior floral tube elongate; petaloid perianth parts yellow, stalked; tubercles soft, 12-19 or 50 mm. long 1. *M. longimamma*.
1. Flower less than 25 mm. in diameter or (if larger) pink to purple; superior floral tube cuplike; petaloid perianth parts pink, purple, yellow, salmon or white, not stalked; tubercles usually firm, less than 12 mm. long (2)
- 2(1). Juice of the tubercles milky; stem broadly turbinate or depressed-globose, flattened apically 2. *M. gummifera*.
2. Juice of the tubercles *not* milky; stem cylindroid to ovoid, *not* markedly flattened apically (3)
- 3(2). Spines not hooked (4)
3. Spines [that is, one or more central(s) but not the radials] hooked (6)
- 4(3). Radial spines flexible, hairlike, turning irregularly; central spines 8 to 10, red, puberulent 3. *M. prolifera*.
4. Radial spines not flexible or hairlike; central spines *not both red and* puberulent (5)
- 5(4). Spines 40 or commonly 50 to 80 per areole, white, in several similar series; stem globose, not more than 38 mm. in diameter; flowers rotate, 9-12 in diameter; petaloid perianth parts white with red midstripes ... 4. *M. lasiacantha*.
5. Spines 34 to 48 per areole, clearly and sharply differentiated into central and radial series; stems cylindroidal or globose, but (if globose) 50-100 cm. in diameter at maturity; flowers campanulate or funnellform; petaloid perianth parts pink or reddish-purple 5. *M. Pottsii*.
- 6(3). Only 1 (of 1 to 3) central spines hooked and dark reddish-brown, any others short, pale and not hooked; radial spines 15 to 35 per areole, 6-10.5 mm. long; seed smooth, shiny, the reticulum inconspicuous; petaloid perianth parts purplish-pink, lanceolate, 4-7 mm. broad; fruit to about 6 mm. in diameter 6. *M. Grahamii*.
6. Central spines all (3 or rarely 2) at maturity hooked, dark-reddish-brown; radial spines 10 to 12, 12 mm. long; seed with prominent pits in the reticulate pattern; petaloid perianth parts pinkish-brown or green, linear-lanceolate, 2-3 mm. broad; fruit to 25 mm. in diameter 7. *M. Wrightii*.

1. *Mammillaria longimamma* DC. Stems numerous, forming dense mounds or clumps, cylindroid, about 5 cm. long, 25-62 mm. in diameter; tubercles soft, mammiform-cylin-

droid, protruding 12-25 mm.; central spines reddish-tan, 1 to 4 per areole, straight, minute, 1-3 mm. long, 0.25 mm. in diameter, long-conical; radial spines gray, 12 to 14 per areole, 6-9 mm. long, slender, 0.1 mm. in diameter; flower 2.5-5 cm. in diameter; floral tube funnellform, constricted above the ovary; petaloid perianth parts yellow.

Var. *sphaerica* (Dietr.) K. Brandeg. Tubercles 12-25 mm. long; radial spines 12 to 14, 6-9 mm. long, *glabrous*; central spines 1 to 4, *glabrous*. Near sea level, Tex. from Val Verde Co. to Nueces and Cameron cos.; also n. Mex.

2. *Mammillaria gummifera* Engelm. Stem usually solitary, turbinata to subglobose, the portion above ground flat, depressed or shallowly convex, 7.5-10 or 15 cm. in diameter; tubercles subconical to subpyramidal, protruding 9-12 mm.; central spines brown, reddish-brown or tan, 0, 1 or 2 per areole, porrect, straight, 3-9 mm. long, 0.25-0.5 mm. in diameter; radial spines tan to brown or nearly white, 6 to 22 per areole, 6-13.5 mm. long; flower 1.2-3 cm. in diameter; petaloid perianth parts pink, white or cream-color; fruit red; seeds brown, rugose-reticulate, 1 mm. long.

Var. *applanata* (Engelm.) L. Benson. Stem apex flattened to concave; tubercles subconical; central spine 1, 6-7.5 mm. long; radial spines 10 or 14 to 22, 7.5-9 mm. long, 0.2 in diameter; flower pink to nearly white or cream-color, to 19 mm. in diameter. Ariz., N.M. and Tex.; also Mex.

Var. *hemisphaerica* (Engelm.) L. Benson. PICHILINGA. Stem apex hemispheroidal, with a smooth appearance; tubercles conical; central spine 1, 3-4.5 mm. long; radial spines 7 to 12 or 14, 6 mm. long, 0.3 mm. in diameter; flowers cream-color to pinkish, to 25 mm. in diameter. Tex. from Jim Hogg and Starr cos. to Nueces and Cameron cos.; also Tam. and N.L.

Var. *meiacantha* (Engelm.) L. Benson. Stem apex hemispheroidal; tubercles subpyramidal; central spine 0 or 1, 3-6 mm. long; radial spines 6 to 9, 7.5-10.5 mm. long, 0.5 mm. in diameter; flower pink or pink-and-white, 2.5-3 cm. in diameter. Ariz., N.M. and Tex. w. of the Pecos River.

3. *Mammillaria prolifera* (Mill.) Haw. Stems forming mounds, cylindroid to short-ovoid, 2-5 or 7.5 cm. long, 12-25 or 62 mm. in diameter; tubercles mammiform, protruding 4.5-6 mm.; spines obscuring the stem, the intermingling hairs nearly as long; central spines red, puberulent, 8 to 10 per areole, straight, 6-9 mm. long, 0.1 mm. in diameter; radial spines white, 30 to 60 per areole, spreading irregularly, capillary, winding and twisting, as long as the centrals; flowers closed-campanulate, 12 mm. in diameter; petaloid perianth parts dirty-yellow to whitish-yellow, or reddish or pink-and-yellow; fruit red; seeds black, reticulate-pitted, 1 mm. long.

Var. *texana* (Engelm.) Borg. Stem 12-25 mm. in diameter; central spines 8 to 10, with dark-brown tips; flower almost white to salmon-yellow or partly reddish or pink-and-pale-yellow; fruit 9-12 mm. long. Grasslands, s. Tex. from Val Verde Co. to Bexar and Hidalgo cos.; also n. Mex.

4. *Mammillaria lasiacantha* Engelm. Stem(s) turbinata, 2-3.8 or 10 cm. long; tubercles protruding about 3 mm.; spines obliterating the stem, white, in several series, the number per series decreasing upward, about 40 to 80 per areole, straight, to 3 mm. long, 0.1 mm. in diameter, white-pubescent or *glabrous*; flower rotate, 9-12 mm. in diameter; petaloid perianth parts each white with a red midstripe; fruit red; seed brown, covered by some dark-gray or black, reticulate-pitted, 1 mm. long. Limestone in the Trans-Pecos desert at 900-1,300 m.; also N.M.

Mammillaria lasiacantha is confused with *Epithelantha micromeris*. Flowers of *Mammillaria* are between tubercles away from the stem apex. Those of the *Epithelantha* are on the apices of newly-forming tubercles at the stem apex. In *Mammillaria lasiacantha* the spines remain intact, but in *Epithelantha* after a year or so they disarticulate near the middles. Thus those of the older areoles on the sides of the stem appear shorter than those in a tuft near the growing point.

5. *Mammillaria Pottsii* Engelm. Stems in clusters, cylindroid or somewhat clavate, 7.5-10 cm. long, 2-2.5 or 4.4 cm. in diameter; tubercles protruding 3 mm.; spines obscuring the stem; central spines pale-tan, in one or two series, the upper spines long and purplish-tipped, curving upward, the central spines (altogether) 7 to 11 per areole, the principal central 9-12 mm. long, 0.3 mm. in diameter; radial spines pale-tan, 27 to 37 per areole, porrect; flower campanulate, 6 mm. in diameter; petaloid perianth parts reddish-purple;

fruit red; seed very dark-brown, deeply reticulate-pitted, 1 mm. long. Gravelly areas in the desert at 750-900 m. in Presidio and Brewster cos.; also Chih. to N.L. and Zac.

6. *Mammillaria Grahamii* Engelm. Stems solitary or little-branched, ovoid to spheroid, 5-7.5 or 10 cm. long, 44-62 or 112 mm. in diameter; tubercles protruding 6-12 mm.; areoles elliptic; central spines dark-reddish-brown or red to nearly black, rarely 2 or commonly 3 or 4 per areole, the major one (central in the areole) with a hook about 1.5 or rarely 2 mm. broad, this spine 12-25 mm. long, the upper marginal centrals much shorter, less deeply colored and straight; radial spines white, 20 to 35 per areole; flower 2-3 or 4.4 cm. in diameter; petaloid perianth parts about 10, rose-purple or the margins pale-pink, lanceolate or oblanceolate, 4-8 mm. broad, blunt, entire; stigmas green or creamy-green, about 7 to 10, 2 or 3-6 mm. long, slender; fruit red, to 6 mm. in diameter; seed black, smooth and shining, the pits occupying less space than the reticulum between pits, 1 mm. long. Grasslands at 900-1,500 m. in El Paso Co.; Ariz., N.M. and Tex.

7. *Mammillaria Wrightii* Engelm. Stem solitary, globose or depressed-globose to turbinate, 3.8-10 cm. long, 4-7.5 cm. in diameter; tubercles protruding 3-4.5 mm.; areoles elliptic; central spines dark-reddish-brown, 3 (rarely 2) per areole, spreading, all somewhat curved and apically hooked, equal, about 25 mm. long, 0.2-0.3 mm. thick; radial spines tan, becoming gray, about 10 to 17 per areole; flower 3-4.4 cm. in diameter; petaloid perianth parts about 20, pink or pink-and-tan or sometimes tan or green, lanceolate-linear; stigmas green, 8 to 10, 2-5 mm. long; fruit red, to 25 mm. in diameter; seed brown, with the reticulum occupying less space than the pits, 1.5 mm. long. Gravelly soils at 1,500-2,400 m. in El Paso Co. and the Panhandle; Ariz., N.M. and Tex.

5. LOPHOPHORA COULT

Stems solitary to numerous, short-cylindroidal or hemispheroidal, 25-75 mm. long, 5-10 cm. in diameter; ribs commonly about 8; leaves not discernible; areoles nearly circular, with long tufts of hairs; spines none in the mature plant, bristlelike in the seedling; flowers on the new growth at the apex of the stem, each at the apex of a new tubercle next to the spine-bearing part of the areole; flower 12-25 mm. in diameter; floral tube above the ovary funnellform, pink; fruit red, fleshy, bare, elongate, clavate or nearly cylindroidal, 12-19 mm. long; seed black, of the *Cereus* type, papillate, longer than broad (hilum to opposite side), 1.3 mm. long; hilum obviously basal; cotyledons accumbent, not foliaceous.

One species near the Rio Grande in Texas to the Mexican Plateau. The plant is narcotic, and it has been used by Indians in their religious ceremonies to produce color hallucinations.

1. *Lophophora Williamsii* (Lem.) Coult. PEYOTE. Stems glaucous-green; petaloid perianth parts pink in the middles, pale to nearly white at the margins. Limestone or partly limestone soils in the desert and brushlands at 150-1,200 m. near the Rio Grande from Presidio Co. to Starr and Jim Hogg cos.; s. to S.L.P. and Qro.

6. FEROCACTUS BRITT. & ROSE BARREL CACTUS

Stems unbranched or branched (especially after injury to the terminal bud), cylindroid to ovoid or depressed-globose, 1.5-30 dm. long, 0.75-4.5 or 6 dm. in diameter; ribs 13 to 30; leaves not distinguishable; areoles circular to elliptic; spines annulate or smooth, red, pink, white, tan, brown or yellow, or becoming gray in age; central spines 4 or rarely 1 or 8, straight, curved or hooked, to 16.2 cm. long, 0.5-4 mm. in diameter, acicular to subulate; radial spines either colored like the central or more often lighter or white, 6 to 20 per areole, straight or curved; flower on the new growth of the current season near the apex of the stem and on the apex of a tubercle adjacent to the spine-bearing part of the areole; floral tube above the ovary obconical to barely funnellform; fruit fleshy, with numerous or sometimes only 10 to 15 broad scales, with the floral tube persistent, opening by a short crosswise or lengthwise slit; seeds black, finely reticulate-pitted or papillate, longer than broad (hilum to opposite side), 1-3 mm. long.

Twenty or thirty species from California to Texas and Mexico.

1. Central spines 4, cross-ribbed, 2 mm. or more broad; stem 6-24 dm. long, 30-60 cm. in diameter; fruit yellow, the rind thick, the pulp not very juicy; radial spines ashy-gray, flexible, winding in and out 1. *F. Wislizenii*.
1. Central spines *not* cross-ribbed or inconspicuously so, slender, 1.2 mm. or less in diameter; stem rarely more than 3 dm. long, mostly 5-15 cm. in diameter; fruit green or red, the rind thin, the pulp juicy; radial spines brown to straw-color or white, stiff, straight (2)
- 2(1). Fruit green, broadly ellipsoidal, 3 cm. long, with about 30 or 40 scales; seeds minutely pitted; stems to 30 cm. or reportedly 60 cm. long, to 15 cm. in diameter; central spines 4 or up to 8, to 100 or 162 mm. long and 1.2 mm. broad 2. *F. hamatacanthus*.
2. Fruit red, spheroidal, 8-12 mm. in diameter, with 10 or 15 scales; seeds minutely papillate; stems 4-10 or 20 cm. long, 4-5 cm. in diameter; central spine 1 or with 2 or 3 accessory ones, 12-38 mm. long, 0.5-0.7 mm. in diameter or broad 3. *F. setispinus*.

1. *Ferocactus Wislizenii* (Engelm.) Britt. & Rose. SOUTHWESTERN BARREL CACTUS. Stem massive, cylindroid or ovoid, 6-16 or 30 dm. long, 3-4.5 or 6 dm. in diameter; ribs 20 to 28; central spines red, colored ashy-gray, 4 per areole, strongly cross-ribbed, the lower ones hooked, to 4-5 cm. long, 1.5-2 mm. broad, flattened; radial spines ashy-gray, 12 to 20 per areole, spreading, slender, curving irregularly, not cross-ribbed; flower 4.4-6.2 mm. in diameter; petaloid perianth parts orange-yellow; fruit yellow, barrel-shaped, with numerous nearly circular shallowly fimbriate scales, 3-4.4 cm. long; seed minutely reticulate, 2-2.5 mm. long. Rocky, gravelly or sandy soils in deserts or grasslands at 300 or 600-1,350 or 1,670 m. in El Paso Co.; Ariz., N.M., Tex., Sin. and Chih.

2. *Ferocactus hamatacanthus* (Mühlenpfordt) Britt. & Rose. TURK'S HEAD, BIZNAGA DE LIMILLA. Stems of mature plants ovoid or ovoid-cylindroid, 1.5-3 or 6 dm. long, 7.5-15 cm. in diameter; ribs about 12 to 17, thin; central spines straw-color to brown, 4 or up to 8 per areole, the lower (largest) porrect, annulate, hooked, nearly straight to flexuous, the others straight, 3 or 5.6-10 or 8.7 cm. long, 0.5 or 1-1.2 mm. in diameter or broad, acicular or subulate; radial spines usually brown or straw-color, 8 to 20 per areole; flower 64-75 mm. in diameter; petaloid perianth parts yellow, with red bases; fruit green, fleshy and juicy, with 30 to 40 scales; seed finely pitted, 1.4-1.6 mm. long. Juvenile plants have central spines 3.1-5 cm. long and only 8 to 11 radials.

Var. *hamatacanthus*. Ribs not much-compressed; central spines angled or flattened, twisting but not flexuous, 6.2-10 cm. long, 1-1.2 mm. in diameter; flower 64-75 mm. in diameter; fruits 3 cm. long; seeds finely pitted. Desert and grassland at 750-1,500 m. from El Paso Co. to Webb Co.

Var. *sinuatus* (Dietr.) L. Benson. Ribs strongly compressed; central spines (lower one) strongly flattened, markedly flexuous, 38-94 mm. long, 1 mm. broad; flowers and fruits smaller than in var. *hamatacanthus*; seed finely pitted. From the Pecos River and Rio Grande to San Patricio Co.; also n.e. Mex.

3. *Ferocactus setispinus* (Engelm.) L. Benson. HEDGEHOG CACTUS. Stems green, ovoid or cylindroid, 3.8-10 or 20 cm. long, 3.8-5 cm. in diameter; ribs about 13, narrow; chief central spine straw-color or reddish-brown with a lighter tip (there being, also, 1 or 2 or 3 upper straight ones per areole), strongly hooked, smooth, finely scaberulous-canescens, 12-38 mm. long, 0.5-0.7 mm. in diameter, usually acicular; radial spines straw-color or white or brown, 12 to 15 per areole, nearly straight; flower 4-5.6 cm. in diameter; petaloid perianth parts clear-yellow, with red bases; fruit red, with about 10 to 15 scales; seed minutely papillate, 1-1.4 mm. long. About 300 m. or less from Val Verde and San Saba cos. to Travis, Refugio and Cameron cos.; also adj. Mex.

7. ECHINOCACTUS LINK & OTTO

BARREL CACTUS

Stems branching or unbranched, 5-60 cm. long, 5-30 cm. in diameter; ribs 8 to 27; leaves not discernible; areoles nearly circular to elliptic; central spines red, sometimes 0 or 1 to 4 per areole, straight or curving, 25-75 mm. long, 1.5-9 mm. broad, nearly

acicular to subulate; radial spines similar to the central but smaller, 5 to 11 per areole; flowers on the new growth near the apex of the stem, at the apex of the tubercle adjacent to the spine-bearing part of the areole; flower 4-6.8 cm. in diameter; floral tube above the ovary obconical to slightly funnellform; sepaloid perianth parts aristate- or spinose-tipped; fruit dry or fleshy, with scales and with long hairs from beneath them; seed black or brown, reticulate, usually broader than long (hilum to opposite side); hilum appearing "lateral" or oblique; cotyledons accumbent, *not* foliaceous.

Twelve or more species from California to Texas and Querétaro.

1. Stem *not* bearing spines, the surface with minute scales with long woolly hairs on the margins; seed brown, the hilum enclosed in a chamber formed from the elaborated margin of the seed coat, the funiculus entering the chamber through a pore
 3. *E. asterias*.
1. Stem bearing spines and *not* scales; seed black, the hilum depressed but *not* enclosed (2)
- 2(1). Fruit densely woolly after drying at maturity, long-persistent among the spines, dehiscent by an apical pore 1. *E. horizontalonius*.
2. Fruit becoming naked, scarlet, at first pulpy and juicy, but drying and bursting irregularly 2. *E. texensis*.

1. *Echinocactus horizontalonius* Lem. TURK'S HEAD, DEVIL'S HEAD, MANCA CABALLO. Stem solitary, depressed-globose to ovoid or sometimes columnar, glaucous, 1-1.5 or 3 dm. long, 1-1.5 dm. in diameter; ribs 7 to 13, commonly 8; central spine pale-gray or sometimes black, with under-layers of red or red-and-yellow, 3 per areole, 1 curving gradually downward, 2.5-3 cm. long, 2-3 mm. broad, somewhat flattened; radial spines gray, 5 or 6 to 8 per areole, curving slightly outward; flower 5-6.4 cm. in diameter; petaloid perianth parts pink; fruit at first juicy but drying at maturity, densely covered with white soft woolly hairs; seed black, papillate and reticulate, 3 mm. broad. Limestone at 900-1,650 m. in the Trans-Pecos; Tex. and N.M. s. to S.L.P.

2. *Echinocactus texensis* Höpffer. HORSE CRIPPLER, DEVIL'S HEAD, DEVIL'S PINCUSHION, MANCA CABALLO. Stems hemispheroidal, 1.25-2 dm. long, to 3 dm. in diameter; ribs 13 to 27; spines red but basally whitened, strongly cross-ribbed, stout and rigid; central spine 1 per areole, curving rigidly downward and exceeding the radials, 3-7.5 cm. long, 3-9 mm. broad, subulate, flattened but angular, tapering; radial spines 6 or sometimes 5 to 7 per areole; flower 5-6 cm. in diameter; petaloid perianth parts with the midribs pale-purple to violet, basally scarlet, then orange and distally pale-pink to white; fruit red, fleshy, the scales more or less deciduous; seed black, finely reticulate, 2.5 mm. broad. *Homalocephala texensis* (Höpffer) Britt. & Rose. Sea level to 1,100 m., from Brewster Co. to Howard, Young, Tarrant, Travis, Refugio and Cameron cos.; also N.M., Coah., N.L. and Tam.

3. *Echinocactus asterias* Zucc. STAR CACTUS. Stem with a covering of white or yellowish circular scales, 25-75 mm. long, to 75 mm. in diameter; ribs usually 8, separated by narrow grooves; areoles bearing many hairs; spines none; flower 3.8-5 cm. in diameter; petaloid perianth parts yellow; fruit green or pink but obscured by the white woolly hairs from the areoles; seed brown, shiny, finely reticulate, the basal part an amazing collar surrounding the hilum, the rim turned inward and forming a membranous covering around the threadlike funiculus, the seed proper 2 mm. long and 3 mm. broad. Grasslands and brushlands at low elev. in Starr Co.; also N.L. and Tam.

8. EPITHELANTHA BRITT. & ROSE

BUTTON CACTUS

Stems unbranched or branching and in clumps, ovoid-cylindroid to cylindroid, 25-62 mm. long; tubercles separate; leaves not discernible; areoles nearly circular; spines in the upper portion of the areole longer, making a tuft in the depression at the apex of the stem, ultimately breaking at the middles, the terminal tuft thereby giving way to "shorter" spines on the sides of the stem, 20 to 100 per areole, in 2 to 5 series, straight, 3-6 mm. long; flowers on the new growth near the apex of the stem, each at the apex of a tubercle adjacent to the spine-bearing part of the areole; floral tube above the ovary funnellform; fruits red or some small and colorless and with only 1 to 5 (instead of 5 or 6 to 11) seeds;

seeds black, impressed-reticulate and sometimes also papillate, broader than long (hilum to opposite side); hilum appearing "lateral;" cotyledons accumbent, not foliaceous.

A few species from Arizona to Texas and northern Mexico.

1. Spines in 2 or sometimes 3 series of about 20, 6 mm. long; flower 3-4.5 mm in diameter; petaloid perianth parts semicircular to obdeltoid, 1 mm. long; stamens 10 to 15; stems usually irregularly short-cylindroid to ovoid, the spines giving the stem a relatively rough irregular surface appearance1. *E. micromeris*.
1. Spines in 4 or 5 series of about 25 or 28 (outer series) to about 10 (inner series); flower 10-12 mm. in diameter; petaloid perianth parts bluntly oblanceolate, 9 mm. long; stamens 35 to 40; stems cylindroidal, the spines giving the stem a shining smooth appearance2. *E. Bokei*.

1. *Epithelantha micromeris* (Engelm.) Weber. Stems solitary or sometimes in small clumps, usually irregularly ovoid-cylindroidal, with a slight apical depression, 4-6.2 cm. long, 2.5-6.2 mm. in diameter; spines in 2 series of about 20 (or sometimes with a third series) per areole, accompanied by white woolly hairs, 6 mm. long; flowers 3-4.5 mm. in diameter; petaloid perianth parts pale-pink, approaching obdeltoid, 1 mm. long; stamens about 10 to 15; seed minutely reticulate-impressed, 1.5 mm. broad. Limestone or sometimes igneous soils in the desert and grassland at 1,000-1,500 m., Ariz., N.M. and Tex. from El Paso Co. to Pecos and Val Verde cos. and in Bandera Co.; also n. Mex.

See note under *Mammillaria lasiacantha*.

2. *Epithelantha Bokei* L. Benson. Stems solitary or many, 2.5-5 cm. long, 2.5-5 cm. in diameter; spines white, in each areole in 4 or 5 series of about 25 to 28 (outer) to about 10 (inner), spreading parallel to the stem, 3-4.5 mm. long; flower 10-12 mm. in diameter; petaloid perianth parts pink, bluntly oblanceolate, about 9 mm. long, 3 mm. broad; stamens 35 to 40; seed impressed-reticulate and papillate, 1 mm. broad. Limestone in the desert at 750-1,200 m. in the Big Bend; also adj. Mex.

9. THELOCACTUS (K. SCHUM.) BRITT. & ROSE

Stems solitary or several, hemispheroidal to ovoid or long-ovoid, 7.5-10 or 12.5 cm. long, 5-10 or 12.5 cm. in diameter; ribs 8 to 12; leaves not discernible; areoles nearly circular; spines smooth, straw-color or tinged with pink; central spines 1 to 4 per areole, straight or curved; radial spines 3 to 17 per areole; flowers on the new growth of the current season near the apex of the stem on the upper side of the tubercle next to the spine-bearing part of the areole; floral tube above the ovary obconic to funnelform; fruit dry, with 5 to 20 scales, subcylindroid, the floral tube persistent, the fruit opening diagonally at the base; seeds black, so far as known finely reticulate-papillate, longer than broad (hilum to opposite side), about 1.75 mm. long; hilum obviously basal; cotyledons accumbent, not foliaceous.

A few species in Texas and Mexico.

1. *Thelocactus bicolor* (Gal.) Britt. & Rose. Stems solitary, ovoid or long-ovoid, 0.75-1 or 1.25 dm. long, 5-7.5 or 12.5 cm. in diameter; ribs about 8, the tubercles coalescent basally into the ribs, crowded tightly against each other and separated by only slitlike spaces, protruding 9-12 mm.; areoles circular; spines straw-color or tinged with pink; central spines 4, the upper spreading with the radials, the lower one porrect, straight, 2.5-3 cm. long, 1 mm. broad, flattened; radial spines 10 to 17 per areole, 1-2.5 or 3 cm. long, acicular; flower 5-6.2 cm. in diameter; petaloid perianth parts rose but basally red; fruit green; seed finely reticulate-papillate, obovoid but basally truncate, 2.5 mm. long.

Var. *Schottii* (Engelm.) Krainz. Spines tinged with pink, the upper flattened radial spines straw-color or white; central spines long, to 44 mm. long, carinate; radial spines 15 to 17, the upper flattened ones 2 to 4, to 75 mm. long, 1.5 mm. broad. Gravelly soils at 1,200 m. or less, from the Big Bend to Starr Co.; also Tam.

Var. *flavidispinus* Backeberg. Spines all straw-color or with a slight tingle of pink; central spines short, the longest (upper) 2 cm. long; radial spines 12 to 14, the upper flattened ones 1 or 2 (instead of 2 or 3), to only 38 mm. long, 0.5 mm. broad. Hills at about 1,200 m. and lower in n.e. Brewster Co. and Starr Co.

10. NEOLLOYDIA BRITT. & ROSE

Stems branched or unbranched, ovoid or cylindroid, 5-15 or 38 cm. long, 25-75 or 125 mm. in diameter; ribs 8 to 21, the tubercles separate, not coalescent and not forming ribs; leaves not discernible; areoles nearly circular to elliptic; spines smooth, black to dark-brown or tan, chalky-blue, straw-color, purplish or pink, sometimes dark-tipped, becoming gray or black in age; central spines 1 to 8 per areole, straight or rarely (in Mexico) curved or almost hooked, 12-44 mm. long, 0.4-1.5 mm. in diameter, acicular or subulate; radial spines white or similar to the central, 3 to 32 per areole; flower on the new growth near the apex of the stem on the upper side of a tubercle in a felted area distant from the spine-bearing part of the areole and connected with it by an isthmus running from half to the full length of the tubercle, 25-75 mm. in diameter; floral tube above the ovary funnellform to obconical; fruit dry, with a few or up to 20 membranous scales, dehiscent basally or in species occurring elsewhere by 1 to 3 longitudinal slits; seed black, reticulate, reticulate-papillate or papillate, either broader than long or longer than broad (hilum to opposite side), 1.5-2.5 mm. in greatest dimension; hilum either obviously basal or appearing "lateral;" cotyledons accumbent, *not* foliaceous.

Twelve or fifteen species from Arizona to Texas and San Luis Potosí.

1. Lower central spine longer than the others, the central spines black or dark-brown; stems branching and forming clumps, green; seed longer (hilum to opposite point) than broad, the hilum obviously basal 1. *N. conoidea*.
1. Lower central spine shorter than the others, the central spines dull-tan tipped with chalky-blue or blue-brown or pinkish or grayish straw-color; stems (so far as known) unbranched; seed broader than long (hilum to opposite point), the hilum appearing "lateral" or perhaps transitional (2)
- 2(1). Central spines usually grayish or straw-color with the upper parts pink or red or sometimes all red; stem green; lower porrect central spine often very short but sometimes to 22 mm. long; seed 2 mm. broad 4. *N. intertexta*.
2. Central spines dull-tan, tipped with chalky-blue or blue-brown; stem glaucous (3)
- 3(2). Radial spines 12 to 14 per areole, not pectinate, spreading irregularly at low angles, blurring the stem; central spines similar to the radial, 4 (or possibly 6, with 2 additional ones above), the upper ones about one fourth longer than the lower porrect one; seed 2 mm. broad 2. *N. Warnockii*.
3. Radial spines 26 to 32 per areole, pectinate, obscuring the stem; central spines much thicker and longer than the radials, 3, the upper ones about three times as long as the lower porrect one; seed 1.5 mm. broad 3. *N. mariposensis*.

1. *Neolloydia conoidea* (DC.) Britt. & Rose. Stems green, not bluish, solitary to several or many, ovoid to cylindroid, 7.5-10 cm. long, 25-62 mm. in diameter; ribs slightly developed; tubercles protruding 6-12 mm.; central spines black or dark-brown, mostly 4 per areole, the lower principal one turned slightly downward, straight, 2-3 cm. long; radial spines white, 15 to 28 per areole, parallel to the stem; flower 4-6 cm. in diameter; petaloid perianth parts magenta or purplish; seed longer than broad. Limestone habitats in Brewster, Pecos and Terrell cos.; also n. Mex.

2. *Neolloydia Warnockii* L. Benson. Stems blue-green, solitary, ovoid to long-ovoid, 7-11.2 cm. long, 5-7.5 cm. in diameter; ribs 13 to 21; tubercles protruding 9 mm.; central spines dull-tan but the tips chalky-blue or partly brown, 4 per areole or perhaps with 2 or more above the upper median one, straight, the lower porrect; radial spines like the central but the dark tips shorter and the diameter a little less, 12 to 14 per areole, spreading rather irregularly; flower 25 mm. in diameter; petaloid perianth parts pink; fruit green; seed black, papillate in a reticulate pattern, 1.5 mm. long, 2 mm. broad; hilum appearing "lateral." Limestone in the desert at 560-900 or 1,200 m., from Hudspeth to Culberson and Brewster cos.

3. *Neolloydia mariposensis* (Hester) L. Benson. Stems blue-green, ovoid- or obovoid-cylindroid, 6.2-10 cm. long, 4-6 cm. in diameter; ribs 21, the tubercles of greater height than the rib beneath them; tubercles protruding 3 mm.; central spines dull-tan with chalky-blue or partly brown tips, 2 to 4 per areole, the lower one turned and curving downward, one third as long but similar to the upper 1 to 3, these straight, 1.5-2 cm.

long; radial spines ashy-white, 26 to 32 per areole; flower to 38 mm. in diameter; seed black, papillate in a reticulate pattern, 1.3 mm. long, 1.5 mm. broad; hilum "lateral" but transitional to the obviously basal type. Limestone in the desert at 750-1,000 m., Presidio Co.; also cen. Coah.

4. *Neolloydia intertexta* (Engelm.) L. Benson. WHITE VIZNAGITA. Stems solitary, elongate-ovoid to cylindroid, 5-15 cm. long, 4-7.5 cm. in diameter; ribs deeply and usually sharply indented between tubercles, the tubercles protruding 3 mm. above the rib; spines dense; central spines pinkish or all but the tips grayish-straw-color, usually 4 per areole, the three upper ones appearing to be radials, 15-22 mm. long, the lower (obviously central) one porrect, 1-3 or up to 15-22 mm. long, elongate-conical; radial spines 13 to 20 per areole, 9-15 or 20 mm. long; flower 2.5-3 cm. in diameter; petaloid perianth parts pink or pale pinkish-white on the margins; fruit green, drying to tan or brown; seed black, minutely and regularly papillate-reticulate, 1.5 mm. long, 2 mm. broad.

Var. *intertexta*. Stem ovoid or obovoid to cylindroid, 5-7.5 or 15 cm. long; upper central spines and radial spines appressed against the stem, shorter than in var. *dasyacantha*, 12-15 mm. long, stouter than in var. *dasyacantha*, to 0.5 mm. in diameter; lower central spine porrect, 1-3 mm. long, elongate-conical, much shorter than the other centrals. Limestone in grasslands at 1,200-1,500 m., Ariz., N.M. and s. in Tex. to Jeff Davis and Brewster cos.; also Son. and Chih.

Var. *dasyacantha* (Engelm.) L. Benson. Stem becoming elongate-ovoid to cylindroid, 7.5-15 cm. long; upper central spines and radial spines *not* strongly appressed against the stem, to 15-20 or 40 mm. long; lower central spine 15-20 mm. long. Limestone in the desert at 900-1,500 m., N.M. and Tex. in El Paso Co.

11. ANCISTROCACTUS BRITT. & ROSE

Stem solitary or rarely with a few branches, globose in young plants and obovoid, ellipsoid, obovoid-cylindroid, obconical, turbinate or globose in older plants; ribs clear in older plants, the bases of the tubercles confluent; leaves not discernible; central spine(s) on juvenile stems 1 per areole, on mature stems 3 or 4, the lower one hooked, the others straight and turned upward; radial spines 6 to 22, straight or some of the lower ones hooked; flower on a new tubercle near the stem apex; flower-bearing portion of the areole on a young stem nearly circular to elliptic and adjacent to the spine-bearing portion of the areole at the apex of the tubercle, the flowers of later seasons lower and lower on the new tubercles and ultimately from their bases, the narrow connecting grooves becoming longer and longer; flower 2.5-3 cm. in diameter; floral tube obconic to funnellform; petaloid perianth segments green to cream-color, pale-yellow, red or rose-purple; fruit green or red, fleshy, indehiscent, bearing 1 or commonly 2 to 13 or numerous scales; seed dark-brown or black, finely papillate, broader than long or longer than broad (hilum to opposite side); hilum obviously basal or appearing "lateral," cotyledons accumbent, not foliaceous.

Four species in southern Texas and Mexico.

1. Radial spines (some longer ones) hooked; principal central spine (the lower hooked one) 50-75 or 112 mm. long; petaloid perianth parts red; fruit bearing numerous scale leaves, red, fleshy, thick-walled, juicy; seed longer than broad, therefore the hilum obviously basal3. *A. uncinatus*.
1. Radial spines *not* hooked; principal central spine (the lower hooked one) 12-44 mm. long; petaloid perianth parts (so far as observed) cream-color to yellow or greenish-yellow or (reportedly) rose-purple; fruit bearing 1 or commonly 2 to 13 scale leaves, green or red-tinged, thin-walled, not juicy; seed broader than long, the hilum appearing "lateral" (2)
- 2(1). Spines finely scaberulous-canescens; radial spines 7 to 9 per areole, spreading rather irregularly; stem almost flat-topped, turbinate or obconical, arising only slightly above ground level1. *A. Tobuschii*.
2. Spines glabrous; radial spines 1 to 22 per areole, spreading rather uniformly; stem at maturity obovoid-cylindroid, elongate (beginning to flower while it is still juvenile and obovoid), rising conspicuously above ground level2. *A. Scheeri*.

1. *Ancistrocactus Tobuschii* W. T. Marsh. Obscure cactus with normally solitary stems, these obconical or turbinate, 3.8-5 cm. long, 3.8-5 cm. in diameter; roots fibrous; central spines at first light-yellow with red tips, changing to gray, 3 per areole, the upper two straight and turned upward, the lower one hooked and porrect, to 22 mm. long and 0.4 mm. broad, subulate; radial spines like the central but small, 7 to 9 per areole, acicular; flower 3-3.8 cm. in diameter; fruit green or tinged with red, with apparently only 1 to 3 scales; seed black, finely papillate, 1.5 mm. long, 1.5 mm. broad or slightly more. Limestone at 450 m. in Bandera Co.

2. *Ancistrocactus Scheeri* (Salm-Dyck) Britt. & Rose. Stems solitary, ellipsoid to nearly globose or obovoid or elongate-obovoid, 2.5-10 or 15 cm. long, 2.5-5 or 10 cm. in diameter; roots fibrous or tuberous; principal central spines ventrally pale-grayish or whitish and dorsally black-yellow and on the curve of the hook, porrect; *juvenile plants* with the longer principal central spines 1-1.2 cm. long and upper central spines mostly 0 to 2, but sometimes 3, pale-gray, the middle one (if present) usually short and weak; *mature plants* with the longer principal central spines 25-44 mm. long and the upper central spines whitish, usually 3, flattened, middle one 1-1.5 cm. long but weak; flower 2.5-3 cm. in diameter; petaloid perianth parts greenish-yellow; fruit green, somewhat fleshy but thin-walled and finally dry at maturity, with 8 to 13 scales; seed brown, finely papillate, 1.5 mm. long, 2 mm. broad. *A. brevihamatus* (Engelm.) Britt. & Rose. Brushy areas in grasslands at low elev. from Val Verde Co. to Jim Wells and Hidalgo cos.; also N.L. and Tam.

3. *Ancistrocactus uncinatus* (Gal.) L. Benson. Stems unbranched, cylindroid-ovoid to ovoid, 7.5-15 cm. long, 5-7.5 or 10 cm. in diameter; ribs present but the constrictions between tubercles slitlike; central spines light-colored, tannish-white to straw-color or pinkish, the principal one turned upward, hooked, 5-7.5 or 11.2 cm. long, 1 or 1.3 mm. broad, somewhat flattened; lower radial spines reddish or reddish-tan, some hooked; flower 2.5-3 cm. in diameter; fruit red, fleshy at maturity, with numerous scales; seed minutely papillate above, 1.5 mm. long, 1 mm. broad; hilum obviously basal, surrounded by a broad border.

Var. *Wrightii* (Engelm.) L. Benson. Upper sepaloid perianth parts obtuse; petals obtuse to acute. Limestone in the desert at 1,000-1,200 m., from El Paso Co. to Crockett, Starr and Victoria cos.; also N.M. and Chih.

12. CORYPHANTHA (ENGELM.) LEM.

Stems solitary or branching, sometimes forming mounds of 200 or more, subglobose to cylindroid, 2.5-10 or 12.5 cm. long, 25-75 mm. in diameter; tubercles separate; leaves not discernible; areoles circular to elliptic; spines smooth, white to gray, pink, yellow, brown or black; central spines 1 to 10 or more per areole, grading into the radial, straight, curved, hooked or somewhat twisted, acicular or sometimes subulate; radial spines 5 to 40 per areole; flower on the new growth near the apex of the stem at the base of the upper side of a tubercle distant from the spine-bearing part of the areole and connected by a narrow isthmus (on immature stems and in *Coryphantha macromeris* up to mid-level on the tubercle), 1.2-5 cm. in diameter; floral tube above the ovary funnelliform; fruit fleshy, green or red at maturity, thin-walled, without surface appendages; seed tan, brown or black, smooth and shining or punctate or reticulate, usually but not necessarily broader than long (hilum to opposite side), 1-2 mm. in greatest dimension; hilum usually appearing "lateral" but sometimes obviously basal or "oblique;" cotyledons accumbent, not foliaceous.

Twenty or thirty species from Alberta to Mexico.

1. Spines cylindroid, each with an abruptly acute apex, the upper 3 large ones of the innermost series strongly bulbous-based, up to 4.5 mm. long, the spines about 20 in 2 or 3 series, gradually diminishing in size, especially in the upper part of the outer series; stems ovoid, about 1.2-2 or 2.5 cm. long 1. *C. minima*.
1. Spines *not* cylindroid, the apices *not* abruptly acute (2)

- 2(1). Mature fruit green, commonly clavate or cylindroid or ellipsoid, but in some species unknown; seeds usually brown, rarely black, usually though not always broader than long, the hilum usually appearing "lateral" but sometimes obviously basal; central spines usually present and different from the radials (3)
2. Mature fruit red (9)
- 3(2). Fruit bearing a few scales; flower at mid-level on the tubercle (even in mature plants) 2. *C. macromeris*.
3. Fruit bearing no scales; flower (except on a juvenile stem) at the base of the ventral side of the tubercle (4)
- 4(3). Tubercles protruding 2.5-3.8 cm., conspicuous; central spines 2.5-3.8 cm. long, 1-1.5 mm. in diameter, straw-yellow with dark-red tips 3. *C. Scheeri*.
4. Tubercles protruding not more than 1.2 or rarely 2 cm.; central spines up to 1.7 cm. long (if the bases are as much as 1-1.5 mm. in diameter) (5)
- 5(4). Lower central spine porrect, either shorter than the upward-directed upper ones or lacking; sepaloid perianth parts ciliate-fimbriate; seeds reticulate (unknown in *C. Hesteri*) (6)
5. Lower central spine porrect, longer than the upward-directed upper ones; sepaloid perianth parts not ciliate nor fimbriate (not determined for *C. ramillosa*); seeds smooth and shining, *not* reticulate, sometimes minutely punctate (unknown in *C. ramillosa*) (7)
- 6(5). Longest spines 12-20 or 25 mm. long; radial spines 9-15 mm. long; flower 1.5-2 cm. in diameter; petaloid perianth parts apically mucronate to acuminate or attenuate; stigmas 1.5-3 mm. long 4. *C. vivipara*.
6. Longest spines 9-10.5 mm. long; radial spines 3-9 mm. long; flower 1.5-2 cm. in diameter; petaloid perianth parts apically acute; stigmas about 1 mm. long 5. *C. Hesteri*.
- 7(5). Central spines at first dark-chocolate-brown, the lower porrect principal one remaining so; perianth parts pale-pink to rose-purple, not yellow 6. *C. ramillosa*.
7. Central spines at first pink, yellow or gray, the lower porrect principal one changing (as do the others) to white or light-gray (8)
- 8(7). Flower opening and reopening on two or three days; each petaloid perianth part yellow apically but pink basally, *not* bristle-tipped; seed smooth, not punctate ... 7. *C. sulcata*.
8. Flower opening only once, then for an hour or two; each petaloid perianth part yellow, apically toothed and bristle-tipped; seed smooth but minutely punctate 8. *C. cornifera*.
- 9(2). Fruit globular; central spine(s) lacking or solitary or rarely 2, similar to the radials; seeds black, slightly longer than broad, the hilum obviously basal; flowers yellow or rarely pink 14. *C. missouriensis*.
9. Fruit much longer than its diameter, ellipsoid to clavate or cylindroid; central spines 5 to 11 or in one species 1 to 4 per areole or in another species not differentiated from the radial; flowers pink to white (10).
- 10(9). Seed broader than long, the hilum appearing "lateral," the seed coat brown; stems usually branching (11)
10. Seed longer than broad, the hilum obviously basal, the seed coat brown to black (12)
- 11(10). Radial spines on the upper side of the areole not markedly longer than those on the lower; fruit usually bright-red (though sometimes green); mature stems 2.5-5 cm. in diameter, 7.5-12.5 or 20 cm. long, solitary or forming clumps of several branches 9. *C. strobiliformis*.
11. Radial spines on the upper side of the areole much longer than those on the lower; fruit green at maturity; stems 1.2-2.5 cm. in diameter, 2.5-7.5 cm. long, branching profusely and forming extensive mats 10. *C. Sneedii*.

- 12(10). Spines in several series, not clearly differentiated into centrals and radials, the inner gradually somewhat larger, 30 to 75 per areole; seed black; stems solitary or rarely 2 or 313. *C. Duncanii*.
12. Spines in a series of larger centrals and one of smaller radials, 17 to 38 altogether; seed dark-brown to black (13)
- 13(12). Stems (so far as known) solitary, cylindroid, 2.5 or 4-5 cm. in diameter, 7.5-17.5 cm. long; anthers oblong, twice as long as broad ... 11. *C. dasyacantha*.
13. Stems branching, often profusely so, obovoid, 1.2-2.5 cm. in diameter, 3.8-5 cm. long; anthers ovoid12. *C. Robertii*.

1. *Coryphantha minima* Baird. Stem simple or sparingly branched, ovoid, 1.2-2 or 2.5 cm. long, 12 mm. in diameter; tubercles subcylindroid, protruding 3 mm.; spines about 20 per areole, pale-ashy-gray or sometimes pinkish, in 2 or 3 series, all spreading parallel to the stem, those of the inner series longer and thicker, the 3 largest in the upper part of the areole about 4.5 mm. long, basally bulbous, above the bulb 0.5 mm. in diameter, cylindroidal with an abruptly acute apex. *C. Nellieae* Croizat. Hills, at 1,200-1,350 m., Brewster Co.; endemic.

2. *Coryphantha macromeris* (Engelm.) Britt. & Rose. Stems solitary or forming clumps, cylindroid to elongate-ovoid, 5-15 cm. long, to 5 cm. in diameter; each tubercle prominent and elongate, unlike those of the other species grooved only on the upper half, protruding to 15-25 mm.; central spines black or dark-gray to pale-gray, 4 to 6 per areole, the lower (principal) one a little longer, the upper 3 or 5 less conspicuous, straight or somewhat curved or twisted, up to 2.5-5 cm. long and 1 mm. broad, subulate; radial spines dark- to pale-gray, lighter than the centrals, 9 to 15 per areole, straight to slightly curving; flower 3-4.4 cm. in diameter; petaloid perianth parts reddish-purple to rose; fruit green, the few fimbriate scales with woolly axils.

Var. *macromeris*. Stems green, 10-15 cm. long and 5 cm. in diameter, in clumps to 3 dm. in diameter; tubercles mostly 15 mm. long vertically, 6-9 mm. broad, protruding 15-25 mm. Clay and gravelly soils in the desert at 800-1,350 m., w. of Pecos River and in Reeves Co.; also N.M. and s. to Zac.

Var. *Runyonii* (Britt. & Rose) L. Benson. Stems gray-green, up to 5-7.5 cm. long, 25-38 mm. in diameter, in clumps to 9 dm. in diameter; tubercles mostly to 7.5 mm. long and 4.5 mm. broad, protruding 12 mm. Gravelly and white silt soils at low elev. from Starr Co. and Cameron Co.; endemic.

3. *Coryphantha Scheeri* (O. Ktze.) L. Benson. Stems solitary or sometimes in clusters, ellipsoid, 1-1.75 dm. long, 7.5-10 cm. in diameter; tubercles elongate, prismatic-cylindroid, protruding 25-38 mm.; central spines straw-color with dark-red tips or pink, 1 to 4 or 5 per areole, nearly porrect, to 38 mm. long and 1 or 1.5 mm. in diameter, acicular; radial spines 1 to 4 or 5 per areole; flower 5-7.5 cm. in diameter; petaloid perianth parts yellow or with red streaks; fruit green, fleshy; seed brown or perhaps becoming black, very finely reticulate, 2 mm. long, 3 mm. broad; hilum in the curve. *C. Muehlenpfordtii* (Poselger) Britt. & Rose.

Var. *Scheeri*. Stem solitary; young areoles *not* covered with wool; central spine 1, to 38 mm. long, *not* strongly curved nor hooked; radial spines 8 to 10 or 11, to 2 cm. long; sepaloïd perianth parts with glabrous margins; petaloïd perianth parts yellow with red streaks. N.M. and Tex. near the Pecos River and in the Big Bend; also Mex.

Var. *valida* (Engelm.) L. Benson. Stem solitary; young areoles covered densely with wool; central spines 1 to 4 or 5, one to 38 mm. long, *not* strongly curved and *not* hooked; radial spines 9 or 12 to 16, to 3 cm. long; sepaloïd perianth parts ciliate; petaloïd perianth parts yellow. Ariz. to N.M. and Tex. e. to the Davis Mts.; also Chih.

Var. *uncinata* L. Benson. Stem branching unknown; young areoles covered densely with deciduous wool; central spines 1 to 3 in young plants, 3 and equal in mature plants, 25 mm. long, all strongly arcuate and apically hooked; radial spines about 16, about 25 mm. long; flowers unknown. Near El Paso; endemic.

4. *Coryphantha vivipara* (Nutt.) Britt. & Rose. Stems depressed-globose to ovoid or cylindroid, in some varieties forming clumps of 200 or more, 4-7.5 cm. in diameter; tubercles protruding 6-19 mm.; central spines usually white basally but tipped with pink, red or black, 3 to 10 per areole, spreading at various angles, straight, up to 12-19 or 25 mm. long, 0.3-0.6 mm. in diameter, acicular; radial spines white, 12 to 40 per areole;

flowers in some varieties open only an hour or two on one day in the year but in other varieties often in several crops produced at different times; flower 2.5-5 cm. in diameter; petaloid perianth parts pink, red, lavender or yellow-green; fruit green, fleshy; seed brown, reticulate, 1.2 mm. long, 1.5-2 mm. broad; hilum appearing "lateral."

Var. *vivipara*. Stems depressed-globose to ovoid, 2-2.5 cm. long, 3.8-5 cm. in diameter; central spines 4, the lower one red and dark-colored or basally white; radial spines 12 to 20, white, 1-1.2 cm. long; fruit 1.2-2 cm. long; seed 1.5-1.8 mm. long. Alta. and Ore., e. to Minn., Kan., N.M., Okla. and the n. Tex. Panhandle.

Var. *radiosa* (Engelm.) Backeberg. Stems ovoid to cylindroid, 5-7.5 cm. long, 2-5.6 cm. in diameter; central spines 3 or 4, the lower one pink to red, relatively less prominent among the radials than in var. *vivipara*; radial spines 20 to 40, white to pink, 1.2-2 cm. long; fruit 2-2.5 cm. long; seed 2 mm. long. Incl. var. *neomexicana* (Engelm.) Backeberg, *C. fragrans* Hester, *Mammillaria vivipara* (Nutt.) Haw. subsp. *radiosa* and var. *texana* Engelm. N.M. to Okla. and w. and cen. Tex.

5. *Coryphantha Hesteri* Y. Wright. Stems forming clumps 1-1.5 dm. in diameter, each broadly obovoid to turbinate or subglobose, 2.5-4 or 5 cm. long, 2-3 or 4.4 cm. in diameter; tubercles wide and prominent, protruding 6-9 mm.; central spines white or sometimes red-tipped, 1 to about 4 per areole, all in the upper portion and turned upward, to 1 cm. long, tapering, acicular; radial spines white, 12 to 14 per areole, 3-9 mm. long; flower 1.5-2 cm. in diameter; petaloid perianth parts lavender. Limestone and other soils at 1,200-1,500 m. in n. Brewster Co.; endemic.

6. *Coryphantha ramillosa* Cutak. Stem globular or broadly obovoid, 6-7.5 cm. long, 6 cm. in diameter; tubercles wide and prominent, protruding 12-15 mm.; central spines 4 with 1 to 3 accessory ones above them, straight or somewhat curved, the lower one dark-brown, porrect, 2.5-4 cm. long, the upper 3 nearly white, turned upward, the principal central spine 0.75 mm. in diameter, acicular; radial spines white, 9 to 20 per areole. Limestone in the desert at 750-1,050 m. in Brewster and Terrell cos.; also Coah.

7. *Coryphantha sulcata* (Engelm.) Britt. & Rose. Stems branching, forming clumps, subglobose or obovoid, 7.5-12.5 cm. long and the same diameter; tubercles protruding 12 mm.; spines at first either yellow-and-pink or pink, later gray or overlain by gray or white; central spine(s) 1 or perhaps 2 or 3 per areole, spreading, slightly curving, up to 9-12 mm. long, 0.5 mm. in diameter, acicular; radial spines similar but shorter, 6 to 8 per areole; flower 4-6.2 cm. in diameter; petaloid perianth parts red basally, yellow distally; fruit green, fleshy; seed brown, smooth and shining, 1 mm. long, 2 mm. broad.

Var. *sulcata*. Stem subglobose, 75-125 mm. long, of equal diameter; spines at first yellow-and-pink or pink, later overlain by gray or white, 0.3-0.5 mm. in diameter; flower to 5-6.2 cm. in diameter. Sandy or gravelly soil at low elev. from Wichita and Tarrant cos. to Uvalde, Austin and Duval cos.

Var. *Nickelsiae* (K. Brandeg.) L. Benson. Stem obovoid, about 5 cm. long, 3.8-5 cm. in diameter; spines pink overlain by gray or white, slender, 0.3-0.4 mm. in diameter; flower about 4 cm. in diameter. Low elev. in Tex., perhaps at Laredo; definitely in N.L.

8. *Coryphantha cornifera* (DC.) Britt. & Rose. Stems solitary or sometimes several, cylindroid (the younger globose), 7.5-10.25 cm. long, 4.4-6 cm. in diameter; tubercles protruding 9-12 mm.; central spines gray or sometimes reddish, 1 to 4 per areole (0 in juvenile plants), the lower (principal) one porrect, 9-17 mm. long, 1-1.5 mm. in diameter, acicular; radial spines 16 to 26 per areole, spreading; flower about 5 cm. in diameter; petaloid perianth parts yellow; fruit green, fleshy; seed brown, smooth and shining, minutely punctate, 1.2 mm. long, 2 mm. broad.

Var. *Echinus* (Engelm.) L. Benson. Central spines 3 or 4, the lower one somewhat larger, straight or curving, 12-17 or 22 mm. long, basally 1-1.5 mm. in diameter; radial spines 16 to 26. Limestone in the desert at 660-900 or 1,400 m., from El Paso Co. to Howard, Coke and Val Verde cos.; also Chih. and Coah.

9. *Coryphantha strobiliformis* (Poselger) Orcutt. Stems solitary or forming clumps, cylindroid, 5-12.5 or 20 cm. long, 2.5-5 cm. in diameter; tubercles cylindroid, protruding 1 cm., becoming spineless, hard and persistent on the lower part of the stem; central spines straw-yellow, usually tipped with pink or pale-red, the principal one central in the areole, surrounded by 5 to 7 smaller ones, straight, up to 12-15 mm. long, 0.3 mm. in diameter, acicular; radial spines pale-straw-color or white or pale-gray, 20 to 30 per areole; flower 2-3 cm. in diameter; petaloid perianth parts pink; fruits red or sometimes

some of them green, fleshy; seed brown, punctate, 0.8 mm. long, 1 mm. broad; hilum very small, appearing "sublateral." *Escobaria tuberculosa* (Engelm.) Britt. & Rose.

Var. *strobiliformis*. Stem 5-12.5 cm. long, 2.5-5 cm. in diameter; the most central spine longest, surrounded by 5 to 7 smaller centrals, up to 12-15 mm. long, to 0.3 mm. in diameter. Limestone in deserts and grasslands at 750-1,550 m. from El Paso Co. to Pecos and Terrell cos.; also Ariz., N.M. and Chih.

Var. *durispina* (Quehl) L. Benson. Stem 15-20 cm. long, about 5 cm. in diameter; the most central one or two spines surrounded by 4 to 6 centrals, some smaller, up to 15-19 mm. long, some about 0.6 mm. in diameter. In the Big Bend; "Mex."

10. *Coryphantha Sneedii* (Britt. & Rose) Berger. Stems much-branched, forming clumps, cylindroid, 25-75 mm. long, 1-2.5 cm. in diameter; tubercles protruding 3 mm., persistent and hard after fall of the spines; spines obliterating the stem; central spines white, tipped with pink or lavender, about 6 to 9 per areole, the strictly central one short, straight, the longer ones 4.5-6 mm. long, to 0.3 mm. in diameter, acicular; radial spines white, 25 to 35 per areole, those on the upper side of the areole 4.5-6 mm. long, those on the lower 3 mm. long; flower 12-19 mm. in diameter; petaloid perianth parts white or at least the midribs pink or rose or magenta or partly brownish; fruit green or tinged with brown or red; seed reddish-brown, strongly reticulate, 0.75 mm. long, 1.25 mm. broad; hilum appearing "sub-basal." Limestone ledges in the desert and grassland at 1,300 or 1,500-1,650 m., N.M. and Tex. in the Franklin Mts.

11. *Coryphantha dasyacantha* (Engelm.) Orcutt. Stems solitary (so far as known), the older ones elongate-cylindroid, 75-175 mm. long, 5-7.5 cm. in diameter; tubercles persisting on the lower part of the stem and becoming hard after the fall of the spines, protruding 4.5-12 mm.; central spines varying upward from the light-colored bases through pink, then red to black, 1 to 4 or 5 per areole, 1 usually porrect to directed downward, up to 9-12 mm. long, 0.25 or to 0.5 mm. in diameter, acicular; radial spines white or straw-color, 16 to 28 per areole; flower 2-2.5 cm. in diameter; petaloid perianth parts pink; fruit red, fleshy; seed dark-brown to "almost black," 1 mm. long, 0.7 mm. broad; hilum large, obliquely basal. *Escobaria dasyacantha* (Engelm.) Britt. & Rose.

Var. *dasyacantha*. Spines obscuring the stem; radial spines white, about 24 to 28 per areole, up to 7.5-10.5 mm. long. Igneous rocks and probably limestone mostly in woodland and grassland at 800-1,700 m. from El Paso to the Big Bend; endemic.

Var. *varicolor* (Tiegel) L. Benson. Spines not dense, the green of the stems conspicuous; radial spines straw-color or some small ones white, 16 to 18 per areole, to 6 mm. long. Igneous rocks, limestone or novaculite in grassland at 500-1,400 m., in Presidio, Jeff Davis and Brewster cos.; endemic.

12. *Coryphantha Robertii* Berger. Stems branching and forming clumps, cylindroid to ovoid-cylindroid, ultimately 3.8-5 or 12.5 cm. long, 2-2.5 cm. in diameter; tubercles protruding 6-9 mm.; spines obscuring the stem; central spines pale-yellow with dark either red, brown or black tips, 5 to 8 per areole, mostly turning upward, straight, to 12 mm. long, 0.2 mm. in diameter, acicular; radial spines white, averaging 20 to 30 per areole; flower as a whole with a bronze-pink appearance, 2-2.5 cm. in diameter; petaloid perianth parts lavender to pale-purple; fruit red, fleshy; seed black or brown, punctate, 1-1.25 mm. long, 1 mm. broad; hilum clearly basal. Limestone in the desert or grassland at 300 m., from Val Verde Co. to Hidalgo Co.; also Coah. to Tam.

13. *Coryphantha Duncanii* (Hester) L. Benson. Stems solitary or rarely 2 or 3, broadly turbinate or subglobose to obconical, 2.5-6 cm. long and of equal diameter; tubercles protruding 4.5-6 mm.; spines completely obscuring the stem, in several series, the innermost larger but the distinction of central and radial spines not clear, white or with short dark-brown tips, 30 to 75 per areole, straight or bent or curved or twisted through crowding, slender, fragile, up to 9-12 or 22 mm. long, 0.1-0.2 mm. in diameter, acicular; flower 10.5-12 cm. in diameter; petaloid perianth parts pink; fruit red; seed black, shiny, the surface pitted, 1-1.2 mm. long, 0.8 mm. broad; hilum obviously basal. Limestone of deserts at 1,000-1,650 m., N.M. and Tex. in Brewster Co.

14. *Coryphantha missouriensis* (Sweet) Britt. & Rose. Stems solitary or branching and forming clumps, hemispheroid to depressed-globose, 2.5-5 cm. long, 3.8-5 or 10 cm. in diameter; tubercles elongate, protruding 12-15 mm.; areoles circular; spines *pubescent*; central spine(s) commonly none but sometimes 1 or rarely 2 per areole, not conspicuously

differentiated; radial spines 8 to 20 per areole, spreading, straight, to 1-2 cm. long, slender, 0.3 mm. in diameter, acicular; flower 25-56 mm. in diameter; fruit red, fleshy; seed black, obviously punctate, 1-2.5 mm. long, 1.5-2 mm. broad; hilum clearly basal, slightly oblique. *Neobesseya missouriensis* (Sweet) Britt. & Rose.

Var. *caespitosa* (Engelm.) L. Benson. Radial spines usually 12 to 15; flower 5-6.2 cm. in diameter; sepaloïd perianth parts fimbriate; petaloïd perianth parts acuminate-attenuate; fruit globular to ellipsoid, 1.5-2 cm. long; seed 2-2.5 mm. long. *Neobesseya similis* (Engelm.) Britt. & Rose. Kan. to Bexar Co., Tex. and n.w. La.

Var. *robustior* (Engelm.) L. Benson. Radial spines usually 12 to 15; flower 4.4-5 cm. in diameter; sepaloïd perianth parts *not* fimbriate; petaloïd perianth parts abruptly long-acuminate; fruit globose, about 1 cm. in diameter; seed not available. *Neobesseya Wissmannii* (Hildemann) Britt. & Rose. Tex. Panhandle and just s. in the Plains Country; endemic.

13. ARIOCARPUS SCHEIDW.

Stem unbranched, turbinate, above ground flattened or depressed-globose, 6-12.5 cm. in diameter; tubercles separate, often flattened and imbricated like the petals of a cultivated rose, in the local species sculptured, cartilaginous, tending to be triangular or prismatic; roots large and fusiform; leaves not discernible; areole none or vestigial in the adult plant; spines present only in very young plants; flower on the new growth near the apex of the stem at the base of the obscure hair-covered upper side of a tubercle and distant from the vestige (if any) of the spine-bearing part of the areole and (in the species in the United States) connected with it by an isthmus; flower 2-5 cm. in diameter, rotate-campanulate; floral tube above the ovary obconical, white or magenta; fruit greenish, red or reddish-purple but turning brown, fleshy at maturity, the surface bare; seed black, shiny, slightly longer than broad (hilum to opposite side); hilum obviously basal; cotyledons accumbent, not foliaceous.

Six species from Texas to Querétaro.

1. *Ariocarpus fissuratus* (Engelm.) K. Schum. **LIVING ROCK.** Stem solitary, gray-green, inconspicuous, broadly turbinate, only the flattened or somewhat convex top protruding above ground, 3.8-5 cm. long, to 1 dm. in diameter; areoles densely woolly; flower to 3.4 or 4 cm. in diameter; petaloïd perianth parts pale-magenta; fruit white to greenish, fleshy but drying at maturity and becoming brown; seed 0.8 mm. long, 0.6 mm. broad. Limestone in the desert at 500-3,300 m., from Presidio Co. to the Pecos River; also adj. Chih. and Coah.

FAM. 132. LYTHRACEAE ST.-HIL.

LOOSESTRIFE FAMILY

Herbs, shrubs or trees; leaves opposite, whorled or alternate, simple, entire; stipules minute or wanting; flowers perfect, regular or sometimes irregular, solitary or clustered, 4- to 7-parted, the peduncles usually bibracteolate; calyx tubular to campanulate, persistent, 4- to 6-toothed and often with accessory teeth in the sinuses, the toothlike lobes valvate; petals inserted in the throat of the hypanthium between the lobes or rarely absent; stamens 4 to many, inserted on the hypanthium, when as many as the petals then opposite the sepals; style simple or wanting, the stigma capitate; fruit capsular, dry, 1- to several-celled.

About 550 species in 25 genera, mostly in the tropics.

1. Shrubs or small trees (2)

1. Herbs or only partially suffrutescent (4)

2(1). Flowers in terminal panicles; terrestrial shrub or small tree 1. *Lagerstroemia*, p. 1114.

2. Flowers axillary (3)

3(2). Flowers in cymes in leaf axils; aquatic shrub 2. *Decodon*, p. 1114.

3. Flower solitary in leaf axils; not strictly aquatic 3. *Heimia*, p. 1114.

- 4(1). Flowers irregular; calyx gibbous or spurred at base; petals unequal
8. *Cuphea*, p. 1117.
4. Flowers regular or nearly so, symmetrical (5)
- 5(4). Hypanthium elongated, cylindrical or tubular4. *Lythrum*, p. 1115.
5. Hypanthium campanulate or turbinate, becoming hemispheric or globose (6)
- 6(5). Flowers two or more in leaf axils; capsules bursting irregularly
5. *Ammannia*, p. 1116.
6. Flowers solitary in leaf axils; capsules indehiscent or regularly dehiscent (7)
- 7(6). Petals wanting; capsules indehiscent; submersed aquatic plants
6. *Pepelis*, p. 1117.
7. Petals present; capsules dehiscent; terrestrial or marsh plants (8)
- 8(7). Flowers sessile; capsules septicidally dehiscent7. *Rotala*, p. 1117.
8. Flowers pedunculate; capsules variously dehiscent3. *Heimia*, p. 1114.

1. LAGERSTROEMIA L.

CRAPE-MYRTLE

About 50 species in Asia and Australasia.

1. *Lagerstroemia indica* L. CRAPE-MYRTLE, CRESPO'N. Deciduous shrub or small tree, to about 7 m. high, the branchlets 4-angled, the trunk to 17 cm. in diameter, the gray bark smooth; leaves sessile or nearly so, alternate, suborbicular to oblong-elliptic or obovate, entire, to 7 cm. long, rounded to broadly cuneate at base, emarginate to rounded or sometimes short-acuminate at apex, glabrous or hirtellous along the midrib beneath; stipules conical, deciduous; flowers in terminal panicles to 2 dm. long, pedicellate, 4- to 7-parted, perfect, regular; pedicels bracted; calyx campanulate, smooth, 7-10 mm. long; petals usually 6, to 2 cm. long, white to pink or purple, with slender claws, the blades orbicular-cordate and crisped-erose; stamens 36 to 42, with long filaments; capsule 6-celled, ellipsoid-globose, loculicidal, about 1 cm. long; seeds winged at top.

A handsome Old World shrub that is widely cultivated for its highly ornamental flowers; occurring as an escape in old fields and about abandoned homesteads in south Texas.

2. DECODON J. F. GMEL.

A monotypic genus.

1. *Decodon verticillatus* (L.) Ell. WATER-WILLOW, SWAMP-LOOSESTRIFE. Perennial herb or suffrutescent, smooth or downy; stems 4- to 6-sided, to 25 dm. long, recurved-arching and rooting at tips, the bark of submersed parts spongy-thickened; leaves shortly petioled, opposite or whorled, elliptic-lanceolate to lanceolate, acute to subacuminate, to about 1 dm. long and 4 cm. wide, the upper ones with clustered pedicelled flowers in their axils; flowers trimorphous; calyx with 5 to 7 erect teeth and as many longer and spreading terete hornlike processes at the sinuses; petals 5, cuneate-lanceolate, magenta, crinkly, about 12 mm. long; stamens 10, of 2 lengths, exerted; style filiform, about 14 mm. long; capsule globose, 3- to 5-celled, loculicidal, black, 3-5 mm. in diameter. In swamps, shallow pools, in and on margin of ponds and lakes in e. Tex., July-Oct.; from Fla. to Tex., n. to N.E., N.Y., s. Ont. and s. Ill.

The characteristic of the stems rooting at their tips enables the plant to spread rapidly.

3. HEIMIA LINK & OTTO

Slender deciduous herbs or shrubs; leaves opposite or with some alternate, exstipulate; flowers pedunculate, solitary in the axils of the leaves; calyx campanulate, with hornlike spreading processes between the lobes; petals 5 to 7; stamens 10 to 18; style slender, the stigma capitate; capsule 4-celled.

Three species from Texas south to Argentina.

- 1. Leaves tapering to a sessile or short-petioled base; peduncle stout, about 2 mm. long, the bracts elliptic-oblancheolate and about 4 mm. long and 2 mm. wide; petals yellow 1. *H. salicifolia*.
- 1. Leaves auricled at base; peduncle filiform, more than 1 cm. long, the bracts ovate and about 2 mm. long and 1 mm. wide; petals pink to purple 2. *H. longipes*.

1. *Heimia salicifolia* (H.B.K.) Link & Otto. HACHINAL. Shrub to 3 m. high, usually much smaller, glabrous throughout; leaves mostly opposite, sessile to short-petioled, linear-oblancheolate to linear-lanceolate or lanceolate, to about 5 cm. long and 1 cm. wide, obtuse to acute at apex; flowers solitary and short-pedunculate in the axils, inodorous; calyx campanulate, 5-9 mm. long, with triangular acuminate lobes that become closely connivent over the capsule; petals 5 to 7, orange-yellow, oval, 12-17 mm. long, fugacious; capsule about 4 mm. in diameter, loculicidal. *Nesaca salicifolia* H.B.K. Along resacas, streams or in wet soil in brushlands in the Rio Grande Plains of s. Tex., Mar.-June; from Tex., s. through Mex. to C.A. and S.A.; also Jam.

2. *Heimia longipes* (Gray) Cory. Subshrubby to somewhat herbaceous plants with sprawling and trailing much-branched slender stems to 9 dm. or more long, glabrous throughout; leaves subsessile, linear, acute at apex, auriculate at base, with prominently revolute margins, to 5 cm. long and 4 mm. wide; peduncles filiform, elongated, often about as long as the leaves, bibracteolate below the flowers; calyx 5-7 mm. long, with short 2-grooved triangular lobes; petals pink to purple, obovate, 6-7 mm. long; style filiform, much-exserted; capsule about 4 mm. in diameter, opening by a little lid and then splitting septifragally. *Nesaea longipes* Gray. On seepage rocks and about springs in the Edwards Plateau and the Trans-Pecos, May-July; apparently endemic.

4. LYTHRUM L. LOOSESTRIFE

Herbs or shrubs with 4-angled stems; leaves opposite, alternate or sometimes whorled, entire; flowers usually solitary in the axils, often dimorphous, with a short bibracteolate peduncle; calyx tube cylindric, 8- to 12-ribbed, 4- to 7-toothed, with an equal number of appendages in the sinuses; petals 4 to 6, attached to the rim of the calyx tube, rarely wanting; stamens 4 to 12, inserted rather low on the calyx tube; style filiform; capsules cylindrical, included in the calyx tube, membranous, 2-celled, usually bursting irregularly; seeds numerous.

About 35 species of wide geographical distribution.

- 1. Stem leaves mostly widest at or above the middle, tapering or abruptly contracted into a subpetiolar base (2)
- 1. Stem leaves mostly widest below the middle, somewhat rounded to subauriculate at the usually sessile to clasping base (3)
- 2(1). Stem leaves broadly elliptic to elliptic-obovate, rounded to subobtuse at apex; endemic in Edwards Plateau 1. *L. ovalifolium*.
- 2. Stem leaves typically narrowly elliptic, acute to acuminate at apex; widespread in eastern third of Texas 2. *L. lanceolatum*.
- 3(1). Leaves of inflorescence typically linear-lanceolate; appendages of calyx tube subulate and erect, much longer than the teeth; distribution Panhandle and north-central Texas 3. *L. dacotanum*.
- 3. Leaves of inflorescence typically linear; appendages of calyx tube fleshy-mammillate and curved outward, about as long as the teeth; distribution south-central and west Texas 4. *L. californicum*.

1. *Lythrum ovalifolium* Koehne. Perennial herb to 35 cm. high, the stem much-branched from near base; stem leaves broadly elliptic to elliptic-obovate, rounded to obtuse at apex, to 25 mm. long and 8 mm. wide, abruptly contracted at base, membranous; leaves of inflorescence similar to stem leaves but much smaller; calyx tube 5-6 mm. long; petals obovate, lavender, 3-4.5 mm. long, 1.5-2 mm. wide. Rare along and in water of rivers and streams in the e. Edwards Plateau, Apr.-June; endemic.

2. *Lythrum lanceolatum* Ell. Plant to 1 m. or more high, the stem usually much-branched (especially above), often in large clumps; stem leaves elliptic to elliptic-lanceolate, to 55 mm. long and 1 cm. wide, acute to acuminate at apex, tapering to a cuneate base with straight margins; leaves of inflorescence similar to stem leaves but much smaller; calyx tube about 5 mm. long, the slenderly subulate appendages much longer than the teeth; petals obovate, purple or cerise-red to lavender-blue, 3-6 mm. long; ovary with a thick ring at base. Rather frequent in meadows, prairies, ditches and depressions in the e. third of Tex., rare elsewhere in Tex., Apr.-Oct.; from Tex. and Okla., e. to Fla., Va. and Tenn.

3. *Lythrum dacotanum* Nieuw. Perennial from a woody rootstock, to about 1 m. high, the stems mostly much-branched, rarely simple; stem leaves elliptic to elliptic-lanceolate or linear-lanceolate, rounded to subauriculate at base, obtuse to acute at apex, to 35 mm. long and 7 mm. wide; leaves of inflorescence similar to the stem leaves but much smaller; calyx tube 5-6 mm. long; petals purple, obovate, 5-7 mm. long. *L. alatum* of Tex. reports (probably). Mostly in prairies and meadows of Panhandle and n.-cen. Tex., May-July; from Tex. and Ark., e. to Ga., Tenn. and Va., w. to Colo. and Wyo., n. to Ont.

4. *Lythrum californicum* T.&G. HERBA DEL CÁNCER. Perennial with creeping woody rootstock, to 15 dm. high, usually much smaller, pale-green and glabrous; stems mostly erect, paniculately and divaricately branched above; stem leaves alternate, firm, narrowly linear to linear-oblong or the lower leaves sometimes lanceolate, acute at apex, more or less rounded to somewhat auriculate at the sessile base, to about 3 cm. long and 5 mm. wide; leaves of inflorescence linear, obtuse to acute, much smaller than the stem leaves; calyx tube cylindric, 5-7 mm. long, the subulate teeth sharply acute; petals obovate, bright-purple, 4-6 mm. long, 2-4.5 mm. wide; capsule oblong-clavate, the linear-lanceolate seeds about 1 mm. long. *L. alatum* Pursh var. *breviflorum* (Gray) Wats., *L. linearifolium* (Gray) Small, *L. parvulum* Nieuw. In moist ground or water along streams, about ponds and springs, in depressions, and salt flats mainly in s.-cen. and w. Tex., Mar.-Nov.; from Tex., n. to Kan. and w. to Calif. and n. Mex.

5. AMMANNIA L.

Mostly low and inconspicuous glabrous annual herbs, the stems mostly 4-angled; leaves opposite, sessile, entire, narrow and often elongated; flowers small, usually in 3- to many-flowered axillary cymes, usually 4-merous; calyx globose or campanulate, 4-angled, 4-toothed, usually with a little horn-shaped appendage in each sinus; petals 4, small, deciduous, sometimes wanting; stamens 4 to 8, inserted on the calyx tube; style somewhat persistent; capsule 2- to 4-celled, bursting irregularly; seeds numerous, angled and minutely pitted.

About 30 species widespread in tropical and warm temperate regions.

- 1. Cymes decidedly pedunculate; mature capsule surpassing the calyx 1. *A. auriculata*.
- 1. Cymes sessile or essentially so; mature capsule equal to or shorter than the calyx (2)
- 2(1). Style 1.5-3 mm. long; leaves linear to narrowly oblong, clasping stem at the auriculate base 2. *A. coccinea*.
- 2. Style about 0.5 mm. long; leaves linear-oblong to oblanceolate, the lower ones cuneate at base, the upper ones truncate to cordate-auriculate at base 3. *A. teres*.

1. *Ammannia auriculata* Willd. Plant erect or with a few short ascending branches, to about 8 dm. high, usually much smaller; leaves linear-lanceolate to linear, long-attenuate, to 5 cm. long and 7 mm. wide, all but the very lowest auriculate-cordate at base; cymes loosely 3- or more-flowered on peduncles to 5 mm. or more long or with solitary flowers on pedicels to about 3 mm. long; calyx 1.5-2 mm. long, with prominent triangular teeth, 8-nerved, in fruit becoming subglobose and 2-3 mm. in diameter; petals minute, purple to white, soon dropping; style filiform, 1.5-3 mm. long; capsule surpassing the calyx; seeds reddish-brown. In swamps, ditches and about pond margins throughout much of cen. Tex., May-July; from Miss. to N.M. and Mex., n. to Ind. and S.D.

2. *Ammannia coccinea* Rottb. TOOTH-CUP. Plants rather stout, ascending or depressed-

spreading, to about 5 dm. high, the stem branched below and spongy when growing in water; leaves linear-oblong to linear-lanceolate, to 1 dm. long and 15 mm. wide, mostly much smaller, cordate-auriculate and clasping stem at base, acute to acuminate at apex; cymes closely 2- to 5-flowered, essentially sessile; calyx 2.5-5 mm. long, in fruit 3-5 mm. in diameter; petals pink to purple, 1-2 mm. long, fugacious; style persistent, 1.5-3 mm. long; capsule about 4 mm. long. In mud of ditches, ponds, lakes and streams in e., cen. and extreme s. Tex., Apr.-Nov.; from Fla. to Tex. and Mex., n. to O., Ill., Minn., Neb., Mont. and Wash.

3. *Ammannia teres* Raf. Plant erect, the stout stems simple or with few erect branches near the base, to about 6 dm. high, usually much smaller, fleshy; leaves oblong to oblanceolate, obtuse to subacute at apex, tapering at base or rarely subauriculate, the longer leaves to 6 cm. long; flowers several in the axils, sessile; calyx teeth very short and broad; petals pink, about 1 mm. long, fugacious; style thick, about 0.5 mm. long; fruiting calyx about 5 mm. in diameter; seeds whitish-brown. Swamps and tidal marshes in s.e. Tex., summer; from Fla. to Tex., n. to N.J.

6. PEPLIS L.

A monotypic genus.

1. *Peplis diandra* Nutt. WATER-PURSLANE. Aquatic or sometimes terrestrial herb, rooting in mud, glabrous, with slender simple stems to about 4 dm. long; leaves opposite, those of submersed plants elongated, linear, minutely retuse at the obtusish apex, thin and flaccid, closely sessile by a broad base, to about 3 cm. long and 3 mm. wide, when emersed shorter and contracted at base; flowers small, greenish, solitary and sessile in axils of leaves; calyx without appendages, 2-3 mm. long, with 4 broad triangular pinkish lobes; petals none; stamens 4; style abbreviated; capsule globose, 2-celled, indehiscent, about 2 mm. in diameter. *Didiplis diandra* (Nutt.) Wood. In shallow water and on margin of water of ponds and lakes in e. Tex., Mar.-June; from Fla. to Tex., n. to Va., O., Ind. and Wisc.

7. ROTALA L.

About 50 species, widespread mostly in tropical or subtropical regions.

1. *Rotala ramosior* (L.) Koehne. ТООТН-СУР. Small annual herb, low and sprawling to erect and spreading, with simple or diffusely branched 4-angled stems, glabrous, to 45 cm. high, usually much smaller; leaves opposite, subsessile to somewhat petioled, linear-oblong to elliptic or oblanceolate, obtuse, to about 45 mm. long and 1 cm. wide; flowers regular or nearly so, small, solitary in leaf axils, 4-merous, bibracteolate; calyx with appendages shorter to longer than the teeth, the tube campanulate to globose; petals 4, attached to rim of calyx tube, white or pink; stamens 4, attached low on calyx tube; capsule globose, 4-celled, enclosed in the membranous calyx, the valves minutely transverse-striate, to 5 mm. long and 4.5 mm. broad, the somewhat persistent style about 0.5 mm. long; bractlets linear-lanceolate to subulate, to 4 mm. long. In sandy or muddy soil in water or on the edge of ponds, lakes, tanks and in depressions in the e. half of Tex., May-Oct.; from Fla. to Tex., n. to N.E., N.Y. and the Lake States; also Wash. and Ore.

Most of our material is referable to var. *interior* Fern. & Griseb. This is a more robust and upright plant than var. *ramosior*. The larger leaves are usually subsessile and are 5-10 mm. wide, the capsules are 3.5-5 mm. long and 3.2-4.5 mm. broad, and the linear-lanceolate bractlets are 1.6-4 mm. long. These organs in var. *ramosior* have smaller measurements.

8. CUPHEA P. BR.*

Herbs or woody plants, mostly clammy-pubescent; leaves entire; flowers solitary in axils or in terminal spikes or racemes; calyx tubular, 12-ribbed, gibbous or spurred at

* See Appendix.

base on upper side, the 6 lobes with small teeth in the sinuses; petals 6, unequal; ovary with a curved gland at the base next to the calyx spur, 1- or 2-celled; style slender, the stigma 2-lobed; stamens 6 to 14, adnate to near the top of the hypanthium; embryo with orbicular cotyledons; capsule ovoid or ellipsoid, few-seeded, soon ruptured on one side.

About 250 species, primarily in the American tropics.

1. Mature calyx 5-7 mm. long, the limb subequally 5-lobed 1. *C. carthagensis*.
 1. Mature calyx 8-12 mm. long, the limb noticeably bilabiate 2. *C. viscosissima*.

1. *Cuphea carthagensis* (Jacq.) Macbr. Plant annual, 2-9 dm. high, the stem and branches with scattered bristly hairs; leaves short-petiolate, elliptic to oval or sometimes obovate, 2-6 cm. long, rugose (especially with age); hypanthium and calyx 5-7 mm. long, usually with few bristles; calyx lobes minute, broadly deltoid; petals pink or bluish, elliptic or nearly so, 1.5-2 mm. long; capsule 4-5 mm. long. On edge of low wet woods, rare in s.e. Tex. (Hardin Co.), July-Sept.; from S.A., n. through C.A. and Mex. to Tex. and N.C.

2. *Cuphea viscosissima* Jacq. BLUE WAXWEED. Plant annual, viscid-hairy, 1-7 dm. high; leaves with petioles to about 15 mm. long; blade lanceolate to ovate-lanceolate, 1-3.5 cm. long; hypanthium and calyx 8-12 mm. long; calyx limb prominently bilabiate, the upper lip much broader than long; petals ovate, short-clawed, rose-purple, the upper ones 4.5-5.5 mm. long; capsule 6-8 mm. long; seeds flat. *C. petiolata* (L.) Koehne. Fields, roadsides and edge of streams and lakes, one Tex. record without definite locality; from Ga. to La., Tex. and Okla., n. to Kan., Ia. and N.E.; July-Oct.

A sheet of the Arizona-Mexican *Cuphea Wrightii* Gray in the Gray Herbarium is labeled "Texas, Hale," but its accuracy is questionable. This species is distinguished from the allied *C. viscosissima* by its greatly reduced petals, more coarse and sparse bristly hairs, and lack of puberulence, especially on lower surface of leaves.

FAM. 133. MELASTOMATACEAE JUSS. MELASTOMA FAMILY

Trees, shrubs, herbs or rarely vines with simple opposite 3- to 7- or rarely 1-nerved leaves and commonly showy cymose flowers; flowers perfect, regular, mostly 4- or 5-merous; hypanthium variously shaped; sepals valvate and petals convolute in bud; stamens twice as many as petals, often dimorphic; anthers opening by pores at the apex, commonly with an appendage; ovary superior; fruit a capsule; seeds usually numerous, variously shaped and adorned.

A large tropical family of about 240 genera and 3,000 species.

1. RHEXIA L.¹³⁸

MEADOW BEAUTY. DEER-GRASS

Erect herbaceous or suffrutescent perennials, with one to several simple or branched stems arising from the bases of previous shoots, from a woody crown, from horizontal-spreading roots or from tuberous roots, essentially glabrous to densely glandular-pubescent throughout; stems becoming woody or spongy below, subterete about the middle with 4 well-defined faces (sides) whose edges are inconspicuously to prominently winged; faces of stem flat to convex and essentially equal or with one pair of opposing faces flat to concave and much narrower than the other pair of convex or rounded faces; leaves opposite, sessile to petiolate, suborbicular-ovate to linear-lanceolate or narrowly elliptic-linear, with one to several palmate veins and with the margins ciliate to serrulate or serrate; flowers usually showy, solitary or borne in cymes; petals 4, distinct, oblique, cuneate to suborbicular, fugacious, mostly rose-color to purple, sometimes white or yellow; hypanthium more or less urceolate, glabrous to variously glandular-pubescent,

¹³⁸ Adapted from C. W. James in Brittonia 8:201-230. 1956. See Appendix.

the lower portion somewhat ventricose and enclosing all or most of the capsule, constricted or narrowed above to usually form a neck, sometimes expanded above the neck; calyx lobes 4, erect to spreading or strongly recurved, deltoid to lanceolate, obtuse to acuminate or rarely aristate; stamens 8, isomorphic; anthers 1-celled at anthesis, basifixed, commonly with an appendage at base, yellow, smooth to papillose, more or less lanceolate in outline, straight or curved to sigmoid, dehiscing by a pore; ovary 4-celled; fruit a capsule; seeds strongly curved to cochleate, variously adorned.

A small genus of about a dozen species that are centered in southeastern United States.

1. Anthers straight, 1-3 mm. long, the pore nearly equaling the diameter of the anther tip; neck of the hypanthium conspicuously constricted at the base, abruptly expanded above (2)

1. Anthers curved, 4 mm. long or more, the pore only about one third the diameter of the anther tip; neck of the hypanthium not constricted at the base, gradually (if at all) expanded above (3)

2(1). Petals rose-color; stem glabrous; leaves ovate to oval or elliptic, less than 3 times as long as wide1. *R. petiolata*.

2. Petals yellow; stem hirsute; leaves typically linear-elliptic, more than 3 times as long as wide2. *R. lutea*.

3(1). One pair of opposing faces of the stem flat to concave and much narrower than the other pair of convex or rounded faces; stem neither conspicuously winged nor spongy-thickened below; leaves petiolate; petals or mature hypanthium (or both) glabrous; flowers white, rose or purple (4)

3. Faces of the stem flat to convex and essentially equal; stem with conspicuous wings (to about 2 mm. wide) and spongy-thickened below or (if neither) then with hairs on the abaxial surface of the petals and on the mature hypanthium; leaves sessile or nearly so; flowers rose to purple (5)

4(3). Mature hypanthium mostly 9-11 mm. long, with scattered hairs; leaves mostly 8-15 mm. wide, rarely falcate; flowers whitish-rose to rose3. *R. mariana* var. *mariana*.

4. Mature hypanthium mostly 6-9 mm. long, usually glabrous; leaves mostly 2-8 mm. wide, frequently falcate; flowers pure-white to rose, occasionally purple3. *R. mariana* var. *exalbida*.

5(3). Roots tuberous; stem with conspicuous wings and often spongy-thickened below; leaves frequently broadest near the base4. *R. virginica*.

5. Roots nontuberous; stem lacking conspicuous wings and rarely spongy-thickened below; leaves frequently broadest near the middle ..5. *R. interior*.

1. *Rhexia petiolata* Walt. Plant to 6 dm. tall; leaves to 25 mm. long and 15 mm. wide, 3-nerved, somewhat petiolate; hypanthium glabrous at maturity, 5-9 mm. long; calyx lobes to 4 mm. long and 3 mm. wide, with serrate to ciliate margins; petals rose-color, elliptic, to 2 cm. long. *R. ciliosa* Michx. In peaty or sandy soils of moist pinelands of s.e. Tex., July-Sept.; along coast from s.e. Va. to cen. Fla., w. to Tex.

The typically oval leaves and sessile flowers are characteristics of this species.

2. *Rhexia lutea* Walt. Plant to 5 dm. tall, the stems usually much-branched; leaves to 25 mm. long and 8 mm. wide, 3-nerved, essentially sessile; hypanthium at maturity glabrous or with few scattered glandular hairs, 5-8 mm. long; calyx lobes to 3 mm. long and wide, with glandular hairs on margins; petals yellow, elliptic, to 13 mm. long. In moist savannahs and open pinelands of s.e. Tex., May-June; along coast from e. N.C. to n. Fla., w. to Tex.

The yellow petals are distinctive.

3. *Rhexia mariana* L. var. *mariana*. Plant to 7 dm. tall, the stem with axillary branches; leaves petiolate, elliptic to lanceolate, to 6 cm. long, the margins serrate, ciliate; calyx lobes triangular to lanceolate, to 3 mm. long; petals obovate, to about 18 mm. long. In ditches, wet meadows, seepage bogs, savannahs, edge of thickets and similar places that are wet or moist, throughout e. Tex., May-Sept.; from Mass. s. to Ga., w. to Tex. and Okla., n.w. to Mo., Ill. and Ind.

The leaves narrowed to petioles readily distinguish this species from *R. virginica*.

Var. *exalbida* Michx. Differing from var. *mariana* in being smaller in all its parts. In similar habitats to those of var. *mariana* but more southern in distribution; from e. N.C. to s. Fla., w. to e. Tex.

4. *Rhexia virginica* L. COMMON MEADOW BEAUTY. Plant to 1 m. tall; leaves ovate to ovate-lanceolate or elliptic, to 1 dm. long and 35 mm. wide, the margins serrate-ciliate, sessile or with petioles to 5 mm. long; hypanthium to 1 cm. long, glandular-hispid at maturity; calyx lobes triangular to lanceolate, to 2.5 mm. long; petals dark-rose-color to purple, obovate, to 17 mm. long. On open seepage slopes and in bogs of e.-cen. Tex., June-Oct.; throughout e. U.S., excluding Fla., n. to N.S. and Ont., w. to Kan. and Tex.

5. *Rhexia interior* Penn. This is not an altogether clear species. It is supposed to differ from the nearly allied *R. virginica* in its nontuberous roots and in its smaller (0.5-0.7 mm. long), less papillose seeds. It is also centered in the interior prairies of Mo. and Kan., extending e. to Ind., Ky. and Tenn. and s. to La. and Tex.

FAM. 134. ONAGRACEAE JUSS.¹³⁹

EVENING PRIMROSE FAMILY

Herbs, sometimes woody near the base; leaves alternate or opposite, simple, entire, toothed or pinnatifid; stipules minute or lacking; flowers actinomorphic or slightly zygomorphic, perfect, 4- or 5- (rarely 6-) merous, borne in the axils of usually reduced foliage leaves; hypanthium prolonged beyond the ovary or not; sepals free; corolla white to rose-purple or yellow, the petals free; stamens as many as the sepals and opposite them or twice as many; ovary 4- or 5-locular; fruit a loculicidally dehiscent, pericidal capsule or nutlike indehiscent structure.

About 650 species in 19 genera, world-wide but largely extratropical; best developed in subarid western North America.

- 1. Sepals persistent in fruit; hypanthium not prolonged beyond the ovary 6. *Ludwigia*, p. 1132.
- 1. Sepals deciduous in fruit; hypanthium obviously prolonged beyond the ovary (2)
- 2(1). Stigma deeply 4-lobed (3)
- 2. Stigma entire (6)
- 3(2). Fruit a dehiscent many-seeded capsule; flowers actinomorphic 4. *Oenothera*, p. 1126.
- 3. Fruit indehiscent, hard; flowers actinomorphic or zygomorphic (4)
- 4(3). Flowers borne in axils of upper leaves, these not much reduced, or the plants acaulescent 4. *Oenothera*, p. 1126.
- 4. Flowers borne in essentially naked inflorescences with leafless branches, the plants not acaulescent (5)
- 5(4). Hypanthium filiform; filaments unappendaged; leaves gradually reduced in the inflorescence 5. *Stenosiphon*, p. 1132.
- 5. Hypanthium funnellform, each filament with a small scale at the base (except in *G. parviflora*); leaves abruptly reduced in the inflorescence 3. *Gaura*, p. 1123.
- 6(2). Seeds with a tuft of hairs (coma) at one end; stigma clavate 7. *Epilobium*, p. 1135.
- 6. Seeds lacking a coma; stigma capitate or peltate (7)
- 7(6). Stigma more or less peltate; flowers yellow 2. *Calylophus*, p. 1121.
- 7. Stigma capitate; flowers white, minute 1. *Camissonia*, p. 1121.

¹³⁹ Contributed by Peter H. Raven, whose work was supported by grants from the National Science Foundation. Cf. another treatment by P. A. Munz in C. L. Lundell, *Flora of Texas* III:208-262. 1944. Measurements of the hypanthium apply only to the portion prolonged beyond the ovary.

1. CAMISSONIA LINK

A genus of 61 species, mostly of subarid far western United States and adjacent Canada and Mexico; 1 in temperate South America.

1. *Camissonia chamaenerioides* (Gray) Raven. Erect slender often well-branched annual 8-50 cm. tall, glandular-pubescent with an admixture of strigulose pubescence in and near the inflorescence; leaves alternate, narrowly elliptic, to 8 cm. long and 25 mm. wide, entire to very sparsely denticulate; petioles of basal leaves 1-3.5 cm. long, the upper leaves sessile; stipules absent; flowers actinomorphic, 4-merous, borne in axils of reduced upper leaves, opening near sunset; hypanthium well-developed, 1.6-2.3 mm. long; sepals not persistent in fruit, 1.5-2.5 mm. long, lacking free tips; petals white, 1.8-3 mm. long; stamens 8; stigma capitate; capsule slender, terete, loculicidally dehiscent, 35-55 mm. long; seeds in 1 row in each locule, 0.9-1 mm. long, lacking a coma; $n = 7$. *Oenothera chamaenerioides* Gray. Sandy desert flats and slopes in the Trans-Pecos, Mar.-Apr.; w. to n. Baja Calif. and n.w. Son., s.e. Calif., s. Nev., and s.w. Ut.

2. CALYLOPHUS SPACH^{139A}

Herbs, sometimes woody near the base, with alternate entire to serrate or dentate leaves; stipules absent; flowers actinomorphic, 4-merous, borne in axils of upper leaves, opening either near sunset or near sunrise; hypanthium well-developed; sepals not persistent in fruit; petals yellow; stamens 8; stigma peltate or more or less globose-peltate; fruit a cylindrical loculicidally dehiscent capsule; seeds lacking a coma, in 2 rows in each locule.

A genus of 5 species of Texas and north-central Mexico, ranging into neighboring regions and north in the Great Plains to south-central Canada.

- 1. Sepals with prominent raised or keeled midribs; flower bud sharply 4-angled (2)
- 1. Sepals without prominent raised or keeled midribs; flower bud not sharply 4-angled, but round (4)
- 2(1). Stigma usually exerted at least to end of outer anthers or positioned outside of circle of anthers; petals mostly 9-21 mm. long; pollen usually 85 to 100 percent fertile3. *C. Drummondianus*.
- 2. Stigma not exerted beyond anthers, usually positioned at distal end of inner anthers; petals mostly 6-12 mm. long in Texas plants; pollen 30 to 60 percent fertile (3)
- 3(2). Young stems canescent with slender appressed hairs; Panhandle and north-central Texas4. *C. serrulatus*.
- 3. Young stems with sparse short, thick, incurved hairs; Gulf Coast5. *C. australis*.
- 4(1). Hypanthium funnelliform in upper two-thirds or more, or less than 15 mm. long; flowers opening near sunrise2. *C. Tubicula*.
- 4. Hypanthium funnelliform in upper half or less, 15-55 mm. long; flowers opening in the afternoon or near sunset1. *C. Hartwegii*.

1. *Calylophus Hartwegii* (Benth.) Raven. Bushy perennial from a woody caudex, 5-40 cm. tall; leaves linear to oblong-lanceolate, glabrous to glandular-pubescent to densely gray-canescenscent or villous, entire or subentire to denticulate, 1-5 cm. long, 0.5-10 mm. wide, sessile to short-petiolate; flowers opening in the afternoon or near sunset; hypanthium 15-55 mm. long; sepals 8-18 mm. long, with free tips 0-12 mm. long; petals 1-3 cm. long; $n = 7, 14$; self-incompatible. Wyo. and Neb. to Ariz., Tex., Zac., S.L.P. and Aguasc.

In Texas represented by 6 intergrading subspecies, as follows:

^{139A} Contributed by Howard F. Towner.

1. Ovary (and usually stems and leaf margins) with long spreading hairs; leaves (except lowest) abruptly narrowed to truncate or slightly clasping at the base subsp. *pubescens*.
1. Ovary, stems and leaf margins without long spreading hairs; leaves gradually narrowed at base or extremely narrow throughout (2)
- 2(1). Ovary, stems and leaves glabrous to glabrescent; flowers opening from one hour before to one hour after sunset subsp. *Fendleri*.
2. Ovary (and usually stems and leaves) with some form of pubescence; flowers usually opening 2 to 5 hours before sunset (3)
- 3(2). Plants low, often caespitose, 8-15 cm. high; free sepal tips 0.5-2 mm. long; ovary, stems and leaves grayish with dense strigose pubescence subsp. *lavandulifolius*.
3. Plants usually taller, 10-40 cm. high; free sepal tips 1.5-6.5 mm. long; ovary, stems and leaves rarely all densely grayish-strigose (4)
- 4(3). Ovary and stem with short very glandular hairs; leaves glabrous to glandular-puberulent; northern Trans-Pecos and southern Panhandle subsp. *filifolius*.
4. Ovary, stem and leaves usually with strigose pubescence; southern Trans-Pecos and Rio Grande Valley (5)
- 5(4). Stem leaves (except lowest) usually with crinkled margins, sparsely strigose or occasionally glandular-puberulent, mostly 4.5 to 11 times as long as wide; lower Rio Grande Plains subsp. *Maccartii*.
5. Stem leaves usually lacking crinkled margins, often densely strigose, mostly 9 to 35 times as long as wide; mountains and canyons bordering on the upper Rio Grande subsp. *Hartwegii*.

Subsp. *pubescens* (Gray) Towner & Raven. Gametic chromosome numbers $n = 7, 14$. *Oenothera Greggii* Gray var. *lampasana* (Buckl.) Munz, *Galpinsia camporum* Woot. & Standl. Common in open sandy places and on limestone, n.-cen. Tex. and n. Edwards Plateau, n. and w. to the Panhandle and Trans-Pecos, Apr.-Aug.; s.e. Ariz., s. and e. N.M., w. Okla., s.w. Kan. and s.e. Colo. through w. Tex. to n. Coah.

Subsp. *Fendleri* (Gray) Towner & Raven. Gametic chromosome number $n = 7$. *Oenothera Hartwegii* var. *Fendleri* Gray and var. *Hartwegii* auct., p. p. Uncommon in the e. Panhandle and at high elev. in the Trans-Pecos, Apr.-Aug.; cen. Ariz. to n. N.M., s.w. Kan., e. Okla. and w. Tex.

Subsp. *lavandulifolius* (T.&G.) Towner & Raven. Gametic chromosome number $n = 7$. *Oenothera lavandulifolia* T.&G. var. *glandulosa* Munz. Frequent on open rocky slopes in the High Plains, scattered s. in the South Plains and mts. of the Trans-Pecos, May-Aug.; s. and e. Nev., n. Ariz. to s.e. Wyo., s.w. S.D., w. Kan., w. Okla. and n. and w. Tex.

Subsp. *filifolius* (Eastw.) Towner & Raven. Gametic chromosome number $n = 7$. *Oenothera Hartwegii* var. *filifolia* (Eastw.) Munz. Gypsum and limestone outcrops in n. Trans-Pecos, w.-cen. Tex. and s. Panhandle, Apr.-Aug.; s.-cen. N.M. to w. Tex. and s. Coah.

Subsp. *Maccartii* (Shinners) Towner & Raven. Gametic chromosome numbers $n = 7, 14$. *Oenothera Greggii* var. *Pringlei sensu* Munz, p. p. Common in open sandy places, South Plains, Mar.-Oct.; s. Tex. to n. Tam., n. N.L. and cen. Coah.

Subsp. *Hartwegii*. Gametic chromosome numbers $n = 7, 14$. *Oenothera Greggii* var. *Pringlei sensu* Munz, p. p. Infrequent in mts. and canyons of s. Trans-Pecos, especially along Rio Grande, Mar.-Oct.; w. Tex. and s.e. Ariz. to N.L., S.L.P. and Aguasc.

2. *Calylophus Tubicula* (Gray) Raven. Bushy perennial from a woody caudex, 1-3 dm. tall; leaves narrowly lanceolate to lanceolate, minutely glandular-pubescent, sub-entire, 1-3 cm. long, 2-5 mm. wide, subsessile; flowers opening 1 to 2 hours before sunrise; hypanthium 5-33 mm. long; sepals 8-12 mm. long, with free tips 1-2 mm. long; petals 5-15 mm. long; $n = 7$; self-incompatible. *Oenothera Tubicula* Gray. Colonial on open slopes and flats in limestone soil, in the Trans-Pecos and adj. cos., Mar.-Sept.; s.e. N.M. and w. Tex. to scattered localities in s. Coah., s. and cen. N.L. and s.w. Tam.

3. *Calylophus Drummondianus* Spach. Bushy to erect perennial or annual, 1-5 dm. tall; leaves linear to oblanceolate, glabrous to canescent, subentire to spinulose-denticulate, 1-8 cm. long, 1-9 mm. wide, subsessile or short-petiolate; flowers opening near sunrise; hypanthium 5-15 mm. long; sepals with sharply raised midrib, 4-10 mm. long, with free tips 0.2-2 mm. long; petals 1-2.5 cm. long, rarely shorter; stigma elevated to or beyond distal end of anthers at anthesis; $n = 7$ (forming pairs or small rings at meiotic metaphase I); self-incompatible. S.e. Colo. and s.w. Kan. through e. N.M., Okla., s.w. La. and Tex. to n. Coah., n.w. N.L. and n. Tam.

Two intergrading subspecies, as follows:

1. Longest stem leaves 34-80 mm. long; plant erect, simple-stemmed, 3-8 dm. high; hypanthium and stigma often black in Texas plants subsp. *Drummondianus*.
1. Longest stem leaves 18-40 mm. long; plant usually bushy, branched from base, 1-4 dm. high; hypanthium and stigma never black subsp. *Berlandieri*.

Subsp. *Drummondianus*. *Oenothera serrulata* var. *Drummondii* T. & G. and var. *spinulosa* auct., p. p. and var. *pinifolia* auct., p. p. Sandy and rocky soil, Edwards Plateau and n.-cen. Tex., Mar.-July; cen. Okla., through cen. Tex. and s.w. La. to mts. of n. Coah. and n.w. N.L.

Subsp. *Berlandieri* (Spach) Towner & Raven. *Oenothera serrulata* var. *serrulata* auct., p. p. and var. *pinifolia* auct., p. p. Sandy soil in Panhandle, n.w. Tex., South Plains and on Gulf Prairies, Mar.-Nov.; s.e. Colo. and s.w. Kan. to e. N.M., w. Okla. and w. and s. Tex.

4. *Calylophus serrulatus* (Nutt.) Raven. YELLOW EVENING PRIMROSE. Similar to preceding but flowers smaller; petals 6-12 mm. long in Tex. (longer in Okla., to 20 mm.); stigma not elevated beyond anthers; anthers shedding pollen directly on the stigma at anthesis, the plants highly autogamous; pollen 30 to 60 percent fertile; $n = 7$ (ring of 14 at meiotic metaphase I). *Oenothera serrulata* Nutt. Infrequent in open sandy or rocky places in the Panhandle and n.-cen. Tex., Apr.-July; n. Tex., e. N.M. and Okla. to Minn., e. Wisc., Sask., Alta. and Man.; also mts. of e.-cen. Ariz. and cen. Chih.

5. *Calylophus australis* Towner & Raven. Similar to *C. Drummondianus* subsp. *Berlandieri* but flowers smaller; petals 8-12 mm. long; stigma not elevated beyond anthers; anthers shedding pollen directly on the stigma at anthesis, the plants highly autogamous; pollen 30 to 60 percent fertile; $n = 7$ (ring of 14 at meiotic metaphase I). *Oenothera serrulata* var. *serrulata* auct., p. p. and var. *pinifolia* auct., p. p. Sandy soil and upper beaches along the Coastal Bend, Mar.-Oct.; coastal Tex. and possibly Tam.

3. GAURA L.

Herbs, sometimes woody near the base, with alternate entire to deeply lobed subsessile leaves; stipules absent; flowers usually zygomorphic, 4-merous or rarely 3-merous, borne in a distinct inflorescence with greatly reduced leaves, usually opening near sunset or sometimes near sunrise; hypanthium well-developed; sepals not persistent in fruit; petals white to pinkish; stamens 8; usually with a scale at the base of each filament inside the hypanthium; stigma deeply 4-lobed or rarely 3-lobed; fruit an indehiscent woody nutlike capsule; seeds lacking a coma.

A genus of 21 species, centering in Texas but ranging north to south-central Canada and south to Guatemala; throughout the eastern United States.

1. Fruit with a slender stipe 3-10 mm. long (2)
1. Fruit subsessile (5)
- 2(1). Plants shrubby, conspicuously and densely soft-villous with long hairs 11. *G. villosa*.
2. Plants herbaceous, not conspicuously and densely soft-villous (3)
- 3(2). Leaves sinuate-pinnatifid, the plants strigulose and villous; south Texas 8. *G. Mckelveyae*.
3. Leaves subentire to sinuate-dentate, the plants subglabrous to strigulose, sometimes villous; widespread (4)

- 4(3). Clumped perennial; apex of the inflorescence in bud slender, the buds small and well-spaced 9. *G. calcicola*.
4. Rhizomatous perennial; apex of the inflorescence in bud stout, the buds large and crowded 10. *G. sinuata*.
- 5(1). Sepals 2-3.5 mm. long; petals 1.5-3 mm. long 1. *G. parviflora*.
5. Sepals 4.5-17 mm. long; petals 3.5-15 mm. long (6)
- 6(5). Fruits fusiform, often curved, 8-17 mm. long, 1-2.5 mm. thick; Trans-Pecos region (7)
6. Fruits variable, 4-13 mm. long, often thicker; widespread (8)
- 7(6). Flowers actinomorphic; hypanthium 9-13 mm. long 2. *G. macrocarpa*.
7. Flowers strongly zygomorphic; hypanthium 5-8.5 mm. long 3. *G. boquillensis*.
- 8(6). Fruits more or less abruptly constricted to a thick cylindrical stipe nearly half the length of the body; perennial species (9)
8. Fruits not abruptly constricted to a thick cylindrical stipe; mostly annual or biennial species from a taproot (10)
- 9(8). Plants from a branching woody caudex; fruits not conspicuously bulging above, 4-8.5 (-9) mm. long, (1-) 1.5-3 mm. thick 4. *G. coccinea*.
9. Plants aggressively rhizomatous; fruits conspicuously bulging above and sharply constricted, 7-13 mm. long, 3-5 mm. thick 5. *G. odorata*.
- 10(8). Flowers 3-merous; fruits 3-angled (11)
10. Flowers 4-merous; fruits 4-angled (12)
- 11(10). Buds very finely strigulose to subglabrous 14. *G. triangulata*.
11. Buds densely strigulose 13. *G. brachycarpa*.
- 12(10). Sepals with long erect hairs; flowers opening near sunrise; petals 10.5-15 mm. long 7. *G. Lindheimeri*.
12. Sepals with appressed or glandular pubescence; flowers opening near sunset; petals 7-15 mm. long (13)
- 13(12). Erect summer- and fall-blooming annual 3-40 dm. tall; fruits thick-fusiform 6. *G. filiformis*.
13. Spring-blooming annuals 2-12 dm. tall; fruits ovoid-pyramidal (14)
- 14(13). Floral parts and inflorescence glabrous 12. *G. suffulta* subsp. *suffulta*.
14. Floral parts and inflorescence pubescent (15)
- 15(14). Floral parts and inflorescence strigulose 13. *G. brachycarpa*.
15. Floral parts and inflorescence glandular-pubescent 12. *G. suffulta* subsp. *Nealleyi*.

1. *Gaura parviflora* Hook. LIZARD-TAIL or VELVET-LEAF GAURA. Rank erect annual (2-) 3-20 (-30) dm. tall, densely glandular-pubescent and sparsely villous, from a heavy taproot; leaves narrowly elliptic to narrowly ovate, 2-12.5 cm. long, 5-40 mm. wide, slightly sinuate-dentate; hypanthium 1.5-4 mm. long, lacking teeth at base of filaments within; sepals 2-3.5 mm. long; petals 1.5-3 mm. long; fruits 5-11 mm. long, 1.5-3 mm. thick, fusiform, sometimes narrowed in lower portion; $n = 7$. Incl. var. *lachnocarpa* Weath. Frequent throughout, often in weedy or cult. situations, but rare in n.e. Tex., Mar.-Nov.; Wash., Mont. and Ind. to Ariz. and La., s. to N.L., Dgo. and Son.; introd. elsewhere.

2. *Gaura macrocarpa* Rothr. Perennial 2-10 dm. tall, with several stems from a branching woody caudex, strigulose with scattered villous pubescence and glandular (more heavily so in the inflorescence); basal leaves spatulate to narrowly oblanceolate, the upper ones narrowly elliptic to narrowly lanceolate, 5-30 mm. long, 1-8 mm. wide, subentire to sinuate-denticulate; flowers actinomorphic; hypanthium 9-13 mm. long; sepals 7-9 mm. long; petals 7-8 mm. long, very broad; fruits 9-17 mm. long, 2-2.5 mm.

thick, fusiform, tapering gradually at both ends; $n = 7$. Sandy flats, local, Brewster, Jeff Davis and Presidio cos., Apr.-July; also Chih.

3. *Gaura boquillensis* Raven & Gregory. Low globose perennial 2.5-10 dm. tall, with many stems from a branching woody caudex, strigulose and also glandular-pubescent (especially in the inflorescence); basal leaves narrowly oblanceolate, the upper ones very narrowly elliptic to narrowly lanceolate, 6-65 mm. long, 1-15 mm. wide, sinuate-dentate to subentire; hypanthium 5-8.5 mm. long; sepals 6.5-9 mm. long; petals 6-10 mm. long; fruits 8-13 mm. long, 1-2.5 mm. thick, fusiform, tapering at both ends, sometimes slightly narrowed in the lower third; $n = 7$. Sandy canyon walls and slopes near the Rio Grande, Brewster Co., Mar.-Aug.; also Coah., Chih. and N.L.

4. *Gaura coccinea* Pursh. SCARLET GAURA. Low well-branched perennial 2-10 dm. tall, with many stems from a branching woody caudex, strigulose or subglabrous; leaves linear to narrowly elliptic, 7-65 mm. long, 1-15 mm. wide, entire to remotely and coarsely serrate; hypanthium 4-11 (-13) mm. long; sepals 5-9 (-10) mm. long; petals 3-7 (-8) mm. long; fruits 4-8.5 (-9) mm. long, (1-) 1.5-3 mm. thick, sharply constricted to a cylindrical stipe below the pyramidal apex; $n = 7, 14, 21, 28$. Incl. var. *glabra* (Lehm.) T. & G., var. *parviflora* (Torr.) T. & G. and var. *epilobioides* (H.B.K.) Munz. Throughout in sandy soils except for e. and s. Tex., rarer eastw., May-Aug.; s.-cen. Can. through the Great Plains to s. Nev., Ariz. and Tex.; throughout Mex. at middle elev.

5. *Gaura odorata* Lag. Low often well-branched perennial 2-6 (-12) dm. tall, with many stems from an aggressively spreading rhizomatous base, strigulose and sometimes with a few longer hairs near the base; leaves narrowly lanceolate to elliptic, 5-75 (-95) mm. long, 1-22 mm. wide, subentire to shallowly sinuate-dentate; hypanthium 4-14 mm. long; sepals 7-11 (-14) mm. long; petals 6-10 mm. long; fruits 7-13 mm. long, 3-5 mm. thick, abruptly constricted from the bulging-pyramidal upper portion to the much narrower cylindrical stipe; $n = 14$. Frequent in sandy soil throughout except for the Plains Country and Trans-Pecos, very rare in e. Tex., Feb.-Nov.; s. to Oax.; introd. elsewhere.

6. *Gaura filiformis* Small subsp. *filiformis*. Tall annual or biennial 3-40 dm. tall, often well-branched in the upper portions, from a stout taproot, strigulose or more rarely glandular in the inflorescence; leaves very narrowly elliptic, those of the main stems 1.5-7 cm. long, 2-13 mm. wide, entire to slightly undulate-denticulate; hypanthium 4-11.5 mm. long; sepals 7-14 mm. long; petals 7-13.5 mm. long; fruits 4.5-6 mm. long, 1.5-2.5 mm. thick, thick-fusiform, 4-angled; $n = 7$. Incl. var. *Kearneyi* Munz, *G. biennis* var. *Pitcheri* of Tex. ref. Open woods and fields, e. and s.-cen. Tex., rare in n.-cen. Tex., June-Dec.; to s. Mo., w. Tenn., and w. Ala.; the species as a whole to Neb., Ia., s. Wisc., s. Minn., N.E. and Md.

7. *Gaura Lindheimeri* Engelm. & Gray. Well-branched perennial 5-15 dm. tall, from a heavy branching woody underground caudex, villous (especially in the inflorescence and also glandular in the inflorescence); leaves very narrowly elliptic, 5-90 mm. long, 1-13 mm. wide, coarsely and remotely serrate; flowers opening near sunrise; hypanthium 4-9 mm. long; sepals 8.5-17 mm. long; petals 10.5-15 mm. long; fruits 6-9 mm. long, 2-3.5 mm. thick, thick-fusiform, 4-angled; $n = 7$. *G. filiformis* var. *Munzii* Cory. Common in black-soil prairie in s.-cen. and s.e. Tex., Apr.-Nov.; also s. La.; widely cult. and occasionally established elsewhere.

8. *Gaura Mckelveyae* (Munz) Raven & Gregory. Low perennial 2-5 dm. tall, from a woody caudex, strigulose and villous; leaves narrowly elliptic to narrowly oblanceolate, 1-6.5 cm. long, 1-15 mm. wide, deeply to more shallowly sinuate-pinnatifid; hypanthium 2-3.5 mm. long; sepals 6-12 mm. long; petals 7-10.5 mm. long; fruits 8-19 mm. long, 1.5-2 mm. wide, with a slender stipe 3-9 mm. long; $n = 7$. *G. villosa* var. *Mckelveyae* Munz. Locally frequent in sandy soil, s. Tex., Mar.-Aug.; also N.L. and Tam.

9. *Gaura calcicola* Raven & Gregory. Clumped perennial 3-8 dm. tall, from a branching woody caudex, subglabrous to strigulose and/or villous; leaves linear to narrowly oblanceolate, 1-12 cm. long, 1-10 mm. wide, subentire to sinuate-dentate; hypanthium 3-9 mm. long; sepals 6-12 mm. long; petals 3-6.5 mm. long; fruits 7-12 mm. long, 1.5-2.5 mm. thick, with a slender stipe 2-5 mm. long; $n = 7$. *G. sinuata* of auth., in part. Rocky banks and flats, usually in limestone soil, Trans-Pecos, Edwards Plateau, n. Rio Grande Plains and s. border of the South Plains, to Callahan and McCulloch cos., Apr.-June (-Oct.); also Coah., Tam., N.L., and n. Dgo.

10. *Gaura sinuata* Sér. WAVY-LEAVED GAURA. Aggressively spreading rhizomatous perennial 2-6 dm. tall, subglabrous to strigulose or more rarely with scattered villous pubescence; leaves linear to narrowly oblanceolate, 1-11 cm. long, 1-20 mm. wide, sinuate-dentate; hypanthium 2.5-5 mm. long; sepals 7-14 mm. long; petals 7-14.5 mm. long; fruits 8-15 mm. long, 1.5-3.5 mm. thick, with a slender stipe 3-8 mm. long; $n = 14$. Frequent in open sandy or often disturbed places throughout, except for the High Plains and Trans-Pecos, Mar.-June; also Okla.; widely introd. elsewhere.

11. *Gaura villosa* Torr. WOOLLY GAURA. Bushy perennial 6-18 dm. tall, with many erect wandlike branches from the woody base, densely villous (especially in the basal portions); leaves linear to narrowly lanceolate, 5-80 mm. long, 1.5-20 mm. wide, sinuate-dentate to subentire; hypanthium 1.5-5 mm. long; sepals 6-14 mm. long; petals 8.5-13 mm. long; fruits 9-19 mm. long, 2-3.5 mm. thick, with a slender stipe 2-10 mm. long.

Consists of the following two subspecies:

Subsp. *villosa*. Pubescence with an understory of glandular or strigulose hairs, these often predominant in the inflorescence; inflorescence not conspicuously umbellate-branching; $n = 7$. *G. villosa* var. *arenicola* Munz. Scattered but locally frequent on open sandy flats and dunes throughout the Plains Country, infrequent southw. to the rim of the Edwards Plateau, May-Sept.; to e. N.M., s.w. Kan. and cen. and w. Okla.

Subsp. *Parksii* (Munz) Raven & Gregory. Pubescence of inflorescence of short dense spreading hairs; inflorescence conspicuously umbellate-branching; $n = 7$. Scattered but colonial on sand deposits, Rio Grande Plains, Apr.-Oct.; endemic.

12. *Gaura suffulta* Gray. WILD HONEYSUCKLE, BEE BLOSSOM, KISSES. Well-branched annual 2-12 dm. tall, from a stout taproot, villous in the lower portions; leaves narrowly lanceolate to lanceolate, 1-9.5 cm. long, 1-23 mm. wide, subentire to sinuate-dentate; hypanthium 6.5-14 mm. long; sepals 11-21 mm. long; petals 10-15 mm. long; fruits 4.5-8 mm. long, 2-4.5 mm. thick, ovoid-pyramidal. Consists of the following two subspecies:

Subsp. *suffulta*. Floral parts and inflorescence glabrous; bracts mostly 4.5-7 mm. long; $n = 7$. Common in open sandy often weedy situations throughout except for the Trans-Pecos, but rare in e. and s. Tex., Apr.-June; to Okla.

Subsp. *Nealleyi* (Coul.) Raven & Gregory. Floral parts and inflorescence glandular-pubescent; bracts 2-5 mm. long; $n = 7$. *G. Nealleyi* Coul., *G. suffulta* var. *terrellensis* Munz, *G. gracilis* and its var. *glandulosa* of Tex. ref. Common in sandy places in the Trans-Pecos, Apr.-Oct.; to s. N.M. and n. Coah.

13. *Gaura brachycarpa* Small. Low well-branched annual, sometimes persisting through mild winters, 15-65 cm. tall, from a slender taproot, villous, strigulose in the inflorescence; leaves narrowly lanceolate to oblanceolate, 1-7 cm. long, 1-16 mm. wide, subentire to slightly sinuate-denticulate; flowers rarely 3-merous; hypanthium 6.5-12 mm. long; sepals 10-15 mm. long; petals 8-12.5 mm. long; fruits 6-9 mm. long, 2-3 mm. thick, usually auriculate near the base with a stipe about 1 mm. long; $n = 7$. *G. tripetala* Cav. var. *Coryi* Munz. Frequent and colonial in open sandy places throughout cen. and e. Tex., Feb.-June; rare and perhaps introd. in Okla., La. and s. Miss.

14. *Gaura triangulata* Buckl. Erect slender annual 1.5-6 dm. tall, usually with several branches near the base, from a slender taproot, villous, lightly strigulose or subglabrous in the inflorescence; leaves very narrowly elliptic to oblanceolate, 1.5-8 cm. long, 2-15 mm. wide, subentire to slightly sinuate-dentate; flowers 3-merous; hypanthium 4-5.5 mm. long; sepals 4.5-6 mm. long; petals 3.5-5 mm. long; fruits 7-9 mm. long, 3-5 mm. thick; $n = 7$ (complete ring of 14 chromosomes at meiotic metaphase I). *G. tripetala* Cav. var. *triangulata* (Buckl.) Munz. Sandy open places, n.-cen. Tex., Mar.-June; also widespread in Okla.

4. OENOTHERA L. EVENING PRIMROSE

Herbs, sometimes woody near the base, with alternate entire to pinnatifid leaves; stipules absent; flowers actinomorphic, 4-merous, borne in the axils of upper leaves or in a more or less distinct inflorescence, opening either near sunset or near sunrise; hypanthium well-developed; sepals not persistent in fruit; petals yellow or white to rose-purple; stamens 8; stigma deeply 4-lobed; fruit a loculicidally dehiscent or nutlike indehiscent capsule; seeds lacking a coma.

About 80 species of the temperate regions of North America and South America, widely introduced elsewhere.

1. Capsule clavate, the lower part narrowed and stipelike; seeds clustered, not in definite rows (2)
1. Capsule ovoid to cylindrical; seeds usually in definite rows (9)
- 2(1). Flowers white or rose-purple (3)
2. Flowers yellow (7)
- 3(2). Inflorescences sharply nodding; capsule with the lower part sterile and cylindrical, sessile 5. *O. speciosa*.
3. Inflorescences erect; capsule tapering, pedicellate (4)
- 4(3). Petals white, fading pinkish; flowers opening near sunset (5)
4. Petals rose; flowers opening near sunrise (6)
- 5(4). Hypanthium 15-21 mm. long; petals 12-21 mm. long 3. *O. texensis*.
5. Hypanthium 4-8 mm. long; petals 4.5-12 mm. long 4. *O. rosea*.
- 6(4). Stigma usually elevated above the anthers; hypanthium 10-30 long; petals 20-35 mm. long 1. *O. tetraptera*.
6. Stigma surrounded by the anthers; hypanthium (5-) 20 mm. long; petals 10-20 mm. long 2. *O. Kunthiana*.
- 7(2). Hypanthium 1.5-2 mm. long; petals 3-5 mm. long .. 8. *O. linifolia*.
7. Hypanthium 4-17 mm. long; petals 5-20 mm. long (8)
- 8(7). Hypanthium 4-6 mm. long; annual 7. *O. Spachiana*.
8. Hypathium 10-17 mm. long; perennial 6. *O. sessilis*.
- 9(1). Capsule ovoid-pyramidal or oblong-ovoid, indehiscent; low rhizomatous herbs (10)
9. Capsule subcylindrical, readily dehiscent at maturity (at least at the apex) (11)
- 10(9). Hypanthium 40-55 mm. long; petals 15-30 mm. long 9. *O. Havardii*.
10. Hypanthium 5-15 mm. long; petals 8-12 mm. long ...10. *O. canescens*.
- 11(9). Flowers white (12)
11. Flowers yellow (15)
- 12(11). Mature buds erect; mature capsules 6-10 mm. thick, conspicuously tuberculate-ridged14. *O. caespitosa*.
12. Mature buds drooping; mature capsules 1-3 mm. thick, not conspicuously tuberculate-ridged (13)
- 13(12). Plants rhizomatous, perennial23. *O. pallida*.
13. Plants annual, from a slender taproot (14)
- 14(13). Stems densely and uniformly covered with villous pubescence; petals 1-1.5 cm. long; seeds in 1 row in each locule22. *O. Engelmannii*.
14. Stems strigulose or sparsely villous; petals 1.5-4 cm. long; seeds in 2 rows in each locule21. *O. albicaulis*.
- 15(11). Capsule conspicuously winged on the angles, at least above (16)
15. Capsule not winged (18)
- 16(15). Capsule winged above, obpyramidal; petals 1-2 cm. long; winter annual 13. *O. triloba*.
16. Capsule broadly winged its entire length; petals 2-5 cm. long; perennial (17)
- 17(16). Plants acaulescent; wings of capsule 1.5-4.5 mm. wide; leaves subentire to pinnatifid12. *O. brachycarpa*.
17. Plants usually caulescent, the stems to 5 dm. long; wings of capsules 7-20 mm. wide; leaves subentire or remotely denticulate11. *O. missouriensis*.

- 18(15). Acaulescent annual with thick-walled capsules; seeds with a deep groove surrounding the raphe 15. *O. primiveris*.
18. Caulescent annuals or perennials; seeds lacking a deep groove surrounding the raphe (19)
- 19(18). Seeds horizontal, sharply angled; capsule gradually tapered upward (20)
19. Seeds ascending, not sharply angled; capsule oblong-fusiform to subclavate (22)
- 20(19). Petals 1-2 cm. long; styles mostly 0.3-1.7 mm. long 26. *O. biennis*.
20. Petals 2-5 cm. long; styles 20-60 mm. long (21)
- 21(20). Hypanthium 25-45 mm. long 24. *O. Hookeri*.
21. Hypanthium 60-110 mm. long 25. *O. Jamesii*.
- 22(19). Flowers in terminal spikes, the upper leaves reduced to bracts; stems erect (23)
22. Flowers in upper leaf axils; stems erect or more or less decumbent (24)
- 23(22). Petals rhombic-obovate, 13-20 mm. long; free sepal tips 0.5-1.5 mm. long; bracts lanceolate 17. *O. rhombipetala*.
23. Petals obovate, 16-30 mm. long; free sepal tips 2-4 mm. long; bracts ovate or lanceolate 18. *O. heterophylla*.
- 24(22). Plants densely invested with canescent-villous pubescence, with numerous more or less woody stems from the base; coastal sands 16. *O. Drummondii*.
24. Plants loosely villous, the stems not woody (25)
- 25(24). Sepals 5-12 mm. long; petals 5-18 mm. long 20. *O. laciniata*.
25. Sepals 20-30 mm. long; petals 20-35 mm. long 19. *O. grandis*.

1. *Oenothera tetraptera* Cav. Well-branched strigulose to hirsute annual to 4 dm. tall; leaves sinuate to sinuate-pinnatifid, the upper ones subentire, lanceolate to oblanceolate or occasionally narrowly elliptic, 1-9 cm. long, (2-) 10-25 mm. wide, the petiole 2-20 mm. long; flowers opening near sunset; mature buds erect; hypanthium 1-3 cm. long; sepals 2-4 cm. long, with free tips to 3 mm. long; petals white, fading pink, 2-3.5 cm. long; pollen fertile; capsule obovoid, 1-2 cm. long, on a pedicel (4-) 10-45 mm. long; seeds in several indistinct rows in each locule, 1.2-1.5 mm. long; $n = 7$ (forming bivalents at meiosis). Gravel bars, alluvial flats and open places, rare and scattered, s. and w. Tex., Mar.-May; to Col. and w. Venez.; cult. and naturalized elsewhere.

2. *Oenothera Kunthiana* (Spach) Munz. Similar in general to *O. tetraptera*; plants subglabrous to strigulose; hypanthium (0.5-) 1-2 cm. long; sepals 5-20 mm. long, with tips coherent at anthesis; petals 1-2 cm. long; pollen approximately 50% sterile; $n = 7$ (ring of 14 in meiosis). Gravel bars and flat sandy often weedy places in the Trans-Pecos, Edwards Plateau and s. Tex., Feb.-May; s. to C. R.

3. *Oenothera texensis* Raven & Parnell. Well-branched strigulose or rarely hirsute perennial herb, flowering the first year, to 5 dm. tall; leaves serrulate to sinuate-pinnatifid, elliptic to ovate, 2.5-4 cm. long, 8-18 mm. wide, the petiole 4-21 mm. long; flowers opening near sunrise; mature buds erect; hypanthium 15-21 mm. long; sepals 15-18 mm. long, lacking free tips; petals rose, 12-21 mm. long; pollen fertile; capsule obovoid, 8-14 mm. long, on a pedicel 7-12 mm. long; seeds in several indistinct rows in each locule, 0.8-1 mm. long; $n = 7$ (forming bivalents at meiosis). Gravel bars and along streams in canyons, Jeff Davis Co. in the Trans-Pecos, May-Aug.; s. to Sin., Coah. and Tam.

4. *Oenothera rosea* Ait. ROSE SUNDROPS. Well-branched strigulose or rarely hirsute perennial herb, flowering the first year, to 4 dm. tall; leaves subentire or sinuate-pinnatifid, elliptic or rarely narrowly ovate, 2-5 cm. long, 1-2.5 cm. wide, the petiole 2-25 mm. long; flowers opening near sunrise; mature buds erect; hypanthium 4-8 mm. long; sepals 7-12 mm. long, lacking free tips; petals rose, 4-12 mm. long; pollen approximately 50% sterile; capsule obovoid, 5-10 mm. long, on a pedicel 4-8 mm. long; seeds in several indistinct rows in each locule, 0.7-0.9 mm. long; $n = 7$ (ring of 14 in meiosis). Along creeks and in low weedy places, Trans-Pecos, Edwards Plateau and s. Tex., Apr.-Aug.; s. to Arg., a pan-trop. weed.

5. *Oenothera speciosa* Nutt. s. lat. AMAPOLA DEL CAMPO, SHOWY PRIMROSE. Rhizomatous strigulose perennial to 5 dm. tall; leaves subentire to (usually) sinuate-pinnatifid, obovate to oblong-lanceolate, 2-9 cm. long, 4-25 mm. wide, the petiole to 3 cm. long; inflorescence sharply nodding; hypanthium 1-2 cm. long; sepals 1.5-3 cm. long, with free tips 1-4 mm. long; petals white or rose-purple, 2.5-4 cm. long; capsule narrowly obovoid, very tough, 1-1.5 cm. long, sessile; seeds in several indistinct rows in each locule, about 1 mm. long; $n = 7, 14, 21$. Incl. var. *Childsii* (Bailey) Munz. Prairies and open woodlands, throughout Tex. but rare and scattered to the n. and w., Apr.-July; Kan. and Mo. to n.e. Mex.

More northern populations of this species tend to be white-flowered, evening-opening and diploid ($n = 7$), whereas the southern populations which are widespread in cultivation and often naturalized are more often rose-purple flowered morning-opening and polyploid ($n = 14, 21$). These latter have been separated as *O. Delessertiana* Steud., but white-flowered, evening-opening plants occur in polyploid populations and a taxonomic separation of these two series of plants would appear to be more confusing than helpful. Both forms, with intermediates between them, are common in Texas.

6. *Oenothera sessilis* (Penn.) Munz. Densely strigose sparsely branched perennial with short rootstalks, the stems to 5 dm. tall; leaves denticulate, lanceolate, 3-6 cm. long, 4-9 (-15) mm. wide, subsessile; flowers opening near sunrise; mature buds erect; hypanthium 1-1.7 cm. long; sepals 1-2 cm. long, with free tips 1-2 mm. long; petals yellow, 1-2 cm. long; capsule linear-clavate, 8-10 mm. long, subsessile; seeds in several indistinct rows in each locule, about 0.8 mm. long. Marshy places, Galveston I., *Lindheimer* (US), Nov.; to s. Ark. and adj. La. Last collected in Texas 115 years ago!

7. *Oenothera Spachiana* T.&G. Erect strigulose annual to 5 dm. tall; leaves subentire, narrowly elliptic to elliptic, 2-5 cm. long, 4-10 mm. wide, short-petioled; flowers opening near sunrise; mature buds erect; hypanthium 4-6 mm. long; sepals 8-10 mm. long, with free tips 1-1.5 mm. long; petals yellow, 5-15 mm. long; capsule clavate, 8-10 mm. long, more or less stipitate; seeds in several indistinct rows in each locule, about 0.6 mm. long; $n = 7$. Open sandy prairies and low ground, e. Tex., Apr.-May; to w. La., Ark. and s.e. Okla.

8. *Oenothera linifolia* Nutt. THREE-LEAVED SUNDROPS. Erect slender subglabrous annual to 3 dm. tall; leaves entire, filiform, 1-2.5 cm. long, to 3 mm. wide, subsessile (except for the broader basal ones); flowers opening near sunrise; mature buds erect; hypanthium 1.5-2 mm. long; sepals 1.5-2 mm. long, lacking free tips; petals yellow, 3-5 mm. long; capsule short-clavate, 4-6 mm. long, short stipitate; seeds in several indistinct rows in each locule, about 1 mm. long; $n = 7$. Sandy slopes and flats, often in open woods, e. Tex., Apr.-May; to Kan., s. Ill., Ala. and n. Ga.

9. *Oenothera Havardii* Wats. Cespitose bushy subglabrous to strigulose rhizomatous perennial with stems to 1 dm. long; leaves narrowly lanceolate to oblanceolate, the cauline ones 1-3.5 cm. long and 2-5 mm. wide, sinuate-pinnatifid, subsessile, the basal ones larger; flowers opening near sunset; mature buds erect; hypanthium 4-5.5 cm. long; sepals 15-25 mm. long, with free tips 0-1.5 mm. long; petals yellow, fading reddish, 1.5-3 cm. long; capsule oblong-ovoid, 1-1.5 cm. long, 4-angled, the valves strongly ribbed; seeds in several rows in each locule, about 2 mm. long; $n = 7$. Rare and local in sandy soil in the s. Trans-Pecos, May-Sept.; to s. Ariz. (where perhaps introd.) and s. to Chih. and Dgo.

10. *Oenothera canescens* Torr. & Frém. SPOTTED PRIMROSE. Low bushy densely strigulose to canescent rhizomatous perennial with stems to 2 dm. long; leaves denticulate, lanceolate, 5-15 mm. long, 2-7 mm. wide, subsessile; flowers opening near sunset; mature buds erect; hypanthium 5-15 mm. long; sepals 8-14 mm. long, lacking free tips; petals pinkish or more rarely white on first opening, 8-12 mm. long, red-spotted all over; capsule ovoid-pyramidal, sharply 4-angled, beaked, 7-8 mm. long; seeds in several rows in each locule, about 1 mm. long; $n = 7$. Dried up ponds and lakes in clay soil, Edwards Plateau n. through the Panhandle, local, May-Aug.; to N.M. and n. on the Plains to Neb. and Wyo.

11. *Oenothera missouriensis* Sims. MISSOURI PRIMROSE, GLADE-LILY. Perennial, the stems to 5 dm. long or more rarely the plants subcaulescent; leaves narrowly lanceolate or elliptic to broadly lanceolate, 3-10 cm. long, 5-30 mm. wide, subentire to remotely denticulate, glabrous to densely canescent, the petioles 1-5 cm. long; flowers opening near sunset; mature buds erect; hypanthium 5-12 cm. long; sepals 2-4 cm. long, with free

tips 1.5-8 mm. long; petals yellow, sometimes fading reddish, 2-5 cm. long; capsule 2-6.5 cm. long, with 4 wings 7-20 mm. wide; seeds in 1 row in each locule, 3-4 mm. long, corky-tubercled. Incl. var. *incana* Gray and var. *oklahomensis* (Nort.) Munz. Limestone knobs, prairies and dry hillsides, n.-cen. Tex. and the Edwards Plateau, n. through the the High Plains, May-Aug.; n. through Okla., w. Ark. and w. Mo. to Kan. and Neb.

12. *Oenothera brachycarpa* Gray. Subcaulescent perennial; leaves linear to narrowly ovate, 3-15 cm. long, 1-3 cm. wide, entire to sinuate-dentate, glabrous to more or less densely strigulose; petioles 1-6 cm. long; flowers opening near sunset; mature buds erect; hypanthium 5-15 cm. long; sepals 3-4 cm. long, with free tips 1-4 mm. long; petals yellow, fading reddish, 3-5 cm. long; capsule broadly fusiform, 2.5-3 cm. long, with 4 wings 1.5-4.5 mm. wide only near the summit or along the entire body; seeds in one row in each locule, 2-4 mm. long, corky-tubercled at least near the apex and base; $n = 7$. Incl. var. *Wrightii* H. Lévl. Rocky slopes from the El Paso area e. through the Trans-Pecos to the s. part of the South Plains and to Callahan Co., Mar.-June; s.w. Ida. and Colo. s. to Ariz., w. Tex., Chih., Coah. and Dgo.

13. *Oenothera triloba* Nutt. Subcaulescent winter annual or biennial; leaves elliptic to oblanceolate, 3-30 cm. long, 1-4 cm. wide, irregularly pinnatifid, glabrous to strigulose or finely glandular-pubescent; petioles 1-2 (-8) cm. long; flowers opening near sunset; mature buds erect; hypanthium 2-10 cm. long; sepals 1-1.8 cm. long, with free tips 3-7 mm. long; petals pale-yellow, 1-2 cm. long; capsule obpyramidal, very hard, 1-2 cm. long, with 4 wings 5-10 mm. wide near the summit; seeds in 2 rows in each locule, about 2 mm. long, narrowly winged near the summit. Grassy slopes and open flats, particularly where moist, n.-cen. Tex. and Edwards Plateau, rare s. to Hidalgo Co., Feb.-May (-July); Kan. to Ky., Tenn. and n. Ala., s. to Tex.

14. *Oenothera caespitosa* Nutt. subsp. *eximia* (Gray) Munz. Stout pilose perennial with stems to 3 dm. long; leaves subentire to sinuate-pinnatifid, oblanceolate, 3-12 cm. long, 1-2 cm. wide, the petioles 2-8 cm. long; flowers opening near sunset; mature buds erect; hypanthium 10-15 cm. long; sepals 25-35 mm. long, with tips appressed in bud; petals white, fading rose-purple, 2.5-4 cm. long; capsule lance-ovoid, hard, tuberculate, 2.5-4 cm. long; seeds in 2 rows in each locule, about 3 mm. long. Rocky slopes in the mts. of the Trans-Pecos, very rare, Culberson Co., June; e. Colo. to w. Tex. and n. N.M.

15. *Oenothera primiveris* Gray. LARGE YELLOW DESERT PRIMROSE. Subcaulescent annual; leaves narrowly elliptic to broadly oblanceolate, 2-12 cm. long, 5-30 mm. wide, irregularly pinnatifid or (rarely) subentire, villous throughout; petioles 5-50 mm. long; flowers opening near sunset; mature buds erect; hypanthium 2-6 cm. long; sepals 1-2.8 cm. long, without free tips; petals lemon-yellow, fading reddish, 1-4 cm. long; capsule broadly fusiform, 1.7-4 cm. long, with a heavy rib down the center of each face; seeds in 2 rows in each locule, 2.5-3 mm. long, with narrow groove surrounding the raphe; $n = 7$. Desert flats in the Trans-Pecos, Mar.-Apr.; w. to s.w. Ut., s. Nev., s. Calif. and n. Son.

16. *Oenothera Drummondii* Hook. BEACH EVENING PRIMROSE. Suffrutescent densely canescent-villous perennial with many woody stems to 1 m. long from the base; leaves oblanceolate to obovate, 1-7 cm. long, 5-15 mm. wide, entire or remotely sinuate-dentate (especially the larger basal ones), densely canescent-villous throughout; petioles 0-3 cm. long; flowers opening near sunset; mature buds erect; hypanthium 2-4 cm. long; sepals 2-3 cm. long, with free tips 2-3 mm. long; petals yellow, fading reddish, 2-3.5 cm. long; capsule cylindrical, 2.5-4 cm. long; seeds in 2 rows in each locule, 1-1.2 mm. long; $n = 7$. Sandy beaches of entire Gulf Coast, Mar.-Nov.; s. to Ver.; introd. widely elsewhere.

17. *Oenothera rhombipetala* T.&G. Erect strigulose winter annual or biennial from a fleshy taproot, the stems to 1 m. tall; leaves narrowly oblanceolate to narrowly ovate (broader above), 2-8 cm. long, 3-15 mm. wide, sinuate-pinnatifid to subentire; petioles short or absent; flowers opening near sunset; mature buds erect; hypanthium 2.5-3 cm. long; sepals 1-1.8 cm. long, with free tips 0-1.5 mm. long; petals yellow, 1.3-2 cm. long; capsule cylindrical, 12-16 mm. long; seeds in 2 rows in each locule, about 1 mm. long; $n = 7$. Common in sandy and waste places, e. half of Tex., June-Sept.; Ind. to Wisc. and Minn. s. to Tex. and scattered (possibly introd.) e. to the Atl. Coast.

18. *Oenothera heterophylla* Spach. Erect hirsute and strigulose winter annual or biennial from a fleshy taproot, the stems to 1 m. tall; leaves 2-9 cm. long, 3-15 mm. wide, sinuate-pinnatifid to subentire, the upper ones sessile with clasping base; flowers opening

near sunset; mature buds erect; hypanthium 2.5-3 cm. long; sepals 1.5-2 cm. long, with free tips 3-4 mm. long; petals yellow, 1.6-3 cm. long; capsule cylindrical, 15-25 mm. long; seeds in 2 rows in each locule, about 1 mm. long; $n = 7$. Colonial in sandy open woods, e. and n.-cen. Tex., June-Sept.; also w. La.

19. *Oenothera grandis* (Britt.) Smyth. Erect simple or much-branched decumbent strigulose and sometimes villous annual, the stems to 8 dm. long; leaves elliptic to oblanceolate, 2-6 cm. long, 5-15 mm. wide, sinuate-pinnatifid or rarely less deeply lobed or entire, subglabrous to strigulose or villous; petioles 0.5 cm. long, mostly short; flowers opening near sunset; mature buds erect, the stem tip nodding; hypanthium 2.5-5 cm. long; sepals 2-3 cm. long, with free tips 2-5 mm. long; petals yellow, 2-3.5 cm. long; capsule cylindrical, 1-3.5 cm. long; seeds in 2 rows in each locule, about 1 mm. long; $n = 7$ (forming pairs or small rings at meiotic metaphase I). *O. laciniata* var. *grandiflora* (Wats.) Robins. Sandy open places, scattered in e., cen. and s. Tex. and in the South Plains, Mar.-June; Kan. and Mo. to Chih., Dgo., Zac. and Tam.

20. *Oenothera laciniata* Hill. CUT-LEAVED EVENING PRIMROSE. Similar to *O. grandis* but the hypanthium 15-35 mm. long; sepals 5-12 mm. long, with free tips 0-2 mm. long; petals 5-18 mm. long; $n = 7$ (ring of 14 chromosomes at meiotic metaphase I). Incl. var. *pubescens* (Willd.) Munz. Sandy fields and waste places throughout except for the South Plains, rarer in the w. and Panhandle, Mar.-Nov.; e. U.S. s. to Ecu.

Apparent hybrids with *O. Drummondii* occur where the ranges of these two very distinct species overlap.

21. *Oenothera albicaulis* Pursh. PRAIRIE EVENING PRIMROSE. Erect strigulose and more or less villous annual, often with additional decumbent branches from the base, the stems to 5 dm. long; leaves elliptic to oblanceolate, 1-8 cm. long, 5-20 mm. wide, sinuate-pinnatifid or the lower ones subentire, strigulose and more or less villous; petioles 0-4 cm. long, mostly short; flowers opening near sunset; mature buds nodding; hypanthium 1.5-3 cm. long; sepals 14-25 mm. long; petals white, fading pink, 1.4-4 cm. long; capsule cylindrical, 2-4 cm. long; seeds in 2 rows in each locule, about 1 mm. long; $n = 7$. Sandy places in the Trans-Pecos, South Plains and Panhandle, Apr.-June; S.D. and Mont. to Tex., Chih., Ariz. and s. Ut.

22. *Oenothera Engelmannii* (Small) Munz. Erect densely villous annual to 8 dm. tall, usually with one main stem from the base, the lateral branches poorly developed; leaves lanceolate, 2-6 cm. long, 1-2 cm. wide, coarsely sinuate-dentate, more or less villous, sessile; flowers opening near sunset; mature buds nodding; hypanthium 2-3 cm. long; sepals 1-1.5 cm. long, lacking free tips; petals white, fading pink, 1-1.5 cm. long; capsule tapering gradually to the apex, 25-45 mm. long; seeds in 1 row in each locule, about 1 mm. long; $n = 7$. Sand dunes and open sandy flats in the South Plains, May-Sept.; to e. N.M.

23. *Oenothera pallida* Lindl. subsp. *runcinata* (Engelm.) Munz & Klein. Bushy much-branched subglabrous to strigulose or sometimes pilose rhizomatous perennial to 4 dm. tall; leaves narrowly lanceolate to ovate, 2-3.5 cm. long, 4-15 mm. wide, deeply sinuate-dentate to sinuate-pinnatifid or more rarely subentire, subglabrous to strigulose, subsessile; flowers opening near sunset; mature buds nodding; hypanthium 1.5-3 cm. long; sepals 1-2.5 cm. long, lacking free tips; petals white, fading pink, 1-2.5 cm. long; capsule cylindrical, 1.5-6 cm. long; seeds in 1 row in each locule, about 1.5 cm. long; $n = 7$. *O. runcinata* (Engelm.) Munz and var. *brevifolia* (Engelm.) Munz, *O. latifolia* sensu Munz, Fl. Tex. 3: 232. 1944. Sandy open or disturbed places in the Trans-Pecos, Apr.-Oct.; s. Ut. to Ariz., w. Tex. and Chih.; the species as a whole from e. Wash., Ida. and Wyo. s. to this area.

24. *Oenothera Hookeri* T.&G. Robust erect biennial or perennial to 2 m. tall; leaves oblanceolate to elliptic, densely strigose and sometimes also pilose, entire to sinuate-serrulate, the rosette leaves narrower near the base, 1-3 dm. long, 2-5 cm. wide, their petioles 5-18 cm. long, the cauline leaves 5-15 cm. long and 8-25 mm. wide, short-petioled to subsessile; flowers opening near sunset; mature buds erect; hypanthium 25-45 mm. long; sepals 2.5-4 cm. long, with free tips 2-6 mm. long; petals yellow, fading reddish, 2-4.5 cm. long; capsule thick, cylindrical, 2-4 cm. long; seeds in 2 rows in each locule, 1-1.6 mm. long; $n = 7$. S.e. Wash. and s. Ida. to Baja Calif., Kan., Tex. and Chih.

In Texas represented by 2 subsp. as follows:

Subsp. *hirsutissima* (Gray) Munz. Pubescence largely loose with some spreading hairs; free sepal tips 2-4 (-5) mm. long; seeds 1.2-1.6 mm. long; $n = 7$. Rare in wet places in the Trans-Pecos, July-Oct.; Ut. and s. Colo. to w. Kan., Chih. and Son.

Subsp. *Hewettii* Cockll. Pubescence appressed; free sepal tips 3-6 mm. long; seeds about 1 mm. long; $n = 7$. Incl. var. *irrigua* (Woot. & Standl.) Gates, *O. Simsiana sensu* Munz, Fl. Tex. 226. 1944. Rare in wet places in the Trans-Pecos, July-Oct.; Nev. and s. Ut. to Tex. and Chih.

25. *Oenothera Jamesii* T.&G. Robust erect densely appressed-pubescent biennial to 2 m. tall; leaves elliptic to broadly lanceolate, appressed-pubescent; rosette leaves narrower near the base, sinuate-pinnatifid to denticulate, 6-20 cm. long and 2-4 cm. wide, their petioles 2-6 cm. long; cauline leaves denticulate, 5-12 cm. long and 2-3.5 cm. wide, short-petioled below to subsessile above; flowers opening near sunset; mature buds erect; hypanthium 6-11 cm. long; sepals 4-6 cm. long, with free tips 3-6 mm. long; petals yellow, fading reddish, 3.5-5 cm. long; capsule thick, cylindrical, 2-5 cm. long; seeds in 2 rows in each locule, 1.5-2 mm. long; $n = 7$. On stream banks in wet places, scattered, Edwards Plateau and Llano area w. to the Trans-Pecos, July-Oct.; Okla. and w. Tex. to Coah.

26. *Oenothera biennis* L. subsp. *centralis* Munz. COMMON EVENING PRIMROSE. Weedy sparsely pubescent biennial to 2 m. tall; leaves lanceolate; rosette leaves sinuate-pinnatifid to denticulate, 8-30 cm. long and 1-6 cm. wide, their petioles long; cauline leaves denticulate, 5-16 cm. long, 15-35 mm. wide, subsessile; flowers opening near sunset; mature buds erect; hypanthium 2-5 cm. long; sepals 1-2 cm. long; the free tips 1-4 mm. long; petals yellow, 1-2 cm. long; capsule thick, cylindrical, 14-25 mm. long; seeds in 2 rows in each locule, 1.2-1.8 mm. long; $n = 7$ (ring of 14 chromosomes at meiotic metaphase I). *O. pratincola* Bartlett. Weedy places and woods, scattered, n.e. Tex., Aug.-Oct.; Alta. to Wisc. and Mich., s. to Tex. and La. and e. to Atl. Coast; the species as a whole ranges to Nfld., Que. and Ont.

Two species have been reported from Texas for which we have seen no material; they are: (1) *Oenothera coronopifolia* T.&G., related to *O. albicaulis* but it is perennial from slender underground rootstocks, has throat of hypanthium with conspicuous white hairs and petals 7-11 mm. long; (2) *Oenothera neomexicana* (Small) Munz, related to *O. Engelmannii* but it has capsules quite erect, not woody, and 2-3 cm. long, petals 2-3 cm. long and the lower leaves (at least) petioled.

5. STENOSIPHON SPACH

A monotypic genus.

1. *Stenosiphon linifolius* (Nutt.) Heynh. Tall virgate perennial herb, somewhat woody near the base, to 3 m. tall, unbranched or with few long branches, glabrous and glaucous; stipules absent; leaves entire, alternate, lanceolate or narrowly lanceolate, 2-6 cm. long, 4-15 mm. wide, sessile; flowers actinomorphic, 4-merous, borne in a more or less distinct wandlike inflorescence with greatly reduced leaves, opening near sunrise; hypanthium well-developed, filiform, 7-11 mm. long; sepals not persistent in fruit, 4-5 mm. long; petals white, 4-5 mm. long; stamens 8; stigma deeply 4-lobed; fruit an indehiscent obovoid nutlike 1-seeded capsule 2-3 mm. long and about 2 mm. thick, 8-ribbed; seeds lacking a coma; $n = 7$. Rocky banks and slopes, usually on limestone, colonial, from the Edwards Plateau n. through n.-cen. Tex. and the Panhandle, June-Oct.; n. to s. Neb. and w. Ark.

6. LUDWIGIA L. SEEDBOX. WATER-PRIMROSE

Herbs of wet places with alternate or opposite entire or minutely toothed leaves; stipules present, minute; flowers actinomorphic, 4- or 5- (rarely 6-) merous, borne in the axils of upper leaves; hypanthium not prolonged beyond the apex of the ovary; sepals persistent in fruit; petals yellow or absent; stamens as many or twice as many as the sepals; stigma capitate or globose, undivided; fruit a loculicidally or poricidally dehiscent capsule; seeds lacking a coma. *Jussiaea* L.

About 70 species, mostly of the tropics and subtropics and best represented in tropical South America.

- 1. Leaves opposite (2)
- 1. Leaves alternate (3)
- 2(1). Petals absent; capsule with a broad green band at each corner 11. *L. palustris*.
- 2. Petals present; capsule lacking green bands 12. *L. repens*.
- 3(1). Stamens twice as many as the sepals, in 2 series (4)
- 3. Stamens as many as the sepals, in 1 series (8)
- 4(3). Stems conspicuously 4-winged 1. *L. decurrens*.
- 4. Stems not conspicuously 4-winged (5)
- 5(4). Sepals 4; seeds in several series in each locule of the capsule, free 2. *L. octovalvis*.
- 5. Sepals 5 (rarely 6); seeds in 1 series in each locule of the capsule, surrounded by woody endocarp at maturity (6)
- 6(5). Seeds each surrounded by a horseshoe-shaped (hippocrepiform) piece of endocarp, readily falling free 3. *L. leptocarpa*.
- 6. Seeds fused in large masses of endocarp, the entire capsule tough and woody (7)
- 7(6). Flowering stems erect; plants covered with long spreading pubescence; petals 12-23 mm. long 5. *L. uruguayensis*.
- 7. Flowering stems usually decumbent; plants subglabrous; petals 7-14 (-24) mm. long 4. *L. peploides*.
- 8(3). Capsule nearly globose, opening by a terminal pore; roots fascicled; stolons lacking (9)
- 8. Capsules variable in shape, irregularly dehiscent; roots not fascicled or if so the capsule not globose; plants with creeping stolons (10)
- 9(8). Plants hirsute; leaves sessile 6. *L. hirtella*.
- 9. Plants glabrous to puberulent; leaves petiolate 7. *L. alternifolia*.
- 10(8). Petals present 8. *L. linearis*.
- 10. Petals absent (11)
- 11(10). Plants conspicuously pilose 9. *L. pilosa*.
- 11. Plants glabrous to very minutely strigulose 10. *L. glandulosa*.

1. *Ludwigia decurrens* Walt. PRIMROSE-WILLOW. Subglabrous erect herb to 2 m. tall, freely branched, the stems 4-winged; leaves lanceolate to elliptical, 2-12 (-16) cm. long, 2-35 mm. wide, subsessile; sepals 4, 7-10 mm. long; petals 8-12 mm. long; stamens 8; disk not elevated, with a sunken white-hairy nectary surrounding the base of each epipetalous stamen; capsule 1-2 cm. long, 3-4.5 mm. thick, sharply 4-angled, irregularly and readily loculicidal, the pedicel 0-1 cm. long; seeds in several series in each locule, free, 0.3-0.4 mm. long, the raphe about one fifth the diameter of the body; $n = 8$. *Jussiaea decurrens* (Walt.) DC. Swamps and wet places, e. Tex., June-Oct.; s.e. U.S. to e. Tex and scattered to n. Arg.

2. *Ludwigia octovalvis* (Jacq.) Raven subsp. *octovalvis*. Subglabrous to strigulose usually well-branched weedy herb to 1 m. tall or more; leaves lanceolate or narrowly lanceolate to narrowly ovate, 3-14.5 cm. long, 4-40 mm. wide, the petiole 0-1 cm. long; sepals 4, (6-) 8-13 mm. long; petals 5-16 mm. long; stamens 8; disk slightly elevated, with a white-hairy sunken nectary surrounding the base of each epipetalous stamen; capsule thin-walled, 17-45 mm. long, 2-8 mm. thick, readily and irregularly loculicidal, the pedicel 0-1 cm. long; seeds in several indistinct rows in each locule, 0.6-0.75 mm. long, free, each with an inflated raphe equal in size to the body of the seed; $n = 16, 24$. *Jussiaea suffruticosa* L. [incl. var. *octofila* (DC.) Munz. and var. *ligustrifolia* (H.B.K.) Griseb.] In swamps and other wet places, widespread through s. half of the state, July-Oct.; warmer regions of the world.

The presence in Texas of the closely related *L. bonariensis* (Mich.) Hara ($n = 8$) requires confirmation. The ovary of this species at anthesis about equals the sepals instead of exceeding them, the capsule is usually shorter than the pedicel instead of longer and the petals are 20-35 mm. long. The specimens upon which this species has been reported (as *Jussiaea bonariensis* Mich.) from Texas are inadequate for certain determination.

3. *Ludwigia leptocarpa* (Nutt.) Hara. Usually robust hairy plants to 15 dm. tall, freely branched; leaves broadly lanceolate, 3.5-18 cm. long, 1-4 cm. wide, the petiole 2-35 mm. long; sepals 5 (rarely 4, 6 or 7), 5.5-11 mm. long; petals 5-11 mm. long; stamens twice as many as the sepals; disk slightly elevated, with a depressed hairy nectary surrounding the base of each epipetalous stamen; capsule 1.5-5 cm. long, 2.5-4 mm. thick, slowly and irregularly loculicidal, the pedicel 2-20 mm. long; seeds in 1 series in each locule, horizontal, 1-1.2 mm. long, each loosely embedded in an easily detached horse-shoe-shaped (hippocrepiform) segment of firm endocarp 1-1.5 mm. thick and about 1 mm. high; $n = 16$. *Jussiaea leptocarpa* Nutt. Wet places, as along ditches, e. Tex., Aug.-Oct.; e. to Mo., Ga., n. Fla., s. to W.I., Peru and Arg.; trop. Afr.

4. *Ludwigia peploides* (H.B.K.) Raven subsp. *peploides*. VERDOLAGA DE AGUA. Subglabrous sprawling or floating herb with somewhat ascending flowering branches to 6 dm. long; leaves oblong to oblong-spatulate, 1-9 cm. long, 5-40 mm. wide, the petiole 2-40 mm. long; sepals 5, 4-12 mm. long; petals 7-14 (-24) mm. long; stamens 10; disk slightly elevated, with a depressed white-hairy nectary surrounding the base of each epipetalous stamen; capsule 1-4 cm. long, 3-4 mm. thick, very tardily and irregularly dehiscent, the pedicel 1-6 (-8) cm. long; seeds in 1 series in each locule, more or less vertical, 1.1-1.3 mm. long, each firmly embedded in a coherent cube of woody endocarp 1.2-1.5 mm. high, 1-1.2 mm. thick, the endocarp firmly fused to the capsule wall; $n = 8$. *Jussiaea repens* L. var. *glabrescens* O. Ktze. and var. *peploides* (H.B.K.) Griseb. Ponds and streams, e.-cen. and e. Tex., locally w. to the Trans-Pecos, Apr.-Oct.; throughout warmer portions of New World; the species as a whole also in n.e. Asia and temp. Austral. and introd. elsewhere.

5. *Ludwigia uruguayensis* (Camb.) Hara. Long hairy perennial herb with decumbent rooting and more or less erect ascending branches to 1 m. tall, the floating branches subglabrous; leaves spatulate to oblanceolate, 3-10 cm. long, 3-10 mm. wide, the petiole 1-5 (-25) mm. long; sepals 5 (rarely 6), 6-14 mm. long; petals 12-23 mm. long; stamens twice as many as the sepals; disk slightly elevated, with a depressed white-hairy nectary surrounding the base of each epipetalous stamen; capsule 13-25 mm. long, 3-4 mm. thick, very tardily and irregularly dehiscent, the pedicel 5-50 mm. long; seeds in 1 series in each locule, more or less vertical, 1-1.3 mm. long, each firmly embedded in a coherent cube of woody endocarp 1.2-1.5 mm. high, 1-1.2 mm. thick, the endocarp firmly fused to the capsule wall; $n = 24$. *Jussiaea uruguayensis* Camb. Wet places, as along ponds and ditches, scattered in s.e. Tex., June-Sept.; s.e. U.S. and scattered s. to n. Arg. and introd. elsewhere.

6. *Ludwigia hirtella* Raf. SPINDLE-ROOT. Erect hirsute herb with fascicled spindle-shaped roots, to 1 m. tall; leaves narrowly lanceolate or lanceolate, 1.5-6 cm. long, 3-18 mm. wide, essentially sessile; sepals 4, 7-10 mm. long; petals 10-15 mm. long; stamens 4; disk strongly elevated, a depressed white-ciliate nectary surrounding the base of each epipetalous stamen; capsule subglobose-cubical, 4-6 mm. long and thick, dehiscent by a terminal pore, the pedicel 4-8 mm. long; seeds in several indistinct rows in each locule, about 0.6 mm. long, free; $n = 8$. Rare along wet places in pine woods, e. Tex., June-Sept.; e. along Coastal Plain to Fla. and N.J.

7. *Ludwigia alternifolia* L. SEED-BOX, RATTLE-BOX. Erect subglabrous or puberulent herb with fascicled spindle-shaped roots, to 12 dm. tall; leaves lanceolate, 4-8 (-12) cm. long, 8-15 (-24) mm. wide, the petiole 3-7 (-10) mm. long; sepals 4, 7-10 mm. long; petals 8-10 mm. long; stamens 4; disk strongly elevated, a depressed white-ciliate nectary surrounding the base of each epipetalous stamen; capsule subglobose-cubical, 5-6 mm. long and thick, dehiscent by a terminal pore, the pedicel 3-5 mm. long; seeds in several indistinct rows in each locule, 0.6-0.7 mm. long, free; $n = 8$. Incl. var. *pubescens* Palm. & Steyerl. Occasional along ditches and in wet places, e. Tex., June-Aug.; Mass. and Ont. to n. Fla., e. Tex. and Ia.

8. *Ludwigia linearis* Walt. Glabrous to puberulent erect usually well-branched herb to 1 m. tall; leaves linear to narrowly elliptical, 2.5-6 cm. long, 1.5-5 mm. wide, subsessile;

sepals 4, 2.5-4 mm. long; petals 3.5-5 mm. long; stamens 4; disk elevated, glabrous, prominently 4-lobed, the lobes opposite the petals; capsule elongate-obpyramidal, 6-8 mm. long, irregularly loculicidal, sessile; seeds in several indistinct rows in each locule, about 0.6 mm. long, free; $n = 8$. Incl. var. *puberula* Engelm. & Gray. Occasional in wet places, especially in pine woods, s.e. Tex., June-Sept.; e. to n. Fla., Tenn. and N.J.

9. *Ludwigia pilosa* Walt. Pilose erect usually well-branched herb to 12 dm. tall; leaves linear to elliptical, 2-10 cm. long, 3-15 mm. wide, the petiole 1-5 (-15) mm. long; sepals 4, 4-5 mm. long; petals absent; stamens 4; disk elevated, glabrous, prominently 4-lobed, the lobes opposite the sepals; capsule cubic-globose, 3-4 mm. long and thick, irregularly loculicidal, sessile; seeds in several indistinct rows in each locule, about 0.5 mm. long, free; $n = 16$. Occasional in wet places, especially in pine woods, s.e. Tex., July-Oct.; e. along the Coastal Plain to n. Fla. and s. Va.

The general habit of the eastern linear-lanceolate to oblong leaved *L. sphaerocarpa* Ell., that reaches Louisiana, is similar to some plants referred here to *L. pilosa*. It may eventually be found in southeast Texas, and may be distinguished by its glabrous to minutely appressed-pubescent herbage and hypanthium, and its very short hypanthium bracteole (less than 2 mm. long) in contrast to the long bracteole (2.5-4.2 mm. long) of *L. pilosa*.

10. *Ludwigia glandulosa* Walt. CYLINDRIC-FRUITED LUDWIGIA. Glabrous or minutely strigulose erect well-branched herb to 1 m. tall; leaves lanceolate or elliptical, 1.5-10 cm. long, 4-20 mm. wide, the petiole 2-10 mm. long; sepals 4, 1-2 mm. long; petals absent; stamens 4; disk elevated, glabrous, prominently 4-lobed, the lobes opposite the petals; capsule subcylindric, 2-8 mm. long, 1.5-2 mm. thick, irregularly loculicidal, sessile; seeds in several indistinct rows in each locule, about 0.6-0.7 mm. long, free; $n = 16$. Incl. var. *Torreyi* Munz. Wet places, as along ditches and in swamps, e. Tex., June-Oct.; n. and e. to s. Ill., Va. and n. Fla.

11. *Ludwigia palustris* (L.) Ell. MARSH PURSLANE. Glabrous herb, creeping and rooting at the nodes, the stems to 5 dm. long; leaves broadly elliptical or subovate, 7-45 mm. long, 4-23 mm. wide, the petiole 3-12 mm. long; sepals 4, 1.4-2 mm. long; petals absent; stamens 4; disk elevated, glabrous, prominently 4-lobed, the lobes opposite the petals; capsule elongate-globose, (2-) 2.5-5 mm. long, 2-3 mm. thick, fairly readily and irregularly loculicidal, sessile; seeds in several indistinct rows in each locule, 0.6-0.9 mm. long, free; $n = 8$. Incl. var. *americana* (DC.) Fern. & Griseb. and var. *nana* Fern. & Griseb. Wet places as about ponds and along rivers; e. and s.-cen. Tex. to the Llano area and in the Davis Mts., June-Sept.; temp. N.A. except Rocky Mt. area to Col.; also in w. Euras., N. and S. Afr. and introd. elsewhere.

12. *Ludwigia repens* Forst. FLOATING OR CREEPING PRIMROSE-WILLOW, WATER PRIMROSE. Glabrous to puberulent herb, creeping and rooting at the nodes, the stems to 5 dm. long; leaves very narrowly elliptic to subrotund, 9-40 mm. long, 2-20 mm. wide, the petiole 3-25 mm. long; sepals 4, 2.4-4.2 mm. long; petals 4-5 mm. long, fugacious; stamens 4; disk elevated, glabrous, prominently 4-lobed, the lobes opposite the petals; capsule short-cylindrical, 3.3-7.5 mm. long, 1.9-4.5 mm. thick, tardily and irregularly dehiscent, the pedicel 0.3-1.5 mm. long; seeds in several indistinct rows in each locule, about 0.7 mm. long, free; $n = 24$. *L. natans* Ell. and var. *rotundata* (Griseb.) Fern. & Griseb. Scattered in wet places as along streams and about ponds, n. of the Rio Grande Plains but very rare in n. Tex. and the Panhandle, July-Sept.; N.C. to Fla., Tex. and Okla., s. to cen. Mex. and W.I.; widely grown as an aquarium plant.

7. EPILOBIUM L. WILLOW-HERB

Perennial herbs of wet places, often flowering the first year; leaves opposite below, alternate above, denticulate or serrate; stipules absent; flowers actinomorphic, 4-merous, borne in the axils of reduced upper leaves; hypanthium well-developed; sepals not persistent in fruit; petals white to pink; stamens 8; stigma subclavate, undivided; fruit an elongate loculicidally dehiscent capsule; seeds numerous, with a coma, strongly papillose.

About 215 species of temperate and cold regions, extending into the tropics in the mountains and world-wide.

- 1. Leaves narrowly lanceolate, rugulose-veiny, with 30 to 75 teeth on each margin; plant mostly 5-10 dm. tall; petals pink; coma cinnamon-colored 1. *E. coloratum*.
- 1. Leaves elliptic to narrowly ovate, faintly veined, usually with about 20 to 30 teeth on each margin; plant 1-4 dm. tall; petals white to very pale-pink; coma white 2. *E. ciliatum*.

1. *Epilobium coloratum* Biehler. Perennial herb with sessile basal rosettes, 5-10 dm. tall, usually well-branched above, minutely strigulose above (especially along elevated lines decurrent from the margins of the petioles); hypanthium about 0.5 mm. long; sepals 1.5-3 mm. long; petals pink, 3-5 mm. long; capsule 3-4.5 cm. long; seeds about 1.5 mm. long, the coma cinnamon-colored. Rare in wet places, Hemphill and Wheeler cos. (High Plains), July-Oct.; Que. to S.D., s. to Ga., Ark. and n. Tex.; also Hisp.

2. *Epilobium ciliatum* Raf. Perennial herb with sessile leafy basal rosettes, 1-4 dm. tall, simple to well-branched, minutely strigulose above (especially along elevated lines decurrent from the margins of the petioles); hypanthium about 1 mm. long; sepals about 2 mm. long; petals white to pale-pink, about 3 mm. long; capsule 4-6 cm. long; seeds 1-1.5 mm. long, the coma white. *E. adenocaulon* Hausskn. var. *perplexans* Trel. Scattered in wet places in the Trans-Pecos, May-Sept.; Nfld. to B.C., s. to N.E., Pa., Wisc., w. Tex. and Calif.

Circaea quadrisulcata (Maxim.) Franch. & Sav. var. *canadensis* (L.) Hara, the "enchanter's nightshade," has been reported from Texas but we have seen no specimens. This is a delicate plant that may be distinguished from all other species of Onagraceae found in Texas by having 2-merous flowers, fruit indehiscent and bristly, and leaves opposite. It usually occurs in rich moist woodlands, thickets and ravines, and flowers in summer. It should be looked for in northeast Texas.

FAM. 135. HALORAGACEAE R. BR. WATER-MILFOIL FAMILY

Aquatic or paludal plants with the inconspicuous symmetrical perfect or unisexual flowers sessile in the axils of leaves or bracts; calyx tube (hypanthium) adherent to the ovary that consists of 3 (or 4) united carpels; styles or sessile stigmas distinct; limb of the calyx obsolete or very short in perfect or pistillate flowers; petals small or none; stamens 1 to 8; fruit indehiscent, 3- or 4-celled, with a single anatropous seed suspended from the summit of each cell.

About 120 species in 6 genera, cosmopolitan. The name is sometimes misspelled "Haloragidaceae."

- 1. Flower parts in threes; leaves alternate, the emersed ones amply foliaceous 1. *Proserpinaca*, p. 1136.
- 1. Flower parts in fours; leaves whorled or rarely partly opposite or alternate, the emersed ones much-reduced and mostly bractlike (sometimes enlarged in *M. heterophyllum*) 2. *Myriophyllum*, p. 1137.

1. PROSERPINACA L. MERMAID-WEED

Low herbaceous perennials with simple or sparsely branched stems that are creeping and rooting at the rhizomatous base; leaves alternate, pinnately dissected or the upper ones lanceolate and serrate, those on the same plant uniform or of both extreme types and intermediate forms; flowers sessile and solitary in the leaf axils, perfect; calyx 3-parted; corolla wanting; stamens 3; pistil 3-angled, with 3 stigmas; fruit nutlike, 3-angled, 3-celled, 3-seeded.

Several species in North America.

- 1. Upper leaves lanceolate, serrate 1. *P. palustris*.
- 1. Upper leaves like the lower ones, pinnately divided ... 2. *P. pectinata*.

1. *Proserpinaca palustris* L. Plant repent and rooting along the stems at base; stems ascending or suberect, occasionally trailing up into shrubs, to 1 m. or more long, the base submersed, the summit becoming emersed; submersed leaves rufescent, sessile, finely pinnatifid, to 6 cm. long, with 8 to 14 linear-filiform divisions on each side, the divisions to 3 cm. long, commonly bearing minute black axillary spicules, the median portion linear and about 1 mm. wide; amphibious leaves petioled, pinnatisect, to 7 cm. long, lanceolate, with the lanceolate middle portion to 1 cm. broad; emersed leaves lanceolate to oblanceolate, to 85 mm. long and 15 mm. wide, serrate; flowers in leaf axils of only the serrate leaves, solitary or in clusters of 2 to 5, subtended by minute lanceolate serrate bracts; calyx tube 3-angled, its ovate to deltoid lobes obtuse to acute; petals rudimentary; fruit trigonous-urceolate or pyramidal. In shallow water, about springs, in ditches and along shores of streams and lakes in e. Tex., spring-summer; from e. Can., s. to Ga. and Tex.

Our plant belongs to var. *amblyogona* Fern., characterized by having the angles of the fruits rounded or nearly obsolete.

2. *Proserpinaca pectinata* Lam. Stem very slender, repent, with an ascending rufescent summit to 3 dm. high; leaves all deeply pinnatifid, ovate-elliptic in outline, to 25 mm. long, with a linear median portion about 1 mm. wide and 4 to 9 slender rather firm divisions (to 7.5 mm. long) on each side, sometimes bearing minute black spicules; flowers solitary or rarely in twos or threes in the middle and upper leaf axils; calyx lobes acuminate; fruit urceolate, with rounded or obtuse angles, 3-4 mm. long, 2-3 mm. broad. In peaty soils of swamps and savannahs and in shallow water, rare in s.e. Tex., spring-summer; mostly in the Coastal Plain from N.S. and s.w. Me., s. to Tenn., Fla. and Tex.

2. MYRIOPHYLLUM L.

WATER-MILFOIL

Perennial aquatics; stems mostly elongated; leaves usually whorled (in ours), the submersed ones pinnately parted into capillary divisions; flowers unisexual and perfect on the same plant, small, sessile, chiefly in the axils of the upper leaves or bracts, usually above water in summer, the uppermost ones staminate; calyx of the staminate flowers 4-parted, of the pistillate flowers 4-toothed; petals 4 or none; stamens 4 or 8; stigmas 4, recurved; fruit nutlike, 4-celled, deeply 4-lobed.

About 45 species, cosmopolitan.

1. Leaf whorls on middle and lower parts of stem mostly 1 cm. or more apart (2)
1. Leaf whorls on middle and lower parts of stem usually much less than 1 cm. apart (3)
- 2(1). Leaf divisions filiform, typically 6 mm. or more long; flowers borne in whorls on a slender terminal spike, mostly longer than the subtending bract 1. *M. spicatum*.
2. Leaf divisions stoutish, mostly less than 6 mm. long; flowers borne in clusters in the axils of leaves 2. *M. brasiliense*.
- 3(1). Floral bracts pinnately dissected or lobed 3. *M. verticillatum*.
3. Floral bracts entire or only toothed (4)
- 4(3). Leaves mostly all in definite whorls; submersed leaves with 5 to 10 capillary divisions on each side; bracteoles ovate to lanceolate, acuminate; carpels with 2 smoothish dorsal ridges 4. *M. heterophyllum*.
4. Leaves whorled, subverticillate, opposite or alternate on the same plant; submersed leaves with about 5 capillary divisions on each side; bracteoles obtusely triangular; carpels with 2 prominently tuberculate dorsal ridges 5. *M. pinnatum*.

1. *Myriophyllum spicatum* L. Stems simple or branched, purplish, becoming pinkish or whitish upon drying; leaves whorled, in threes or fours, to about 3 cm. long, broadly oval to elliptic in outline, with 6 to 11 capillary usually flaccid divisions on each side, the divisions to 2 cm. long; spikes almost naked, to 1 dm. long, with verticillate flowers, the lower flowers pistillate, the upper flowers staminate; bracts rarely equalling the fruit,

spatulate-obovate to oblong-cochleariform, the lower bracts serrate, the upper bracts entire; bracteoles ovate, entire, to 1 mm. long; petals oblong-obovate, concave, about 2.5 mm. long; anthers 8, oblong, to 1.8 mm. long; fruits subglobose, very slenderly 4-sulcate, 2.3-3 mm. long, the carpels rounded on the back and smooth or rugulose. In ponds, tanks, pools, lakes and quiet streams, often calcareous or somewhat brackish, mainly through cen. Tex. from e. to w., also in the Panhandle, Apr.-Sept.; from s.e. Lab. to Alas., s. to W.Va., Tex., Ariz. and s. Calif.

Our plants are usually referred to var. *exalbescens* (Fern.) Jeps. (*M. exalbescens* Fern.).

2. *Myriophyllum brasiliense* Camb. PARROT'S-FEATHER, WATER-FEATHER. Plants pallid or light-green, with the upper part emersed or trailing on mud or seepage and erect-ascending; stems simple or sparsely branched; leaves all whorled, oblong in outline, stiffish, 2-5 cm. long, puberulent when young, glabrous with age, dissected into 10 or more pectinately arranged linear-filiform divisions on each side, the upper divisions 3-6 mm. long, the lower divisions much-reduced; bracteoles filiform, 2- or 3-cleft; flowers unisexual, in the axils of the leaves; pistillate flowers about 1.5 mm. long, conspicuous as a tuft of white or pinkish plumose stigma-lobes; staminate flowers not seen; fruit 1.5-2 mm. long, minutely glandular. *M. proserpinacoides* Gill. Widely scattered in ponds, ditches, streams and on seepage slopes, mainly on the Edwards Plateau and in e. Tex., Mar.-May; nat. to S.A., tending to escape from cult. and persistent in s. U.S.

3. *Myriophyllum verticillatum* L. Stems simple or with few elongate branches to 25 dm. long, in autumn producing crowded winter-buds 1-2 cm. long; leaves in fours and fives; submersed leaves to 45 mm. long, with 9 to 13 opposite or alternate pairs of capillary flaccid divisions to 28 mm. long; emersed leaves and bracts smaller and with coarser divisions or merely pectinate-pinnate; flowers in whorls of 4 to 6, perfect or the lower ones pistillate and the upper staminate; bracteoles palmately 7-lobed, about 0.5 mm. long; petals (merely rudiments in pistillate flowers) spoon-shaped, obtuse, about 2.5 mm. long; anthers 8 or 4, about 2 mm. long; fruit subglobose, 2-2.5 mm. long, deeply 4-furrowed, the brown smooth or somewhat tuberculate (in ours) carpels rounded on back. In lakes in n.e. Tex., Apr.-June; a highly variable circumpolar species that occurs in N.A. from Nfld. to B.C., s. to Ut. and n.e. Tex.

Plants referred here are typical in regard to leaves and floral bracts, but their fruits are atypical in that they closely resemble those of *M. heterophyllum*. These plants may eventually be found to represent a completely new entity.

4. *Myriophyllum heterophyllum* Michx. Stems rather stout; leaves whorled, in fours to sixes, the submersed pinnate leaves 2-5 cm. long and with 7 to 10 flaccid capillary divisions on each side, the divisions to about 2 cm. long, the amphibious leaves pinnatisect; emersed leaves and bracts firm, lanceolate or spatulate-lanceolate to elliptic, entire or serrate, to 3 cm. long and 1 cm. wide; spikes emersed, to 4 dm. long, usually much shorter; flowers in whorls of 4 to 6, perfect or with the lower pistillate and the upper staminate; bracteoles ovate, acuminate, serrate, 1-1.3 mm. long, 0.5-0.7 mm. wide; petals (of staminate flowers) acutish, 1.5-3 mm. long; anthers 4, to 2.5 mm. long; fruit subglobose, 1-1.5 mm. long and wide, minutely papillose, with the carpels 2-ridged on the back but rounded on the sides and prominently beaked. In ponds, lakes and streams, mainly on the Edwards Plateau and in s.e. Tex., Apr.-Aug.; from Fla. to Tex. and N.M., n. to N.D., Ont. and s.w. Que.

A large-bracted form of this species occurs in southeast Texas.

5. *Myriophyllum pinnatum* (Walt.) B.S.P. GREEN PARROT'S-FEATHER. Plant variable, either submersed or essentially terrestrial; stems rooting in mud and freely branched or becoming much-elongated when growing in water; leaves in whorls of 3 to 5 or subverticillate or commonly scattered, to about 3 cm. long, the submersed leaves with about 5 short remote capillary divisions on each side; emersed leaves linear to oblanceolate, pectinate or sharply serrate, to 2 cm. long; flowers in the axils of the emersed leaves, perfect or unisexual; bracteoles bluntly triangular, about 1 mm. long; petals purplish, 1.5-2 mm. long, rounded above, with a short claw; anthers 4, about 1 mm. long; fruit pale, ovoid, 1.3-1.8 mm. long, the carpels with flat sides and 2 tuberculate dorsal ridges. *M. scabratum* Michx. In swamp forests, on muddy shores or in shallow waters in e. and s.e. Tex., Mar.-June; from Fla. to Tex., n. to s. N.E., W.Va., Ky., Ill. and Ia.

FAM. 136. ARALIACEAE JUSS.

GINSENG FAMILY

Herbs, shrubs or trees with usually alternate compound or decomposed leaves and stipules; flowers regular or nearly so, epigynous, usually perfect, 4- or 5-merous; calyx small, its limb truncate to denticulate; petals usually distinct, not inflexed, deciduous at maturity; stamens inserted on disk within the calyx, alternate with the petals; anthers short, longitudinally dehiscent; ovary inferior, several-celled, with a solitary anatropous ovule suspended in each cell; styles as many as the cells of the ovary, distinct or more or less connate; fruit a 5-celled berry.

About 700 species in about 55 genera, most abundant in tropics but widespread. Especially in east Texas, *Hedera helix* L. (English ivy), the cultivated root-climber, persists about old homesteads and occasionally spreads to woodlands and glades. Its leaves are dimorphic—those on the climbing shoots lobed and sometimes mosaic, those of the fertile, freely projecting shoots unlobed.

I. ARALIA L.

Plants perennial, often with spicy-aromatic roots; flowers small, regular, polygamous, in umbels that form terminal panicles; petals and stamens each 5; ovary 5-celled; fruit a 5-seeded berry, tipped by the persistent style.

About 35 species in Asia and North America.

1. Trees or sometimes shrubs; stem and leaf stalks prickly; umbels numerous, in a large broad panicle 1. *A. spinosa*.
1. Herbs without prickles; umbels in a racemose panicle .. 2. *A. racemosa*.

1. *Aralia spinosa* L. HERCULES'-CLUB, DEVIL'S-WALKING-STICK, ANGELICA-TREE. Shrub or tree to 12 m. tall or more, the stout trunk to 3 dm. in diameter; leaves to 1 m. long or more; leaflets firm, ovate to broadly elliptic, broadly rounded to cuneate at base, acute to acuminate at apex, to 1 dm. long and 6 cm. wide, serrulate to serrate, pale on lower surface; umbels in a large compound panicle; peduncles and pedicels copiously pilose; fruit black, about 6 mm. in diameter. In woodlands, mostly along streams, in e. Tex., May-June; from Fla. to Tex., n. to N.J., Pa., w. N.Y., O., Ind., s. Ill. and Ia.

2. *Aralia racemosa* L. AMERICAN SPIKENARD. Herb to 2 m. tall or occasionally more, prickleless, widely branched; leaves wide-spreading, to about 8 dm. long; leaflets ovate to ovate-elliptic, obliquely cordate at base, long-acuminate at apex, to 17 cm. long and 12 cm. wide, usually much smaller, doubly serrate, slightly downy; umbels racemose-paniculate; peduncles and pedicels copiously puberulent; styles united at base; fruit dark-purple, about 5 mm. in diameter. *A. bicrenata* Woot. & Standl. In rich woods and thickets in high mts. of the Trans-Pecos (collected once in fruit at base of "dome" on top of Mt. Livermore, Davis Mts., Sept. 21, 1935, L. C. Hinckley 405); from Que. w. to Man., s. to Ga., Tex., Ariz. and n. Mex.

FAM. 137. UMBELLIFERAE JUSS.¹⁴⁰

PARSLEY FAMILY

Primarily herbaceous plants, acaulescent or caulescent, annual, biennial or perennial, with commonly hollow stems; leaves alternate or rarely opposite or basal, compound or sometimes simple, usually much-incised or -divided, with usually sheathing petioles; flowers small, regular, in simple or compound umbels, or the umbels sometimes proliferous or capitate; rays sometimes subtended by bracts forming an involucre; umbellets usually subtended by bractlets forming an involucre; calyx tube wholly adnate to the ovary; calyx teeth usually obsolete or small; petals 5, usually with an inflexed tip; stamens 5, inserted on an epigynous disk; ovary inferior, bilocular; styles 2, sometimes swollen at the base, forming a stylopodium; fruit consisting of two mericarps united by their faces

¹⁴⁰ Contributed by Mildred E. Mathias and Lincoln Constance; cf. their earlier treatment in C. L. Lundell, *Flora of Texas* III:263-329. 1951.

(commissure), compressed or flattened dorsally (parallel to the commissure), laterally (at right angles to the commissure) or terete, each mericarp with 5 primary ribs, one down the back (dorsal rib), two on the edges near the commissure (lateral ribs) and two between the dorsal and lateral ribs (intermediate ribs) and rarely with secondary ribs, the ribs filiform to broadly winged and thin or corky; oil tubes obsolete or present in the intervals (spaces between the ribs) and on the commissural surface, rarely also in the pericarp; mericarps 1-seeded, splitting apart at maturity, usually suspended from the summit of a slender prolongation of the axis (carpophore).

A cosmopolitan family of worldwide distribution consisting of at least 200 genera and perhaps 3,000 species.

1. Flowers and fruits borne in compound umbels or bracteate heads (2)
1. Flowers and fruits borne in simple noncapitate umbels; leaves small and relatively simple (43)
- 2(1). Flowers and fruits (or some of them) pedicellate; fruits more or less evidently ribbed; calyx minute or obsolete (3)
2. Flowers and fruits sessile or subsessile in dense bracteate heads or headlike umbellets; fruits with obsolete ribs, crowned by the prominent and persistent calyx and densely beset with scales, tubercles or uncinatate prickles (42)
- 3(2). Fruits terete to somewhat compressed laterally, the ribs not prominently winged (4)
3. Fruits strongly flattened dorsally, some or all of the ribs broadly winged (34)
- 4(3). Fruits merely bristly-pubescent to glabrous (5)
4. Fruits armed with uncinatate or barbed bristles or prickles, or tuberculate, papillate or callous-toothed (31)
- 5(4). Fruits oblong to ellipsoid, less than twice as broad as long (6)
5. Fruits linear to oblong, more than twice as long as broad (26)
- 6(5). Petals subequal; pericarp corky or chartaceous, not hardened; oil tubes evident (7)
6. Outer petals usually radiant (cf. also *Sium*); pericarp very hard; oil tubes lacking (25)
- 7(6). Pericarp not corky-thickened; fruit ribs filiform to prominent, never corky (8)
7. Pericarp of some or all of the fruit ribs corky-thickened (18)
- 8(7). Perennials; leaflets not pinnately dissected; stylopodium lacking (9)
8. Annuals or biennials; leaflets usually pinnately dissected; stylopodium depressed-conic to conic (11)
- 9(8). Plants acaulescent; seed face deeply sulcate 1. *Tauschia*, p. 1143.
9. Plants caulescent, branching; seed face plane or slightly concave (10)
- 10(9). Leaflets serrate or dentate; involucre present; central flower of each umbellet fertile, sessile or subsessile 2. *Zizia*, p. 1143.
10. Leaflets entire; involucre lacking; central flower of each umbellet sterile, pedicellate 3. *Taenidia*, p. 1143.
- 11(8). Leaves entire, parallel-veined 14. *Bupleurum*, p. 1149.
11. Leaves pinnate to decompose, pinnately veined (12)
- 12(11). Involucre present (13)
12. Involucre lacking (14)
- 13(12). Fruit ribs plane; oil tubes solitary in the intervals; stems not spotted 15. *Ammi*, p. 1150.
13. Fruit ribs undulate, crenate; oil tubes very small, numerous, irregular; stems variously spotted 16. *Conium*, p. 1150.
- 14(12). Involucre lacking (cf. also *Ammoselinum* and *Spermolepis*) (15)
14. Involucre present (16)

- 15(14). Flowers yellow; carpophore divided to the base ..17. *Foeniculum*, p. 1151.
- 15. Flowers white; carpophore bifid or shallowly cleft ...18. *Apium*, p. 1151.
- 16(14). Slender erect biennials; pedicels numerous, subequal; flowers yellow or greenish-yellow, the petals with a narrower inflexed apex; carpophore divided to the middle or the base19. *Petroselinum*, p. 1152.
- 16. Low diffuse annuals; pedicels few, unequal; flowers white, the petals obtuse and plane; carpophore divided only at the apex (17)
- 17(16). Fruit ribs filiform, rounded, subequally spaced; plants glabrous27. *Spermolepis*, p. 1155.
- 17. Fruit ribs acute, the lateral of the two mericarps contiguous and appearing to form a single rib; plants roughened26. *Ammoselinum*, p. 1155.
- 18(7). Perennials; pericarp or at least some of the dorsal as well as the lateral fruit ribs corky-thickened (19)
- 18. Annuals; only the lateral fruit ribs corky-thickened (22)
- 19(18). Plants acaulescent or with few stem leaves, growing in dry rocky places in the mountains; flowers yellow; pedicels mostly less than 3 mm. long; fruit oblong, the ribs corky-winged 4. *Aletes*, p. 1144.
- 19. Plants caulescent, growing in wet places (swamps, marshes, along streams); flowers white; pedicels 2-15 mm. long; fruit orbicular to suborbicular, about as long as broad, the ribs not winged (20)
- 20(19). Fruit ribs obscure in the corky-thickened pericarp; plants stoloniferous 7. *Berula*, p. 1146.
- 20. Fruit ribs prominent, corky-thickened; plants not stoloniferous (21)
- 21(20). Involucre prominent; rays few; fruit ribs subequal in cross section 5. *Sium*, p. 1144.
- 21. Involucre inconspicuous or lacking; rays usually numerous; fruit ribs unequal in cross section 6. *Cicuta*, p. 1145.
- 22(18). Ultimate leaf divisions laciniate; bracts and bractlets equaling or exceeding the rays and pedicels, respectively; petal apex bilobed; carpophore divided to the base10. *Daucosma*, p. 1147.
- 22. Ultimate leaf divisions or leaves entire; bracts and bractlets shorter than the rays and pedicels, respectively; petal apex entire; carpophore bifid or divided about to the middle (23)
- 23(22). Leaves decompose with filiform divisions11. *Ptilimnium*, p. 1147.
- 23. Leaves entire, palmately parted or pinnate, with narrow elongated divisions (24)
- 24(23). Fruit prominently beaked; cauline leaves palmately parted; petals with a narrower inflexed apex12. *Cynosciadium*, p. 1148.
- 24. Fruit rounded at apex; leaves entire or pinnate; petal apex not inflexed13. *Limnosciadium*, p. 1148.
- 25(6). Basal leaves ternate-pinnately decompose, their divisions filiform; fruit conspicuously constricted to a narrow commissure, the mericarps separating readily .. 8. *Bifora*, p. 1146.
- 25. Basal leaves pinnately dissected, their divisions flabelliform; fruit not at all constricted at the commissure, the mericarps not separating readily 9. *Coriandrum*, p. 1146.
- 26(5). Fruits without secondary ribs (27)
- 26. Fruits with prominent corky or bristly secondary ribs (30)
- 27(26). Involucel lacking or inconspicuous; carpophore divided to the base; seed face plane21. *Cryptotaenia*, p. 1153.
- 27. Involucel conspicuous; carpophore bifid or 2-cleft above the middle; seed face sulcate (28)

- 28(27). Bractlets lobed or dissected; fruits with a long differentiated beak 23. *Scandix*, p. 1154.
28. Bractlets entire; fruits obtuse, acute or shortly beaked (29)
- 29(28). Annuals; fruits 4-8 mm. long, obtuse at base 20. *Chaerophyllum*, p. 1152.
29. Perennials; fruits 10-20 mm. long, acute or caudate at base 22. *Osmorhiza*, p. 1153.
- 30(26). Petals subequal; fruits glabrous, the primary ribs obscure; pedicels 1 mm. long or less 24. *Trepocarpus*, p. 1154.
30. Outer petals radiant; fruits setulose and bristly, the primary ribs filiform; pedicels 2-8 mm. long 25. *Cuminum*, p. 1154.
- 31(4). Mericarps flattened dorsally; secondary ribs prominently winged and armed with barbed or glochidiate prickles 29. *Daucus*, p. 1157.
31. Mericarps compressed laterally or terete; secondary ribs lacking or hidden by the prickles or tubercles occupying the intervals (32)
- 32(31). Fruit intervals beset with coarse prickles or tubercles, the lateral primary ribs displaced onto the commissure; petals with a narrow inflexed apex 28. *Torilis*, p. 1156.
32. Fruits finely tuberculate, papillate or callous-toothed; petals without an inflexed apex (33)
- 33(32). Fruit ribs filiform, rounded, subequally spaced; plants glabrous 27. *Spermolepis*, p. 1155.
33. Fruit ribs acute, the lateral of the two mericarps contiguous and appearing to form a single broad rib; plants roughened 26. *Ammoselinum*, p. 1155.
- 34(3). Lateral ribs and one or more of the dorsal broadly winged; plants usually acaulescent or subcaulescent, perennial (35)
34. Lateral ribs broadly winged, the dorsal very narrowly winged to obsolete (36)
- 35(34). Peduncles scaberulous at the summit; calyx teeth evident; seed face plane; plants caulescent or subcaulescent 31. *Pseudocymopterus*, p. 1160.
35. Peduncles glabrous; calyx teeth obsolete or inconspicuous; seed face concave to sulcate; plants acaulescent 30. *Cymopterus*, p. 1158.
- 36(34). Perennials or biennials (doubtful cases should be keyed under both alternatives) (37)
36. Annuals (40)
- 37(36). Plants from fascicled tubers; flowers white; stylopodium conical; lateral fruit wings nerved dorsally at the inner margin, the fruit thus appearing 5-ribbed 32. *Oxypolis*, p. 1160.
37. Plants from taproots; flowers yellow; stylopodium depressed or lacking; dorsal ribs of the fruit 3 (38)
- 38(37). Plants low, acaulescent; bractlets connate above the middle 35. *Lomatium*, p. 1162.
38. Plants tall, caulescent, branching; bractlets distinct or lacking (39)
- 39(38). Involucel present; lateral fruit wings corky-thickened; calyx teeth evident; stylopodium lacking 33. *Polytaenia*, p. 1161.
39. Involucel usually lacking; lateral fruit wings thin; calyx teeth obsolete; stylopodium present 34. *Pastinaca*, p. 1162.
- 40(36). Plants scaberulous; bracts and bractlets prominent, 3-cleft or ternate, reflexed .. 36. *Eurytaenia*, p. 1162.
40. Plants glabrous and glaucous; bracts and bractlets lacking or inconspicuous, entire, not prominently reflexed (41)
- 41(40). Leaves pinnately dissected, with filiform divisions; flowers yellow; lateral fruit wings thin 37. *Anethum*, p. 1163.
41. Leaves entire or palmately divided, with linear to linear-lanceolate divisions; flowers white; lateral fruit wings thick, corky 12. *Cynosciadium*, p. 1148.

- 42(2). Flowers in definite headlike umbellets arranged in irregular umbels; fruits with uncinat prickles38. *Sanicula*, p. 1163.
42. Flowers subtended by bractlets in dense bracteate heads; fruits scaly or tuberculate39. *Eryngium*, p. 1165.
- 43(1). Plants stellate-pubescent; leaves stipulate42. *Bowlesia*, p. 1169.
43. Plants glabrous or pubescent with simple trichomes; leaves exstipulate (44)
- 44(43). Involucre of 2 conspicuous bracts; fruit with 3 primary and 2 reticulated secondary dorsal ribs; petioles sheathing40. *Centella*, p. 1168.
44. Involucre multibracteate, inconspicuous; fruit without secondary ribs; petioles not sheathing41. *Hydrocotyle*, p. 1168.

1. TAUSCHIA SCHLECHT.

A genus of about 20 species of the highlands of Mexico and northern South America, and western United States.

1. *Tauschia texana* Gray. Acaulescent perennial from a taproot, 1-4 dm. high, glabrous throughout; leaves oblong, to 15 cm. long and 4 cm. wide, pinnate; leaflets sessile to petiolulate, ovate, distinct, the larger ones pinnately parted or lobed, the divisions cuneate; inflorescence of compound umbels; peduncles 1-4 dm. long; involucre lacking or of a single foliaceous bract; involucre of several linear to lanceolate connate bractlets, shorter than the flowers; fertile rays 5 to 8, unequal, 5-25 mm. long; flowers yellow, with pedicels 1-2 mm. long; calyx teeth minute; fruit oval, 3-4 mm. long, 2-3 mm. broad, slightly compressed laterally, glabrous, the ribs filiform; oil tubes 3 or 4 in the intervals and 4 on the commissure; seed face deeply sulcate. *Musenopsis texana* (Gray) Coult. & Rose. In alluvial thickets and wet woods in s. part of Blackland Prairies and in coastal region in Tex., Feb.-June; endemic.

2. ZIZIA KOCH

A genus of about 4 species, primarily of eastern United States and adjacent Canada, but extending to the Pacific Northwest.

1. *Zizia aurea* (L.) Koch. GOLDEN ALEXANDERS. Erect caulescent usually branching perennial from fascicled roots, 4-8 dm. high; basal leaves petiolate, ovate to orbicular, to 1 dm. long and 12 cm. wide, biternate or the middle leaflet pinnatifid; leaflets ovate to lanceolate, distinct, sharply serrate; cauline leaves like the basal, becoming narrowly lanceolate and confluent upwards; inflorescences of compound umbels; peduncles 5-15 cm. long; involucre lacking; involucre of a few inconspicuous linear acute bractlets 1-3 mm. long, shorter than or equaling the pedicels; rays 10 to 15, spreading-ascending, unequal, 1-3.5 cm. long; pedicels 2-3 mm. long; the central flower of each umbellet sessile or subsessile; flowers yellow; calyx teeth prominent; stylopodium lacking; fruit oblong-ovoid, 2-4 mm. long, 1.5-2 mm. broad, compressed laterally, the ribs filiform; oil tubes solitary in the intervals and 2 on the commissure; seed face slightly concave. In sandy woodlands and sandy-clay floodplains in the e. third of Tex., Apr.-Aug.; from e. Can., s. to Fla., w. to Sask., Mont. and Tex.

3. TAENIDIA DRUDE

A monotypic genus of the eastern and central United States and adjacent Canada.

1. *Taenidia integerrima* (L.) Drude. YELLOW PIMPERNEL. Plant perennial from taproots, erect, 3-8.5 dm. high, the slender stems branching and purplish toward the base; basal leaves ovate to obovate, 2- or 3-ternate or -pinnate, to 9 cm. long and wide; leaflets sessile, ovate to lanceolate, rounded to acute and shortly mucronulate at the apex, slightly decurrent to rounded at the base; cauline leaves like the basal, with wholly sheathing petioles; peduncles terminal and axillary, to 20 cm. long; umbels compound; involucre and involucre lacking; rays 15 to 20, 15-95 mm. long, spreading to ascending, unequal,

the central rays sterile and half the length of the fertile; flowers yellow, the calyx teeth obsolete, the stylopodium lacking; umbellets about 35-flowered, the central flowers sterile and short-pedicellate; fertile pedicels 7-12 mm. long; carpophore divided to the base; fruit oblong-oval, compressed laterally, glabrous, the filiform ribs unwinged; oil tubes several in the intervals and 4 on the commissure; seed face plane, 3-4 mm. long, 2-3 mm. broad. In rocky open woods, lowland woods and on bluffs in e. Tex., May-June; from e. Can., s. to Ga., w. to Minn., Kan., Ark. and Tex.

4. ALETES COULT. & ROSE

Plants low, caespitose, acaulescent or with few stem leaves, herbaceous, perennial from slender to stout elongated branching roots; leaves petiolate, pinnate or bipinnate to ternately decomposed, the short leaflets orbicular to filiform, distinct or confluent and often lobed and spinulose-dentate; inflorescence of compound umbels, the peduncles terminal; involucre usually lacking; involucrel subdimidiate, of connate or free bractlets; rays few to rather numerous, spreading to reflexed, the short pedicels spreading; flowers yellow, the deltoid-ovate calyx teeth usually conspicuous, the stylopodium lacking; carpophore divided to the base; fruit oblong to ovoid-oblong, slightly compressed laterally or subterete, glabrous, the ribs subequal, prominent and corky-winged or obscure; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane or concave.

A genus of 6 species, chiefly of southwestern United States.

1. Leaves 1- or 2-pinnate; leaflets lanceolate to orbicular . . . 1. *A. acaulis*.
1. Leaves ternately decomposed; leaflets filiform 2. *A. filifolius*.

1. *Aletes acaulis* (Torr.) Coult. & Rose. Plant acaulescent, 5-35 cm. high; leaves petiolate, oblong, to 1 dm. long and 4 cm. wide, 1- or 2-pinnate; leaflets lanceolate to orbicular, acute, confluent, pinnately lobed and spinulose-dentate, 4-10 mm. long, 5-15 mm. wide, sometimes puberulent on the veins and ciliate; peduncles 5-27 cm. long, longer than the leaves, occasionally puberulent at the base of the umbel; bractlets lanceolate to linear, acute, 2-3 mm. long, membranaceous and sometimes ciliate, connate at the base; rays 8 to 15, subequal, 5-30 mm. long, spreading to reflexed, sometimes puberulent; pedicels 1-2 mm. long; fruit oblong, 4-7 mm. long, about 2 mm. broad, the 2 or 3 dorsal and the lateral ribs corky-winged, the wings obtuse; an accessory oil tube in the apex of each rib. In rocky ravines and canyons, and on cliffs, above 5,000 ft. alt. in the mts. of the Trans-Pecos, Apr.-Aug.; in the Rocky Mts. of Colo. and N.M., s. to Tex., Ariz. and Chih.

2. *Aletes filifolius* Math., Const. & Theobald. Plant 2-4 dm. tall, caespitose from a branching woody root crowned with old leaf sheaths, acaulescent or with 1 or 2 stem leaves; leaves petiolate, broadly ovate; blades 2.5-20 cm. long, 2.5-14 cm. broad, ternately pinnately decomposed, the filiform ultimate segments 5-56 mm. long and 1-2 mm. broad; peduncles 7-38 cm. long, longer than the leaves, scaberulent at the base of the umbel; bractlets of involucrel linear to lanceolate, 2-5 mm. long, free to slightly connate at base, rarely reduced to one; rays 4 to 21, 6-20 mm. long, spreading-ascending; pedicels 1.5-5 mm. long; fruits oblong to ovoid-oblong, 2.4-8 mm. long, 1.8-4 mm. broad, the dorsal and lateral ribs prominent and corky-winged; wings pale-yellow to white, rarely inconspicuous; oil tubes large. Usually in rocky places in mts. of the Trans-Pecos, May-Aug.; endemic.

5. SIUM L. WATER-PARSNIP

A chiefly circumboreal genus, containing perhaps a dozen species.

1. *Sium suave* Walt. Plant stout, perennial, 6-12 dm. high, the corrugated branching stems arising from fusiform fascicled roots; leaves oblong to ovate, to 25 cm. long and 18 cm. wide, pinnate or rarely simple and serrate and incised, the submerged leaves usually decomposed; leaflets lanceolate to linear, 1-4 cm. long, 3-15 mm. wide, distinct, remote, the lower frequently obsolete, finely to coarsely serrate or incised; peduncles stout, 4-10 cm. long; involucre of 6 to 10 lanceolate or linear bracts 3-15 mm. long that

are acute, entire or incised, unequal and reflexed; involucre of 4 to 8 linear-lanceolate bractlets 1-3 mm. long, acute, entire; rays 10 to 20, slender, subequal, 1.5-3 cm. long; pedicels 3-5 mm. long; flowers white; calyx teeth minute, the stylopodium usually depressed; the halves of the carpophore adnate to the mericarps; fruit oval to orbicular, 2-3 mm. long, 2-2.5 mm. broad, slightly compressed laterally and constricted at the commissure, the ribs prominent, subequal, corky; oil tubes 1 to 3 in the intervals and 2 to 6 on the commissure, the seed face plane; a prominent group of strengthening cells in the apex of each rib. *Sium cicutaefolium* Schrank. In swamps and marshes and other wet places in s.-cen. Tex., May-Sept.; from Nfld., s. to S.C., w. to B.C. and Calif.

This species, which superficially resembles the deadly poisonous *Cicuta maculata*, may be distinguished from that species by its simply pinnate leaves and corrugated stems.

6. CICUTA L. WATER-HEMLOCK

Plants stout or slender, erect, caulescent, branching, herbaceous, perennial from a tuberous base bearing fibrous to fleshy-tuberous roots; leaves 1- to 3-pinnate or ternate-pinnate, the leaflets serrate to incised; inflorescence of compound umbels, the peduncles terminal and lateral, exceeding the leaves; involucre usually lacking; involucre of several narrow bractlets or rarely lacking; rays numerous, slender, spreading-ascending, the slender pedicels spreading; flowers white or greenish, the calyx teeth evident, the stylopodium depressed or low-conic; carpophore divided to the base, deciduous; fruit oval or ovoid to orbicular or ellipsoid, compressed laterally and constricted at the commissure or not constricted, the usually prominent ribs obtuse and corky; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane to slightly concave.

A circumboreal genus of about 8 species, one Eurasian, the others American. These plants, abundant in wet places, are notable for being *virulently poisonous*.

- 1. Fruits constricted at the commissure, the lateral ribs about equaling the dorsals in surface display; oil tubes very large; seed conspicuously oily, evidently channeled under the tubes1. *C. mexicana*.
- 1. Fruits not constricted at the commissure, the lateral ribs much broader than the dorsals in surface display; oil tubes only moderately large; seed not conspicuously oily, scarcely sulcate under the tubes2. *C. maculata*.

1. *Cicuta mexicana* Coult. & Rose. Plant stout, from a usually erect tuberous base bearing fleshy-tuberous roots, 9-24 dm. high; leaves ovate-deltoid, to 35 cm. long, ternate-pinnate or 2-pinnate; leaflets oblong-lanceolate, 4-10 cm. long, 1.5-4 cm. wide, finely to coarsely serrate, thick and strongly reticulate; peduncles 5-9 cm. long; involucre of 1 to several narrow bracts or lacking; involucre of several lanceolate to linear acute scarious-margined bractlets 2-5 mm. long, shorter than or equaling the flowers; rays very unequal, 2-8 cm. long; pedicels 3-15 mm. long; fruit orbicular or nearly so, 2-3 mm. long, constricted at the commissure, the low ribs broad and corky, subequal in surface display, broader than the intervals, the lateral ribs of the two carpels separated by an interval; oil tubes large; seed very oily, deeply sulcate under the tubes, the face plane or concave. *Cicuta Curtissii* Coult. & Rose. In swamps and other wet places in e. third of Tex. and along the coast, May-Oct.; from Middle Atl. U.S., s. to the Isthmus of Tehuantepec, Mex.

2. *Cicuta maculata* L. SPOTTED COWBANE, BEAVER-POISON. Plant stout, from a usually erect tuberous base bearing fleshy or fleshy-tuberous roots as well as often some fibrous roots above (all of which are deadly poisonous to man and animals), 6-18 dm. high; leaves ovate, to 3 dm. long and 26 cm. wide, 2- to 3-pinnate; leaflets lanceolate, acute to acuminate, 2-12 cm. long, 5-30 mm. wide, sharply and coarsely serrate or incised; peduncles 2-10 cm. long; involucre of a few narrow bracts or lacking; involucre of several linear to lanceolate acute to acuminate scarious-margined bractlets, 2-5 mm. long, entire or denticulate, shorter than the flowers; rays unequal to subequal, 1.5-6 cm. long; pedicels 3-10 mm. long; fruit oval to orbicular, 2-4 mm. long, 2-3 mm. broad, not constricted at the commissure, the ribs low and corky, about as broad as the usually reddish-brown intervals, the lateral ribs of the two carpels closely contiguous and forming a broad flat band and with much greater surface display than the dorsal ribs; oil tubes

moderately large; seed not very oily, not sulcate or only very shallowly so under the tubes, the face plane to concave. Along streams, in marshes and other wet places in e., cen. and n. Tex., May-Sept.; throughout e. U.S. and Can., s. to Ga. and La., w. to the Dakotas and Tex.

7. BERULA HOFFM. WATER-PARSNIP

A genus of two species, one circumboreal, the other African.

1. *Berula erecta* (Huds.) Cov. Plants slender, erect, stoloniferous, perennial from fascicled fibrous roots, 2-8 dm. high; leaves narrowly oblong, to 3 dm. long and 1 dm. wide, pinnate; leaflets oblong, distinct, subentire to serrate or lobed, those of the submerged leaves decomposed; cauline leaves reduced, the leaflets often linear; inflorescence of compound umbels; peduncles terminal and axillary, 2-8 cm. long; involucre of 6 to 8 linear to lanceolate unequal foliaceous scarious-margined entire to incisely toothed bracts, 5-15 mm. long; involucl of 4 to 8 linear to lanceolate acute entire bractlets, 1-5 mm. long; rays 6 to 15, subequal, spreading-ascending, 1-2 cm. long; pedicels 2-5 mm. long; flowers white, the minute calyx teeth subulate, the stylopodium conic; carpophore divided to the base, the halves wholly adnate to the mericarps; fruit oval to orbicular, 1.5-2 mm. long, compressed laterally, the filiform ribs obscure in the thick corky pericarp; oil tubes numerous about the seed, the seed face plane; strengthening cells lacking. *B. pusilla* (Nutt.) Fern. In wet places in the Blackland Prairies, Plains Country and Trans-Pecos, May-Nov.; throughout the U.S. and adj. Can., s. to Guat.; also Eur. and the Medit. region.

8. BIFORA HOFFM.

A genus of 4 species, three in the Mediterranean region and the Caucasus, the other American.

1. *Bifora americana* (DC.) Benth. & Hook. Plant slender, branching, annual with a slender taproot, 25-75 cm. high, glabrous or somewhat scaberulous; leaves ovate-oblong, to 5 cm. long and 3 cm. wide, ternate-pinnately decomposed, the ultimate divisions filiform, distinct, obtuse, glabrous; inflorescence of compound umbels; peduncles slightly scaberulous at the summit, terminal and axillary; involucre of a few small entire to pinnatifid linear bracts; involucl of bractlets like the bracts, shorter than or equaling the flowers; rays 4 to 14, spreading-ascending, 15-35 mm. long; pedicels about 2 mm. long; flowers white, the outer petals frequently radiant, the calyx teeth evident to obsolete, the stylopodium low-conic; carpophore divided to the base; fruit subglobose and didymous, 2-3 mm. long, 4-5 mm. broad, compressed laterally and constricted at the commissure, glabrous, the ribs filiform, the pericarp very thin and hard; oil tubes lacking, the seed face deeply and broadly concave. Weedy in prairies, fields and on rocky hills, mostly in n. and cen. Tex., Apr.-June; in Tex. and adj. Okla. and Ark.

9. CORIANDRUM L. CORIANDER

A genus of three species of the Mediterranean region.

1. *Coriandrum sativum* L. Plant slender, erect, caulescent, herbaceous, annual, from slender taproots, 2-7 dm. high; basal leaves ovate, to 15 cm. long and 10 cm. wide, simple and ternately or pinnately lobed or pinnate; leaflets flabelliform, cuneate at the base, variously toothed or incised; cauline leaves pinnately dissected, the ultimate divisions of some of the upper leaves linear to filiform, obtuse, entire; inflorescence of compound umbels; peduncles terminal and lateral, 3-10 cm. long, occasionally abortive; involucre lacking or of a single bract; involucl dimidiate, of a few linear bractlets 2-4 mm. long; rays 2 to 8, 1-2.5 cm. long; pedicels 2-5 mm. long; petals white or rose, the outer ones radiant; calyx teeth ovate-lanceolate, unequal, the outer ones to 1 mm. long, the stylopodium conic; carpophore divided to the base; fruit orbicular, terete, 1.5-5 mm. in diameter, with a hard pericarp, glabrous, the mericarps boat-shaped, not separating

readily at maturity, the primary ribs filiform, the secondary filiform or obscure; oil tubes lacking, the seed face concave. Sporadically escaped from cult. at various places in s. and cen. Tex., Apr.-July; nat. of the Old World, widely introd. in W. Hemis.

10. DAUCOSMA ENGELM. & GRAY

A monotypic genus, apparently related to *Ptilimnium*.

1. *Daucosma laciniatum* Gray. Plant slender, erect, caulescent, branching, herbaceous, annual, 9-12 dm. high, from slender taproots; leaves triangular-ovate, ternate-pinnately dissected, to 10 cm. long and 11 cm. wide, the ultimate divisions lanceolate, laciniate; inflorescence of compound umbels; peduncles terminal and axillary, 1.5-10 cm. long, callous-roughened above, exceeding the leaves; involucre of conspicuously pinnately parted bracts equaling or longer than the rays; involucre of bractlets like the bracts, equaling or longer than the pedicels; rays 14 to 17, 2-5 cm. long, spreading-ascending; pedicels about 20, spreading, 3-9 mm. long; flowers white, the conspicuous calyx teeth subulate, the stylopodium conic; carpophore divided to the base; fruit ovoid-oblong, 3-4 mm. long, about 2 mm. broad, compressed laterally, glabrous, the dorsal ribs broad and low, the lateral prominent, forming an acute ridge around the fruit; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane. *Ptilimnium laciniatum* (Engelm. & Gray) O. Ktze. Moist places in s. Blackland Prairies and on the Edwards Plateau, May-Aug.; endemic.

11. PTILIMNIUM RAF. MOCK BISHOP'S-WEED

Plants slender, erect, caulescent, branching, herbaceous, annual, from a fascicle of fibrous roots; leaves pinnately decompose with filiform ultimate divisions or the leaves reduced to fistulose sheathing petioles; inflorescence of compound umbels, the peduncles terminal and axillary; involucre of entire or pinnatifid bracts; involucre of entire bractlets; rays few to numerous, spreading-ascending to spreading, the pedicels spreading; flowers white, rarely pink, the calyx teeth small to prominent, the stylopodium conic; carpophore bifid at the apex or cleft to the middle; fruit ovoid to suborbicular, compressed laterally, the dorsal ribs filiform, rounded or acute, the lateral ribs small to corky-winged, forming a band around the fruit; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane.

A genus of five species of southeastern and south-central United States.

- 1. Leaf segments crowded, appearing verticillate; styles 1.5-3 mm. long; plant robust, 8-15 dm. high 2. *P. costatum*.
- 1. Leaf segments not crowded; styles 0.2-1.5 mm. long; plants 2-8 dm. high (2)
- 2(1). Leaf segments usually 3 at a node on the rachis; bracts usually 3-cleft; styles 0.2-0.5 mm. long, not strongly recurved 1. *P. capillaceum*.
- 2. Leaf segments usually 2 at a node on the rachis; bracts usually entire; styles 0.5-1.5 mm. long, strongly recurved 3. *P. Nuttallii*.

1. *Ptilimnium capillaceum* (Michx.) Raf. Plant 1-8.5 dm. high; leaves verticillate at the nodes, polymorphic in submerged forms, broadly oblong, to 13 cm. long and 4 cm. wide, pinnately decompose, the segments usually filiform, 3 at a node on the rachis; peduncles 2.5-10.5 cm. long, exceeding the leaves; involucre of several pinnately cleft or rarely entire bracts about one half as long as the rays; involucre of filiform bractlets shorter than the pedicels; rays 4 to 20, spreading, subequal, 1-3.5 cm. long; pedicels 5 to 20, 3-12 (usually 4-6) mm. long; calyx teeth small, persistent; styles 0.2-0.5 mm. long, not strongly recurved; fruit broadly ovoid, 1.5-3 mm. long, 1.5-2 mm. broad, the lateral ribs conspicuous. In wet places in the e. half of Tex., May-Aug.; from Mass., s. to Fla., w. to Mo., Kan. and Tex.

2. *Ptilimnium costatum* (Ell.) Raf. Plant 8-15 dm. high; leaves oblong, to 14 cm. long and 7 cm. wide, pinnately decompose, the ultimate divisions filiform, crowded, appearing verticillate; peduncles 7-14 cm. long, exceeding the leaves; involucre of very short usually entire bracts; involucre of usually entire bractlets shorter than the pedicels;

rays about 20, spreading, subequal, 1.5-4 cm. long; pedicels 15 to 20, spreading, 4-5 mm. long; calyx teeth conspicuous, deltoid, acute to subacuminate, persistent; styles 1.5-3 mm. long; fruit ovoid, 2-4 mm. long, 2-3 mm. broad. In swamps and other wet places in the e. half of Tex., June-Oct.; from N.C. to Ga., w. to Mo. and Tex.

3. *Ptilimnium Nuttallii* (DC.) Britt. Plant 3-6 dm. high; leaves oblong, to 9 cm. long and 4 cm. wide, pinnately decomposed, the ultimate divisions filiform, usually 2 at a node on the rachis; peduncles 4-12 cm. long; involucre of filiform mostly entire bracts much shorter than the rays; involucre of filiform entire bractlets shorter than the pedicels; rays 25 to 30, spreading, subequal, 15-35 mm. long; pedicels 25 to 30, spreading, 3-8 mm. long; calyx teeth conspicuous, linear-lanceolate, persistent; styles 0.5-1.5 mm. long, strongly recurved; fruit ovoid, 1-1.5 mm. long, 1 mm. broad, the lateral ribs inconspicuous, only slightly corky-thickened. In moist sandy soil, in prairies and other moist places in the e. half of Tex., Apr.-July; from Ill., s. to La. and w. to Kan. and Tex.

Plants described as *P. texense* Coult. & Rose, formerly referred to *P. costatum* by Mathias and Constance, are considered by Easterly (Brittonia 9: 144. 1957) to be of possible hybrid origin, combining the fruit characteristics of *P. Nuttallii* with the vegetative characteristics of *P. capillaceum*. The center of distribution apparently is in Robertson County and the taxon is found through a large area of eastern Texas in acid bogs and marsh land, flowering July to August.

12. CYNOSCIADIUM DC.

A monotypic genus.

1. *Cynosciadium digitatum* DC. Plant slender, erect, caulescent, herbaceous, annual, 15 cm. high, dichotomously branching in the inflorescence, from a fascicle of fibrous roots; basal leaves linear-lanceolate, tapering at base, acute at apex, entire and septate, to 12 cm. long and 5 mm. wide; cauline leaves 3 to 5, palmately parted with narrow elongate divisions; inflorescence of compound umbels, the peduncles (1.5-8 cm. long) axillary and terminal; involucre and involucre usually lacking or the latter of a few linear bractlets shorter than the pedicels; rays 2 to 10, unequal, slender, spreading-ascending, 1-4 cm. long or some umbellets frequently sessile or proliferating; pedicels 2 to 11, 5-20 mm. long, spreading-ascending; flowers white, the prominent calyx teeth ovate, the stylopodium conic; carpophore bifid at the apex; fruit ovoid, 2-3 mm. long, 1.5-2.5 mm. broad, glabrous, prominently beaked at the apex, rounded at the base, slightly compressed laterally or nearly terete, the narrow dorsal ribs prominent, the lateral ribs broadly corky-winged; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane. In wet places in the Coastal and Blackland prairies of Tex., May-July; from Tex. n. to s. Mo. and e. to La.

13. LIMNOSCIADIUM MATH. & CONST.

Plants low and diffuse to erect, slender, caulescent, branching, herbaceous, annual, from a fascicle of fibrous roots; leaves entire and septate or pinnate with narrow elongate divisions; inflorescence dichotomously branching, of compound umbels, the peduncles axillary and terminal or some umbels sessile; involucre lacking or of a few narrow entire bracts; involucre of several narrow entire bractlets shorter than the pedicels; rays few, unequal, spreading-ascending; flowers white, the prominent calyx teeth ovate-lanceolate, the stylopodium conic; carpophore shortly bifid at the apex; fruit oblong-oval to orbicular, rounded at apex and base, slightly compressed dorsally, glabrous, the dorsal ribs filiform, the lateral broadly corky-winged; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane.

A genus of 2 species, inhabiting wet places in the south-central United States.

1. Plant erect or assurgent; calyx teeth 0.5 mm. or less long, attached well below and shorter than the stylopodium; fruit oblong-oval, 2-4 mm. long, 1-2 mm. broad . . .
 1. *L. pinnatum*.

1. Plant low and diffuse; calyx teeth to 1.5 mm. long, attached shortly below and equaling the stylopodium; fruit oval to orbicular, 2-3 mm. long, 2 mm. broad 2. *L. pumilum*.

1. *Limnoscium pinnatum* (DC.) Math. & Const. Plant erect or assurgent, 1-8 dm. high; basal leaves linear-lanceolate, acute at the apex, tapering at the base, to 20 cm. long and 25 mm. wide, entire and septate or pinnate, the terminal division elongate; cauline leaves pinnate or the lowest and uppermost entire, with 2 to 9 linear to linear-lanceolate divisions, acute at both ends; peduncles 1-8 cm. long or some umbels sessile; involucre of several linear or linear-lanceolate reflexed bracts 2-6 mm. long; involucre of several linear bractlets 1-5 mm. long; rays 3 to 12, slender, 5-35 mm. long; pedicels 4 to 20, 2-8 mm. long; calyx teeth 0.5 mm. long or less, attached well below and shorter than the stylopodium; fruit oblong-oval, 2-4 mm. long, 1-2 mm. broad, the dorsal ribs low, the lateral corky wings slightly broader. *Cynosciadium pinnatum* DC. In wet places in the e. half of Tex., s. to the Rio Grande Plains, May-June; from Tex. and La., n. to Ill. and Kan.

2. *Limnoscium pumilum* (Engelm. & Gray) Math. & Const. Plant low and diffuse, 5-40 cm. high or long; basal leaves lanceolate to linear-lanceolate, acute at the apex, tapering at the base, to 8 cm. long and 8 mm. wide, entire and septate or pinnate, the terminal division elongate; cauline leaves pinnate or entire, with 3 to 7 filiform to lanceolate divisions, acute at the apex, tapering at the base; peduncles 5-75 mm. long or frequently some umbels sessile; involucre lacking or of a few minute bracts; involucre of several linear to linear-lanceolate bractlets 2-4 mm. long; rays 3 to 8, slender, 1-5 cm. long; pedicels several, 2-4 mm. long; calyx teeth to 1.5 mm. long, attached shortly below and about equaling the stylopodium; fruit oval to orbicular, 2-3 mm. long, 2 mm. broad, the dorsal ribs filiform, the lateral wings broad and corky. *Cynosciadium pumilum* (Engelm. & Gray) Coult. & Rose. In wet places in cen. and s. Tex., Mar.-June; endemic.

14. BUPLEURUM L. THOROUGHWAX

Plants low or slender, erect or spreading, herbaceous or woody at base, caulescent or rarely acaulescent, alternately or dichotomously branching, glabrous and often glaucous, annuals or perennials, rarely biennials, from woody or fibrous taproots; basal leaves entire with usually parallel venation; cauline leaves usually sessile and clasping, auriculate or perfoliate, the petioles sheathing; inflorescence of compound umbels, the peduncles terminal and lateral; involucre of conspicuous foliaceous bracts or lacking; involucre of broad foliaceous often connate and rarely colored bractlets that sometimes exceed the flowers and fruit; rays few, spreading-ascending to divaricate, the pedicels spreading; flowers yellow, sometimes greenish or purplish-tinged, the calyx teeth obsolete, the stylopodium depressed-conic; carpophore divided to the base; fruit oblong to orbicular or ellipsoid, slightly compressed laterally and constricted at the commissure, glabrous or roughened or tuberculate, the ribs filiform; oil tubes numerous and continuous about the seed or several in the intervals and on the commissure, sometimes obscure or lacking, the seed face plane.

A chiefly circumboreal genus, with the bulk of its approximately 100 species in Eurasia.

1. Rays 4 to 10; fruit oblong-oval, smooth 1. *B. rotundifolium*.
1. Rays 2 to 5; fruit ovoid-globose, tuberculate or rugose . . 2. *B. lancifolium*.

1. *Bupleurum rotundifolium* L. Plant annual, 2-6 dm. high; basal and lower cauline leaves oblong- to obovate-lanceolate, to 8 cm. long and 5 cm. wide, rounded at the apex, subpetiolate or perfoliate at the base; upper cauline leaves numerous, ovate, perfoliate; peduncles 2-7 cm. long; involucre lacking; involucre of 5 or 6 broadly ovate to obovate acuminate bractlets; bractlets 8-12 mm. long, 6-10 mm. wide, united at the base, two to three times as long as the flowers and fruit; rays 4 to 10, spreading-ascending, 5-15 mm. long; pedicels 10 to 12, equaling or shorter than the fruit; flowers yellow; fruit oblong-oval, 2.5-3 mm. long, 1.5-2 mm. broad, dark-purplish-brown, smooth, the ribs filiform; seed face slightly concave. Sporadically introd. in the Blackland Prairies, Apr.-June; a Medit. species introd. in cen. and e. U.S.

2. *Bupleurum lancifolium* Hornem. Plant annual, about 5 dm. high; basal leaves linear to oblong-lanceolate, subpetiolate; cauline leaves numerous, broadly ovate, acute to acuminate, perfoliate; peduncles 1-8 cm. long; involucre lacking; involucre of 5 or 6 suborbicular to obovate-rotund short-acuminate bractlets; bractlets 8-15 mm. long, united at the base or rarely to the middle, twice as long as the flowers and fruit; rays 2 to 5, divaricate, 5-25 mm. long; pedicels 10 to 20, slender, about as long as the fruit; flowers yellow; fruit ovoid-globose, 3-5 mm. long, about 3.5 mm. broad, black, tuberculate or rugose, the ribs prominent; seed face plane. *Bupleurum subovatum* Link. Sporadically introd. in the Coastal Prairies and s. Rio Grande Plains, Apr.-July; a Medit. species introd. in various parts of the U.S. probably in bird-seed.

15. AMMI L. BISHOP'S-WEED

Plants slender, erect, caulescent, branching, herbaceous, annuals, biennials or perennials from slender taproots; leaves ternate-pinnate or pinnately dissected, the ultimate divisions filiform to lanceolate; inflorescence of compound umbels, the peduncles terminal and axillary; involucre of numerous entire or divided bracts, the involucre of numerous entire bractlets; rays numerous, spreading-ascending, the pedicels spreading; flowers white, the calyx teeth minute, the stylopodium depressed-conic; carpophore entire or divided to the base; fruit oblong to ovoid, compressed laterally, glabrous, the ribs acute; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane.

An Old World genus of 6 species, chiefly of the Mediterranean region.

1. Inflorescence borne on a discoid receptacle; umbels compact in fruit; carpophore entire 1. *A. Visnaga*.
1. Inflorescence not borne on a discoid-receptacle; umbels spreading in fruit; carpophore divided to the base 2. *A. majus*.

1. *Ammi Visnaga* (L.) Lam. **BISNAGA**. Plant erect, branching, biennial (?), 2-8 dm. high, glabrous; leaves ovate-triangular, to 20 cm. long, pinnately decompose; ultimate divisions of leaf linear to filiform, setaceous to cuspidate-acute, divaricate, entire; cauline leaves ternately or pinnately dissected; peduncles 8-14 cm. long; involucre of numerous setiform-acute bractlets, ascending at maturity and equaling or exceeding the pedicels; rays 60 to 100, subfiliform, unequal, 2-5 cm. long, spreading in flower but rigidly contracted in fruit, borne on a discoid receptacle; pedicels numerous, filiform, unequal, to 13 mm. long, spreading in flower but rigidly contracted in fruit, borne on a discoid receptacle; pedicels numerous, filiform, unequal, to 13 mm. long, spreading in flower but rigidly contracted in fruit, borne on a small discoid receptacle; carpophore entire; fruit oblong-ovoid to ovoid, 2-2.5 mm. long, 1.5-1.7 mm. broad. Sporadically introd. in waste places, thus far known only in the Trans-Pecos, Apr.-June; a Euras. species that is widely introd. in the W. Hemis.

2. *Ammi majus* L. Plant erect, branching, annual, 2-8 dm. high, the inflorescence scabrous; leaves oblong, to 2 dm. long and 14 cm. wide, ternate or pinnate; leaflets lanceolate, obtuse to acute at the apex, cuneate at the base and somewhat recurved on the rachis, setulose-serrate with minute subequal teeth; cauline leaves bipinnate with linear divisions, the uppermost greatly reduced; peduncles 8-14 cm. long; involucre of numerous linear-acuminate scarious-margined bractlets, spreading to reflexed at maturity and slightly shorter than the pedicels; rays 50 to 60, subfiliform, 2-7 cm. long, spreading to ascending in flower but spreading in fruit, scabrous; pedicels numerous, filiform, unequal, to 1 cm. long, spreading to ascending; carpophore divided to the base; fruit oblong, 1.5-2 mm. long, 1 mm. or less broad. Sporadically introd. in e. and s. Tex., Mar.-June; a Euras. species that is widely introd. in the W. Hemis.

16. CONIUM L.

A genus of 2 species, one circumboreal in damp places, the other African.

1. *Conium maculatum* L. **POISON HEMLOCK**. Plant slender, erect, glabrous, 5-30 dm. high, biennial from stout taproots, the branching stems usually spotted; leaves broadly ovate, 1.5-3 dm. long, 5-30 cm. broad, pinnately decompose, the ultimate divisions

pinnately incised; inflorescence a compound dichasium of compound umbels, the peduncles terminal and axillary; involucre of short ovate-acuminate bracts; involucre of numerous bractlets like the bracts, with a conspicuous midrib, shorter than the pedicels; rays numerous, subequal, 15-25 mm. long, spreading-ascending; pedicels spreading, 4-6 mm. long; flowers white, the calyx teeth obsolete, the stylopodium depressed-conic; carpophore entire; fruit broadly ovoid, 2-2.5 mm. long, about 2 mm. broad, compressed laterally, glabrous, the prominent obtuse ribs undulate and crenate; oil tubes very small and numerous, irregular, the seed face deeply and narrowly sulcate. Sporadically introd. in wet places in the s. half of Tex., May-Aug.; a Euras. species widely introd. throughout temp. regions in the World.

Fatally poisonous if eaten.

17. FOENICULUM ADANS. FENNEL

A genus of about 5 species, chiefly of the Mediterranean region.

1. *Foeniculum vulgare* Mill. COMMON FENNEL. Plant rather stout, erect, branching, glabrous and glaucous, with a strong anise odor, perennial or biennial from taproots, 9-21 dm. high; leaves ovate to ovate-triangular, 3 dm. long, 4 dm. wide, pinnately decomposed, dark-green, the ultimate divisions filiform; inflorescence of compound umbels; peduncles terminal and axillary, 15-65 mm. long; involucre and involucre lacking; rays 15 to 40, spreading-ascending in flower, ascending to suberect in fruit, somewhat unequal, 1-6.5 cm. long; pedicels several, spreading, 2-10 mm. long, subequal; flowers yellow, the calyx teeth obsolete, the stylopodium conic; carpophore divided to the base; fruit 3.5-4 mm. long, 1.5-2 mm. broad, oblong, slightly compressed laterally, glabrous, the prominent ribs acute or obtuse; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane or slightly concave. Introd. in marshes and low areas in coastal and s. Tex., Mar.-May; a Medit. species that is adv. throughout the W. Hemis.

18. APIUM L. CELERY

Plants slender or stout, erect, ascending or prostrate, caulescent (usually), branching, herbaceous, glabrous, annual, biennial or a somewhat woody-based perennial from taproots or creeping rootstocks rooting at the nodes; leaves simply pinnate to ternate-pinnately decomposed; inflorescence of compound (rarely simple) umbels, the peduncles lateral and terminal or some umbels sessile; involucre and involucre lacking to conspicuous; rays usually few, spreading-ascending, the pedicels spreading to ascending; flowers white or greenish, the calyx teeth minute or obsolete, the stylopodium short-conic to depressed; carpophore entire, shortly bifid or more or less deeply 2-cleft; fruit oblong-oval to orbicular or ellipsoid, compressed laterally and somewhat constricted at the commissure, glabrous or rarely somewhat setulose, the prominent filiform ribs subequal and obtuse; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane.

A cosmopolitan genus of about 30 species.

1. Plant annual; leaves pinnately or ternate-pinnately decomposed, the leaflets filiform to linear 1. *A. leptophyllum*.

1. Plant perennial or biennial; leaves pinnate, the leaflets orbicular to ovate 2. *A. graveolens*.

1. *Apium leptophyllum* (Pers.) F. v. Muell. Plant annual, alternately branched above, 5-60 cm. high; leaves oblong-ovate, to 10 cm. long and 8 cm. wide, 3- or 4-pinnately decomposed, the leaflets linear to filiform; umbels simple or compound, sessile or pedunculate, the peduncles to 2 cm. long; involucre and involucre lacking; rays 3 to 5, 1-2.2 cm. long; pedicels 2-8 mm. long; calyx teeth inconspicuous; carpophore shortly 2-cleft; fruit ovoid, 1.2-3 mm. long, 1.5-2 mm. broad, glabrous. *Apium ammi* (Jacq.) Urban. Widely distributed in moist or wet soil in the Coastal and Blackland prairies and the Rio Grande Plains, Mar.-June; from s. U.S. and W.I., s. to S.A.; a pan-trop. weed.

2. *Apium graveolens* L. WILD CELERY. Plant perennial, erect or ascending from a taproot, not rooting at the nodes, 5-15 dm. high; leaves oblong to obovate, to 18 cm.

long and 8 cm. wide, pinnate with few pairs of ovate to suborbicular leaflets that are usually 3-lobed to near the middle; cauline leaves frequently cuneate, sometimes lacinate; umbels sessile or short-pedunculate, the peduncles to 12 mm. long; involucre and involucrel lacking; rays 7 to 16, to 25 mm. long; pedicels 1-6 mm. long; calyx teeth minute but evident; carpophore shortly bifid; fruit suborbicular to ellipsoid, about 1.5 mm. long, 1.5-2 mm. broad. *Celeri graveolens* (L.) Britt. Occasionally in wet places in the Trans-Pecos, June-July; a Euras. species widely adv. in the W. Hemis.

19. PETROSELINUM HOFFM.

A European genus of 3 species, very closely related to *Apium*.

1. *Petroselinum crispum* (Mill.) Mansf. PARSLEY. Plant slender, erect, caulescent, branching, glabrous, herbaceous, biennial from taproots, 3-13 dm. high; leaves ternate-pinnately or pinnately decomposed, ovate-triangular, the ultimate divisions ovate-lanceolate to linear, distinct, toothed or lobed; inflorescence of compound umbels; peduncles terminal and axillary, 3-8 cm. long; involucre of a few inconspicuous entire bracts or wanting; involucrel of 5 to 6 linear acute entire bractlets shorter than the yellow or greenish-yellow flowers; rays 10 to 20, subequal to unequal, spreading-ascending, 1-5 cm. long; pedicels spreading, 2-5 mm. long; calyx teeth obsolete, the stylopodium low-conic; carpophore divided to the base or 2-cleft to the middle; fruit ovoid-oblong, 2-4 mm. long, 1.5-3 mm. broad, compressed laterally, glabrous, the prominent ribs filiform; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane. Sporadically escaped from cult. in the s. Blackland Prairies; a Eur. species adv. throughout the W. Hemis.

20. CHAEROPHYLLUM L. CHERVIL

Plants erect or spreading, caulescent, branching, glabrous or pubescent, herbaceous, annual or biennial from taproots or tubers; leaves ternate-pinnately decomposed, the ultimate divisions or lobes small; inflorescence of compound umbels, the peduncles terminal and axillary or frequently obsolete; involucre usually lacking; involucrel of numerous conspicuous bractlets that are longer or shorter than the pedicels and reflexed or spreading in fruit; rays few, spreading-ascending, the pedicels spreading; flowers white (rarely red or yellow), the calyx teeth obsolete, the stylopodium conic; carpophore 2-cleft part-way to the base; fruit linear to narrowly oblong, beaked or beakless, often narrowed toward the apex, rounded or narrowed toward the base, compressed laterally, the prominent ribs unwinged and narrower or broader than the intervals; oil tubes small, usually solitary in the intervals and 2 on the commissure, the seed face sulcate; each rib with a large group of strengthening cells.

A circumboreal genus of about 40 species, chiefly Eurasian.

1. Ovaries and fruits glabrous 1. *C. Tainturieri* var. *Tainturieri*.
 1. Ovaries and fruits conspicuously pubescent 1. *C. Tainturieri* var. *dasycarpum*.

1. *Chaerophyllum Tainturieri* Hook. var. *Tainturieri*. Plant erect, 1.5-9 dm. high, annual, the stems solitary and usually branching near the base, sparsely hispid or hispidulous above and densely retrorsely hispid beneath to glabrate; leaves oblong to ovate-oblong, to 12 cm. long and 10 cm. wide, ternate-pinnately dissected, the ultimate divisions distinct or more or less confluent, linear to ovate, obtuse to acute, glabrous to more or less hispid; peduncles usually obsolete; involucre of several conspicuous ovate rounded to acute ciliate-margined bractlets usually longer than the pedicels and spreading or reflexed in fruit; rays 1 to 5 (usually about 3), to 75 mm. long; pedicels 3 to 20, to 1 cm. long; fruit narrowly oblong, beaked or narrowed toward the apex, rounded to narrowed toward the base, 4-8 mm. long, 1.5-2 mm. broad, the ribs narrower to much broader than the intervals. *C. texanum* Coult. & Rose. In prairies, woodlands and alluvial thickets, widespread but chiefly in the e. half of Tex., Mar.-May; from Va., s. to Fla., w. to Kan., Mo., Tex. and Ariz.

Var. *dasycarpum* Wats. Similar to var. *Tainturieri* in vegetative characters but the ovaries and fruits are conspicuously pubescent. With the typical phase chiefly in the e. half of Tex., Mar.-May; from Tex. e. to Ala. and n. to Mo.

21. CRYPTOTAENIA DC. HONEWORT. WILD CHERVIL

A chiefly circumboreal genus of about 6 species.

1. *Cryptotaenia canadensis* (L.) DC. Plant slender, erect, caulescent, branching, glabrous, herbaceous, perennial from slender fascicled roots, 3-9 dm. high; leaves ternate, oblong-ovate, to 13 cm. long and 15 cm. wide; leaflets oblong-lanceolate to obovate, to 13 cm. long and 8 cm. wide, short-acuminate at the apex, cuneate at the base, closely and doubly serrate or occasionally deeply 2- or 3-lobed; upper cauline leaves reduced to lanceolate dentate bracts; inflorescence of compound umbels, the peduncles terminal and lateral, usually paniculate; involucre and involucl lacking or of few inconspicuous bracts or bractlets; rays 2 to 7, unequal, ascending, 1-6 cm. long, the 2 to 10 unequal pedicels ascending and to 35 mm. long; flowers white, the calyx teeth obsolete or minute, the styles erect or reflexed, the stylopodium slender-conic; carpophore divided to the base; fruit linear-oblong, compressed laterally, 3.5-8 mm. long, 1.5-3 mm. broad, glabrous, the filiform obtuse ribs subequal and conspicuous; oil tubes 1 to 4 in the intervals and 2 on the commissure, the seed face plane. *Deringia canadensis* (L.) O. Ktze. Moist woodlands in the Timber Belt, May; from e. Can., s. to Ga., w. to Man., Neb. and Tex.; also Japan and s. China.

22. OSMORHIZA RAF. SWEET CICELY

Plants slender to rather stout, erect or decumbent at the base, caulescent, branching, herbaceous, perennial from thick fascicled roots; leaves ternate or ternate-pinnate, the lanceolate to orbicular leaflets serrate to pinnatifid and with mucronate teeth or lobes; inflorescence of compound umbels, the peduncles terminal and lateral and usually exceeding the leaves; involucre usually lacking; involucl of several narrow foliaceous reflexed bractlets or lacking; rays few, slender, ascending to divaricate and reflexed, unequal, the pedicels spreading to divaricate; flowers white, purple, or greenish-yellow, the calyx teeth obsolete, the stylopodium conic; carpophore 2-cleft less than one half its length; fruit linear to oblong, cylindrical to clavate, obtuse, tapering, beaked or constricted at the apex, rounded or caudate at the base, compressed laterally, the filiform ribs acute; oil tubes obscure or lacking, the seed face concave or sulcate.

A genus of 11 species of East Asia and eastern North America, and of western North America to South America.

- 1. Fruit base obtuse and without appendages (or these rudimentary), glabrous; fruit 10-12 mm. long; style and stylopodium less than 0.5 mm. long 1. *O. bipatriata*.
- 1. Fruit base attenuate into prominent appendages; fruit conspicuously bristly at least at the base, 15-20 mm. long; style and stylopodium 2-4 mm. long 2. *O. longistylis*.

1. *Osmorhiza bipatriata* Const. & Shan. Plant slender, 2-6 dm. high, sparsely hirsutulous; leaves ovate, 4-12 cm. long and broad, ternate-pinnate; leaflets ovate to ovate-oblong, laciniately lobed to pinnatifid; peduncles 3-18 cm. long; involucre lacking; involucl of several linear ciliate bractlets 1-3 mm. long; rays 2 to 5, spreading-ascending, to 35 mm. long; pedicels spreading, 3-6 mm. long; flowers white, tinged with green or rose; stylopodium low-conic; carpophore cleft about one fourth of its length; fruit linear-fusiform, 10-12 mm. long, tapering into a short beak at the apex, acute or with rudimentary appendages at the base, glabrous (or with a few bristles at the very base). Known in Tex. only from Mt. Livermore, Davis Mts., in the Trans-Pecos, June-July; also N.L.

2. *Osmorhiza longistylis* (Torr.) DC. ANISE-ROOT. Plant rather stout, 6-10 dm. high, villous or hirsutulous; leaves orbicular, 8-25 cm. long, biternate or ternate-pinnate; leaflets ovate to oblong-lanceolate, acute, coarsely serrate, incised or pinnately lobed toward the

base, hirsutulous especially on the veins and margins; peduncles 5-13 cm. long; involucre of 1 to several linear or lanceolate foliaceous, ciliate, sharply reflexed bracts to 15 mm. long; rays 3 to 6, spreading-ascending, 1.5-5 cm. long; pedicels spreading-ascending, 5-8 mm. long; flowers white, the stylopodium high-conic; carpophore cleft about one third of its length; fruit oblong-fusiform, 15-20 mm. long, acute at the apex, caudate at the base, the appendages 4-6 mm. long, sparingly bristly on the ribs. Along streams in the Blackland Prairies and perhaps in the Timber Belt, rare; from e. Can., s. to Ala. and Tex., w. to Alta., Colo. and N.M.

23. SCANDIX L.

A genus of the Mediterranean region, comprising about a dozen species.

1. *Scandix Pecten-Veneris* L. VENUS'-COMB, CROW-NEEDLES. Plant 15-35 cm. high, hispid, annual from slender taproots, commonly branched from the base; leaves pinnately decomposed, oblong, to 14.5 cm. long and 7 cm. wide, the short linear ultimate divisions acute; peduncles terminal and lateral; involucre usually lacking; involucre of two bractlets connate at the base and lobed above, 4-15 mm. long, shorter than the flowers; rays 1 or 2, spreading-ascending, 1-3 cm. long; pedicels 8 mm. long to obsolete; flowers white, the outer petals radiant, the calyx teeth minute or obsolete, the stylopodium depressed; carpophore entire or bifid at the apex; fruit linear or narrowly oblong, 6-15 mm. long, 1-2 mm. broad, ciliate, terminating in an elongated linear beak 2-7 cm. long, compressed laterally, the beak hispid-ciliate on the margins, the filiform ribs obtuse and prominent; oil tubes very small, solitary in the intervals or obscure, the seed face sulcate. Adv. on the Coastal and Blackland prairies, Mar.-Apr.; a Euras. species that is adv. throughout the U.S. and in B.C.

24. TREPOCARPUS DC.

A monotypic genus of the southern United States.

1. *Trepocarpus Aethusae* Nutt. Plant slender, erect, 3-5.5 dm. high, caulescent, simple or branching, glabrous, herbaceous, annual from slender taproots; leaves pinnately decomposed, 8-10 cm. long, the short divisions linear and acute; cauline leaves little reduced upward; inflorescence of compound umbels; peduncles to 95 mm. long, lateral and opposite the leaves; involucre of 1 to several foliaceous entire or divided bracts to 15 mm. long; involucre of bractlets (3-8 mm. long) like the bracts; rays 2 to 4, spreading, to 15 mm. long, the 2 to 8 pedicels very short; flowers white, the calyx teeth linear and unequal, the stylopodium conic; carpophore divided to the base; fruit oblong-linear, 8-10 mm. long, slightly compressed laterally, glabrous, the primary ribs obsolete but 4 secondary ribs and the face of the commissure prominently corky; oil tubes small, solitary under the secondary ribs and 2 on the commissure, more or less imbedded in the seed and adhering to it, the seed face plane or slightly concave. Chiefly on river bottoms and terraces in the Timber Belt and Blackland and Coastal prairies, Apr.-June; from Tex., n. to Ark. and e. to S.C.

25. CUMINUM L.

A southern Mediterranean genus of 2 species.

1. *Cuminum Cyminum* L. CUMIN. Plants slender, glabrous, 2-3 dm. high, annual from slender taproots; basal leaves ovate, to 1 dm. long, ternately dissected, the entire ultimate divisions linear-filiform; peduncles terminal and lateral, to 1 dm. long; involucre of 5 to 7 linear and entire or ternately dissected bracts with unequal linear divisions to 5 cm. long and reflexed; involucre of bractlets like the bracts, to 1 cm. long; rays 2 to 6, spreading-ascending, to 25 mm. long, unequal; pedicels to 8 mm. long; flowers white or rose-color, the outer petals radiant, the subulate calyx teeth longer than the short styles, the conic stylopodium attenuate; carpophore divided to the base; fruit oblong, 6-7 mm. long, 2.5-3

mm. broad, slightly compressed laterally, attenuate at the apex and base, setulose and bristly, the filiform primary ribs minutely setulose, the bristly secondary ribs very prominent; oil tubes solitary in the intervals and 2 on the commissure, the seed face slightly concave. A Medit. plant escaped from cult. in vic. of El Paso.

26. AMMOSELINUM T. & G. SAND-PARSLEY

Plants low, slender, erect or diffuse, caulescent, branching, roughened, herbaceous, annual from slender taproots; leaves ternately or ternate-pinnately decomposed, the ultimate divisions linear to spatulate; inflorescence of compound umbels, the peduncles axillary and terminal or the umbels often sessile; involucre usually lacking; involucrel of several narrow entire or toothed bractlets; rays few, spreading-ascending or spreading, unequal, the few pedicels unequal and slender to obsolete; flowers white, the calyx teeth obsolete, the stylopodium low-conic; carpophore 2-cleft at the apex; fruit oblong-ovoid to ovoid, compressed laterally, the prominent ribs acute or rounded and coarsely scabrous to glabrous, the lateral ribs (with or without corky appendages or callous teeth) of the two mericarps closely contiguous and appearing to form a single broad rib and often covering the commissure with corky tissue; oil tubes 1 to 3 in the intervals and 2 to 4 on the commissure, the seed face plane to concave; pericarp composed almost exclusively of strengthening cells.

A genus of 4 species of the south-central and southwestern United States and adjacent Mexico; one species in southern South America.

- 1. Umbels sessile; fruit glabrous to sparsely roughened; ribs acute, the lateral without corky appendages 1. *A. Butleri*.
- 1. Umbels pedunculate; fruit roughened with callous teeth; ribs rounded, the lateral with corky appendages 2. *A. Popei*.

1. *Ammoselinum Butleri* (Wats.) Coult. & Rose. Plant branching from the base, 4-5 cm. high; leaves oblong, to 25 mm. long and 15 mm. wide, biternate or ternate-pinnate; ultimate divisions of leaves linear, obtuse, mucronulate, glabrous; umbels sessile in the axils; involucre lacking; involucrel of a few foliaceous bractlets, shorter than the pedicels; rays 2 to 6, unequal, to 2 cm. long to obsolete; pedicels 1 to 10, unequal, 1-6 mm. long; fruit ovoid, 2.5-3 mm. long, 1-1.5 mm. broad, glabrous to sparsely roughened with callous teeth, the subacute ribs prominent; oil tubes solitary in the intervals and 2 on the commissure, the seed face plane or nearly so. Principally in bottomlands and moist woodlands in the Timber Belt and the Blackland and Coastal prairies, Mar.-Apr.; also Okla. and Ark.

2. *Ammoselinum Popei* T.&G. Plant branching from the base, 1-3.5 dm. high; leaves oblong-ovate, to 4 cm. long and wide, ternate-pinnately dissected; ultimate divisions of leaves linear, obtuse, mucronulate, glabrous or roughened with callous teeth; peduncles axillary and terminal, 1.5-4 cm. long; involucre lacking or of a solitary foliaceous bract; involucrel of several linear bractlets, longer than the pedicels; rays 3 to 10, unequal, to 2.5 mm. long; pedicels 3 to 12, to 11 mm. long; fruit oblong-ovoid, 3-5 mm. long, about 3 mm. broad, more or less roughened with callous teeth, the ribs rounded, the lateral ribs with corky appendages; oil tubes solitary in the intervals and 2 on the commissure; seed face slightly concave. In sandy soil throughout w. and s. Tex., Feb.-June; from Okla., s. to N.L. and w. to N.M.

27. SPERMOLEPIS RAF. SCALE-SEED

Plants slender, erect or spreading, caulescent, branching, glabrous, herbaceous, annual from slender taproots; leaves ternately or ternate-pinnately decomposed, the ultimate divisions linear to filiform; inflorescence of compound umbels, the terminal and axillary peduncles exceeding the leaves; involucre lacking; involucrel of a few linear bractlets usually shorter than the pedicels; rays few, erect to divaricate, the few pedicels spreading or some of the flowers sessile; flowers white, the calyx teeth obsolete, the stylopodium low-conic; carpophore 2-cleft at the apex; fruit ovoid, compressed laterally and slightly constricted at the commissure, smooth, tuberculate or echinate, the filiform ribs rounded; oil tubes 1 to 3 in the intervals and 2 on the commissure, the seed face sulcate.

A genus of 5 species, three in the southeastern and central United States and adjacent Mexico, one in southern South America, and the fifth in the Hawaiian Islands.

- 1. Fruit covered with short echinate bristles; plants usually low and somewhat spreading; leaves ovate3. *S. echinata*.
- 1. Fruit smooth or tuberculate; plants slender, erect; leaves oblong to oblong-ovate (2)
- 2(1). Rays divaricate, subequal; ultimate leaf divisions linear1. *S. divaricata*.
- 2. Rays erect, unequal; ultimate leaf divisions filiform ...2. *S. inermis*.

1. *Spermolepis divaricata* (Walt.) Raf. Plant slender, erect, 1-7 dm. high; leaves oblong to oblong-ovate, to 5 cm. long and 35 mm. wide, ternately or ternate-pinnately decomposed; ultimate divisions of leaves linear, acute; peduncles 1-5 cm. long; involucre of a few linear acute bractlets with the margins scarious and usually callous-toothed; rays 3 to 7, divaricate, subequal, 5-35 mm. long; pedicels 1 to 6, to 3 cm. long or the central flower of each umbellet sessile; fruit 1.5-2 mm. long, about 1.5 mm. broad, tuberculate. Swamps and moist woodlands in the Timber Belt and Blackland Prairies, Apr.-June; from Va., s. to Fla., w. to Kan. and Tex.

2. *Spermolepis inermis* (DC.) Math. & Const. Plant slender, erect, to 6 dm. high; leaves oblong-ovate, to 5 cm. long and 4 cm. wide, ternately decomposed; ultimate divisions of leaves filiform, mucronulate; peduncles 2-7 cm. long; involucre of a few narrow callous-toothed to glabrous bractlets shorter than the pedicels; rays 5 to 11, erect, unequal, 1-13 mm. long; pedicels 1 to 6, to 6 mm. long, the central umbellets bearing 1 to 3 sessile or shortly pedicellate flowers; fruit 1.5-2 mm. long, about 1.5 mm. broad, tuberculate to smooth. *S. patens* (DC.) Robins. Widely distributed in sandy or gravelly soil, mostly in s. half of Tex., Mar.-May; from Ind. and Neb., e. to N.C., w. to N.M., s. to Miss., Tex. and n. Mex.

3. *Spermolepis echinata* (DC.) Heller, Plant low and often spreading, to 4 dm. high; leaves ovate, to 25 mm. long and 2 cm. wide, ternately decomposed; ultimate divisions of leaves filiform, mucronulate; peduncles to 65 mm. long; involucre of a few filiform callous-toothed to glabrous bractlets that are shorter than the pedicels; rays 5 to 14, suberect, unequal, 1-15 mm. long; pedicels 1 to 6, to 7 mm. long, the central sessile umbellets 1-flowered; fruit ovoid, 1.5-2 mm. long and broad, covered with short echinate bristles. Widely distributed and usually in sandy soil, mostly in w. Tex., Mar.-May; from Mo., e. to Fla., s. to La. and Tex., w. to s. Calif. and n. Mex.

28. TORILIS ADANS. HEDGE-PARSLEY

Plants erect or decumbent, caulescent, branching, pubescent, herbaceous, annual from slender taproots; leaves 1- to 2-pinnate or pinnately decomposed, the ultimate divisions narrow; inflorescence of capitate or open compound umbels, the sessile or pedunculate umbels lateral or terminal and lateral; involucre of a few small bracts or lacking; involucre of several linear or filiform bractlets; rays 6 to 12, spreading-ascending or obsolete, the spreading pedicels short or obsolete; flowers white, the calyx teeth evident to obsolete, the thick stylopodium conic; carpophore bifid at the apex or cleft above the middle; fruit ovoid or oblong, compressed laterally, tuberculate or prickly, the primary ribs filiform and setulose, the lateral ribs displaced onto the commissural surface, the secondary ribs hidden by the numerous glochidiate prickles or tubercles that occupy the entire interval; oil tubes solitary under the secondary ribs and 2 on the commissure, the seed face concave to shallowly sulcate; strengthening cells present in the primary ribs, absent from the secondary.

A genus of about 20 species, principally of the Mediterranean region.

- 1. Umbels sessile or short-pedunculate, capitate, opposite the leaves1. *T. nodosa*.
- 1. Umbels usually long-pedunculate, spreading, terminal and lateral2. *T. arvensis*.

1. *Torilis nodosa* (L.) Gaert. **KNOTTED HEDGE-PARSLEY.** Plants to 6 dm. high, hispid throughout; leaves oblong, pinnately decomposed, ultimate divisions of leaves filiform, 2-8 mm. long, 1-2 mm. broad, acute, entire or pinnately lobed; peduncles much shorter than the leaves, to 25 mm. long to obsolete; involucre absent or of an inconspicuous linear bract; involucre of linear acute bractlets longer than the pedicels; rays few, short to obsolete; pedicels very short; fruit ovoid, 3-5 mm. long, 1-2 mm. broad, the outer mericarps bristly, the inner mericarps merely warty or sometimes only the outer part of the mericarp bristly. In moist places chiefly in the Timber Belt and the Blackland and Coastal prairies, Apr.-June; this Old World species is adv. in the W. Hemis.

This plant can become an extremely noxious pest in lawns.

2. *Torilis arvensis* (Huds.) Link. Plants slender, hispid throughout, the branches ascending; leaves ovate to ovate-lanceolate, 2- or 3-pinnate; leaflets ovate to linear-lanceolate, acute or acuminate, regularly incised or divided; peduncles 2-12 cm. long, longer than the leaves; involucre wanting; involucre of several subulate bractlets longer than the pedicels; rays 2 to 10, subequal to somewhat unequal, 5-25 mm. long; pedicels 1-4 mm. long; fruit ovoid-oblong, 3-5 mm. long, 2-3 mm. broad, the mericarps densely covered with uncinat bristles about as long as the width of the fruit. Chiefly in the Blackland Prairies and the Edwards Plateau, Apr.-June; adv. from the Old World.

29. DAUCUS L. CARROT

Plants erect, caulescent, branching, pubescent, herbaceous, annual or biennial from taproots; leaves pinnately decomposed, the ultimate divisions small and narrow; inflorescence of compound umbels that may become subcompact by the incurving of the rays after anthesis, the peduncles terminal and axillary; involucre of numerous dissected or entire bracts or lacking; involucre of numerous toothed or entire bractlets or lacking; rays few to numerous, spreading or the outer connivent over the shorter inner ones, the spreading pedicels unequal; flowers white or the central flower of each umbellet purple or rarely all reddish or yellow, the outer petals often radiant, the calyx teeth obsolete to evident, the stylopodium conic; carpophore entire or bifid at the apex; fruit oblong to ovoid, flattened dorsally, the bristly primary ribs filiform, the secondary ribs winged, the wings divided into a single row of barbed or glochidiate prickles; oil tubes solitary under the secondary ribs and 2 on the commissure, the seed face shallowly concave to nearly plane.

A nearly cosmopolitan genus of 50 to 60 species.

- 1. Bracts pinnately divided into short linear or lanceolate divisions; rays usually 4-40 mm. long; carpel usually broadest below the middle; central flower of umbellet white 1. *D. pusillus*.
- 1. Bracts pinnately divided into elongate filiform divisions; rays 30-75 mm. long; carpel broadest at the middle; central flower of umbellet rose or purple 2. *D. Carota*.

1. *Daucus pusillus* Michx. **RATTLESNAKE-WEED.** Plant annual, to 9 dm. high; stems usually solitary, simple or few-branched above, retrorsely papillate-hispid; leaves oblong, to 10.5 cm. long and 7 cm. wide; ultimate divisions of leaves linear, acute, hispid; peduncles 11-45 cm. long, retrorsely papillate-hispid; involucre of foliaceous pinnately decomposed bracts, with the short divisions linear to lanceolate; involucre of linear acute bractlets about equaling the pedicels; rays few to numerous, unequal, 4-40 mm. long, compact in fruit; pedicels unequal, 2-9 mm. long; flowers white; fruit oblong, 3-5 mm. long, about 2 mm. broad, usually broadest below the middle, the commissural surface with 2 rows of hispidulous hairs. Widespread almost throughout Tex., especially in the e. portion, commonly in disturbed soil, Apr.-May; across s. U.S. n. to B.C. and in n. Mex. and temp. S.A.

2. *Daucus Carota* L. **WILD CARROT, QUEEN ANNE'S LACE.** Plant biennial, 1.5-12 dm. high; stems solitary, glabrous to retrorsely hispid; leaves oblong, to 15 cm. long and 7 cm. wide; ultimate divisions of leaves linear to lanceolate, acute, mucronate, entire or few-cleft, glabrous to hispid especially on the veins and margins; divisions of the cauline leaves often elongate; peduncles 2.5-6 dm. long, retrorsely hispid; involucre of filiform elongate pinnately divided or rarely entire scarious-margined bracts 3-30 mm. long, usually

reflexed; involucre of linear acuminate entire or rarely pinnate more or less scarious ciliate bractlets that equal or exceed the flowers; flowers white (yellow or pinkish), the central flower of each umbellet purple or pinkish; fruit ovoid, 3-4 mm. long, about 2 mm. broad, broadest at the middle. Sporadic in waste places in the Blackland Prairies and the Rio Grande Plains, Apr.-May; widely distributed in the W. Hemis.; nat. of Euras.

30. CYMPTERUS RAF.

Plants low, acaulescent or subcaulescent, glabrous or pubescent, herbaceous, perennial from slender to thickened or fusiform taproots; leaves membranaceous to subcoriaceous or somewhat fleshy, green to pallid and glaucescent, ternate, digitate, pinnate or bipinnate to pinnately or ternate-pinnately decomposed; leaflets or ultimate divisions variously toothed or lobed to entire, usually narrow; inflorescence of compound umbels, the peduncles terminal and longer or shorter than the leaves; involucre lacking or present, the bracts scarious or foliaceous; involucre usually conspicuous, dimidiate, the bractlets foliaceous to scarious; rays few and spreading or abortive, the spreading pedicels slender to abortive; flowers white, yellow or purple, the calyx teeth small or obsolete, the stylopodium lacking; carpophore divided to the base; fruit ovoid to oblong, flattened dorsally, glabrous to pubescent, the lateral and usually one or more of the dorsal ribs broadly winged with the wings membranaceous to spongy-corky and broader or narrower than the body; oil tubes 1 to numerous in the intervals, 2 to numerous on the commissure and sometimes solitary at the base of the wings, the seed face concave to sulcate; strengthening cells absent or present.

A western North American genus of about 32 species.

1. Flowers yellow; bractlets of the involucre subscarious to foliaceous, not prominently nerved 1. *C. Fendleri*.
1. Flowers white to purple; bractlets of the involucre scarious, prominently nerved, sometimes connate (2)
- 2(1). Mature peduncles shorter than or equaling the leaves; fruit wings conspicuously enlarged at the base 2. *C. montanus*.
2. Mature peduncles equaling or exceeding the leaves; fruit wings not conspicuously enlarged at the base (3)
- 3(2). Bractlets lacerate-fringed at the apex 3. *C. macrorhizus*.
3. Bractlets entire or obtusely lobed at apex (4)
- 4(3). Bractlets white or whitish, few-nerved; pedicels 3-12 mm. long 4. *C. bulbosus*.
4. Bractlets purple or greenish, conspicuously many-nerved; pedicels less than 1 mm. long to obsolete 5. *C. multinervatus*.

1. *Cymopterus Fendleri* Gray. Plant acaulescent or subcaulescent, not cespitose, with the development of a pseudoscape 4-30 cm. high, the mature pseudoscape 1-3 cm. long, glabrous; leaves ovate to oblong-obovate, to 75 mm. long and 6 cm. wide, pinnate to bipinnate, green; leaflets longer than broad, entire to pinnately lobed, with obtuse or occasionally acute lobes; peduncles usually equaling or exceeding the leaves; involucre usually a low sheath, sometimes with 1 to 3 linear bracts; involucre of subscarious to foliaceous linear to ovate-oblong acute and frequently 3-toothed bractlets that equal or exceed the flowers; umbels compact, the fertile rays usually 3 to 5, to 25 mm. long, the central sterile umbellet sessile; pedicels obsolete; flowers yellow; fruit ovoid to ovoid-oblong, 5-13 mm. long, 4-10 mm. broad, the wings narrowed at the base and sometimes acuminate at the apex and about half as broad as the body, the dorsal wings 1 to 3 and similar to the lateral wings; oil tubes 3 to 16 in the intervals, 6 to 12 on the commissure, sometimes solitary at the wing base. In the Trans-Pecos and Plains Country, Mar.-Apr.; from Tex. to Colo., n. Ut., N.M. and Ariz.

2. *Cymopterus montanus* T.&G. Plant acaulescent or subcaulescent from long fusiform or subfusiform roots, with the development of a pseudoscape to 3 dm. high; leaves ovate-oblong, to 8 cm. long and 6 cm. wide, pinnate to bipinnate or occasionally ternate-

bipinnate, somewhat fleshy, pallid, with the leaflets entire to pinnately lobed; leaflet lobes usually obtuse, mucronate, confluent, roughened on the margins and veins; peduncles shorter than or equaling the leaves, to 10 cm. long, minutely roughened throughout or only at the base of the umbel; involucre lacking or of a low inconspicuous sheath or of conspicuous linear-oblong bracts; involucre of conspicuous ovate-oblong mostly acute bractlets; bractlets sometimes lacerate toward the apex, white with a conspicuous green central nerve, usually shorter than the flowers, the umbels subcompact; fertile rays 3 to 6, slightly spreading, to 2 cm. long, glabrous or minutely hirtellous, the sterile rays short; pedicels 2-5 mm. long; flowers white or purple; fruit ovoid to ovoid-oblong, 5-12 mm. long, 4-10 mm. broad; fruit wings conspicuously enlarged at the base, narrowed toward the apex, twice as broad as the body; oil tubes 1 to 4 in the intervals, 2 to 6 on the commissure, accessory oil tubes occasionally present in the wings. *Phellopterus montanus* Nutt. In the Plains Country, Mar.-May; from Tex. to S.D., Wyo. and n. N.M.

3. *Cymopterus macrorhizus* Buckl. Plant acaulescent or subcaulescent from fusiform to subglobose roots, with the development of a pseudoscape to 2.5 dm. high; leaves ovate-oblong, to 65 mm. long and 3 cm. wide, pinnate to bipinnate, pallid, somewhat fleshy, the leaflets entire to pinnately lobed; leaflet lobes obtuse, usually mucronate, confluent, sometimes minutely roughened on the margins; peduncles longer than the leaves, to 17 cm. long, usually minutely roughened at the base of the umbel; involucre lacking or of one or more linear bracts; involucre of conspicuous subcuneate bractlets lacerate-fringed at the apex, the bractlets white with a dark central nerve and usually shorter than the flowers; fertile rays 1 to 6, spreading, to 3 cm. long, glabrous or slightly roughened, the inner umbellets usually sessile and sterile, the sterile rays 5-10 mm. long, the sessile inner flowers sterile; pedicels 2 mm. long; flowers pinkish; fruit ovoid to ovoid-oblong, 4-9 mm. long, 3-8 mm. broad, the linear wings about equaling the body; oil tubes 3 to 8 in the intervals, 4 to 10 on the commissure, accessory tubes occasionally present in the wing base. *Phellopterus macrorhizus* (Buckl.) Coult. & Rose. Mostly in limy soil of the Blackland Prairies, the Plains Country and the Edwards Plateau in Tex. and adj. Okla., Mar.-May.

4. *Cymopterus bulbosus* A. Nels. Plant acaulescent or subcaulescent with the development of a pseudoscape to 35 cm. high, from long slender to clavate taproots, glabrous; leaves ovate-oblong, to 9 cm. long and 7 cm. wide, pinnate to bipinnate, pallid, somewhat fleshy, the leaflets entire to pinnately lobed; leaflet lobes obtuse, linear, confluent; peduncles usually several and exceeding the leaves, to 25 cm. long; involucre conspicuous, varying from a low sheath to conspicuous connate whitish 1- to 3-nerved bracts; involucre similar to the involucre, equaling or exceeding the flowers; fertile rays 3 to 8, spreading, to 3 cm. long, the sterile rays short; pedicels 3-12 mm. long; flowers purplish; fruit ovoid-oblong to oblong, 7-17 mm. long, 4-12 mm. broad; wings of fruit narrow or slightly enlarged at the base, narrower to broader than the body, acute; oil tubes 1 to 9 in the intervals, 3 to 10 on the commissure. Only in the Plains Country, spring; from Tex. to e. Ut., s.w. Wyo. and Ariz.

5. *Cymopterus multinervatus* (Coult. & Rose) Tidest. Plants acaulescent or subcaulescent, with the development of a pseudoscape to 2 dm. high, with long slender or subfusiform taproots; leaves ovate-oblong, to 85 mm. long and 6 cm. wide, pinnate to bipinnate or occasionally ternate-pinnate, somewhat fleshy, pallid, the leaflets entire to pinnately lobed; leaflet lobes acute or obtuse, mucronulate, usually confluent, glabrate; peduncles equaling or exceeding the leaves, 2-14 cm. long, glabrous; involucre a low scarious sheath or of 1 or 2 conspicuous nerved bracts, sometimes a conspicuous purplish connate cup with irregular many-nerved lobes; involucre of conspicuous ovate to ovate-oblong subconnate many-nerved greenish or purple bractlets, usually with a whitish margin and about equaling the flowers; umbels compact, the 1 to 5 glabrous fertile rays usually 5-25 mm. long, the inner rays shorter and the umbellets usually sterile, the sterile rays short; pedicels less than 1 mm. long; flowers purplish; fruit ovoid to ovoid-oblong, 8-17 mm. long and broad, frequently purplish-tinged, the long slender wings slightly enlarged at the base and twice to thrice as broad as the body; oil tubes 3 to 9 in the intervals, 5 to 12 on the commissure, accessory tubes occasionally present in the wings. Only in the Trans-Pecos, spring; from Tex. to s. Ut., s. Nev., s.e. Calif. and n. Mex.

31. PSEUDOCYMOPTERUS COULT. & ROSE

Plants slender to low, erect, subcaulescent to caulescent, glabrous to pubescent, herbaceous, perennial from long slender taproots; leaves 1- to 3-pinnate to ternate-pinnately decomposed, the leaflets or ultimate divisions filiform to obovate; inflorescence of compound umbels, the peduncles terminal and sometimes axillary, exceeding the leaves, conspicuously hirtellous-pubescent at the base of the umbels and occasionally on the rays; involucre usually lacking; involucre dimidiate, of oval to filiform bractlets free to connate at the base, longer or shorter than the flowers; rays few, spreading to ascending, subequal to unequal, the pedicels spreading; flowers yellow or purple, the ovate to deltoid calyx teeth evident, the stylopodium lacking; carpophore divided to the base; fruit ovoid to ovoid-oblong, flattened dorsally, glabrous, the lateral ribs broadly spongy-winged or membranous, linear to triangular in cross section, almost equaling the body, one or more dorsal ribs similarly winged (or all reduced to conspicuous ribs, or obsolete); oil tubes solitary to several in the intervals, 2 to several on the commissure, rarely also at the base of the wings, the seed face more or less plane; strengthening cells absent or present.

A highly variable genus of the western United States and adjacent Mexico, with at least two discrete species.

1. Leaves pinnately decomposed; rays 10-20 mm. long, ascending; fruit 3.5-5 mm. long
..... 1. *P. montanus*.
1. Leaves ternate-pinnately decomposed; rays 17-58 mm. long, spreading; fruit 6-9 mm.
long 2. *P. longiradiatus*.

1. *Pseudocymopterus montanus* (Gray) Coult. & Rose. MOUNTAIN PARSLEY. Plant to 85 cm. high; leaves ovate-oblong to broadly ovate; blades 1- to 3-pinnate, to 17 cm. long and 14 cm. wide, the ultimate divisions filiform to broadly lanceolate, acute, remote or more or less confluent; peduncles 14-30 cm. long; involucre of several acute bractlets 2-8 mm. long, connate at the base; rays 4 to 18, ascending, 10-20 mm. long, often scaberulous; pedicels 1-3 mm. long; fruit 3.5-5 mm. long, 1.5-2.5 mm. broad; oil tubes small, 1 to 3 in the intervals, 3 to 6 on the commissure. Usually in rocky places at 6,000-8,000 ft. alt. in the mts. of the Trans-Pecos, reported only from Mt. Livermore, July-Aug.; n. to Wyo. and w. to Ut. and Ariz., southw. into Mex.

Material from western Texas and adjacent Mexico, now referred to this species, may warrant recognition as a distinct taxon. However, more collections, particularly of fruiting material, and additional field studies are needed in order to define the nature of variability in this highly polymorphic species.

2. *Pseudocymopterus longiradiatus* Math., Const. & Theobald. Plant 3-9 dm. tall, caulescent with 1 to 3 stem leaves, rarely acaulescent; leaves ovate-oblong to broadly ovate, 4.5-15 cm. long, 3.5-13 cm. broad, ternate-pinnately decomposed, the ultimate divisions ovate to oblong, pinnately lobed to parted with the lobes obovate to linear-oblong, acute to distinctly acuminate; peduncles 13-49 cm. long; rays 8 to 18, spreading, 17-58 mm. long; bractlets of involucre linear-lanceolate, 3-11 mm. long, free to slightly connate at base; pedicels 2-6 mm. long; fruit 6-9 mm. long, 3-5 mm. broad; oil tubes large, solitary in the intervals, 2 on the commissure. In shady, damp, sandy or rocky places in canyons in the mts. of the Trans-Pecos, Apr.-Aug.; also in adj. N.M.

32. OXYPOLIS RAF. HOG-FENNEL

Plants slender, erect, caulescent, glabrous, herbaceous, perennial from fascicled tubers; leaves simply pinnate to ternate or reduced to hollow acute septate phyllodes; leaflets (when present) broad or narrow, serrate to incised, mostly distinct and sessile; inflorescence of compound umbels, the peduncles terminal and axillary; involucre of a few slender bracts or lacking; involucre similar to the involucre or lacking; rays few to numerous, usually spreading-ascending, the slender pedicels ascending to spreading; flowers white or purple, the calyx teeth prominent or minute, the stylopodium conic; carpophore divided to the base; fruit oblong to obovoid, strongly flattened dorsally, glabrous, the dorsal ribs filiform, the lateral broadly thin-winged and nerved dorsally at the inner margin to give the appearance of 5 filiform dorsal ribs; oil tubes large, solitary in the

intervals, 2 to 6 on the commissure, the seed face plane; strengthening cells beneath the dorsal ribs and the nerves of the lateral wings.

A genus of about half a dozen species, chiefly of the eastern and southeastern United States.

- 1. Leaves reduced to cylindrical or flattened entire septate phyllodes; rays 8 to 14 1. *O. filiformis*.
- 1. Leaves pinnate, the leaflets broad or narrow; rays 15 to 45 2. *O. rigidior*.

1. *Oxypolis filiformis* (Walt.) Britt. Plant to 14 dm. high; leaves reduced to hollow septate phyllodes 2-6 dm. long; peduncles 2-9 cm. long; involucre of several linear to lanceolate bracts 5-15 mm. long; involucre of linear to lanceolate bractlets 2-4 mm. long; rays 8 to 14, spreading, slightly unequal, 2-4.5 cm. long; pedicels spreading, 5-10 mm. long; calyx teeth conspicuous; fruit oval or obovoid, 5-8 mm. long, 3-5 mm. broad, the lateral wings thinner than the body. Wet places in the Timber Belt and the Blackland and Coastal prairies, July-Sept.; from Va. s. to Fla. and w. to Tex.; also Bah. I. and Cuba.

2. *Oxypolis rigidior* (L.) Raf. COWBANE, WATER-DROPWORT. Plant 6-15 dm. high; leaves oval to triangular or lanceolate, to 30 cm. long and 25 cm. wide, pinnate; leaflets 5 to 9, lanceolate or linear, remotely salient-dentate or entire; peduncles 6-30 cm. long; involucre of a few linear bracts 1-2 cm. long; involucre of a few linear bractlets 3-5 mm. long; rays 15 to 45, spreading, subequal, 3-12 cm. long; pedicels spreading, 5-15 mm. long; calyx teeth conspicuous; fruit oval or oblong, 4-7 mm. long, 2.5-4 mm. broad. Along streams and in other wet places in the Timber Belt and the Blackland and Coastal prairies, Aug.-Oct.; from N.Y., s. to S.C., w. to Minn. and Tex.

33. POLYTAENIA DC.

Plants stout, erect, caulescent, branching, puberulent, herbaceous, perennial from subfusiform taproots; leaves bipinnate or ternate-pinnate, with large crenate to incised or lobed leaflets; inflorescence of compound umbels, the terminal and lateral peduncles exceeding the leaves; involucre lacking; involucre of several linear to filiform entire puberulent bractlets shorter than the flowers; rays rather few, spreading-ascending, puberulent, the puberulent pedicels spreading-ascending; flowers yellow, the calyx teeth ovate and acute or acuminate, the stylopodium lacking; carpophore divided to the base; fruit broadly oval to orbicular or obovate, strongly flattened dorsally, glabrous, the dorsal ribs filiform to obscure, the lateral ribs corky-winged; oil tubes distinct or indistinct, solitary or several in the intervals, 2 to several on the commissure and scattered throughout the pericarp, the seed face plane.

A genus of 2 species, in the central and south-central United States.

- 1. Fruit 5-11 mm. long, 4-7 mm. broad, the lateral wings narrower and thicker than the body; oil tubes indistinct, several in the intervals . . . 1. *P. Nuttallii*.
- 1. Fruit 9-11 mm. long, 6-7 mm. broad, the lateral wings broader and thinner than the body; oil tubes distinct, solitary in the intervals 2. *P. texana*.

1. *Polytaenia Nuttallii* DC. PRAIRIE-PARSLEY. Plant 5-10 dm. high, puberulent (especially in the inflorescence); leaves oblong to ovate, to 18 cm. long and 15 cm. wide, bipinnate or ternate-pinnate; leaflets sessile, distinct or the terminal confluent, ovate to oblong, obtuse at the apex, rounded or cuneate at the base; upper cauline leaves ternate with conspicuously dilated sheaths; peduncles 2-10 cm. long; bractlets 2-5 mm. long; rays 10 to 20, to 6 cm. long, subequal to unequal; pedicels 3-5 mm. long; fruit 5-11 mm. long, 4-7 mm. broad, the dorsal ribs filiform to obscure, the lateral narrowly corky-winged with the wings narrower and thicker than the body; oil tubes indistinct, several in the intervals and on the commissure. *Pleiotaenia Nuttallii* (DC.) Coult. & Rose. In sandy soil in the Timber Belt and the Blackland Prairies, Mar.-June; from Tex. and La., n. to Ky., Mich. and Ia.

2. *Polytaenia texana* (Coult. & Rose) Math. & Const. TEXAS-PARSLEY. Plant 5-8 dm. high; leaves ovate to oblong, to 13 cm. long and 10 cm. wide, ternate-pinnate; leaflets sessile, distinct or confluent, broadly ovate to oblong, obtuse at the apex, cuneate at the

base; upper cauline leaves ternate with broadly cuneate divisions; peduncles 1-5 cm. long; bractlets 2-5 mm. long; rays 10 to 15, subequal, 1-2.5 cm. long; pedicels 2-6 mm. long; fruit 9-11 mm. long, 6-7 mm. broad, the dorsal ribs filiform, the lateral broadly corky-winged with the wings broader but thinner than the body; oil tubes distinct, solitary in the intervals, 2 on the commissure. *Pleiotænia Nuttallii* var. *texana* Coult. & Rose. Abundant on the Blackland and Coastal prairies and the Edwards Plateau, Apr.-July; endemic.

34. PASTINACA L.

A genus of about 15 species of boreal Eurasia, closely related to *Heracleum*.

1. *Pastinaca sativa* L. GARDEN PARSNIP, WILD PARSNIP. Plant erect, biennial or perennial from taproots, 3-10 dm. high; leaves pinnately compound, oblong to ovate, to 25 cm. long and 15 cm. wide, cordate; leaflets oblong to ovate, coarsely serrate and lobed or divided, puberulent or glabrate; cauline leaves with conspicuously dilated sheaths; peduncles stout, terminal and lateral, 7-15 cm. long; involucre and involucel lacking; rays 15 to 25, unequal, spreading-ascending, to 10 cm. long; pedicels spreading, 5-10 mm. long; petals yellow; calyx teeth minute or obsolete, the stylopodium depressed-conic; carpophore divided to the base; fruit orbicular to obovate, 5-6 mm. long, 4-5 mm. broad, strongly flattened dorsally, glabrous, the dorsal ribs filiform, the lateral ribs broadly thin-winged and nerved near the outer margins; oil tubes large, solitary in the intervals and 2 to 4 on the commissure, the seed face plane; strengthening cells in the dorsal ribs and near the outer wing-margins. The cult. parsnip has been reported as adv. in the Trans-Pecos; a Eur. species widely naturalized in the U.S., Can. and W.I.

35. LOMATIUM RAF.

The largest western North American genus in the family with about 80 species.

1. *Lomatium daucifolium* (Nutt.) Coult. & Rose. Plant acaulescent, to 45 cm. high, perennial with a long usually swollen taproot, villous-tomentose to glabrate; leaves broadly ovate to obovate, to 19 cm. long, ternate, then 3- to 4-pinnate; ultimate divisions of leaf linear, crowded, entire, apiculate; peduncles usually terminal, exceeding the leaves; involucre usually lacking; involucel of subdimidiate lanceolate acute to acuminate subscurious bractlets that are conspicuously nerved and connate to above the middle, equaling the flowers; rays 12 to 30, erect to spreading, to 7 cm. long, subequal; pedicels slender, to 13 mm. long, the umbellets 20- to 40-flowered, the central flowers often sterile; flowers yellow, the calyx teeth obsolete or small, the stylopodium lacking; carpophore divided to the base; fruit ovate-oblong, 6-9 mm. long, 3-6 mm. broad, flattened dorsally, glabrous, the dorsal ribs filiform or obsolete, the lateral ribs with membranaceous or corky wings narrower than the body; oil tubes 1 to 3 in the intervals, 2 to 4 on the commissure, occasionally solitary near the base of each wing, the seed face plane to slightly concave. In the n. Blackland Prairies and Plains Country, Mar.-Apr.; from Tex. n. to S.D.

36. EURYTAENIA T. & G.

Plants slender, erect, caulescent, branching, scaberulous, herbaceous, annual from slender taproots; basal leaves lobed or pinnatifid with obtuse crenate-serrate lobes, the cauline leaves pinnately or ternate-pinnately dissected with narrow often elongate entire or serrate divisions; inflorescence of compound umbels, the peduncles terminal and lateral; involucre of 1- to 2-ternate reflexed bracts shorter than the rays; bractlets like the bracts or entire; rays few, spreading-ascending, unequal, scaberulous, the slender pedicels spreading-ascending and scaberulous; flowers white, the calyx teeth prominent, the stylopodium depressed; carpophore divided to the base; fruit oblong-oval to orbicular, strongly flattened dorsally, scaberulous to glabrous, the dorsal ribs filiform to narrowly winged, the lateral ribs broadly winged, the wings nerved near the middle and with their margins contiguous; oil tubes large and flattened, solitary in the intervals and 2 on the commissure, the seed face plane; strengthening cells prominent in the ribs.

A genus of 2 species, endemic to Texas and Oklahoma.

1. Fruit oval to orbicular, 4-6 mm. long and broad, the lateral wings thin and lighter-colored than the body1. *E. texana*.
1. Fruit oblong-oval, 5-8 mm. long, 4-5 mm. broad, the lateral wings thicker than and homochromous with the body2. *E. Hinckleyi*.

1. *Eurytaenia texana* T.&G. TEXAS SPREAD-WING. Plant 3-12 dm. high, scaberulous in the inflorescence or glabrate; leaves ovate, to 10 cm. long and 5 cm. wide, lobed or pinnatifid with obtuse crenate or serrate lobes; cauline leaves pinnately or ternate-pinnately dissected; divisions of leaf oblong-lanceolate to linear or filiform, sharply serrate to entire, the terminal ones often elongate; peduncles 4-15 cm. long; involucre of about 5 usually 3-cleft bracts that are to 1 cm. long and scarious-margined toward the base; involucre of several bractlets like the bracts or entire; rays 8 to 15, spreading-ascending, 1.5-8 cm. long; pedicels 5-8 mm. long; fruit oval to orbicular, 4-6 mm. long and broad, scaberulous to glabrous, emarginate at the apex, the dorsal ribs filiform, the thinner lateral wings broader and lighter-colored than the body, distinctly nerved only on the commissural surface, their margins tapering gradually. Sandy soil in the Coastal and Blackland prairies, the Rio Grande Plains, and the Plains Country, Apr.-June; also Okla.

2. *Eurytaenia Hinckleyi* Math. & Const. Vegetatively very similar to *E. texana*; fruit oblong-oval, 5-8 mm. long, 4-5 mm. broad, scaberulous, truncate or emarginate at the apex, the dorsal ribs very narrowly winged, the lateral wings thicker than and homochromous with the body, prominently carinate-nerved on the dorsal surface; mericarps appearing 5-ribbed, their margins abruptly narrowed to a thin bordering flange. On white (perhaps gypsum) sands in the extreme s.w. Plains Country and adj. Trans-Pecos, May-July; endemic.

37. ANETHUM L.

A western Asiatic genus of 2 species.

1. *Anethum graveolens* L. DILL. Plant slender, 4-17 dm. high, erect, caulescent, alternately branching above, glabrous and glaucous, herbaceous, with a strong anise-odor, annual from subfusiform roots; leaves oblong to obovate, to 35 cm. long and 20 cm. wide, pinnately dissected with filiform divisions; upper cauline leaves greatly reduced; inflorescence of compound umbels, the terminal and lateral peduncles 7-16 cm. long and exceeding the leaves; involucre and involucre usually lacking; rays 10 to 45, spreading, 3-10 cm. long; pedicels 20 to 50, slender and spreading, 6-10 mm. long; flowers yellow, the calyx teeth obsolete, the stylopodium conic; carpophore divided to the base; fruit ovoid, about 4 mm. long and 2 mm. broad, flattened dorsally, glabrous, the ribs narrowly winged, the lateral ones broader than the dorsal; oil tubes solitary in the intervals, 2 to 4 on the commissure; seed face plane or slightly concave. Adv. primarily in Rio Grande Plains, sporadic elsewhere, Apr.-May; nat. to the Old World and adv. throughout warmer parts of the New World.

38. SANICULA L. BLACK SNAKEROOT. SANICLE

Plants low or slender, erect, spreading or decumbent, herbaceous, caulescent or acaulescent, branching, glabrous or pubescent, biennial or perennial from taproots, rootstocks, tubers, or fascicled fibrous roots; leaves petiolate to sessile, palmately or pinnately divided to pinnately or ternate-pinnately decomposed, rarely entire, the divisions variously toothed to lobed or entire, the rachis naked or winged; inflorescence of irregularly arranged capitulate umbellets, the peduncles terminal or terminal and lateral; involucre of small or occasionally large entire or lobed bracts longer or shorter than the umbellets; rays spreading to obsolete; flowers white, greenish-white, greenish-yellow, yellow, or purple, perfect or staminate, the staminate flowers often prominently pedicellate, the connate sepals prominent and persistent; stylopodium lacking; fruit oblong-ovoid to subglobose or ellipsoid, somewhat compressed laterally, densely covered with uncinat bristles or tubercles or lamellae, the ribs obsolete; oil tubes large or small, irregularly

arranged, several to numerous on the dorsal and lateral surfaces, usually 2 on the commissure, the seed face plane to concave or sulcate; strengthening cells absent.

A nearly cosmopolitan genus (absent from Australia and New Zealand) of 35 to 40 species.

1. Fruits sessile; plant from fascicled tuberous roots3. *S. Smallii*.

1. Fruits pedicellate or stipitate; plants from fascicled fibrous roots (2)

2(1). Styles exerted in fruit; flowers greenish-yellow; calyx deeply cleft, the lobes much shorter than the petals1. *S. gregaria*.

2. Styles included in fruit; flowers white; calyx cleft to the middle, the lobes exceeding the petals2. *S. canadensis*.

1. *Sanicula gregaria* Bickn. Plant erect, 2-7.6 dm. high, perennial from slender fascicled fibrous roots, glabrous, the stems solitary or several from the base and dichasially branched above; leaves broadly triangular to ovate, to 12 cm. long and 20 cm. wide, palmately 3- to 5-parted; primary divisions of leaf cuneate-obovate to lanceolate, acute, petiolulate, distinct or the lateral somewhat united, sharply serrate to incised-lobed above with spinulose teeth; cauline leaves few, similar; involucre of inconspicuous subscarious bracts; umbels few-flowered; sterile and fertile flowers in the same umbellet or the sterile in separate peduncled heads in the axils of the stem or main branches; fertile rays about 2 mm. long; flowers greenish-yellow; calyx cleft to the middle, the triangular-ovate lobes subobtusate with an inconspicuous central nerve and much shorter than the petals; anthers bright-yellow, exerted; styles conspicuous, recurved, exceeding the bristles; fruits usually 3 in each umbellet, subglobose to obovoid, 3-5 mm. long, 2-3 mm. broad, distinctly stipitate, minutely bristly or papillose, the numerous bristles not crowded and arranged in rows, conspicuous above but rudimentary below; oil tubes small, solitary in the intervals, 2 or 3 on the commissure; seed face plane, the scar linear. In moist woods in the Timber Belt and Blackland Prairies, Apr.-May; from Que., s. to Fla., w. to S.D. and Tex.

2. *Sanicula canadensis* L. Plant erect, to 10 dm. high, biennial from fibrous woody roots, glabrous, the usually solitary stem alternately dichotomously branched above and 3- to 4-furcate at the apex; leaves triangular to suborbicular, to 14 cm. long and 16 cm. wide, palmately 3-parted (occasionally 5-parted or appearing so by division of the lateral primary divisions); primary divisions of leaf ovate-lanceolate to cuneate-obovate, obtuse to acute, distinct, closely serrate and sometimes deeply incised above, the teeth mucronate to spinulose; cauline leaves becoming sessile above; involucre of a few small leaflike bracts; umbels few-flowered; sterile and fertile flowers in the same umbellet, the sterile flowers shortly radiate; rays 1-2 mm. long; flowers white; calyx deeply cleft, the narrowly lanceolate lobes acute and exceeding the petals; anthers white, slightly exerted; styles shorter than the calyx, inconspicuous; fruits 3 in each umbel, globose, 2-5 mm. long and broad, wrinkled, striate, the bristles dilated below, numerous in longitudinal rows, well-developed throughout; oil tubes large, solitary in the grooves of the dorsal surface, 2 on the commissure; seed face convex, the scar linear. In moist woods throughout e. and cen. Tex., Apr.-June; from Vt., s. to Fla., w. to S.D. and Tex.

3. *Sanicula Smallii* Bickn. Plant erect, 33-64 cm. high, biennial or perennial from fascicled tuberous roots, glabrous, the usually solitary stem occasionally alternately branched and 2- to 3-furcate above; leaves ovate, to 8 cm. long and 14 cm. wide, palmately 3-parted (appearing 5-parted by division of the lateral primary divisions); primary divisions of leaf ovate-lanceolate, acute, distinct, closely and regularly serrate, the teeth mucronate; cauline leaves becoming sessile above; involucre of small triangular-ovate subacuminate bracts; umbels few-flowered; sterile and fertile flowers in the same umbellet, the sterile flowers shortly radiate; fertile rays obsolete; flowers white; calyx deeply cleft, the rigid linear-subulate lobes with a conspicuous central nerve and about equaling the petals; anthers exerted; styles equaling or exceeding the calyx, shorter than the bristles; fruits usually 3 in each umbel, sessile, subglobose to ovoid, 3-5 mm. long, about 3 mm. broad, the numerous bristles short below and exceeding the erect calyx lobes above; oil tube large, solitary in the intervals, 2 or 3 on the commissure; seed face usually concave, the scar broadly linear. In moist woodlands in the Timber Belt, Apr.-May; from N.C., s. to Fla., w. to Mo. and Tex.

39. ERYNGIUM L. ERYNGO

Plants creeping to erect, caulescent or acaulescent, usually glabrous, herbaceous, annual, biennial or perennial from stout taproots or rootstocks bearing fibrous roots; leaves coriaceous or membranaceous, entire to pinnately or palmately lobed to divided, often ciliate to spinose, the venation parallel or reticulate, the petioles sheathing and sometimes septate; inflorescence capitate, the heads solitary or in cymes or racemes; involucre of one or more series of entire or lobed bracts subtending the head; involucel of entire or lobed bractlets subtending the flowers; flowers white to purple, sessile; sepals ovate to lanceolate, obtuse to acute, entire or rarely spinescent, persistent; stylopodium lacking; carpophore lacking; fruit globose to obovoid, scarcely compressed laterally, variously covered with scales or tubercles, the ribs obsolete, the commissure broad; oil tubes mostly 5, inconspicuous; seed face plane or slightly concave.

A genus of more than 200 species, in the temperate and warmer parts of the world, with important centers of development in Brazil-Paraguay, Mexico, western Asia, the Mediterranean region, and southeastern and western United States.

- 1. Leaves parallel-veined; plants with a monocotyledonous habit (2)
- 1. Leaves reticulate-veined; plants not monocotyledonoid (3)
- 2(1). Leaves 10-30 mm. broad, the marginal setae usually solitary; bracts ovate-lanceolate1. *E. yuccifolium* var. *yuccifolium*.
- 2. Leaves 5-10 mm. broad, the marginal setae usually in groups of 2 to 4; bracts linear-lanceolate2. *E. yuccifolium* var. *synchaetum*.
- 3(1). Cauline leaves conspicuously spinulose-pungent; bracts mostly broad, variously spinose-toothed, rarely entire, pungent (4)
- 3. Cauline leaves entire to pinnatifid, not spinulose-pungent; bracts very narrow, sometimes pungent-tipped, entire or occasionally with 3 to 5 spiny teeth (7)
- 4(3). Heads large, 2-3.5 cm. long, bright purple to red; bractlets spinescent with 3 to 7 prominent teeth; coma of about 8 prominent spinescent bracts 1-2 cm. long5. *E. Leavenworthii*.
- 4. Heads small, 2 cm. or less long; bractlets entire; coma-bractlets entire, inconspicuous or lacking (5)
- 5(4). Bracts bicolored, green or bluish beneath, yellowish-white above3. *E. heterophyllum*.
- 5. Bracts greenish above and below, not bicolored (6)
- 6(5). Plant diffusely branched; basal leaves deeply palmately parted, sessile or subsessile6. *E. diffusum*.
- 6. Plant erect; basal leaves serrate or dentate, petiolate ..7. *E. Hookeri*.
- 7(3). Plant erect; lower bractlets tricuspidate; basal leaves usually cordate8. *E. integrifolium*.
- 7. Plants prostrate to ascending; bractlets entire; basal leaves not cordate (8)
- 8(7). Heads in a terminal branched inflorescence, subsessile, many-flowered; bractlets exceeding the fruit4. *E. nasturtiifolium*.
- 8. Heads solitary, axillary, on filiform peduncles, few-flowered; bractlets shorter than the fruit9. *E. prostratum*.

1. *Eryngium yuccifolium* Michx. var. *yuccifolium*. RATTLESNAKE-MASTER, BUTTON SNAKE-ROOT. Plants stout, glabrous, 3-18 dm. high, perennial from a fascicle of tuberous woody roots; stems slender, solitary, branching above; basal leaves rigid, broadly linear, to 10 dm. long, 1-3 cm. wide, acute, remotely bristly with solitary (or occasionally 2 or more) bristles, the venation parallel; sheaths short; cauline leaves like the basal, reduced above; inflorescence cymosely branched, the pedunculate heads large, the flowers numerous; heads globose-ovoid, 1-2.5 cm. in diameter; bracts 6 to 10, spreading-ascending, ovate-lanceolate, to 15 mm. long, cuspidate, mostly entire, shorter than the

heads; bractlets like the bracts, entire or minutely serrulate, exceeding the fruit; coma wanting; sepals ovate, obtuse, mucronulate; styles exceeding the sepals; fruit oblong, 4-8 mm. long, the flattened scales of the angles lanceolate, 1.5-3 mm. long, those of the dorsal surfaces reduced or obsolete. In open prairies in the Timber Belt and the Coastal and Blackland prairies, May-Aug.; from Conn., s. to Fla., w. to Minn., Kan. and Tex.

2. *Eryngium yuccifolium* var. *synchaetum* Coult. & Rose. Plants slender; basal leaves to 35 cm. long and 1 cm. wide, remotely spinulose-setose, with the weak setae in groups of 2 to 4 and to 1 cm. long; heads subglobose, 1-1.5 cm. in diameter; bracts 6 to 9, spreading or reflexed, linear-lanceolate, to 1 cm. long, entire or few-toothed; bractlets like the bracts but broader, about 5 mm. long, entire, exceeding the fruit; sepals acute; petals oblong, 1.5 mm. long. *E. synchaetum* (Coult. & Rose) Coult. & Rose. In pine woodlands in the Timber Belt and in the Blackland and Coastal prairies, July-Aug.; from Ga. and Fla., w. to Tex. and Okla.

Var. *synchaetum* is distinguishable from var. *yuccifolium*, if at all, with difficulty; it may be an ecological variant, but it requires further study.

3. *Eryngium heterophyllum* Engelm. MEXICAN-THISTLE. Plants rather stout, caulescent, glabrous, 2-6 dm. high, perennial from a stout taproot, the stems erect and branching; basal leaves rosulate, narrowly oblanceolate to oblong-oval, to 12 cm. long and 3 cm. wide, cuneate, acute or obtuse, those of the sterile rosettes setose-dentate, the fertile leaves spinose-serrate to pinnatifid or bipinnatisect, the teeth or lobes acute, pungent, callous-margined, the venation pinnately reticulate; petioles narrowly winged, sheathing at the base, shorter than the blades; cauline leaves numerous, like the basal, the lower pinnatifid or bipinnatisect, the upper leaves opposite, sessile and palmately parted; inflorescence paniculately branched, the numerous pedunculate heads rather small, the flowers numerous; heads ovoid, blue to white, 7-15 mm. long, 5-10 mm. broad; bracts 8 to 14, rigid, spreading-ascending, linear-lanceolate to lanceolate, to 25 mm. long and 5 mm. wide, pungent or acuminate, with 1 or 2 pairs of spinose teeth or entire, green or bluish beneath and yellowish-white above, exceeding or occasionally shorter than the heads; bractlets subulate, 3-5 mm. long, entire, curved, exceeding the fruit; coma of 1 to 4 entire bractlets 5-15 mm. long or occasionally obsolete; sepals ovate, about 1 mm. long, obtuse or truncate and apiculate; styles slender, exceeding the sepals; fruit globose, 1.5-2.5 mm. in diameter, with flat scales below the sepals and on the upper angles, the faces papillate. In sandy soil in mts. of the Trans-Pecos, July-Sept.; from w. Tex., w. to Ariz., s. to Oax.

4. *Eryngium nasturtiifolium* Juss. HIERBA DEL SAPO. Plants prostrate, ascending or rarely erect, 1-3 dm. high or long, glabrous, biennial or perennial from a fascicle of fibrous roots or a slender taproot, the leafy stems several and branched from the base; basal leaves spatulate to oblanceolate, to 10 cm. long, 1-3 cm. wide, cuneate, coarsely dentate to runcinate-pinnatifid, the teeth or lobes mucronulate or spinose, the venation reticulate; petioles broad, winged; cauline leaves like the basal, spinose-dentate or spinose-pinnatifid; inflorescence divaricately trifurcate or cymose, the lateral branches often elongated and continuous to form a monochasium, the small heads numerous and nearly sessile, the flowers numerous; heads ovoid to ovoid-cylindric, to 15 mm. long and 8 mm. broad; bracts 5 to 9, rigid, spreading, subulate to linear-lanceolate, 8-20 mm. long, entire, pungent, about equaling the heads; bractlets lanceolate to obovate, 4-9 mm. long, broadly scarious-margined at the base, entire, exceeding the fruit; coma of several short bractlets 3-7 mm. long, resembling the bracts; sepals ovate, 1-1.5 mm. long, obtuse or acute, mucronulate, serrulate toward the apex; styles shorter than to exceeding the sepals; fruit ovoid-globose, 2-3 mm. long, densely covered with elliptic to linear white or flavescent scales to 2 mm. long. In moist heavy soil in the Rio Grande Plains, Mar.-July; Tex., Mex. and Cuba.

5. *Eryngium Leavenworthii* T.&G. Plants rather slender, glabrous and purplish, 5-10 dm. high, annual from a slender taproot, the leafy stems erect and divaricately branching; lower cauline leaves short-petiolate, broadly oblanceolate, to 6 cm. long and 2 cm. wide; upper cauline leaves sessile, broadly ovate to orbicular, deeply palmately parted, the divisions pinnatifid with pungent lobes, the venation reticulate; inflorescence sparingly cymose, the usually few short-pedunculate heads large, the flowers numerous; heads purplish to red, ovoid to ovoid-cylindric, to 35 mm. long and 25 mm. broad; bracts about

8, oblong, 3-4 cm. long, spinose-pinnatifid like the upper leaves, about equaling the heads; bractlets linear, 1 cm. long, spinose-lobed with 3 to 7 prominent teeth, exceeding the fruit; coma of about 8 prominent spinescent bractlets 1-2 cm. long; sepals oblong, 5 mm. long, spinose-pinnatifid toward the apex; styles shorter than the sepals; fruit oblong, 2-4 mm. long, densely covered on the angles and faces with linear or claviform white scales 1-2 mm. long. In plains and prairies throughout Tex. except in the Rio Grande Plains and the Trans-Pecos, July-Sept.; from Tex., n. to Kan.

6. *Eryngium diffusum* Torr. Plants low, caulescent, diffusely branched, prostrate to erect, 1-4 dm. high or long, glabrous, annual (?) from a slender taproot; basal leaves nearly sessile, obovate to cuneate, to 5 cm. long and 2 cm. wide, deeply palmately parted, the cuneate or oblong divisions spinulose-dentate or lobed, the venation palmately reticulate; cauline leaves numerous, like the basal; inflorescence successively trifurcate or some lateral branches elongated to form a monochasium, the small heads numerous and very short-pedunculate, the flowers numerous; heads bluish, globose-ovoid, 8-12 mm. long, 6-8 mm. broad; bracts 10 to 12, rigid, spreading, linear-lanceolate, 10-15 mm. long, 2-3 mm. wide, pungent, spinose-serrate, scarious-margined at the base, exceeding the heads; bractlets lanceolate, 5 mm. long, mucronate, entire, broadly scarious-winged at the base, exceeding the fruit; coma lacking; styles shorter than to slightly exceeding the sepals; fruit globose-ovoid, 2.5-3 mm. long, densely covered with linear acute subequal white scales 1-2 mm. long. In sandy soil almost throughout Tex. except in the Timber Belt and Trans-Pecos, May-Aug.; also in adj. Okla.

7. *Eryngium Hookeri* Walp. Plants slender, caulescent, glabrous, 3-6 dm. high, annuals from fascicled fibrous roots, the erect stems solitary and branched above; basal leaves obovate to oblong-lanceolate, 6-9 cm. long, 2-3 cm. wide, acute, somewhat serrate or dentate, the venation reticulate; petioles slender, sheathing at the base; lower cauline leaves nearly sessile, lanceolate, laciniately toothed and spinulose with a pair of small lacinate segments at the base; upper cauline leaves ovate, palmately divided with 5 to 7 oblong lacinate or pinnatifid spinulose lobes 2-3 cm. long; inflorescence cymosely branched, the pedunculate heads rather large, the flowers numerous; heads amethystine, ovoid to cylindrical-ovoid, 8-15 mm. in diameter; bracts numerous, rigid, linear-lanceolate, 1-2 cm. long, spinulose-serrate, broadly winged at the base, exceeding the heads; bractlets lanceolate, 4-6 mm. long, pungent, entire, exceeding the fruit; coma of a few elongate bractlets or wanting; sepals ovate-lanceolate, 2 mm. long, pungent-acuminate; styles shorter than the sepals; fruit 1-2 mm. long, densely covered with flat tawny scales to 0.5 mm. long. In moist limy soil in the Coastal and Blackland prairies, July-Sept.; also La.

8. *Eryngium integrifolium* Walt. Plants slender, caulescent, glabrous, 3-8 dm. high, perennial from a fascicle of tuberous or fleshy-fibrous roots, the erect stems solitary and branching above; basal leaves oblong-lanceolate to oblong-ovate, to 6 cm. long and 2.5 cm. wide, usually cordate at the base, obtuse, entire to shallowly crenate, the venation reticulate; petioles sheathing at the base, lower cauline leaves like the basal but short-petiolate to sessile, the uppermost leaves linear to oblanceolate or ovate, acute, usually spinulose-serrate or rarely lacinate or subentire; inflorescence branched, the pedunculate heads rather small, the flowers numerous; heads amethystine, ovoid to globose, 5-15 mm. in diameter; bracts 6 to 10, rigid, linear, 1-2 cm. long, entire or usually with 3 to 5 spiny teeth, exceeding the heads; bractlets tricuspidate, 3 mm. long, exceeding the fruit; coma lacking; sepals lanceolate, 1-1.5 mm. long, mucronate; styles slender, exceeding the sepals; fruit about 2 mm. long, the angles densely covered with rows of lanceolate white scales 0.5-1 mm. long, the surfaces usually scaleless. In moist woods and bogs in the Timber Belt and the Coastal and Blackland prairies, Aug.-Oct.; from N.C., s. to Fla. and w. to Tex. and Okla.

9. *Eryngium prostratum* DC. Plants low, prostrate or ascending, glabrous, 1.5-7 dm. high, perennial from a fascicle of fibrous roots, the stems very slender and simple or somewhat branched above; basal leaves ovate to lanceolate, to 55 mm. long and 25 mm. wide, simple or palmately lobed, the margins entire or irregularly and remotely dentate, the venation reticulate; petioles slender; cauline leaves like the basal, reduced, clustered at the nodes, sessile above; inflorescence of elongated monochasia bearing small numerous heads on filiform axillary peduncles, the flowers few; heads often blue, ovoid to ovoid-cylindric, to 9 mm. long and 4 mm. broad; bracts 5 to 10, foliaceous, reflexed, lanceolate,

to 12 mm. long, acute, equaling the heads; bractlets narrowly subulate, about 1 mm. long, acute, shorter than the fruit; coma lacking; sepals ovate to semiorbicular, about 0.8 mm. long, obtuse, mucronulate; styles exceeding the sepals; fruit subglobose, 2 mm. in diameter, sparsely covered with low white tubercles. In moist soil in the Timber Belt and the Coastal and Blackland prairies, May-Sept.; from S.C., s. to Fla. and w. to Ky., Mo. and Tex.

40. CENTELLA L.

A genus of perhaps 20 species, chiefly of the Southern Hemisphere.

1. *Centella asiatica* (L.) Urban. Plant perennial from slender creeping rootstocks, with stems 1 to several dm. long, rooting at nodes; leaves ovate-cordate to oblong, obtuse, to 10 cm. long and 9 cm. wide, entire or repand-toothed; petioles glabrous to fulvous-pubescent, usually with a tuft of hairs at the apex, to 35 mm. long, usually much shorter; inflorescence of simple lax to subcapitate umbels; peduncles axillary, shorter than to exceeding the leaves, to 11.5 cm. long; involucre of 2 conspicuous ovate to suborbicular scarious bracts; rays 2 to 5, to 4 mm. long; flowers white or rose-tinged, the calyx teeth obsolete, the stylopodium obsolete; carpophore entire; fruit ellipsoid, 3-4 mm. long, 3-5 mm. broad (broader than long), constricted at the commissure and flattened laterally, glabrous, the filiform primary ribs prominent, the secondary ribs and reticulations evident, the seed face plane; an oil-bearing layer beneath the epidermis, occasionally containing small oil tubes and a thick layer of strengthening cells surrounding the seed cavity. *C. erecta* (L. f.) Fern. Edges of streams and other wet places in e. half of Tex., May-Sept.; from Del., s. to Fla. and w. to Tex.; also W.I. and Mex. to C.A., S.A. and e. Asia.

41. HYDROCOTYLE L.

WATER-PENNYWORT

Plants low, glabrous or pubescent, herbaceous, perennial with slender creeping stems or rootstocks, rooting at the nodes; leaves peltate or nonpeltate, entire or parted to the base; inflorescence usually a simple umbel, sometimes proliferous or an interrupted spike, the axillary peduncles obsolete to much longer than the leaves; involucre inconspicuous, of numerous bracts; rays spreading to reflexed, sometimes obsolete; flowers white, greenish or yellow, the calyx teeth minute or obsolete, the stylopodium conspicuously conic to depressed; fruit ovoid to ellipsoid (broader than long), strongly flattened laterally, the dorsal surface rounded or acute, the dorsal ribs acute or obsolete, the slender lateral ribs conspicuous and acute or rarely obsolete; oil-bearing cells conspicuous to obsolete, strengthening cells usually surrounding the seed cavity, the seed face plane to concave.

A genus of about 100 species, chiefly of the tropics and the Southern Temperate Zone.

1. Leaves not peltate, the petioles attached in a sinus at one edge of the blade 5. *H. ranunculoides*.
1. Leaves peltate, the petioles attached to the middle of the blade (2)
- 2(1). Flowers and fruits in a simple (not proliferous) umbel 1. *H. umbellata*.
2. Flowers and fruits in a proliferous umbel or an interrupted spike (3)
- 3(2). Inflorescence profusely branched 4. *H. bonariensis*.
3. Inflorescence usually unbranched or only bifurcate (4)
- 4(3). Inflorescence often bifurcate; fruits sessile or subsessile 2. *H. verticillata* var. *verticillata*.
4. Inflorescence rarely bifurcate; fruits pedicellate 3. *H. verticillata* var. *triradiata*.

1. *Hydrocotyle umbellata* L. OMBLIGO DE VENUS. Plants glabrous; stems slender to somewhat thickened, floating or creeping; leaves orbicular-peltate, to 75 mm. in diameter, crenate or crenately lobed; petioles mostly slender, to 40.5 cm. long, usually much shorter;

peduncles usually exceeding the leaves, to 35 cm. long; umbels simple, many-flowered; rays to 2.5 mm. long, spreading and reflexed; stylopodium depressed; fruit orbicular to ellipsoid, 1-2 mm. long, 2-3 mm. broad, the dorsal surface acute, the dorsal and lateral ribs evident and obtuse; strengthening cells lacking. In wet places principally in the e. half of Tex., Apr.-Oct.; from N.S., s. to Fla., w. to Minn. and Tex.; also Ore., Calif., W.I. and from Mex., s. to S.A.

2. *Hydrocotyle verticillata* Thunb. var. *verticillata*. Plants glabrous; stems filiform, creeping; leaves orbicular-peltate, to 6 cm. in diameter, 7- to 14-veined, shallowly 8- to 13-lobed, the lobes crenate; petioles slender, to 26 cm. long, usually much shorter; inflorescence an axillary simple interrupted once- or twice-bifurcate (rarely tri- or quadrifurcate) spike, to 17 cm. long, with 2 to 7 few-flowered verticils, the interverticillar distance to 6 cm., the flowers sessile or subsessile; involucre of a few inconspicuous lanceolate bracts; fruit ellipsoid, 1-3 mm. long, 2-4 mm. broad, the dorsal surface acute, narrowly rounded to cuneate at the base, oblong in cross section, the acute dorsal and lateral ribs distinct, the commissural surface constricted; oil-bearing cells conspicuous; seed oblong-ovate in cross section. In wet places in the Timber Belt, Coastal and Blackland prairies and the Edwards Plateau, June-Aug.; from Mass., s. to Fla., w. to Mo., Tex., s. Ut., N.M., Ariz., Mex. and W.I.; also in H.I. and S. Afr.

3. *Hydrocotyle verticillata* var. *triradiata* (A. Rich.) Fern. Similar in habit to var. *verticillata*; leaves to 6 cm. in diameter, 8- to 14-nerved, shallowly 8- to 14-lobed; petioles slender, to 35 cm. long; inflorescence an axillary interrupted simple or rarely branched spike to 22 cm. long, with few 4- to 15-flowered verticils, the interverticillar distance to 4 cm., the flowers radiate, the rays to 1 cm. long. *H. Canbyi* Coult. & Rose, *H. australis* Coult. & Rose. In wet places chiefly in the Timber Belt, Coastal and Blackland prairies, Rio Grande Plains and Edwards Plateau, May-Aug.; from Mass., s. to Fla., w. to Nev. and Calif., also Mex., C.A., W.I. and S.A.

4. *Hydrocotyle bonariensis* Lam. **SOMBRELLLO**. Plants glabrous; stems slender, creeping; leaves orbicular to ovate-peltate, to 12 cm. in diameter, shallowly 12- to 19-lobed, the lobes crenate; petioles slender, to 37 cm. long; peduncles exceeding the leaves; umbels proliferous, many-flowered; rays to 2 cm. long, spreading and reflexed; involucre of lanceolate, acute bracts; flowers white to yellow; stylopodium depressed; fruit ellipsoid, 1-2 mm. long, 2-4 mm. broad, the dorsal surface acute, the acute dorsal and lateral ribs evident, the commissural surface constricted. In wet places in the Coastal and Blackland prairies, and on the Gulf side of the Rio Grande Plains, May-Nov.; from N.C., s. to S.A.; S. Afr.

5. *Hydrocotyle ranunculoides* L.f. Plants glabrous; stems slender to somewhat thickened, floating or creeping; leaves roundish-reniform with a sinus at the base, not peltate, to 8 cm. long and wide, 5- or 6-lobed about to the middle, the lobes crenate or lobulate; petioles mostly slender, to 34.5 cm. long; peduncles shorter than the leaves, axillary; umbels simple, 5- to 10-flowered; rays 1-3 mm. long, spreading and ascending; stylopodium depressed; fruit suborbicular, 1-3 mm. long, 2-3 mm. broad, the dorsal surface rounded, the ribs obsolete; strengthening cells absent. In wet places in the Timber Belt and Blackland Prairies, Apr.-July; from Pa. and Del., s. to Fla., w. to Ark. and Ariz.; also from Wash., s. along the coast to Pan., Cuba and S.A.

42. BOWLESIA R. & P.

A genus of 14 species, chiefly of South America.

1. *Bowlesia incana* R. & P. Plants annual from slender taproot, stellate-pubescent to glabrate, prostrate to suberect; stems slender, dichotomously branched, 1-5 dm. long or high; leaves opposite, with petioles to 7 cm. long, suborbicular in outline, to 3 cm. long and 45 mm. wide, palmately 5- to 7-lobed, the lobes entire to dentate; scarious stipules lacerate; peduncles to 2 cm. long, axillary, shorter than the leaves; umbels 2- to 6-flowered; involucre of a few subulate lacerate bracts; rays very short or obsolete; flowers white or purplish, the ciliate calyx teeth prominent, the styles very short, the stylopodium depressed-conic; carpophore entire; fruit sessile to subsessile, ellipsoid, 1-1.5 mm. long, 2-3 mm. broad; carpels depressed on the dorsal surface, the dorsal region inflated. *B. septentrionalis* Coult. & Rose. Adv. from S.A., in moist thickets and lawns, primarily, in s.e. half of Tex., Feb.-June; from Fla. to Calif. and Mex.; Eur., Asia and elsewhere.

FAM. 138. CORNACEAE DUM.

DOGWOOD FAMILY

Shrubs to large trees; leaves alternate or opposite, simple, entire or nearly so, without stipules; flowers regular, small, perfect or unisexual, 4- or 5-merous; calyx small or obsolete; petals (when present) 4 or 5; stamens 4 or as many as 12 in two series; filaments elongate; anthers introrse; pistil 1; styles 1 or 2; ovary inferior, 1- or 2-celled; fruit a drupe.

About 120 species in 14 genera, chiefly in the North Temperate Zone but also in the tropics of both hemispheres.

1. Large trees, mostly above 10 m. in height; leaves alternate; stamens 5 or more 1. *Nyssa*, p. 1170.
1. Shrubs or small trees, mostly less than 5 m. in height; leaves opposite; stamens 4 (2)
- 2(1). Flowers unisexual, apetalous, in catkinlike racemes; styles 2; leaves evergreen, with the opposing petioles basally connate 2. *Garrya*, p. 1171.
2. Flowers perfect, with petals, in open or congested cymes; style 1; leaves deciduous, the petioles free 3. *Cornus*, p. 1171.

1. NYSSA L.

TUPELO. SOUR-GUM

Trees with simple alternate deciduous leaves and greenish or greenish-white flowers borne at the summit of axillary peduncles; leaves entire or rarely slightly toothed, often crowded near tip of branchlets; flowers perfect or unisexual; *staminate flowers* numerous, the calyx small and 5-parted, the small fleshy petals soon deciduous or entirely lacking; stamens 5 to 12, inserted on the outer edge of a convex disk; *pistillate flowers* solitary or as many as 8, sessile in a bracted cluster, much larger than the staminate flowers; style simple, elongate; ovary 1-celled; fruit an ovoid to ellipsoid 1-seeded drupe.

A small genus of about 10 species in North America and Asia. Placed by some authors in the segregate family Nyssaceae.

1. Leaves usually much more than 1 dm. long, mucronate; staminate flowers sessile in a capitule; pistillate flowers solitary; fruits 20 mm. or more long; endocarp wing-ridged 1. *N. aquatica*.
1. Leaves usually less than 1 dm. long, not mucronate; staminate flowers pedicellate in an umbel or congested raceme; pistillate flowers 2 or more on a peduncle; fruits less than 15 mm. long; endocarp smooth or obtusely ridged (2)
- 2(1). Leaves obovate to broadly elliptic, typically about 2 times as long as broad, usually thin-textured, when young with a densely long-pilose petiole 2. *N. sylvatica* var. *sylvatica*.
2. Leaves mostly linear to oblanceolate, typically 3 times as long as broad, usually leathery, the petiole subglabrous or only sparsely short-pilose 2. *N. sylvatica* var. *biflora*.

1. *Nyssa aquatica* L. TUPELO, COTTON-GUM. Large tree to 30 m. or more tall, with the trunk somewhat swollen at base; leaves with petioles to 6 cm. long, ovate to broadly oblong-elliptic, cuneate or sometimes slightly cordate at base, rather abruptly acute to acuminate and mucronate at apex, to 3 dm. long and 1 dm. broad, pale and usually downy-pubescent on lower surface; fruit ellipsoid, bluish. *N. uniflora* Wang. In inundated swamps and along sluggish streams in e. Tex., Mar.-Apr.; from Va., s. Ind., s. Ill. and Mo., s. to Fla. and Tex.

2. *Nyssa sylvatica* Marsh. var. *sylvatica*. BLACK-GUM, SOUR-GUM, PEPPERIDGE. Rather large trees to 30 m. tall, with horizontally spreading branches; leaves with petioles to 2 cm. long, broadly rounded to abruptly acuminate at apex, lustrous on upper surface, smooth and glabrate or eventually glabrous on lower surface, to 14 cm. long and 7 cm. broad; fruiting peduncle usually more than 3 cm. long; fruits somewhat acid. Incl. var. *dilatata* Fern. and var. *caroliniana* (Poir.) Fern. In swamps, low woods and sandy open woodlands in e. Tex., Apr.-May; from Me., s. to Mo., Fla. and Tex.; also Mex.

Var. *biflora* (Walt.) Sarg. **BLACK-GUM**. Large trees to 35 m. tall, with the base of trunk swollen when submersed; leaves rounded to acute at apex, glabrous or nearly so, to 12 cm. long or more and rarely to 4 cm. broad; fruiting peduncle usually less than 3 cm. long; fruits bitterish. *N. biflora* Walt. In periodically inundated swamps, low wet woods and along streams in e. Tex., Mar.-Apr.; from Del. and Md., s. to Fla. and Tex.

2. GARRYA LINDL. SILK-TASSEL

Evergreen dioecious shrubs or small trees with 4-angled branchlets and opposite short-petioled leathery leaves; the opposing petioles basally connate; flowers unisexual, apetalous, in lax or dense pendulous spikes; *staminate flowers* pedicelled, in clusters of 3, with 4 stamens and a 4-parted calyx; *pistillate flowers* essentially sessile, solitary in the axils of the bracts, with the calyx 2-lobed or obsolete; ovary inferior, 1-celled; styles 2, persistent; fruit a dry or somewhat juicy drupe, the bitter pulp enveloping the 1 or 2 seeds, blackish or dark-purple.

About 18 species found only in North America. Segregated by some authors as a separate family, the Garryaceae.

1. Leaves typically elliptic to obovate, plane, with the margin smooth, not roughened nor muriculate; plants endemic to Edwards Plateau . . 1. *G. Lindheimeri*.
1. Leaves typically oblong-elliptic to ovate-elliptic, plane or undulate, with the margin roughened and more or less muriculate, especially above the middle; plants of the Trans-Pecos and Plains Country (2)
- 2(1). Leaves prominently undulate (especially when dry), when young the lower surface more or less covered with curled or crisped hairs 2. *G. ovata*.
2. Leaves plane, essentially glabrous or with the lower surface sparsely sericeous 3. *G. Wrightii*.

1. *Garrya Lindheimeri* Torr. Shrub or small tree 15-35 dm. tall; leaves oblong-elliptic to broadly elliptic or obovate, mostly broadly rounded and mucronate at apex, 4.5-8 cm. long, 2.5-5 cm. wide, plane, pubescent with curled or crinkly hairs on lower surface, with age becoming glabrate and lustrous on upper surface, the margins smooth and even; fruits blue, glaucous, 8-10 mm. in diameter. *G. ovata* var. *Lindheimeri* (Torr.) Coult. & Evans. On rocky slopes, ledges and bluffs, along streams and in ravines, limestone areas, endemic to Edwards Plateau, Mar.

2. *Garrya ovata* Benth. Shrub 15-25 dm. tall; leaves elliptic to ovate-elliptic, obtuse to subacute and apiculate at apex, 3-6 cm. long, 1.5-4 cm. wide, noticeably undulate or repand, when young densely tomentulose on both surfaces with loose curled or crinkly hairs, with age glabrate and lustrous on upper surface, the margins roughened and somewhat muriculate; fruits dark-blue, 4-8 mm. in diameter. *G. Goldmanii* Woot. & Standl. On steep slopes, in canyons and on ledges of mts. in the Trans-Pecos, reported from Plains Country, limestone and igneous areas, Mar.-Apr.; w. Tex., s. N.M. and n. Mex.

3. *Garrya Wrightii* Torr. Shrub or small tree 1-4 m. tall; leaves elliptic to broadly elliptic or oblong-elliptic, subobtusate to acute and mucronulate at apex, 3-5.5 cm. long, 1.5-3 cm. wide, when young sericeous, with age glabrous or nearly so, the margins roughened and somewhat muriculate; lowermost floral bracts foliaceous; fruits dark-blue, 4-7 mm. in diameter. Crevices of cliffs, among boulders and on open-wooded slopes in limestone and igneous-rock regions of the mts. of the Trans-Pecos, May-Aug.; from w. Tex. to s. Ariz. and n. Mex.

3. CORNUS L. DOGWOOD. CORNEL

Shrubs or small trees with opposite (in ours) deciduous leaves and small flowers in open cymes or close heads; flowers perfect; calyx minutely 4-toothed; petals 4, oblong-elliptic, obtuse, spreading; stamens 4, the filaments slender; style slender; stigma flat or capitate; fruit a small drupe, with a 2-celled and usually 2-seeded stone.

About 40 species in the North Temperate Zone.

1. Flowers in a congested cyme or head, subtended by a 4-bracted white or pinkish corollalike conspicuous involucre; fruits ellipsoid, red or rarely orange-yellowish 1. *C. florida*.
1. Flowers in open cymes; involucre none; fruit subglobose, blue or white (2)
- 2(1). Cymes elongate, laxly paniculate; pedicels usually bright-red; branches grayish; fruit white or creamy-white at maturity 2. *C. racemosa*.
2. Cymes broad, compact, flat or only slightly rounded across the top (3)
- 3(2). Leaves more or less scabrous on upper surface, pilose-woolly on lower surface; pith usually brown; fruits white at maturity 3. *C. Drummondii*.
3. Leaves glabrous or nearly so; pith white; fruits bluish at maturity 4. *C. foemina*.

1. *Cornus florida* L. FLOWERING DOGWOOD. Large shrubs or small trees to 12 m. tall, with a trunk to 5 dm. in diameter and a crown spreading to 11 m. or more across; branchlets usually greenish; leaves with petioles mostly less than 1 cm. long, ovate to ovate-elliptic or broadly elliptic, acute to acuminate at apex, tapering to a rounded base, to 12 cm. long and 8 cm. wide, dark-green on upper surface, pale and glabrous or silky-pubescent on lower surface; flowers yellowish-green to greenish-white, sessile, subtended by 4 white or pinkish showy petaloid bracts; bracts obovate, emarginate to somewhat pointed at apex, to 5 cm. long and 3 cm. wide, deciduous; fruits ellipsoid, 1-1.5 cm. long, dark-red to occasionally yellowish. *Cynoxylon floridum* (L.) Raf. In woodlands in e. and cen. Tex., Mar.-Apr.; in e. half of U.S., s.e. Can., s. to Fla. and Tex.

2. *Cornus racemosa* Lam. Shrub or small tree to 5 m. high, often forming thickets, the slender twigs reddish, soon becoming grayish, the pith usually pale-brown; leaves narrowly ovate or lanceolate to elliptic, mostly 4-8 cm. long, to about 4 cm. wide, abruptly long-acuminate, cuneate at base, papillose and somewhat whitened beneath, minutely appressed-strigillose on both sides; lateral veins 3 or 4 on each side; inflorescences often numerous, usually paniculiform, to 6 cm. long; pedicels and branchlets reddish; fruit at first lead-color, becoming white with maturity, 5-7 mm. high, the stone obliquely subglobose. *C. candidissima* Marsh., non Mill. In moist or wet soil on seepage slopes, in thickets and on stream banks in open woodlands in e. Tex., Apr.-June; from Me. to Man., s. to Fla. and Tex.

3. *Cornus Drummondii* C. A. Mey. ROUGH-LEAF DOGWOOD. Shrubs or small trees to 5 m. tall; branchlets gray or sometimes dark-brown or reddish, the pith brownish; leaves with petioles to 15 mm. long, ovate to elliptic-lanceolate, usually abruptly acuminate-attenuate at apex, to 10 cm. long and 6 cm. wide, more or less scabrous on upper surface, pilose-woolly on lower surface with the hairs mostly spreading; cymes (or corymbs) round-topped, pubescent, to about 75 mm. across; flowers white or creamy-white, somewhat malodorous; corolla cylindric in bud; petals 3.5-5.5 mm. long; fruits white, 5-6 mm. in diameter, the stone globose. *C. asperifolia* of auth. In damp woodlands and thickets, occasionally on dry hills, in e. half of Tex., Apr.-June; from e. Va., s. Ind. and s.e. Mo., s. to Fla. and Tex.

4. *Cornus foemina* Mill. ENGLISH DOGWOOD. Shrub or small tree to 4 m. tall; branchlets reddish or brown, smooth, the pith usually white; leaves with petioles 1 cm. or less long, broadly lanceolate to narrowly ovate-elliptic, tapering to a narrow elongate tip, to about 10 cm. long and 4 cm. wide, glabrous or nearly so, dark-green on upper surface, paler on lower surface; cymes round-topped, open; flowers creamy-white; corollas subcylindric in bud; anthers bluish; fruits bluish, about 5 mm. in diameter, the stone longer than broad and slightly furrowed. *C. stricta* Lam., *Svida stricta* (Lam.) Small. Swamps and low wet woodlands in e. Tex., May-June; from Ind. and Va., s. to Fla., La. and Tex.

FAM. 139. CLETHRACEAE KL.¹⁴¹

WHITE ALDER FAMILY

Shrubs with alternate serrate deciduous leaves, simple or stellate hairs and very fragrant flowers in crowded terminal simple or paniculate racemes; flowers regular, hypogynous,

¹⁴¹ Cf. Robert L. Wilbur in C. L. Lundell, *Flora of Texas* II: 18-20. 1969 for another treatment.

polypetalous, 5-merous; disk none; sepals separate, imbricate in bud; stamens 10, the filaments elongate; anthers sagittate, extrorse in bud, their sacs opening by pores at base and inverted at anthesis; ovary superior, 3-celled; style 3-cleft near summit; capsule globose, 3-valved, the valves 2-cleft at maturity, many-seeded, enclosed in the persistent calyx.

Only one genus.

1. CLETHRA L. SWEET PEPPER-BUSH. WHITE ALDER

Characters those of the family. Consisting of about 120 species that are found mainly in Asia and tropical America; also in temperate America and Madeira.

1. *Clethra alnifolia* L. Shrub to 3 m. tall; leaves 5-12 cm. long, obovate-elliptic to cuneate-obovate or occasionally elliptic-lanceolate, obtuse to shortly acuminate at apex, tapering to a petiole to 2 cm. long, sharply serrate above the middle, nearly entire below the middle, straight-veined; racemes erect, to 2 dm. long, densely short-pubescent; the deciduous bracts shorter than the flowers; flowers on short-pubescent pedicels 2-5 mm. long; calyx lobes triangular-ovate, acute, short-pubescent; petals white, oblong-obovate, about 8 mm. long; filaments glabrous; style slender; capsule pubescent, about 3 mm. in diameter, erect or ascending. In swamps, about lakes and in wet woods and thickets in s.e. Tex., July-Sept.; from Me. s. to Fla. and Tex.

In some regions this species is known as "poor man's soap"—the flowers when crushed in water form a lather.

FAM. 140. ERICACEAE JUSS.¹⁴² HEATH FAMILY

Shrubs, trees or rarely herbs or vines, evergreen or deciduous; leaves simple, alternate or rarely opposite or whorled, exstipulate, leathery to thin-herbaceous, entire or serrate; flowers perfect, regular or irregular, usually in racemes or panicles, rarely solitary; calyx of 4 to 7 distinct or partially united sepals, usually persistent; corolla of 4 to 7 distinct or united petals, commonly funnellform, campanulate or urceolate; stamens hypogynous, twice as many as the corolla lobes; anthers bilocular, often appendaged, dehiscing by "apical" slits, clefts or pores; style single, the stigma minute and discoid; fruit a loculicidal or septicidal capsule, drupe or berry.

Perhaps 2,000 species in about 75 genera nearly world-wide in distribution. A great many ornamental species occur in this family primary of which are the rhododendrons.

- 1. Plants parasitic or saprophytic herbs, without green coloring matter; leaves reduced to scales (2)
- 1. Plants autophytic and green, woody; leaves with well-developed blades (3)
- 2(1). Petals distinct; anthers without horns; plants glabrous or merely pubescent7. *Monotropa*, p. 1180.
- 2. Petals somewhat united; anthers horned; plants densely glandular-pubescent8. *Pterospora*, p. 1180.
- 3(1). Leaves coriaceous, evergreen; fruit a berry or drupe produced from a superior ovary, not juicy; found only in or west or north of the Edwards Plateau in Texas (4)
- 3. Leaves thin or sometimes coriaceous, deciduous or evergreen; fruit either a capsule from a superior ovary or a juicy berry produced from an inferior ovary; confined to the eastern third of Texas (5)
- 4(3). Small trees; cells of the ovary several-ovuled; fruit berrylike, only slightly fleshy, the surface granular-papillose1. *Arbutus*, p. 1174.
- 4. Shrubs; cells of the ovary 1-ovuled; fruit drupelike, dryish, the surface not granular2. *Arctostaphylos*, p. 1174.

¹⁴² Ref.: Carroll E. Wood, Jr. in Jour. Arnold Arb. 42:10-80. 1961.

- 5(3). Ovary inferior; fruit a juicy berry crowned by the persistent calyx teeth3. *Vaccinium*, p. 1175.
5. Ovary superior; fruit a dry capsule (6)
- 6(5). Corolla funnellform, elongate, the tube more or less glandular-stipitate; capsule ellipsoid-conic, septicidal4. *Rhododendron*, p. 1177.
6. Corolla urceolate, ovoid or cylindric, short, nonglandular; capsule subglobose to ovoid, loculicidal (7)
- 7(6). Inflorescence clearly elongate, racemose; sepals imbricate (at least in bud); capsule ovoid, truncate, the margins not differentiated5. *Leucothoë*, p. 1179.
7. Inflorescence of corymbose clusters in axils of leaves or bracts of the same or preceding season; sepals valvate or separated even in bud; capsule subglobose-compressed, the carpel midrib not differentiated ...6. *Lyonia*, p. 1179.

I. ARBUTUS L.

About 20 species in Asia, the Mediterranean region and the New World.

1. *Arbutus xalapensis* H.B.K. TEXAS MADRONE, NAKED INDIAN, LADY'S LEG. Small evergreen tree or rarely shrub, usually to 10 m. high or sometimes higher, with a trunk to 3 dm. in diameter; bark thin, pinkish to red-brown, peeling off in large papery sheets, the crooked stout spreading branches forming a distinct crown; leaves alternate, petiolate, ovate to oval or oblong-elliptic, to 1 dm. long and 45 mm. wide, rounded to acute at apex, rounded to subtruncate at base, coriaceous, entire or sometimes serrate, usually tomentose below when young, glabrate with age; flowers perfect, in tomentose panicles; floral bracts scaly, ovate, tomentose, concave, 3-4 mm. long; calyx lobes 5, scarious, pinkish-white, tardily deciduous; corolla ovoid-urceolate, 5-toothed, white, often pink-tinged, about 7 mm. long; stamens included, twice as many as the corolla lobes; filaments dilated at base; anthers compressed, bearing a pair of slender reflexed awns on back and each cell opening by a terminal pore; ovary 5-celled, pubescent; fruit dark-red to yellowish-red, 8-10 mm. in diameter, waxy-granular, edible. Incl. var. *texana* (Buckl.) Gray, *A. texana* Buckl. On wooded rocky hills and mt. slopes, in canyons and rarely on open plains in the Edwards Plateau, Trans-Pecos and South Plains, n. to Hockley Co., Feb.-Apr.; from Tex. and s.e. N.M., s. through Mex. to Guat.

2. ARCTOSTAPHYLOS ADANS.

About 40 species with all but one confined to the New World.

1. *Arctostaphylos pungens* H.B.K. MEXICAN MANZANITA. Shrub erect or ascending, to about 3 m. high, branching from the base to form thickets, with smooth red-brown exfoliating bark, the branchlets more or less cinereous with a fine tomentum; leaves alternate, with petioles to 1 cm. long, ovate to oblong-elliptic or obovate to oblanceolate, obtuse to acute and pungent at apex, narrowed and subcuneate at base, entire, coriaceous, persistent, to 3 cm. long and 15 mm. wide, cinereous-tomentose and somewhat bluish-green when young, becoming glabrate and dull-green or somewhat shining in age; racemes short, spikelike, simple or with 1 or 2 short branches; bracts triangular, about 3 mm. long, tomentose throughout; pedicels 5-7 mm. long, subtomentose to glabrous; flowers small, nodding; calyx 5-lobed, persistent; corolla cylindric-urceolate, white or pinkish, about 7 mm. long, with 5 short rounded recurved lobes; stamens 10, included; filaments dilated and usually hairy; anthers each with 2 dorsal awns, opening by terminal pores; ovary glabrous; fruit depressed-globose, glabrous, drupaceous, smooth, 5-8 mm. broad, chestnut-brown, edible; nutlets 4 to 10, separable or more or less coalescent, dorsally carinate and prominently roughened. On mt. slopes in the Trans-Pecos, rare, Feb.-Apr.; from w. Tex. to Ut. and Calif., s. in Mex. to Oax.

3. VACCINIUM L.¹⁴³

BLUEBERRY

Shrubs or small trees; leaves alternate, entire to serrate; flowers usually solitary, in clusters or racemes; corolla variously shaped, the limb 4- or 5-cleft; stamens 8 or 10; anthers awned on back or awnless, the cells opening by a terminal pore; berry 4- or 5-celled, many-seeded, sometimes 8- or 10-celled by false partitions extending from the back of each cell to the placenta, edible in most species.

A large genus of polymorphic species that are represented throughout the world. The edible fruits of several species provide the "blueberry" of the market place.

1. Flowers on specialized lateral branches, subtended by foliaceous bracts (2)
1. Flowers not on specialized branches, usually at the first nodes of a normal leafy branch (4)
- 2(1). Usually small trees or large shrubs; flowers and fruits articulated with pedicels; corolla enclosing the parts in bud; stamens enclosed in the usually broadly campanulate corolla at anthesis; leaves coriaceous, usually with some marginal teeth, shining or sometimes somewhat glaucous, essentially evergreen 1. *V. arboreum*.
2. Usually small shrubs, rarely arborescent; pedicels not articulated; corolla not enclosing the parts in bud; stamens exerted from the funnel-form corolla at anthesis; leaves thin, entire, dull-green or glaucous, deciduous (3)
- 3(2). Bracts of inflorescence conspicuously smaller than the foliage leaves, rarely more than 1 cm. wide; mature leaves rarely less than 5 cm. long 2. *V. stamineum*.
3. Bracts of inflorescence one half to nearly as large as the foliage leaves, 1-2 cm. wide; mature leaves to 5 cm. long 3. *V. caesium*.
- 4(1). Leaves coriaceous, evergreen, to 15 mm. long 4. *V. Darrowii*.
4. Leaves thin or thick-herbaceous, deciduous, 20 mm. or more long (5)
- 5(4). Lower surface of leaves bearing small glandular hairs (6)
5. Lower surface of leaves nonglandular (7)
- 6(5). Plants mostly less than 10 dm. high; leaves 3-4.5 (rarely 5) cm. long; corolla 6-9 mm. long 5. *V. virgatum*.
6. Plants 15 dm. or more high; leaves 4-5 (rarely 6.5) cm. long; corolla 9-12 mm. long 6. *V. amoenum*.
- 7(5). Leaves serrate, rarely more than 3 cm. long 7. *V. Elliottii*.
7. Leaves entire, rarely less than 5 cm. long 8. *V. arkansanum*.

1. *Vaccinium arboreum* Marsh. FARKLEBERRY, SPARKLEBERRY. Coarse shrub or small tree to 8 m. high, with a trunk to 3 dm. in diameter; leaves obovate to oblong-elliptic, mostly cuneate at base, rounded to obtuse and apiculate at apex, subentire or with some teeth (especially on lower margins), darker green and lustrous above, thick and leathery, to about 7 cm. long and 35 mm. wide, essentially evergreen in our area; flowers about 5 mm. long, spicy-scented, in loose leafy-bracted racemes, the bracts much smaller than and sometimes of different shape from the foliage leaves; pedicels jointed; corolla white, open-campanulate, the minute toothlike lobes recurved-reflexed; anthers included, their awns more than half the length of the tubular tips; style exerted; berry black or reddish-black, mostly hard and dry but sometimes somewhat moist, with hard stonelike seeds. *Batodendron arboreum* (Marsh.) Nutt. In sandy soils in pinelands, open mixed forests, thickets, clearings, fields and coastal scrub-forests, rather frequent along wooded streams, in e. and s.-cen. Tex., Mar.-May; from Fla. to Tex., n. to Va., s. Ind., s. Ill., s. Mo. and Okla.

Those plants that are more glaucous than usual have been segregated as var. *glaucescens* (Greene) Sarg.

¹⁴³ Adapted partly from W. H. Camp in Brittonia 5:203-275. 1945.

2. *Vaccinium stamineum* L. DEERBERRY, SQUAW-HUCKLEBERRY. Diffusely branched shrub to 3 m. high, commonly stoloniferous, the young branchlets and leaves more or less pubescent to essentially glabrous; leaves subsessile or with a petiole to 3 mm. long, ovate or oblong-elliptic to elliptic-lanceolate or elliptic-oblong, subcordate to rounded or cuneate at base, obtuse to acute and apiculate at apex, to 9 cm. long and 4 cm. wide, pale, often glaucous or whitened beneath; flowers 6-10 mm. long, in loose bracted racemes, pendulous on filiform pedicels about 1 cm. long; floral bracts similar to but usually much smaller than the foliage leaves, obtuse to acute, usually much less than 1 cm. wide; calyx glabrous or the lobes marginally ciliate; corolla white to greenish-white or purplish, open-campanulate, with 5 spreading lobes; anthers much-exserted, their awns much shorter than the tubular tips; berry juicy, tough-skinned, greenish to amber-color, sometimes purple or blue, with or without bloom, about 1 cm. in diameter, dropping promptly; seeds soft. *Polycodium stamineum* (L.) Greene. In sandy or clayey soils in pinelands, mixed forests, savannahs and bottomlands in s.e. Tex., rarely on wooded bluffs in n.e. Tex. (Bowie Co.), Mar.-May; from Tex. to Fla., n. to Mass., N.Y., s. Ont., O., Ind. and Mo.

This is a highly variable species and, east of Texas, a number of segregates have been proposed based on the presence or lack of pubescence and glaucousness of the leaves, stems, hypanthium and calyx. Most of these unstable variants can probably be found in our flora but they are scarcely worth recognizing.

3. *Vaccinium caesium* Greene. Small shrubs mostly less than 5 dm. high, pubescent to glabrate; leaves green or somewhat whitened beneath, typically oblong-elliptic, rounded to subcordate at base, usually bluntly obtuse-apiculate at apex, to 5 cm. long; bracts of inflorescence similar in shape to foliage leaves and one half to nearly as long as them, 1-2 cm. wide, noticeably exceeding the pedicels. In savannahs and open pine-hardwood forests in e. Tex., rare, Mar.-Apr.; from Fla. to Tex., n. to W.Va. and Pa.

This dubious species is distinguished from *V. stamineum* solely in having small, bluntly rounded foliage leaves, and bracts of the racemes 1-2 cm. wide and one half to nearly as large as the foliage leaves.

4. *Vaccinium Darrowii* Camp. Plants usually in extensive colonies, the stems twiggy above, rarely more than 4 dm. high; leaves coriaceous, evergreen, often markedly glaucous (especially when young), the lower surface nonglandular and usually glabrous or at most obscurely puberulent along the midvein, narrowly elliptic to spatulate, to 15 mm. long and 7 mm. wide, the margin entire or serrate (through introgression with *V. Elliottii*); corolla urceolate, 5-6 mm. long, pink or red; fruit blue, 4-6 mm. in diameter, of only fair flavor. Usually in dry sandy soil along open banks of creeks in s.e. Tex., Mar.; from Tex. to Fla.

5. *Vaccinium virgatum* Ait. Shrubs in rather extensive colonies, rarely more than 1 m. high; leaves deciduous, green, the lower surface conspicuously glandular, pubescent along the midrib or sometimes glabrous, spatulate to oblanceolate or narrowly elliptic, narrowly cuneate at base, acute to acuminate at apex, usually 3-4.5 (sometimes 5) cm. long and 1-1.5 (sometimes 2) cm. wide, the margin sharply serrate; corolla cylindrical-urceolate, 6-9 mm. long, pink-tinged, often conspicuously so; fruit usually shiny-black, 6-10 mm. in diameter, generally of poor flavor and texture. Mostly along streams in open forests, in boggy areas and flatwoods in e. Tex., Mar.-Apr.; from n. Fla., Ga. and Ala., w. to Tex. and Ark.

This species and *V. amoenum* are separated entirely upon size-differences of certain organs as given in the key. Although such a basis for separating species is usually eschewed, this particular characteristic for these two entities is remarkably constant.

6. *Vaccinium amoenum* Ait. Plants suckering to form dense clumps that are occasionally a meter or more in diameter at the base, sometimes crown-forming, 15-25 dm. high; leaves deciduous, dark-green or rarely slightly glaucous, the lower surface bearing conspicuous glands, pubescent along the veins or rarely glabrescent, obovate to oblanceolate or elliptic, cuneate at base, acuminate at apex, 4-5 (rarely to 6.5) cm. long and 15-25 (rarely to 30) mm. wide, the margin sharply serrate; corolla narrowly to broadly cylindrical-urceolate, 9-12 mm. long, often deep-pink; fruit black or dark-blue, 8-10 mm. in diameter, usually thick-skinned and of unpleasant flavor. Usually along streams in woodlands and on edge of woods and savannahs in e. Tex., Mar.-May; from S.C. to n. Fla., w. to Tex. and Ark.

7. *Vaccinium Elliottii* Chapm. ELLIOTT'S BLUEBERRY. Plants crown-forming or sometimes in much-restricted colonies, 2-4 m. high; leaves deciduous, usually thin-textured, green and shining, the lower surface nonglandular, glabrous to puberulent or even pubescent, usually broadly elliptic, to 3 cm. long and 15 mm. wide, the margins serrate or rarely subentire; corolla narrowly urceolate, 6-7 mm. long, usually some shade of pink; fruit usually dark, sometimes black and shining but often dull and occasionally glaucous, 5-8 mm. in diameter or larger in some forms, the flavor fair to poor. In open flatwoods and ravines, rarely in swampy areas and occasionally in cleared river bottoms that are subject to periodic flooding, in e. Tex., Feb.-Apr.; from s.e. Va., s. to Fla., w. to Tex. and Ark.

8. *Vaccinium arkansanum* Ashe. Large shrub, often with several stems, crown-forming or (if disturbed) suckering from a rather small base, 2-4 m. high; leaves deep-green, the lower surface rather pale and nonglandular, pubescent, broadly elliptic, rounded to cuneate at base, acute and apiculate at apex, to 8 cm. long and 4 cm. wide, the margin entire; corolla cylindric-urceolate, 6-8 mm. long, greenish-white, often with pink or red stripes or the whole surface suffused with pink; fruit dull-black or with a bloom, 7-10 mm. in diameter, of fine flavor. *V. atrococcum* and *V. corymbosum* of Texas reports. Sandy lake or stream margins or in swamps, occasionally in bogs or open flatwoods, in e. and s.e. Tex., Feb.-Apr.; from n. Fla., w. to Tex. and Ark.

This species has excellent possibilities of being improved and commercially grown for its tasty fruit on sour evergreen-shrub bog soils in southeast Texas. Where found, it produces abundant deep blue fruits with a fine blueberry flavor.

4. RHODODENDRON L.

RHODODENDRON. AZALEA

Shrubs or small trees, evergreen or deciduous; buds with several to many imbricate scales; leaves alternate, entire or rarely serrulate; flowers pedicellate, usually in umbellate clusters or corymbs; calyx small, 5-parted, persistent; corolla variously colored from white to purple or red, sometimes yellow, funnellform to tubular or rotate to campanulate, usually with a 5-lobed limb, deciduous; stamens mostly twice as many as the corolla lobes and greatly exceeding them, usually declined; anther cells opening by a small apical pore; style elongated and mostly surpassing the stamens, the stigma capitate; capsule septicidal, usually ellipsoid-conic, the seeds numerous.

About 600 species in temperate and cold regions of the Northern Hemisphere.

1. Outer surface of corolla lobes with stipitate glands extending up to or near the apex; flowers appearing (or expanding) after the leaves have unfolded; pedicels, calyx and capsules copiously stipitate-glandular; filaments usually only slightly exceeding the corolla (2)
1. Outer surface of corolla lobes without stipitate glands to near the apex, glabrous or at most puberulent or pubescent; flowers appearing before or with the leaves as they unfold; filaments usually conspicuously longer than the corolla (3)
- 2(1). Shrubs 4-10 dm. high, rhizomatous to form colonies 1. *R. Coryi*.
2. Shrubs rarely less than 10 dm. high, not noticeably rhizomatous or colonial 2. *R. oblongifolium*.
- 3(1). Pedicels, young twigs, petioles, calyx and capsules all canescent-strigose, rarely with a few short scattered inconspicuous glands 3. *R. canescens*.
3. Pedicels, young twigs, petioles, calyx and (to a lesser extent) the capsules all copiously and conspicuously glandular-stipitate 4. *R. prinophyllum*.

1. *Rhododendron Coryi* Shinnery. Shrub 4-10 dm. high, with a woody rhizome, the branches more or less strigose; leaves oblong-obovate to obovate-elliptic or oblanceolate, to 45 mm. long and 2 cm. wide, mostly marginally strigose; flowers produced after the leaves have unfolded; pedicels pubescent and glandular-stipitate; sepals much-abbreviated, pubescent and glandular-stipitate; corolla probably white, about 4 cm. long, the lobes dorsally glandular-stipitate up to or near the apex. In bogs and low woodlands along streams in s.e. Tex., Mar.-May; apparently endemic.

In Texas, this species replaces the similarly rhizomatous *R. atlanticum* (Ashe) Rehd. of eastern United States. It differs markedly, however, from that species. The pedicels, calyx and corolla of *R. Coryi* are not only adorned with stipitate glands but are also more or less densely pilose while those of *R. atlanticum* are essentially glabrous and only glandular-stipitate. The style of *R. Coryi* also is only puberulent or minutely pubescent near its base whereas the style of *R. atlanticum* is conspicuously long-pubescent in most or all of its lower half.

As in *R. oblongifolium*, the flowers in this species develop after the leaves have unfolded, whereas the flowers of *R. atlanticum* appear before or with the young leaves. There is little besides its rhizomatous habit and small stature to separate *R. Coryi* from *R. oblongifolium*. A more realistic treatment might be to consider it as only varietally different from *R. oblongifolium*.

2. *Rhododendron oblongifolium* (Small) Millais. Shrub to 25 dm. high; branchlets finely villous to glabrous and more or less reddish-strigose; buds grayish-pubescent; leaves short-petioled, obovate to elliptic or oblanceolate, to 1 dm. long, cuneate or only slightly rounded at base, rounded to acute and mucronate at apex, pubescent beneath to nearly glabrous and sometimes glaucescent; pedicels to 15 mm. long, hirsute to subglabrous and glandular-stipitate; flowers white, produced after the leaves are developed; sepals ovate to lanceolate, 1-3 mm. long, glandular; corolla tube usually stoutish, 2-3 cm. long, rather abruptly dilated at the apex, villous and copiously glandular-stipitate on the outside; corolla lobes dorsally glandular-stipitate up to or near the apex; styles white or pink; capsule ellipsoid-conic, 1.5-2 cm. long, blackish and sometimes shiny, profusely adorned with large stipitate glands. *Azalea oblongifolia* Small. In sandy or light soils in boggy or seepage areas, along wooded streams and ravines, and in open low pine and pine-hardwood forests in e. Tex. and La., Apr.-July or even as late as Sept.

In our region this species takes the place of the more eastern *R. viscosum* (L.) Torr. (*Azalea viscosa* L.) which it closely resembles and under which name our plant has been placed in the past. It is our most widespread and frequent rhododendron, and it also begins flowering a little later than the other species found in Texas. The flowers are manifestly viscid or glutinous to the touch.

3. *Rhododendron canescens* (Michx.) Sweet. HOARY AZALEA. Shrub to about 3 m. high, sparingly branched; branchlets canescent-pilose and more or less strigose and sometimes with scattered small glands; leaves mostly oblanceolate to narrowly obovate or oblong, subglabrous to grayish-pubescent or tomentose beneath, to 11 cm. long, cuneate at base, rounded to subacute and mucronate at apex; flowers produced before or with the leaves, slightly fragrant; pedicels canescent-strigose, rarely sparsely glandular; calyx lobes glandless, canescent; corolla tube slender, 15-23 mm. long, usually pink, abruptly expanded at the apex, about twice as long as the whitish glandless lobes; filaments mostly about 3 times the length of the corolla tube; style 4-6 cm. long; capsule dark-brown, ellipsoid, about 15 mm. long, villous-setose, nonglandular. *Azalea canescens* Michx. In sandy or light soils in and on the edge of bogs, in seepage areas, along wooded streams and in pine-hardwood flats in e. Tex., Mar.-May; from Fla. to Tex., n. to Del., Md. and O.

This species includes those plants from Texas that have previously been placed in *R. nudiflorum* (L.) Torr. (*Azalea nudiflora* L.). The name, var. *subglabrum* Rehd., has been assigned to those plants with glabrous or glabrescent leaves.

4. *Rhododendron prinophyllum* (Small) Millais. HONEYSUCKLE, EARLY-AZALEA. Shrub to about 3 m. high; branchlets finely pubescent and more or less strigose and glandular-stipitate; buds grayish-pubescent; leaves usually narrowly oblanceolate to elliptic, sometimes obovate, more or less dull-bluish-green in color, to 9 cm. long, obtuse to acute or short-acuminate, grayish-pubescent or short-pilose beneath, more or less pilose above; flowers produced with the leaves, very fragrant; pedicels with stipitate glands among the villosity; calyx lobes ovate, rarely 1 mm. long, glandular-ciliate; corolla glandular-stipitate and villous, bright-pink varying to whitish or with the tube rose-color; corolla tube 1.5-2 cm. long, gradually dilated upward, more or less glandular-stipitate on outside, pubescent inside, about equaling the glandless lobes; filaments mostly about twice the length of the corolla tube; style 4-5 cm. long, commonly purplish above base; capsule dark-brown, oblong-ellipsoid, 1.5-2 cm. long, slightly puberulous and somewhat glandular. In sandy or light soils usually in moist or wet situations in swamps, along wooded streams and in

bog areas in s.e. Tex., late Feb.-May; from Me. to Que., s. and s.w. to Tenn., Mo. and Tex.

5. LEUCOTHOE D. DON

FETTER-BUSH. LEUCOTHÖE

About 50 species mostly in the New World with several in eastern Asia.

1. *Leucothoe racemosa* (L.) Gray. Deciduous shrub to 4 m. high, with ascending branches; leaves alternate, short-petioled, oblong to oblanceolate or obovate, acute to short-acuminate, finely serrulate, to 8 cm. long, somewhat pubescent when young; racemes mostly solitary, somewhat secund, ascending or divergent, mostly terminating leafless branches of the previous year, to 7 cm. long; pedicels 2-3 mm. long; flowers white, 5-merous, scaly-bracted; sepals ovate-lanceolate, ciliate, about 3 mm. long, persistent, imbricated in bud; corolla 7-9 mm. long, tubular, constricted at throat, the short lobes spreading; stamens 10; anther-cells each 2-awned; capsules depressed-globose, not lobed, 2.5-3 mm. long, 3-4 mm. thick, the style long-persistent, the sutures not thickened; seeds angled and wingless. *L. elongata* Small. Moist thickets, swamp forests and sunny lake shores in s.e. Tex., spring-fall; from Tex. to Fla., n. to Mass., s.e. N.Y. and e. Pa.

6. LYONIA NUTT.

Shrubs or rarely arborescent, deciduous or evergreen; leaves alternate, herbaceous to coriaceous, entire or serrulate; flowers white to rose-color, 5-merous, long-pedicellate, in fascicles, racemes or panicles; calyx lobes valvate; corolla cylindric-ovoid to globose-urceolate, with short lobes; stamens 10; filaments basally dilated, hairy and often toothed or appendaged; anthers ovate to oblong, awnless, opening by 2 terminal pores; capsule globose to ovoid, scarcely 5-angled, the dorsal sutures with a thickened ridge that usually divides at dehiscence of the capsule.

About 30 species in Asia and the New World.

1. Leaves serrulate; inflorescence paniculate; sepals triangular, 1-1.5 mm. long; corolla globose- to ovoid-urceolate, white, about 3 mm. long . . . 1. *L. ligustrina*.
1. Leaves entire; inflorescences umbellate-racemose; sepals oblong, 3-10 mm. long; corolla nodding, cylindric-ovoid, white to pink, 8-13 mm. long 2. *L. mariana*.

1. *Lyonia ligustrina* (L.) DC. HE-HUCKLEBERRY, MALEBERRY. Shrub to 4 m. high, sometimes arborescent, deciduous, the bark scaly; leaves short-petiolate, thin, elliptic or elliptic-lanceolate to obovate or oblanceolate, acute to abruptly acuminate, to 95 mm. long and 45 mm. wide, serrulate to rarely subentire; racemes borne in panicles terminating the branches or from the upper axils, the bracts (in ours) foliaceous; sepals 1-1.5 mm. long, broadly triangular; corolla whitish, globose- to ovoid-urceolate, to 3 mm. long; filaments flat, not appendaged; capsule globose to subglobose, to 3 mm. long, about 4 mm. thick. Incl. var. *capreaefolia* (Wats.) DC. In bog and seepage areas, and along wooded streams in e. Tex., Apr.-June; from Fla. to Tex., n. to N.E., N.Y., W.Va., Ky., Ark. and Okla.

2. *Lyonia mariana* (L.) D.Don. STAGGER BUSH. Slender upright shrub, usually with stems naked below and with strongly ascending branches above, usually more or less pilose throughout, to about 2 m. high, usually less than 1 m. high; leaves shortly petiolate, borne on new shoots, deciduous, elliptic-oblong to elliptic-lanceolate or narrowly obovate, obtuse to acute, to 11 cm. long and 5 cm. wide, entire; inflorescences umbellate-racemose, fascicled along leafless old branches; pedicels 1-2 cm. long, bracteolate at the very base; flowers nodding; sepals narrowly oblong, to 1 cm. long, tardily deciduous; corolla cylindric to cylindric-ovoid, 8-13 mm. long, white or pinkish; filaments usually bidentate near apex; capsule ovoid-pyramidal, truncate at the contracted apex, about 7 mm. long, surrounded by the finally appressed sepals. Peaty or sandy pinelands and edge of evergreen shrub bogs, usually in moist soils, in e. and s.-cen. Tex., Mar.-June; from Fla. to Tex., n. to s. N.E., s.e. N.Y., e. Pa., w. Tenn., s. Mo. and Ark.

The foliage is considered to be poisonous to young grazing animals.

7. MONOTROPA L.

Low fleshy herbs, apparently devoid of chlorophyll, variously colored tawny, reddish or white, turning black in drying, parasitic or growing on decomposing vegetable matter; stems clustered, erect, arising from a mass of matted fibrous brittle roots; leaves reduced to bracts along the stems; flowers one to several, at first nodding but erect in fruit; calyx of 2 to 5 bractlike segments, deciduous; corolla urceolate or broadly tubular, composed of erect spatulate or cuneate scalelike petals that are gibbous or saccate at the base and tardily deciduous; stamens 8 or 10; filaments subulate, pubescent; anthers becoming 1-celled, opening by 2 clefts across the top; style columnar; stigma discoid, 4- or 5-rayed; capsule ovoid, 8- to 10-grooved, the 4 or 5 cells loculicidal.

A few widely distributed species in the Northern Hemisphere.

1. Plants glabrous, 1-flowered, inodorous; style much-abbreviated and broad, glabrous, shorter than the ovary 1. *M. uniflora*.
1. Plants more or less pubescent, with several flowers in a scaly raceme, mostly fragrantly aromatic; style commonly longer than the ovary, pubescent (2)
- 2(1). Plant mostly yellowish; bracteal leaves typically ovate-oblong and 1 cm. or less long; distribution northeast Texas 2. *M. Hypopithys*.
2. Plant mostly reddish; bracteal leaves typically suborbicular-ovate and more than 1 cm. long; distribution Trans-Pecos Texas 3. *M. latisquama*.

1. *Monotropa uniflora* L. INDIAN-PIPE. Plants to about 2 dm. high, smooth, at first waxy-white, finally tinged with rose-color, drying black, the stems solitary or several; leaves scalelike, 5-10 mm. long; flower solitary, nodding, to 15 mm. long; sepals 2 to 4, linear-oblong to oblong-spatulate, soon deciduous; petals 5 or 6, exceeding the sepals, oblong-spatulate; filaments pubescent; capsule ovoid-oblong, 1-1.5 cm. long. In humus of moist pine-hardwoods in e. Tex., Apr.-July; from Nfld. to Alas., s. to Mex.; also e. Asia.

2. *Monotropa Hypopithys* L. AMERICAN PINESAP. Plants to about 25 cm. high, yellowish, finally tinged with pink or crimson, darkened in drying, downy or finely pubescent throughout; leaves scalelike, ovate-oblong, 5-12 mm. long; flowers few and separated or rather numerous and crowded, to 15 mm. long; pedicels about as long as or shorter than the flowers; sepals as many as the petals, cuneate to narrowly oblanceolate, acute to acuminate; petals cuneate to cuneate-oblong, exceeding the sepals; filaments and style pubescent; stigma clavate, retrorsely bearded on the margin; capsules ovoid to globose, 4-5 mm. long. Moist woods in deep humus in n.e. Tex., Apr.-June; from Nfld. to Alas., s. to Mex.; also Euras.

3. *Monotropa latisquama* (Rydb.) Hult. Plants usually red or pink, the stem rather stout, more or less pubescent throughout, to about 3 dm. high; leaves thickish, broadly ovate to orbicular-ovate, the larger upper ones 1-1.5 cm. long, undulate or erose; bracts shorter than the flowers; flowers about 12 mm. long; sepals spatulate to narrowly cuneate, ciliate; petals cuneate to obovate, pubescent, ciliate; filaments 7-8 mm. long; capsules globose-ovoid, 6-7 mm. long. In rich soil under conifers in mt. canyons of the Trans-Pecos, Oct.-Nov.; from Alas., s. to w. Tex., N.M. and Mex.

8. PTEROSPORA Nutt.

A monotypic genus of temperate North America.

1. *Pterospora Andromeda* Nutt. PINEDROPS. Saprophytic herb with brownish or purplish herbage, the stems erect and simple, to 1 m. high, viscid-pubescent, arising from a thick ball-like mass of roots; leaves crowded below, scalelike, linear-lanceolate, 15-35 mm. long, mostly crowded at base of stem, the upper ones scattered and small; raceme erect, virgate, to 5 dm. long, many-flowered; flowers nodding on recurved pedicels; sepals 5, linear-lanceolate, 4-5 mm. long, glandular-pubescent, slightly united at base; corolla urceolate, 7-8 mm. long, white, the 5 short lobes rounded and recurved, marcescent; stamens 10, included, with slender filaments, the 2 dorsal appendages of the anthers about as long as the pollen sacs; ovary 5-celled, depressed-globose, the short style stout, the capitate-peltate stigma shallowly 5-lobed; capsule 8-12 mm. broad, strongly depressed,

5-lobed, loculicidal; seeds numerous, broadly winged at the apex. Growing in humus in coniferous forests in the Guadalupe Mts. of the Trans-Pecos, June-Sept.; from Tex., n.e. to Pa., w. to B.C. and Calif., also n. Mex.

The eastern Sorrell-tree or Sourwood, *Oxydendrum arboreum* (L.) DC. has been reported from Texas, but we have seen no material from the state. We believe the report to be erroneous and based on misidentified material. This is a small deciduous tree with long elliptic-lanceolate leaves and small white flowers in long one-sided racemes that are clustered in open panicles that terminate the branches of the season. On the living trees the inflorescences have a graceful "down-swept" appearance.

FAM. 141. PRIMULACEAE VENT.¹⁴⁴

PRIMROSE FAMILY

Annual or perennial herbs with simple or rarely dissected leaves and regular perfect usually 5-merous flowers; calyx free from or partially adherent to the ovary, merely toothed or divided nearly to base; corolla gamopetalous, shallowly lobed to deeply divided; stamens as many as the lobes of the corolla and inserted opposite to them on the tube or at base of lobes; ovary 1-celled, with a central free placenta rising from the base and bearing several to many seeds; style and stigma one, the stigma truncate to capitate; fruit a dehiscent capsule.

About 1,000 species in about 20 genera that are widely distributed in the Northern Hemisphere.

1. Aquatic plants with pectinately dissected leaves; flowers in whorls on the conspicuously inflated floating peduncles 1. *Hottonia*, p. 1181.
1. Terrestrial or marsh plants with entire or merely toothed leaves; flowers solitary, umbellate or racemose (2)
- 2(1). Ovary partially inferior, adnate to the calyx tube; inflorescence racemose, the pedicels bracteate or ebracteate 2. *Samolus*, p. 1182.
2. Ovary wholly free from the calyx (3)
- 3(2). Scapose; flowers in involucrate umbels (4)
3. Caulescent; flowers solitary in the leaf axils or in racemes (5)
- 4(3). Low rosulate annuals with pubescent leaves; corolla inconspicuous, the lobes erect or spreading at anthesis; calyx accrescent, the lobes green and not ridged, the tube white and prominently ridged; stamens distinct, included 3. *Androsace*, p. 1183.
4. Perennials with broad glabrous or glabrate leaves; corolla conspicuous, the lobes reflexed at anthesis; calyx herbaceous and not ridged, the lobes and tube similar in texture; filaments connate below, the anthers forming an exerted cone 4. *Dodecatheon*, p. 1183.
- 5(3). Capsule valvate; corolla yellow; perennials with opposite or whorled leaves; flowers 5- or 6-merous 5. *Lysimachia*, p. 1184.
5. Capsule circumscissile; corolla scarlet, salmon-color, blue or white; annuals with alternate or opposite leaves; flowers 4- or 5-merous (6)
- 6(5). Leaves opposite or whorled; corolla exceeding the calyx 6. *Anagallis*, p. 1185.
6. Leaves alternate; corolla shorter than calyx 7. *Centunculus*, p. 1185.

1. HOTTONIA L.

FEATHERFOIL. WATER-VIOLET

Two species, the Eurasian *H. palustris* L. and the present one in the United States.

1. *Hottonia inflata* Ell. AMERICAN FEATHERFOIL. Aquatic herb with the erect or ascending hollow leafless flower stems to 3 dm. long, the internodes inflated; submersed stems to

¹⁴⁴ Ref.: R. B. Channell and C. E. Wood, Jr. in Jour. Arnold Arb. 40:268-288. 1959.

5 dm. long; leaves oblong in outline, to about 7 cm. long, dissected into filiform divisions, clustered at base of flower stems and scattered along the rooting and floating vegetative stems; flowers white, pedicellate, subtended by sepeloid bracts, several in whorls at the nodes or joints to form an interrupted raceme; calyx and corolla subequal, 4-5 mm. long; calyx 5-parted, the divisions linear; corolla with a short tube, the limb 5-parted; stamens 5, included, the filaments short; capsule subglobose or obpyriform, many-seeded, the 5 valves cohering at base and summit; seeds anatropous. In lakes, pools and ditches in e. Tex., Apr.-June; from Fla. to Tex., n. to N.E., N.Y., O., Ind., s. Ill. and Mo.

This species has the potential nuisance value of the water hyacinth (*Eichhornia crassipes*).

2. SAMOLUS L.

WATER-PIMPERNEL. BROOKWEED

Perennial somewhat succulent caulescent herbs; leaves in basal rosettes and then usually alternate on stem, entire; flowers on wiry pedicels in simple or paniced bracted or naked racemes; calyx herbaceous, campanulate, 5-lobed, persistent; corolla perigynous, white or pink, the tube short, the 5 rounded lobes imbricated; stamens 5, included, adnate to the corolla tube, sometimes alternating with 5 narrow staminodia that are in the sinuses between the corolla lobes; anthers cordate, erect; ovary half-inferior, 1-celled, the stigma obtuse or capitate; ovules numerous, half-anatropous, in a subglobose placenta; capsule subglobose, 5-valved at the thickened apex; seeds numerous.

About 10 species that are widely distributed, especially in the Southern Hemisphere.

1. Racemes sessile or nearly so; corolla lobes longer than tube, with staminodia in the sinuses between the lobes 1. *S. parviflorus*.
1. Racemes long-peduncled; corolla lobes usually much shorter than tube, the staminodia wanting (2)
- 2(1). Peduncles and racemes glandular-pilose; corolla 4-6 mm. broad, the lobes typically cuneate-obovate; distribution inland Texas 2. *S. cuneatus*.
2. Peduncles and racemes glabrous; corolla 6-9 mm. broad, the lobes typically suborbicular; distribution coastal Texas 3. *S. ebracteatus*.

1. *Samolus parviflorus* Raf. Plant light-green, glabrous, to 6 dm. tall, the stems simple or diffusely branched; leaves obovate to spatulate or oblanceolate, sessile or narrowed into a winged petiole, rounded to obtuse at apex, to 15 cm. long and 4 cm. wide; racemes sessile or nearly so, the slender rachis straight or flexuous; pedicels filiform, spreading or ascending, to 2 cm. long; calyx lobes ovate to triangular-ovate, acute, about as long as or shorter than the tube; corolla white, 2-3 mm. broad; corolla lobes oblong, rounded or emarginate at apex and longer than the tube; staminodia 5; capsule 2-3 mm. in diameter. *S. floribundus* H.B.K. In wet soils and about various types of wet rocks, along streams, about lakes and seepage areas throughout Tex., Mar.-Sept.; from Fla. to Calif. and Mex., n. to e. Can., Mich., Ill. and B.C.; also trop. Am.

2. *Samolus cuneatus* Small. Plant deep-green, to 6 dm. tall, usually much smaller, the usually branched stems more or less tufted and ascending or reclining; leaves obovate to oblanceolate or broadly spatulate, the bases decurrent as broad wings, rounded and usually minutely mucronate at apex, to 15 cm. long and 6 cm. wide; racemes with stoutish straight peduncles longer than the stems, both more or less glandular-pilose; pedicels slender, spreading or ascending, to 3 cm. long; calyx lobes triangular, acute, somewhat roughened in appearance and often purple-tinged, longer than or about as long as the tube; corolla white, 4-6 mm. broad; corolla lobes broadly cuneate to cuneate-obovate, somewhat coarsely toothed at the rounded to subtruncate apex; capsules 3-4 mm. in diameter. *S. ebracteatus* subsp. *cuneatus* (Small) Knuth. On wet limestone and seepage areas or in moist soil along streams and rivers from cen. to Trans-Pecos Tex., s. to the Rio Grande Plains, Mar.-Oct.; also n. Mex.

3. *Samolus ebracteatus* H.B.K. Plant glabrous, bright-green or glaucous, to 55 cm. tall, the usually sparingly branched stems solitary or tufted and erect or ascending; leaves spatulate to obovate, sessile or with winged petioles, decurrent, rounded to obtuse and sometimes apiculate at apex, to 1 dm. long and 35 mm. wide, usually much smaller; racemes with stoutish erect straight peduncles that usually exceed the stems, to 2 dm.

long; pedicels ascending, to 5 cm. long, usually much shorter; calyx lobes triangular-ovate to triangular-lanceolate, acute, equal to or up to about twice as long as the tube; corolla pink or whitish, 6-9 mm. broad; corolla lobes suborbicular, rounded and often noticeably erose or retuse at apex, with a glandular tuft at base, shorter than the tube; stigma subentire to notched; capsules 3-4 mm. in diameter. In salt marshes and flats, in saline and brackish soil; and on dunes and in sandy soil on the coast of Tex., Apr.-Oct.; from Fla. to Tex. and Mex.; also W.I.

A glaucous plant that is more or less confined to dry sands along the coast is segregated as *S. alyssoides* Heller [*S. ebracteatus* subsp. *alyssoides* (Heller) Knuth]. It is described as having flowers with pedicels to 1 cm. long and a corolla 6-9 mm. broad. It apparently is closely related to *S. ebracteatus*.

3. ANDROSACE L. ROCK-JASMINE

Small annual herbs with clustered radical leaves and very small flowers in an umbel terminating a scape; calyx 5-cleft, the obconic tube short; corolla salverform or funnel-form, the somewhat inflated tube shorter than the calyx, constricted at the throat, the limb 5-parted; capsule longitudinally 5-valved, enclosed in the persistent calyx.

About 100 species in cooler parts of the North Temperate Zone.

- 1. Calyx lobes linear-elliptic to triangular-lanceolate, equal to or longer than the tube; involucre bracts broadly elliptic-obovate to oblanceolate 1. *A. occidentalis*.
- 1. Calyx lobes deltoid, much shorter than the tube; involucre bracts narrowly lanceolate to subulate 2. *A. septentrionalis* var. *glandulosa*.

1. *Androsace occidentalis* Pursh. Dwarf plants to 7 cm. tall, usually much smaller; rosette leaves typically elliptic-obovate, to 2 cm. long and 6 mm. wide, entire or somewhat coarsely dentate above middle, white-pubescent above with mostly simple hairs; scapes one to many, erect or recurved-ascending, more or less equal in length, scabrous with stellate hairs; involucre bracts elliptic-obovate to oblanceolate, to 6 mm. long; pedicels erect or ascending, mostly less than 25 mm. long, stellate-pubescent; calyx tube pale, campanulate, the bright-green pubescent lobes linear-elliptic to narrowly triangular-lanceolate. Dry soils in open country or in open rocky woods in cen. and w. Tex., Feb.-Apr.; from Ont. to B.C., s. to Tex., N.M. and Ariz.

2. *Androsace septentrionalis* L. var. *glandulosa* (Woot. & Standl.) St. John. Plant to 3 dm. tall, more or less puberulent with reddish glandular hairs; rosette leaves linear-spatulate to oblanceolate, to about 35 mm. long and 6 mm. wide above middle, often with stellate pubescence, entire or jagged-toothed; scapes usually several, erect, only the central one well-developed with the others much shorter or wanting; umbels compact; involucre bracts mostly linear-subulate, to 3 mm. long; pedicels strictly ascending or erect, to at least 55 mm. long, soon glabrate; calyx turbinate-campanulate, stramineous to green, with short deltoid lobes. *A. glandulosa* Woot. & Standl. In open rocky areas on mt. summits in the Trans-Pecos, June-July; in high mts. of s.w. U.S.

4. DODECATHEON L. SHOOTING-STAR. AMERICAN COWSLIP

About 50 species in North America and Asia.

1. *Dodecatheon Meadia* L. Perennial glabrous herb with fibrous roots and a cluster of basal leaves from which arise a simple naked scape to 55 cm. high that supports at the summit an involucre of small bracts that subtend an umbel of showy flowers; leaves narrowly elliptic-oblong to oblanceolate, blunt or rounded at apex, tapering from the reddish-tinged base into the petiole, usually with entire margins, to 2 dm. long and 4 cm. wide above middle; flowers few to many; pedicels slender, erect when young, recurving in anthesis, ascending in fruit; calyx lobes 5, lanceolate, usually about 5 mm. long in anthesis, slightly longer and persistent in fruit; corolla lilac to pale-pink, with a very short tube and thickened throat, the 5 oblong-elliptic lobes to 25 mm. long and 1 cm.

wide, strongly reflexed; tube of filaments 1-2 mm. long; anthers linear, about 8 mm. long, connivent to form a slender cone; capsule ovoid, dark-reddish-brown, to 18 mm. long, with firm ligneous walls, opening by 5 short terminal valves. On open slopes, base of bluffs, in cedar brakes and in open moist woods in e. third of Tex. w. rarely to Travis Co., Mar.-May; from D.C., w. to Wisc., s. to Ga. and Tex.

5. LYSIMACHIA L. LOOSESTRIFE

Leafy-stemmed perennials with entire opposite or whorled leaves and long-pedicelled yellow to orange-color and sometimes purple-dotted corollas; calyx 5- or 6-parted, imbricate or valvate in bud; corolla 5- or 6-parted, rotate, convolute in bud or with each division convolute about its stamen; stamens 5, the filaments distinct or nearly so on a ring at base of corolla or monadelphous at base, the anthers ovoid to slender; capsule subglobose to ovoid, few- to many-seeded, the style persistent on one valve.

About 200 species of wide distribution, especially eastern Asia and North America.

1. Stems of flowering branches arched-reclining or creeping, often rooting at nodes; divisions of corolla 3-5 mm. long 1. *L. radicans*.
1. Stems erect, slender, arising from slender cordlike rhizomes and stolons; divisions of corolla 7-13 mm. long (2)
- 2(1). Principal leaves ovate or ovate-lanceolate, with rounded or cordate base with a distinct petiole 2. *L. ciliata*.
2. Principal leaves linear to linear-lanceolate, gradually tapering at base 3. *L. lanceolata*.

1. *Lysimachia radicans* Hook. Stem slender, soon reclined, to 1 m. long, laxly and diffusely branched, the elongated branches often rooting at the nodes; leaves membranous, with a slender narrowly winged bristly-ciliate petiole to 3 cm. long; blade ovate-lanceolate to lanceolate, to 9 cm. long and 25 mm. wide, rounded at base, acuminate at apex; pedicels filiform, to 3 cm. long; flowers nodding, to 12 mm. wide; calyx segments ovate-lanceolate, acuminate, 3-5 mm. long; corolla segments obovate-cuneate, erose-dentate and cuspidate; capsule exceeding the calyx. *Steironema radicans* (Hook.) Gray. In swamp forests, along streams and in moist pinelands in s.e. Tex., May-July; from Miss. to Tex., n. to Mo., Tenn. and locally to e. Va.

2. *Lysimachia ciliata* L. Stem erect, simple or branched, 12 dm. high from a slender rhizome; leaves ovate to ovate-lanceolate, acuminate, broadly rounded to subcordate at the base, the blades to 15 cm. long with long ciliate-fringed petioles; flowers on thin axillary peduncles, mostly whorled, to 28 mm. wide; calyx segments firm, subulate-tipped, to 1 cm. long; corolla yellow, not spotted, its broad segments cuspidate and erose-dentate; capsule exceeding or shorter than the mature calyx. *Steironema pumilum* Greene. Swamps, marshes, low ground, thickets, rich woods and shores in n.e. Tex., June-Aug.; from s. Can. to Fla., to Tex, Ariz. and Colo.

3. *Lysimachia lanceolata* Walt. Stems slender and firm, from elongate slender cordlike rhizomes and stolons, to 7 dm. tall, simple or with ascending branches; basal leaves often rosulate and long-petiolate, elliptic to oblong-elliptic, usually persistent; middle and upper leaves linear or linear-lanceolate, to 13 cm. long and 15 mm. wide, attenuate to the usually short-petiolate bristly-ciliate base, acuminate at apex, paler beneath; pedicels filiform, to 4 cm. or more long at anthesis, from upper axils; flowers to 2 cm. wide; calyx segments firm, linear-lanceolate, acuminate, to 7 mm. long; corolla segments suborbicular to broadly obovate, erose, cuspidate; filaments equalling or longer than anthers; capsule shorter than the calyx. *Steironema lanceolatum* (Walt.) Gray. Dry or moist open woods, in thickets, sometimes in or about water of lakes, seepage and streams in e. Tex., May-July; from Fla. to Tex., n. to Pa., O., w. to Mich. and Wisc.

A plant segregated as *L. hybrida* Michx. [*L. lanceolata* subsp. *hybrida* (Michx.) Ray] has been reported from Texas. It is considered to be closely allied to *L. lanceolata* from which it differs in having a thicker, more robust stem with longer internodes, basal offshoots and nonpersistent essentially sessile basal leaves, no cordlike rhizomes, and a more open-paniculate inflorescence. The leaves are also green on both surfaces instead of being pale-green or somewhat glaucous beneath as in *L. lanceolata*.

6. ANAGALLIS L. PIMPERNEL

About 28 species that are cosmopolitan in distribution.

1. *Anagallis arvensis* L. SCARLET PIMPERNEL, HIERBA DEL PÁJARO. Low spreading or procumbent annual herb with opposite leaves and solitary flowers on axillary pedicels, forming loose prostrate mats, the diffuse 4-angled stems much-branched and to 3 dm. long; leaves sessile or somewhat clasping the stem, suborbicular to ovate or elliptic, to 2 cm. long and 1 cm. wide; pedicels slender, exceeding the leaves; flowers variable in size and color, from scarlet to salmon-color and sometimes almost white or blue [in f. *caerulea* (Schreb.) Baumg.] with the petals more or less without cilia; calyx lobes lanceolate, 3-4 mm. long; corolla rotate; petals 5, about equal to the calyx lobes, obovate to cuneate-obovate, somewhat fringed with minute teeth and stalked glands at the obtuse to rounded apex; stamens 5, inserted near base of corolla tube, the filaments bearded; capsules about 4 mm. in diameter, globose, membranous, circumscissile, many-seeded. Usually in moist places in prairies and flatlands mostly in e. and s. Tex., Mar.-May; nat. from Eur.

7. CENTUNCULUS L. CHAFFWEED

A monotypic genus that is sometimes included in *Anagallis*.

1. *Centunculus minimus* L. Annual, often forming mats or small clumps, the stems erect or ascending, to 12 cm. long; leaves subsessile, alternate, entire, obovate to oblanceolate or oblong-spatulate, to 8 mm. long and 5 mm. wide; flowers sessile in leaf axils, ephemeral, 4- or occasionally 5-merous; sepals linear-lanceolate, about 2 mm. long; corolla rotate, pinkish, about 1 mm. wide, with an urceolate short tube and ovate-lanceolate lobes about half as long as the tube, withering on the apex of the capsule; stamens 4 or 5, inserted near corolla throat, included, the filaments beardless; capsule subglobose, circumscissile, to 2 mm. in diameter. In damp sand and mud in depressions, bogs, grasslands and open woods mainly in e. and s. Tex., Feb.-May; from Fla. to Tex., Calif. and Mex., n. to N.S., O., Ill., Minn. and Sask., nearly cosmopolitan.

FAM. 142. PLUMBAGINACEAE JUSS.

PLUMBAGO FAMILY

Perennial herbs or shrubs, with basal or alternate entire leaves and perfect and regular flowers; calyx inferior, 4- or 5-toothed, sometimes plaited at the sinuses, the tube 5- to 15-ribbed; corolla of 4 or 5 hypogynous clawed segments connate at the base or united into a tube; stamens 4 or 5, opposite the corolla segments, hypogynous; anthers 2-celled, dorsally attached to the filaments, the sacs longitudinally dehiscent; disk none; ovary superior, 1-celled; ovule solitary, anatropous, pendulous; styles 5, fruit a utricle, achene or capsule, enclosed by the calyx; seed solitary.

About 10 genera and 500 species of wide distribution, many in saline or semiarid situations.

1. Acaulescent plants with a leafy caudex, the leaves basal; calyx glabrous or with simple hairs below the middle, glandless; petals with the claws nearly distinct; filaments partly adnate to the petals; styles distinct; fruit an achenelike structure1. *Limonium*, p. 1185.
1. Caulescent plants with alternate leaves; calyx beset with long-stalked glands; petals with the claws united into a slender tube; filaments free; styles united; fruit a capsule2. *Plumbago*, p. 1187.

1. LIMONIUM MILL.¹⁴⁵

SEA-LAVENDER. MARSH-ROSEMARY

Perennials with woody roots and petioled radical thick leaves, the nearly naked erect flowering stems or scapes branched into panicles; flowers solitary or 2 or 3 together in

¹⁴⁵ Adapted partly from S. F. Blake in *Rhodora* 25:55-60. 1923.

several-bracted spikelets that are approximate or scattered on 1-sided branches; calyx funnellform, dry and membranous, persistent; corolla of 5 nearly or quite distinct petals, with long claws, the 5 stamens attached to their bases; styles 5 or rarely 3, separate; fruit membranous and indehiscent, scarcely exerted from the calyx.

About 300 species that are widely distributed. This genus, in North America, is sorely in need of a modern revision.

1. Calyx 4 mm. long or less, the short broadly triangular-ovate lobes spreading at maturity; plants of alkaline flats in Trans-Pecos Texas . . . 1. *L. limbatum*.
1. Calyx 5 mm. long or more, the narrowly ovate-lanceolate lobes erect at maturity; plants of beach and dune areas along the Gulf Coast (2)
- 2(1). Spikelets 1- to 3-flowered, mostly 3 mm. or less apart; calyx usually prominently pubescent on ribs below middle, rarely glabrous . . . 2. *L. Nashii* var. *Nashii*.
2. Spikelets nearly all 1-flowered, mostly 4 mm. or more apart at maturity; calyx glabrous or sparsely short-pubescent near base 2. *L. Nashii* var. *angustatum*.

1. *Limonium limbatum* Small. Plant to 6 dm. high, bluish-green or glaucescent; leaves with petioles to 15 cm. long, obovate to elliptic, rounded or retuse at the barely mucronulate apex, narrowed into the petiole, thick, leathery, venose, to 16 cm. long and 65 mm. wide; scape stout, much-branched from below the middle; panicle large, to 3 dm. wide or more, the branches divergent-ascending, the 2-flowered spikelets densely and distichously aggregated into 1-1.4 cm. long spikes on the ultimate branchlets or somewhat elongated in var. *glabrescens*; outermost bractlet ovate-orbicular to orbicular, acute to acutish, mucronate or apiculate, hyaline-margined, 1-1.4 mm. long; middle bractlet oblong-oval, retuse at apex, hyaline with green midrib, 3 mm. long; innermost bractlet very firm, elliptic, rounded to retuse at apex, hyaline-margined, 3-3.5 mm. long; calyx trumpet-shaped, with wide-spreading limb, about 4 mm. long, with 2 or 3 of the ribs pubescent to the middle and the other ribs generally pubescent only at the extreme base or not at all, the ribs glabrous or nearly so in var. *glabrescens*; calyx lobes deltoid-ovate, obtuse to acute, about 0.7 mm. long; intermediate teeth depressed-deltoid, about 0.2 mm. long or obsolescent; corolla bright-blue. In saline flats and in depressions in the Trans-Pecos, reported from the Panhandle, June-Aug.; also N.M.

The ultimate branchlets of the inflorescence in var. *glabrescens* Correll are somewhat elongated and more laxly flowered than in var. *limbatum*. The calyx ribs are also glabrous or are provided with only a few scattered hairs instead of being densely pubescent as in var. *limbatum*.

2. *Limonium Nashii* Small. Plant 3-8.5 dm. high, the scape solid; leaves with a petiole to 16.5 cm. long, linear-elliptic to narrowly spatulate or obovate, obtuse to rounded at the barely mucronulate apex, narrowed into the petiole, to 17 cm. long and 45 mm. wide; scape paniculately much-branched from near the middle; panicle 2-3 dm. across, the somewhat zigzag lax branches spreading-ascending or arcuate, the ultimate branchlets compactly or loosely flowered; spikelets 1- to 3-flowered; outermost bractlet ovate, acute to acuminate, mucronate, hyaline-margined, 1.8-2.5 mm. long; middle bractlet ovate to oblong, somewhat erose at the obtuse to mucronate apex, hyaline with a distinct midrib, 2.5-4 mm. long; innermost bractlet elliptic, rounded to retuse to subacute at apex, hyaline-margined, 3.8-4.5 mm. long; calyx obconic, glabrous to sparsely or rather densely pilose at extreme base and often on one or two ribs for about half their length, 5-7 mm. long, the whitish 5-lobed limb erect; calyx lobes ovate-lanceolate, acuminate, 1-1.5 mm. long; teeth very short and bifid or obsolescent; corolla violet to lavender; capsule 5-7 mm. long. On beaches, salt flats and marsh borders, in grasslands and in loose sand among dunes along the Gulf Coast, June-Nov.; mostly from S.C., s. to Fla. and w. to Tex. and n.e. Mex., rare n. of S.C.

The inflorescence of this species is more laxly and openly branched than in that of the eastern *L. carolinianum* (Walt.) Britt. Plants ascribed to *L. carolinianum* var. *compactum* Shinnery belong to var. *Nashii*.

In our region var. *angustatum* (Gray) Ahles seems to be more southern in its distribution than var. *Nashii*, being rather frequent on south Padre Island. Its leaf blades are typically smaller than those of var. *Nashii*, being up to about 10 cm. long and 2.5 cm. wide. *L. angustatum* (Gray) Small, *L. carolinianum* var. *angustatum* (Gray) Blake.

2. PLUMBAGO L. LEADWORT

About 12 species that are natives of Eurasia and warm regions in America.

1. *Plumbago scandens* L. **HIERBA DE ALACRÁN, PITILLO.** A perennial woody herb, the brittle branches often elongated and vinelike, glabrous, sometimes 1 m. long; leaves alternate, ovate to elliptic-lanceolate, membranous, glabrous, 3-10 cm. long, acute to acuminate at apex, narrowed at base, the petioles 1 cm. long or less; spikes slender, peduncled, several- to many-flowered, 5-12 cm. long; bracts lanceolate, acuminate, persistent, 4-5 mm. long; calyx tubular, 8-10 mm. long, 5-ribbed, beset with long-stalked glands; corolla white, its filiform tube about 2 cm. long, its obovate mucronate spreading lobes 5-7 mm. long; stamens 5, distinct, the filaments dilated at the base, the anthers linear; styles filiform, stigmatic on the inner side, partly united; capsule linear-prismatic, beaked, about 7 mm. long. In woods, palm groves and thickets in extreme s. Tex., Mar.-Apr.; also s. Fla. and s. Ariz., and widespread in trop. Am.

FAM. 143. SAPOTACEAE JUSS. SAPODILLA FAMILY

Shrubs or trees, commonly spiny and with milky juice; leaves alternate, petiolate, simple, entire, exstipulate, often rusty-downy on lower surface; flowers small, perfect, usually in axillary clusters; calyx free, persistent; fertile stamens usually as many as the lobes of the short hypogynous corolla and opposite them, inserted on its tube along with one or more rows of appendages and scales or staminodes; anthers turned outward; ovary 4- to 12-celled, with a single anatropous ovule in each cell; style single, pointed; fruit drupaceous or baccate, the solitary seed large.

A mostly tropical family of perhaps 40 genera and 800 species.

1. BUMELIA Sw.¹⁴⁶ IRONWOOD

Shrubs or small trees, mostly but not always spiny; leaves often fascicled on short spurs; flowers whitish to yellowish or sometimes greenish, mostly 5-merous; corolla lobes each with a pair of lateral lobes or appendages at base; staminodes petaloid, entire to erose or laciniate; ovary usually somewhat hairy or occasionally glabrous; fruit fleshy, 1-seeded, the seed scar small, nearly basal; endosperm wanting.

About 60 species in the Western Hemisphere, mostly tropical.

- 1. Leaves not conspicuously reticulate-veiny; style more than 2 mm. long 1. *B. celastrina*.
- 1. Leaves closely and conspicuously reticulate-veiny, with the veins evidently raised; style less than 2 mm. long (2)
- 2(1). Leaves finely silvery-strigose or sericeous on lower surface when young, soon glabrate, the larger leaves 4-13 cm. long; sepals and pedicels essentially glabrous; distribution extreme southeast Texas 2. *B. lycioides*.
- 2. Leaves loosely woolly-villous on lower surface, variable in size; sepals and pedicels more or less pubescent (3)
- 3(2). Most of the leaves 5-10 cm. long and more than 2 cm. wide; pedicels mostly much more than 3 mm. long; plants over 5 m. high (4)
- 3. Most of the leaves 2-5 cm. long and less than 2 cm. wide; pedicels rarely more than 3 mm. long; plants seldom over 5 m. high (5)
- 4(3). Lower leaf surface with a thin covering of entangled grayish to somewhat tawny hairs; pedicels sometimes stout and much shorter than the fruit 3. *B. lanuginosa* var. *oblongifolia*.
- 4. Lower leaf surface with a dense covering of less tangled whitish hairs; pedicels usually slender and as long as or longer than the fruit 3. *B. lanuginosa* var. *albicans*.

¹⁴⁶ Adapted from R. B. Clark in Ann. Missouri Bot. Gard. 29:155-182. 1942.

- 5(3). Lower leaf surface with a dense covering of hairs or sometimes only lightly pubescent3. *B. lanuginosa* var. *rigida*.
 5. Lower leaf surface glabrous or only obscurely pubescent or with a few hairs along the midrib3. *B. lanuginosa* var. *texana*.

1. *Bumelia celastrina* H.B.K. LA COMA. A thorny shrub or small tree 2-9 m. tall; leaves with petioles to 1 cm. long, generally fascicled except on vigorous young shoots, glabrous or with only a few very fine inconspicuous white hairs when young, oblanceolate to obovate or sometimes nearly elliptic, broadly rounded at the apex, cuneate at the base, to 4 cm. long and 25 mm. wide, occasionally a little larger, firm, the veins not very prominent, the reticulum rather obscure or indiscernible; flowers 3 to 15 in a cluster, fragrant, the pedicels glabrous or with a few inconspicuous white hairs, to 1 cm. long; corolla 3-4.5 mm. long, the short tube 0.8-1.2 mm. long; anthers 1-1.5 mm. long; staminodes lance-elliptic to rhombic-ovate, 2-3 mm. long; ovary pilose toward the base, glabrous above, the style 2.5-4 mm. long; fruit ellipsoid-cylindric to narrowly obovoid, 7-13 mm. long, blue-black. *B. angustifolia* Nutt. In thickets, along resacas, on gravelly hills and in salt marshes in s. Tex., May-Nov.; from s. Tex., s. to Venez., Fla., Bah. I. and Cuba.

2. *Bumelia lycioides* (L.) Pers. Shrub or small tree to 10 m. tall, often thorny; young twigs glabrous; leaves with petioles to 15 mm. long, mostly elliptic or elliptic-oblanceolate and narrowed to the obtuse to acuminate apex, occasionally obovate and broadly rounded at apex, to 13 cm. long and 5 cm. wide, usually much smaller, pale-green and conspicuously reticulate-veiny on both surfaces, glabrous above, glabrous or more commonly with a few short hairs chiefly along the midrib beneath, the very young leaves more evidently silvery but the pubescence evanescent; flowers numerous, usually 20 or more in a cluster, the pedicels glabrous or slightly hairy and to 1 cm. long; sepals glabrous or with a few reddish hairs within, 1.4-2.9 mm. long; corolla 3.2-4 mm. long, the tube shorter than or sometimes equaling the lobes; anthers 1.2-1.7 mm. long; style 1.1-2 mm. long; ovary short-hairy; staminodes ovate to rhombic-ovate, 1.8-2.4 mm. long; fruit ellipsoid to obovoid or globose, 7-13 mm. long; seeds 6-9 mm. long, commonly tan or light-brown occasionally a little variegated. In low woods and savannahs, rare in s.e. Tex., Apr.-June; from Fla. to Tex., n. to Ark., s. Mo., s. Ind. and s. Va.

Plants with smaller (2-6 cm. long) leaves that are prominently reticulate have been segregated as *B. Smallii* Clark.

3. *Bumelia lanuginosa* (Michx.) Pers., s. *amplo*. COMA. Shrub or small tree to 15 m. or more tall, more or less thorny; leaves oblanceolate to sometimes obovate or elliptic, broadly rounded to sometimes acute at the apex, to 1 dm. long and 35 mm. wide, loosely woolly-villous with white to tawny or rufous hairs when young, soon glabrate above, persistently hairy to sometimes soon glabrate beneath, reticulate-veiny on both sides, sometimes fascicled; flowers more or less numerous in each cluster, the hairy or subglabrous pedicels to 15 mm. long; sepals strongly hairy or nearly glabrous, 1.5-3.2 mm. long; corolla 3-4.7 mm. long, the tube 1.3-2 mm. long; staminodes deltoid-ovate, 1.9-2.7 mm. long, nearly equaling the corolla lobes; anthers 1-1.5 mm. long; ovary pilose; style 1-1.5 mm. long; fruit obovoid to broadly ellipsoid or subglobose, commonly purplish-black, 7-12 mm. long. Mostly in uplands or sometimes in bottomlands from Fla. to Mo. and Kan., s. to Tex., s. Ariz. and n. Mex.

Represented in Texas by 4 varieties separated in the key.

Var. *oblongifolia* (Nutt.) Clark. *B. lanuginosa* subsp. *oblongifolia* (Nutt.) Cronq. var. *oblongifolia* (Nutt.) Clark. In sandy or rocky soils in woods and on hills and along streams in e. and n. Tex., May-July; from w. La. and Tex., n. to s. Mo. and s.e. Kan.

Var. *albicans* Sarg. This is the tallest *Bumelia* in the United States. It may attain a height of 20 m. The dense whitish pubescence, especially on the lower leaf surface, is characteristic. *B. lanuginosa* subsp. *oblongifolia* var. *albicans* Sarg. In woods and on sandy slopes, shell ridges and on rock outcrops in the e. half of Tex., May-July.

Var. *rigida* Gray. The persistent pubescence, somewhat similar to that of var. *albicans*, on the lower surface of the coriaceous leaves is distinctive. *B. rigida* (Gray) Small, *B. lanuginosa* subsp. *rigida* (Gray) Cronq. var. *rigida* Gray. On limestone or gypsum, espe-

cially along bluffs of rivers and streams, mainly on the Edwards Plateau in s.-cen. Tex., Apr.-June; from Tex., w. to s.e. Ariz. and adj. Mex.

Var. *texana* (Buckl.) Cronq. It is entirely possible that this plant should be maintained as a separate species from *B. lanuginosa*. The small, essentially glabrous, heavily veined, coriaceous leaves and slender, short pedicels, as well as the geographic distribution, would tend to support this conclusion. For the present, it is included in the *B. lanuginosa* complex. *B. lanuginosa* subsp. *rigida* var. *texana* (Buckl.) Cronq., *B. texana* Buckl., *B. monticola* Buckl., *B. riograndis* Lundell. On limestone and gypsum, commonly on rimrock or bluffs along streams, in cen. and w. Tex., June-July; from s.w. Okla. and Tex. to n. Mex.

FAM. 144. EBENACEAE GÜRKE

PERSIMMON OR EBONY FAMILY

Trees or shrubs; leaves alternate, entire, deciduous or persistent, exstipulate; flowers small, unisexual, axillary, solitary or in cymes; calyx inferior, the connate segments persistent and accrescent in fruit; corolla urceolate to campanulate or salverform; stamens 3 to many, inserted at base of the corolla; ovary 2- to 16-celled, the ovules usually solitary; fruit baccate, containing several large seeds.

Three genera containing several hundred species, mostly in the Old World.

1. DIOSPYROS L.

PERSIMMON

Shrubs or trees; leaves somewhat persistent or deciduous; flowers unisexual (male and female on separate plants, rarely an occasional flower appearing perfect), axillary, cymose or fasciculate; calyx 4- or 5-lobate; corolla urceolate to campanulate or salverform, the obtuse lobes spreading or recurved; stamens usually 15 or 16; fruit baccate, containing as many as 10 seeds.

Nearly 500 species that comprise the valuable wood ebony and many species with edible fruits, including those in Texas.

1. Ovary and fruit glabrous; fruit yellow to reddish when ripe; leaves petiolate, ovate to elliptic, acute to acuminate, essentially glabrous beneath 1. *D. virginiana*.
1. Ovary and fruit pubescent; fruit black when ripe; leaves subsessile, obovate to oblong-obovate, rounded at apex, hirtellous beneath 2. *D. texana*.

1. *Diospyros virginiana* L. COMMON PERSIMMON. Trees to about 30 m. high, mostly forming a cylindrical or spreading crown, with very hard blackish wood; leaves rather thick, short-petiolate, mostly ovate-oblong, glabrous or nearly so, usually with dark glands or necrotic spots on dorsal surface of the midrib, to about 15 cm. long; peduncles very short; calyx 4-parted; corolla pale yellow, somewhat leathery, campanulate-urceolate, the pistillate corollas 1-1.5 cm. long, the staminate corollas much smaller; styles 4, bilobed at apex; ovary 8-celled; fruit to 5 cm. in diameter, very astringent when green, sweet and edible when ripe (usually after exposure to frost). In dryish woods, old field and clearings mostly in e. Tex. but extending w. to the Rolling Plains, Apr.-June; from Fla. to Tex., n. to N.E., N.Y., Pa., W.Va., O., Ind., Ill., Ia. and Kan.

2. *Diospyros texana* Scheele. TEXAS OR MEXICAN PERSIMMON, BLACK PERSIMMON, CHAPOTE. Shrub or small tree rarely to 16 m. high, with a trunk to 6 dm. thick, the hard compact wood nearly black; bark smooth, thinnish, light reddish-gray, the outer layers peeling off to leave the trunks and stems resembling those of crape-myrtle (*Lagerstroemia*); leaves nearly sessile, coriaceous, broadly ovate to oblong-obovate, rounded or emarginate at apex, to about 5 cm. long, at margin revolute, pubescent beneath; corolla white, sericeous, 8-12 mm. long; fruit black when ripe, about 2 cm. in diameter, the black juicy pulp sweet and edible; seeds 3 to 8. *Brayodendron texanum* (Scheele) Small. In rocky open woodlands, open slopes, arroyos and other such places throughout most of the w. two thirds of Tex. e. to Grimes and Refugio cos., Feb.-June; also Tam., N.L. and Coah.

FAM. 145. STYRACACEAE DUM.

STORAX FAMILY

Shrubs or trees commonly with stellate pubescence; leaves alternate, simple, ~~em~~stipulate; flowers regular, perfect; calyx adherent to the ovary or at least to its base, entire or with 4 to 8 valvate teeth or lobes; corolla with 4 or 5 (rarely more) petals that are (in ours) united at base or rarely more; stamens as many as or several times as many as the corolla lobes, free or adnate to corolla tube; anthers elongate; ovary inferior or partly inferior in *Styrax*; style one; fruit a drupe or capsule.

A small family of about 180 species in 12 genera in warm temperate regions.

- 1. Calyx adherent to whole surface of ovary, corolla 4-lobed; fruit ellipsoid to ellipsoid-obovoid, 2- to 4-winged 1. *Halesia*, p. 1190.
- 1. Calyx adherent only to base of ovary; corolla 5-lobed; fruit globular, wingless 2. *Styrax*, p. 1190.

1. HALESIA ELLIS

Shrubs or small trees, with large veiny deciduous leaves and snowy-white flowers drooping on slender pedicels in clusters or short racemes, the pubescence partly stellate; calyx inversely conical, 4-toothed, the tube ribbed; corolla openly campanulate; petals 4, white, united at base or sometimes to above the middle; stamens 8 to 16; filaments united into a ring at base and usually a little adherent to the base of the corolla; anthers linear-oblong; ovules 4 in each cell; fruit large and dry, bony within; seeds single, cylindrical.

A few species found in North America and China.

- 1. Corolla lobes shorter than the tube; fruit 4-winged 1. *H. carolina*.
- 1. Corolla lobes longer than the tube; fruit 2-winged 2. *H. diptera*.

1. *Halesia carolina* L. CAROLINA SILVER-BELLS, O'POSSUM-WOOD. Large shrubs or small tree to about 12 m. tall; leaves broadly ovate to elliptic or obovate, to 15 cm. long and 8 cm. wide, acute to acuminate, serrulate; flowers in clusters of 2 to 5, with slender pedicels to 15 mm. long; calyx 5-6 mm. long; corolla to 2 cm. long; filaments and styles glabrous; fruit 2.5-4 cm. long, ellipsoid to ellipsoid-obovoid, short-beaked. In rich woods and along stream banks in e. Tex., Apr.-May; from Fla. to Tex. (*vide* Small), n. to Va., W.Va., s. O., s. Ind., s. Ill., s.e. Mo. and Okla.

2. *Halesia diptera* Ellis. SNOWDROP-TREE. Small tree or shrub to 8 m. tall; leaves elliptic to obovate or sometimes ovate, rounded to cuneate at base, abruptly acute to acuminate at apex, when mature essentially glabrous, to 15 cm. long and 9 cm. wide, rather coarsely toothed; calyx 3-4 mm. long, pubescent; corolla 1.5-2 cm. long, copiously pubescent, with pedicels about 1 cm. long; petals broadly elliptic, obtuse; filaments and style pubescent; fruit 3.5-5 cm. long, narrowly ellipsoid, prominently beaked. Woods and along streams in e. Tex., Mar.-Apr.; from n. Fla. n. to S.C., w. to Tex. and Ark.

2. STYRAX L.

STORAX. SILVER BELLS

Shrubs or small trees with deciduous leaves and axillary or leafy-racemed white and showy flowers on drooping peduncles; calyx somewhat 5- to 7-toothed and sometimes glandular at truncate apex; petals soft-downy; stamens twice as many as the corolla lobes; filaments flat, united at the base into a short tube; anthers linear; fruit dry, often 3-valved; seeds globular, erect, with a hard coat.

Over 130 species found in warm regions of North America and Eurasia.

- 1. Leaves characteristically broadly elliptic to obovate; distribution in east Texas 1. *S. americana*.
- 1. Leaves characteristically suborbicular to broadly ovate; distribution in central and west Texas (2)

- 2(1). Pedicels densely and coarsely stellate-pubescent; distribution in Trans-Pecos Texas 2. *S. Youngae*.
- 2. Pedicels merely puberulent; distribution on the Edwards Plateau in central Texas (3)
- 3(2). Both leaf surfaces similar, with scattered stellate hairs to subglabrous 3. *S. platanifolia*.
- 3. Lower leaf surface covered with a fine white puberulence, the upper surface smooth and glossy 4. *S. texana*.

1. *Styrax americana* Lam. **MOCK-ORANGE**. Shrub or small tree to 6 m. tall; leaves elliptic to obovate, tapering to base, more or less abruptly acute to short-acuminate at apex, to 13 cm. long and 8 cm. wide, subglabrous to pulverulent or somewhat scurfy on lower surface, the margins (especially above the middle) irregularly serrulate to serrate-sublobulate; flowers axillary or in several-flowered racemes to 7 cm. long, the racemes subglabrous to scurfy-canescenscent, the pedicels usually about 5 mm. long; calyx puberulent; corolla lobes valvate to somewhat convolute in bud, elliptic to elliptic-oblongate, obtuse to acute at apex, to 15 mm. long and 5 mm. wide; capsule subglobose, about 1 cm. long, apiculate. Incl. f. *pulverulenta* (Michx.) Perkins, *S. pulverulenta* Michx. In moist woods and along streams in e. Tex., Apr.-May; from Fla., w. to Tex., n. to s.e. Va., s. Ind., s.e. Mo., Ark and Okla.

2. *Styrax Youngae* Cory. Shrub to 3 m. tall; leaves orbicular to elliptic, to 5 cm. long and 35 mm. broad, subentire, thin, greenish and densely pubescent with coarse stellate hairs on upper surface, tomentose on lower surface with a fine indumentum and with scattered stellate hairs; flowers in racemose clusters of 3 to 7, with stout pedicels that are densely and coarsely stellate-pubescent; peduncles to 2 cm. long, coarsely stellate-pubescent; calyx campanulate, about 4 mm. long and broad, dark-brown, stellate-pubescent, with the truncate apex inconspicuously toothed; petals 5, narrowly elliptic, obtuse, densely stellate-pubescent, 15-17 mm. long. Apparently endemic in the Davis Mts. of the Trans-Pecos, May.

3. *Styrax platanifolia* Engelm. Shrub or small tree to 4 m. tall, much-branched; leaves more or less pubescent with stellate hairs, rarely subglabrous, strongly reticulate-veined, broadly ovate to suborbicular, with the margins undulate to angulate or occasionally sinuately lobulate, truncate to subcordate at base, obtuse to somewhat abruptly acute at apex, to 1 dm. long and wide; flowers several in corymbose racemes, with puberulent pedicels; calyx puberulent; petals elliptic to elliptic-lanceolate, acute, about 15 mm. long; capsule about 1 cm. in diameter, puberulent, apiculate. Incl. var. *stellata* Cory. Along streams in limestone canyons of Edwards Plateau, Apr.-May; endemic.

4. *Styrax texana* Cory. A spreading slender shrub to 3 m. tall; leaves suborbicular, to 65 mm. long and broad, entire, cuneate to truncate or rounded at base, acute at apex, bright-green and glabrous on upper surface, silvery with a very fine and dense silky-tomentum on lower surface; flowers usually in clusters of 3 to 5, with puberulent pedicels to 1 cm. long; peduncles about as long as the pedicels, often recurved, subglabrate to puberulent; calyx campanulate, about 5 mm. long and 4 mm. wide, densely puberulent and similar in color to the corolla, glandular and 6- to 7-toothed at the truncate apex; petals 5, puberulent, narrowly elliptic, obtuse, to 2 cm. long; fruit globose, about 8 mm. in diameter. Along streams of Edwards Plateau, Apr.-May; endemic.

FAM. 146. SYMPLOCACEAE DESF.

SWEET-LEAF FAMILY

Tree or sometimes shrubs; leaves alternate, simple, without stipules; flowers perfect, regular; calyx campanulate, adherent to the ovary, its lobes valvate or imbricate; corolla with as many as 11 petals (5 in ours) that are united at base; stamens in clusters at the base of each petal, in several series, free or variously united at base; anthers minute, subglobose; ovary partly inferior, 2- to 5-celled; ovules 2 to 4, pendulous; style 1; fruit baccate or drupaceous, crowned by the calyx lobes, 1- to 5-celled, with a solitary anatropous seed in each cell.

Two genera of about 500 species, mostly tropical and subtropical.

1. SYMLOCOS JACQ. SWEET-LEAF

Characters of the family. About 350 species, mostly in tropical regions of both hemispheres.

1. *Symplocos tinctoria* (L.) L'Her. HORSE-SUGAR, YELLOW-WOOD. Large shrubs or small trees to 6 m. tall; leaves elliptic to elliptic-obovate or oblanceolate, tapering to the short petiole, acute to shortly acuminate at apex, subentire to obscurely toothed, usually subcoriaceous and evergreen or late-deciduous, glossy on upper surface, pale and minutely pubescent on lower surface, to 15 cm. long and 6 cm. wide; flowers 6 to 14 in close and bracted clusters on the old wood, yellow, fragrant, the clusters axillary and sessile, opening before or with the leaves; petals 5, obovate, 6-8 mm. long; drupes cylindric-ellipsoid, about 1 cm. long. In woods, swamps and bottomlands in e. Tex., Feb.-Apr.; from Fla. to Tex. and Ark., n. to Del.

The sweetish leaves are much-relished by browsing animals.

FAM. 147. OLEACEAE HOFFMSG. & LINK
OLIVE FAMILY

Trees, shrubs or rarely subherbaceous; leaves opposite or rarely alternate, simple to pinnatifid or pinnate, exstipulate; flowers perfect or unisexual, regular, variously disposed; calyx 4-lobed or -parted, rarely 5- to 16-lobed or wanting; corolla gamopetalous, 4-lobed or rarely 6- to 12-lobed, sometimes of distinct petals or wanting; stamens 2 or rarely 3 to 5, adnate to the corolla and alternate with the lobes; ovary free, 2-celled, with usually 2 ovules in each cell; style 1 or wanting, with a simple or 2-lobed stigma; fruit a drupe, capsule or samara; seeds anatropous, with large straight embryo, with or without albumen.

About 30 genera with over 600 species in temperate and tropical regions. Many ornamental species; a few are of economic importance and some are valuable timber trees. Species of the Old World jasmine (*Jasminum* spp.) are commonly cultivated in our area. They sometimes persist when planted or volunteer. They are climbing or erect shrubs that bear on the ends of the branchlets attractive yellow, white or occasionally reddish flowers with a salver-shaped corolla. The leaves are usually pinnate but may also be reduced to one leaflet.

1. Fruit a samara; leaves pinnately compound (simple in *F. Greggii*) 1. *Fraxinus*, p. 1192.
1. Fruit a capsule or drupe; leaves entire or (if pinnately lobed) the plant less than 3 dm. high (2)
- 2(1). Fruit a didymous thin-walled capsule 2. *Menodora*, p. 1195.
2. Fruit a drupe (3)
- 3(2). Corolla lobes linear, many times longer than the tube, valvate; flowers in pendulous panicles 3. *Chionanthus*, p. 1198.
3. Corolla lobes broad and short or corolla wanting (4)
- 4(3). Flowers in terminal panicles; corolla salverform, well-developed 4. *Ligustrum*, p. 1198.
4. Flowers axillary, in clusters or small racemes; corolla wanting 5. *Forestiera*, p. 1198.

1. FRAXINUS L. ASH

Deciduous trees or very rarely shrubs; winter buds often superposed, with 1 or 2 pairs of outer scales, usually brown or black and scurfy, the outer pair sometimes foliar (that is, obscurely pinnate at apex); leaves opposite, petioled, odd-pinnate, rarely reduced to 1 leaflet; male and female flowers on separate plants or occasional flowers may appear perfect; flowers small, in crowded panicles or racemes; calyx small, 4-parted or -lobed or wanting; corolla of 2 to 6 (usually 4) distinct petals, rarely connate at base or wanting;

stamens usually 2; ovary 2-celled; stigmas 2; fruit a samara or 1-seeded nutlet with a usually elongated wing at the apex; seed oblong, albuminous.

About 70 species in the Northern Hemisphere. Ornamental trees with handsome foliage, some with conspicuous flowers; several species are important timber trees.

1. Plants in the eastern two thirds of Texas from the eastern Panhandle through the central Edwards Plateau south to the Rio Grande Plains and Valley (2)
1. Plants in the western third of Texas, mainly in the Trans-Pecos and western Edwards Plateau (5)
- 2(1). Body of fruit compressed, its broad wing extending to the base; confined to southeast Texas1. *F. caroliniana*.
2. Body of fruit terete or nearly so (3)
- 3(2). Wing of fruit decurrent to about or below the middle of the fruit body; leaves lighter green but not noticeably pale on the lower surface2. *F. pensylvanica*.
3. Wing of fruit terminal or only slightly decurrent on the fruit body; leaves usually pale-glaucous on lower surface, somewhat papillose on upper surface (4)
- 4(3). Leaflets 5 to 9, typically 7, ovate to broadly elliptic or lanceolate, abruptly pointed or acuminate at apex, herbaceous, usually much more than 6 cm. long; fruits usually well over 3 cm. long3. *F. americana*.
4. Leaflets 5 or 7, typically 5, suborbicular-ovate to obovate or sometimes narrowly elliptic, rounded to abruptly acute at apex, often subcoriaceous, usually about 6 cm. long or less; fruits never over 3 cm. long4. *F. texensis*.
- 5(1). Flowers with corolla, in terminal panicles on lateral leafy branchlets of the year; mature leaflets lanceolate to ovate-lanceolate, typically acuminate-attenuate and occasionally cuspidate at apex; confined to the Trans-Pecos region5. *F. cuspidata*.
5. Flowers without a corolla or corolla unknown, unisexual or polygamous, in axillary panicles, from separate buds, in the axils of leaves of the previous year; mature leaflets not acuminate-attenuate or cuspidate, at most simply acuminate (6)
- 6(5). Petiole and leaf rachis more or less winged; leaflets with obscure veins, mostly less than 3 cm. long; distribution Val Verde to Brewster counties6. *F. Greggii*.
6. Petiole and leaf rachis not winged; leaflets with distinct veins, much more than 3 cm. long (7)
- 7(6). Leaves and branchlets glabrous; wing of the fruit decurrent to or near the base of the somewhat compressed fruit body; mainly in the Edwards Plateau and Rio Grande Plains and Valley7. *F. Berlandieriana*.
7. Leaves and branchlets pubescent or glabrous; wing of the fruit (at most) decurrent to above the middle of terete fruit body; mainly in the Trans-Pecos region (8)
- 8(7). Leaflets usually finely pubescent beneath; wing of samara mostly but not always about equaling or shorter than the body8. *F. velutina*.
8. Leaflets glabrous and glaucous beneath; wings of samara longer than the body9. *F. papillosa*.

1. *Fraxinus caroliniana* Mill. CAROLINA ASH, POP ASH, WATER ASH. Shrubby tree rarely more than 10 m. high and trunks to 3 dm. in diameter, the winter buds chestnut-brown; branchlets terete, glabrous or pubescent; leaves with terete petioles; leaflets 5 or 7, with slender petiolules to 2 cm. long, ovate-lanceolate to elliptic or oblong, to 12 cm. long, broadly cuneate or sometimes rounded at the base, acuminate at apex, serrate or rarely entire, pale-green and glabrous or sparingly pilose on the veins or rarely pubescent beneath; anthers linear, apiculate, on slender filaments; samaras rhombic to elliptic or obovate-oblong, 3-5 cm. long, acute to emarginate, the fruit body compressed and surrounded by the wing, sometimes 3-winged. Usually in swamps and along rivers in s.e. Tex., Mar.-May; from Va. to Fla., w. to Ark. and Tex.

2. *Fraxinus pennsylvanica* Marsh. RED ASH. Tree to 20 m. high, with a trunk rarely to 5 dm. in diameter; branchlets and petioles densely pubescent to glabrous; leaflets 5 to 9, with petiolules to about 1 cm. long, ovate to elliptic-oblong or lanceolate, to 15 cm. long, broadly cuneate to somewhat rounded at base, acute to acuminate at apex, the margins entire to serrate, bright-green above, pubescent to glabrous or pubescent only along midrib beneath; panicle rather compact, tomentose to glabrous; anthers linear-oblong, on short filaments; samaras 3-7.5 cm. long, brownish; fruit body slender, terete, to 3 cm. long; wing lanceolate to oblong-obovate, rounded to acuminate or rarely emarginate at apex, decurrent to about or below the middle or very rarely nearly to the base. Along rivers and streams, in alluvial woods and swamps, and in depressions in savannahs, mainly e. of a line drawn from Victoria Co. on the coast to Hemphill Co. on the Rolling Plains in the Panhandle, Feb.-Apr.; from N.S. to Man., s. to Ga., Ala. and Tex.

Our plant is usually referred to var. *integerrima* (Vahl) Fern. [var. *lanceolata* (Buckl.) Sarg.] which is essentially glabrous throughout.

3. *Fraxinus americana* L. WHITE ASH, FRESNO. Tall tree to 40 m. high; young branchlets dark-green or brownish, glabrous and lustrous; leaflets 5 to 9, usually 7, with slender petiolules to 15 mm. long, ovate to ovate-lanceolate or elliptic-lanceolate, to 15 cm. long, cuneate to rounded at the base, mostly acuminate but sometimes blunt at apex, usually entire or only slightly undulate or dentate toward the apex, dark-green above, glaucous beneath and usually glabrous; anthers linear to oblong, apiculate; samaras 3-5 cm. long, the terete fruit body to 15 mm. long; wing narrowly oblong to spatulate, not decurrent, 4-7 mm. broad, emarginate or obtuse at apex. Along streams and in forests in the e. third of Tex., Feb.-Mar.; from N.S. to Minn., s. to Fla. and Tex.

4. *Fraxinus texensis* (Gray) Sarg. TEXAS ASH. Small tree to 15 m. high, essentially glabrous throughout; leaflets 5 or 7, usually 5, with slender petiolules to 2 cm. long, suborbicular-ovate to obovate or sometimes narrowly elliptic, rounded at base, rounded to abruptly acute at apex, 3-8 cm. long or sometimes larger on young trees, crenulate-serrate chiefly above the middle, reticulate on lower surface; samaras 1.5-3 cm. long. *F. americana* var. *texensis* Gray. On bluffs in canyons, on rocky slopes in open woods and about lakes in cen. and n.-cen. Tex., Feb.-Mar.; endemic.

This species is closely allied to *F. americana* and, as Gray did, it probably should be considered as only a variety of that species.

5. *Fraxinus cuspidata* Torr. FRAGRANT ASH, FLOWERING ASH. Shrub or small tree to 6 m. high and 2 dm. in trunk diameter; branches slender, glabrous; bark smoothish, gray, becoming much-fissured into ridges and scaly; winter buds dark-reddish-brown, glutinous; leaves petioled, pinnately compound, to 18 cm. long; leaflets 3 to 9, usually 7, long-petiolulate, ovate to oblong-lanceolate or lanceolate, long-pointed and occasionally cuspidate at apex, 3.5-7 cm. long, essentially entire to coarsely toothed, thin, shiny dark-green above, paler and somewhat pubescent beneath when young; flowers appearing with the leaves, about 13 mm. long, in glabrous clusters 7.5-10 cm. long, fragrant, the whitish corolla 4-parted into linear-oblong lobes; samaras several in clusters, 2-2.5 cm. long, oblong-obovate to rarely lanceolate, the rounded usually emarginate wing 6 mm. wide in upper half and extending nearly to base of flattened fruit body. Scattered and local on rocky slopes of canyons and mts. in the Trans-Pecos, May-June; from w. Tex. to Ariz.

6. *Fraxinus Greggii* Gray. GREGG ASH, LITTLE-LEAF ASH, ESCOBILLA, BARRETA CHINA. Shrub or sometimes a small tree to 6 m. high and 2 dm. in trunk diameter, nearly evergreen; branches slender, terete; bark smooth, thin, gray, the brown wood dark and heavy; leaves pinnately compound, 2.5-4 cm. long, the axis narrowly winged, remaining attached through the winter until after flowering time; leaflets 3 to 7, obovate to oblanceolate, to 35 mm. long, rounded at the apex, inconspicuously toothed, thick and leathery, dark-green above, paler and covered with small black dots beneath; flowers small, partly male and female and partly bisexual, appearing before the new leaves, in small clusters; samaras few in a cluster, spatulate to oblong-obovate, 13-16 mm. long, with a broad linear-oblong wing about 6 mm. wide extending to the base of the short terete fruit body which it greatly exceeds in length, the usually retuse apex of the wing tipped with a very short distinct style. On bluffs, talus slopes, rocky hills and in arroyos and canyons of limestone from Val Verde to Brewster cos., Mar.-May; from Tex. to Ariz.

7. *Fraxinus Berlandieriana* A. DC. MEXICAN ASH, FRESNO. Small tree to about 10 m. high; leaves petiolate, grayish-green to bright-green; leaflets 3 to 5, with petiolules to 12 mm. long, lanceolate to elliptic or obovate, typically narrow, to 12 cm. long, narrowly to broadly cuneate at base, subobtusate to acuminate at apex, nearly entire to coarsely serrate, pale and glabrous or hairy in the axils of the veins beneath; samaras 25-35 mm. long, oblong-obovate to spatulate; wing decurrent to or near the base of fruit body, occasionally 3-winged. Mostly along wooded streams and in canyons in the Edwards Plateau and on the Rio Grande Plains and Valley, s. to Cameron Co., Mar.-Aug.; from Tex. to N.M. and adj. Mex.

8. *Fraxinus velutina* Torr. VELVET ASH, ARIZONA ASH, DESERT ASH, FRESNO. Small to medium-sized tree to 12 m. high and 3 dm. in trunk diameter, with spreading branches to form a rounded crown; bark deeply furrowed into ridges, gray, the light-brown wood soft and heavy; branchlets velvety-tomentose to glabrescent; twigs brown, glabrous to pubescent; leaves petioled, pinnately compound, 7.5-15 cm. long; leaflets 3 to 9, usually 5, short-petiolulate to sessile, varying greatly in appearance, elliptic to lanceolate or ovate, obtuse to long-pointed at apex, 25-75 mm. long, essentially entire to somewhat dentate on upper margins, varying from thin to thick and leathery and from glabrous to densely short-pubescent beneath; flowers small, yellow (staminate) and green (pistillate), appearing before the leaves, many in clusters; samaras numerous in dense clusters, 2-3.5 cm. long; wing oblong-obovate to elliptic or spatulate, shorter than the terete fruit body and decurrent scarcely to the middle, 3-4 mm. wide. Incl. f. *Toumeyii* Britt. and var. *Toumeyii* (Britt.) Rehd., *F. Standleyi* Rehd. In canyons and along streams in the Trans-Pecos, spring; from w. Tex. to Ut., Nev., Calif. and n. Mex.

Similarly to most of our ashes, *F. velutina* is an extremely variable species that has been given a number of names based on its variations. The plant with glabrous branchlets and leaves has been designated as var. *glabra* (Thornb.) Rehd.

9. *Fraxinus papillosa* Lingelsh. Tree to about 6 m. high; leaves 8-15 cm. long, the rachis canaliculate; leaflets subcoriaceous, 5 to 9, essentially sessile, elliptic to elliptic-lanceolate or ovate-elliptic, 3-7 cm. long, 1-3 cm. wide, subobtusate to acuminate, serrulate to subentire, glabrous and glaucous beneath, dull-green above; samaras linear to spatulate, 2.5-3 cm. long, the wing obtuse to emarginate. In canyons and rocky slopes of mts. in Trans-Pecos Tex., Mar.-Apr.; also n. Mex.

Specimens from Presidio Co. have been tentatively identified as this species (*vide* E. L. Little, Jr.). Additional material is needed for complete verification.

2. MENODORA H. & B.¹⁴⁷

Perennial herbs or small shrubs; leaves simple, entire or variously lobed, mostly alternate, exstipulate; flowers perfect, showy, in corymbs, panicles, cymes or occasionally solitary in upper leaf axils; calyx gamosepalous, persistent, prominently lobed; corolla gamopetalous, rotate-campanulate to tubular, yellow or rarely reddish-purple or whitish; stamens 2, inserted on corolla; style filiform, exserted; capsules didymous, thin-walled, circumscissile or indehiscent; seeds 2 or 4 in each cell.

A dozen or more species, mainly in southwestern United States to South America. Plants of this genus are considered to be highly palatable to livestock, and they often constitute an important source of food.

1. Plants diffuse or decumbent; lower leaves cleft; flowers solitary, terminal or axillary; pedicels recurved in fruit 1. *M. heterophylla*.
1. Plants mostly erect; leaves all entire or rarely some slightly lobed; flowers in few- to many-flowered cymes or rarely appearing to be solitary; pedicels erect in fruit (2)
- 2(1). Leaves (at least the upper ones) reduced to bracts, becoming rudimentary; calyx lobes normally 5 or 6 or sometimes with one to several additional reduced lobes ..
..... 5. *M. scoparia*.
2. All leaves foliose, the blades well-developed; calyx lobes 7 or more (3)

¹⁴⁷ Adapted from J. A. Steyermark in Ann. Missouri Bot. Gard. 19:87-176. 1932.

- 3(2). Corolla tube elongated, 25-50 mm. long, salverform, entirely glabrous within4. *M. longiflora*.
3. Corolla tube short, 2.5-7 mm. long, subrotate to shortly infundibuliform, pilose at the orifice (4)
- 4(3). Plants relatively tall; stems much-branched (5)
4. Plants relatively low, subcespitose, flaxlike; stems mostly simple and subherbaceous (6)
- 5(4). Leaves mostly linear or linear-lanceolate3. *M. decemfida* var. *longifolia*.
5. Leaves mostly elliptic-oblong or oblong-lanceolate2b. *M. scabra* var. *ramosissima*.
- 6(4). Leaves mostly linear or linear-lanceolate; corolla lobes oblong to narrowly obovate, obtuse and slightly mucronate2. *M. scabra* var. *scabra*.
6. Leaves mostly ovate to oblong-elliptic or oblong-lanceolate; corolla lobes broadly ovate to subovate, acute and distinctly mucronate2a. *M. scabra* var. *laevis*.

1. *Menodora heterophylla* Moric. Perennial, diffuse, decumbent, subherbaceous, to 25 cm. high; stems numerous, slender, slightly angled, sparsely hispidulous; leaves opposite, slightly petiolate, numerous, crowded, submembranaceous, linear to oblong-lanceolate, acute, entire or pinnately 3- to 7-cleft or -lobed, to 4 cm. long (including the petiole) and 3 cm. broad, the segments linear-lanceolate to obovate, glabrous except for the slightly hirtellous margins; flowers relatively few; pedicels solitary, terminal, slender, 5-8 mm. long, scaberulent, recurved in fruit; calyx campanulate, 6-11 mm. long, the tube 1-3 mm. long, in anthesis about 1.5-2 mm. broad, in fruit 4-5 mm. broad, scaberulent; calyx lobes 10 to 14, linear, acute, entire, 5-10 mm. long, 0.5-1 mm. broad, hirtellous on the margins; corolla shortly infundibuliform, to about 15 mm. long, light-yellow to reddish-purple; corolla tube short, 2-5 mm. long, about 5 mm. broad at the orifice, sparsely pilose near the base of the throat within; corolla lobes 5 or 6, obovate, 6-12 mm. long, 3.5-6 mm. broad, obtuse, slightly mucronate; stamens exerted, 8-10 mm. long; filaments glabrous, connective not conspicuously prolonged at the apex; pistil about 1 cm. long, the stigma capitate; capsule 6-10 mm. long, 1-1.8 cm. broad; seeds 4 in each cell, 5-7 mm. long, about 4 mm. broad, coarsely and rather irregularly reticulated. Rather ubiquitous in cen. and s. Tex., in clay, gravel, sandy loam, on caliche outcrops and rocky hills, and in mesquite pastures, Feb.-Oct.; from Tex., s. to cen. Mex.

2. *Menodora scabra* Gray var. *scabra*. Plant nearly herbaceous, erect, to 35 cm. high; stems numerous, slender, strict, mostly terete, clustered below, simple and elongated above, sparsely to moderately scaberulent or rarely glabrous; leaves opposite or alternate, numerous, crowded, sessile, foliose throughout, linear to linear-lanceolate, the lowest leaves mostly oblong-lanceolate to obovate, to 4 cm. long and 4 mm. broad, entire, acute, subcoriaceous, sparsely hirtellous (especially on the margins and midrib); flowers very numerous, in subcorymbose cymes; pedicels slender, to 2 cm. long, sparsely scaberulent, erect in fruit; calyx campanulate, 4-9 mm. long, somewhat scaberulent; calyx tube 1.5-3 mm. long, in anthesis 1.5-3 mm. broad, in fruit 3-5 mm. broad; calyx lobes 7 to 12, equal or unequal, linear to linear-spatulate, entire, acute to slightly obtuse, 3-7 mm. long, to 0.8 mm. broad, slightly roughened; corolla subrotate, 9-12 mm. long, bright-yellow; corolla tube short, 3-4 mm. long, 2-3 mm. broad at the orifice, pilose at the orifice within; corolla lobes 5, oblong to obovate, obtuse, slightly mucronate, 5-8 mm. long, 3-5 mm. broad, glabrous or sparsely pilose without; stamens exerted, 6-8 mm. long; filaments glabrous, connective prolonged into a short rounded protuberance; pistil about 1 cm. long, the stigma capitate; capsule 5-7 mm. long, 7-12 mm. broad; seeds 4 in each cell, scrobiculate (with small, narrow, deeper irregular pits), seeming smooth to the naked eye, 5-6 mm. long, 4 mm. broad. In sandy, gravelly or clayey soils on rocky hills, river terraces, grassy slopes and mesas in the w. Edwards Plateau and Trans-Pecos, Mar.-Sept.; from s. Colo. to Tex., Ut. and Baja Calif., s. to Dgo.

2a. *Menodora scabra* var. *laevis* (Woot. & Standl.) Steyerem. Leaves (including the petiole) to 17 mm. long and 5 mm. broad, obtuse or acute, distinctly mucronate, glabrous or sparsely scaberulent, the lower and middle ones ovate or elliptic-oblong to oblong-lanceolate, the upper ones becoming lanceolate; pedicels glabrous to moderately

scaberulent; calyx glabrous to slightly roughened; corolla 11-14 mm. long; corolla tube almost entirely glabrous within except for the few slender hairs around the insertion of the filament on the tube; corolla lobes elliptic-obovate to subovate, acute to acuminate, distinctly mucronate; connective of the anther prolonged at the apex into a short sub-cuneate protuberance; seeds 4-5 mm. long, 3-3.5 mm. broad. In arroyos, along creek beds and on slopes in w. Edwards Plateau and Trans-Pecos, Apr.-Aug.; from Tex., w. to s.e. Calif. and Mex.

2b. *Menodora scabra* var. *ramosissima* Steyerl. Plant paniculately branched, erect, suffruticose, to 9 dm. high; stems much-branched but not clustered below; leaves petiolate below, subsessile above, elliptic-oblong to sublanceolate, to 4 cm. long (including the petiole) and 9 mm. broad, submembranaceous, distinctly mucronate, glabrous to sparsely scaberulent; flowers in loose paniculate to subcorymbose cymes; calyx glabrous to densely scaberulent; corolla tube 4.5-5 mm. long; corolla lobes 4.5-6 mm. long; stamens 9-10 mm. long; connective prolonged at the apex into a short cylindrical blunt protuberance; pistil about 1 cm. long; seeds coarsely reticulate with the deeper irregular pits appearing on the surface more frequently than in var. *scabra*, 4.5-5 mm. long, about 3 mm. broad. On gravelly hills and in rocky stream beds in the Trans-Pecos, Aug.-Nov.; from w. Tex. to cen. Ariz. and n. Mex.

3. *Menodora decemfida* (Gill) Gray var. *longifolia* Steyerl. Plants tall, the stems much-branched; leaves (including the petiole) to 4 cm. long, mostly linear to linear-lanceolate, slightly mucronate at apex; calyx 5-11 mm. long, the calyx tube 2-3 mm. long; calyx lobes 8 to 11, 4-8 mm. long; corolla tube 4-5 mm. long; corolla lobes oblong to obovate, 1-1.2 cm. long, 5-8 mm. wide; stamens 11-12 mm. long. In clay and limestone soils in the Trans-Pecos, July-Sept.; from w. Tex. to cen. Mex.

4. *Menodora longiflora* Gray. Plant erect, branching, nearly herbaceous but with woody base, to 9 dm. high; stems very numerous, slender, almost simple and much-elongated to paniculately branched and shortened, slightly angled, glabrous to densely hirsute-pilose; leaves mostly opposite or the uppermost alternate, numerous, sessile to subpetiolate, linear to elliptic-lanceolate or elliptic-oblong, to 55 mm. long and 8 mm. broad, mostly entire, occasionally the lowest 2- or 3-lobed, obtuse to acute or mucronate, glabrous to somewhat hirsute-pilose, subcoriaceous; flowers numerous in terminal sub-corymbose cymes; pedicels slender, to 22 mm. long, glabrous to moderately hirsute-pilose, erect in fruit; calyx campanulate to turbinate, to 23 mm. long, glabrous to somewhat hirsute-pilose; calyx tube 2-3 mm. long, in anthesis 2-3 mm. broad, in fruit 4-6 mm. broad; calyx lobes 8 to 12, equal or unequal, linear, entire and rarely bifid, to 18 mm. long and 1 mm. broad, glabrous to moderately hirsute; corolla bright-yellow, hypercrateriform, 3-6 cm. long; corolla tube 2.5-5 cm. long, 4-5 mm. broad at the orifice, entirely glabrous; corolla lobes 5, ovate, acute, distinctly mucronate, 9-15 mm. long, 5-8 mm. broad; stamens included; filaments glabrous; pistil 2.5-5 cm. long, the stigma broadly capitate; capsule 8-10 mm. long, 1-1.7 cm. broad; seeds 4 in each cell, with large irregular reticulations, 5-7 mm. long, 4-5 mm. broad. *M. hispida* E. J. Palm. In rocky soil and on ledges along streams in canyons on the Edwards Plateau and Trans-Pecos, June-Sept.; from Tex. and s. N.M., s. to cen. Mex.

5. *Menodora scoparia* Engelm. Plant paniculately branching, erect, suffruticose, to 9 dm. high; stems very numerous, much-branched, opposite or clustered at the base, simple and elongated above, strict, slender, slightly angled, mostly glabrous or less often scaberulent; leaves opposite below, subalternate above, relatively few, to 3 cm. long (including the petiole) and 4 mm. broad, entire, acute to obtusish, mostly glabrous or sparsely scaberulent on the margins and upper surface, the well-developed subpetiolate lower leaves slightly crowded and oblong-obovate to oblanceolate, the rudimentary subsessile upper leaves remote and linear or linear-subulate; flowers few, disposed in loose subcorymbose cymes; pedicels slender, to 1 cm. long, erect in fruit, glabrous or sparsely scaberulent; calyx campanulate, 3-6 mm. long, glabrous or sparsely scaberulent; calyx tube 1.5-2.25 mm. long, in anthesis about 2 mm. broad, in fruit about 4 mm. broad, mostly glabrous, rarely sparsely scaberulent; calyx lobes usually 5 or 6 (infrequently with as many as 3 intermediate smaller and narrower lobes), to 4 mm. long and 1 mm. broad, linear to lanceolate, acute to acuminate, entire, mostly glabrous, infrequently sparsely scaberulent on the margins; corolla yellow, subrotate, to about 12 mm. long; corolla tube short, 3-5 mm. long, about 3 mm. broad at the orifice, moderately pilose at

the orifice within; corolla lobes 5, obovate, more or less obtuse, 5-8 mm. long, 3-4 mm. broad; stamens slightly exerted, 7-9 mm. long, connective slightly prolonged into a blunt cylindrical protuberance; pistil to 12 mm. long, the stigma capitate; capsule 4-6 mm. long, about 1 cm. broad; seeds 4 in each cell, ratherly coarsely and regularly reticulate, 4-5 mm. long, about 3 mm. broad. In limestone soils on hills and flats in the Trans-Pecos, June-Aug., from Tex. to s.e. Calif. and n. Mex.

3. CHIONANTHUS L. FRINGE-TREE

Two species, ours and another in eastern Asia.

1. *Chionanthus virginica* L. OLD-MAN'S BEARD. Low deciduous tree to about 10 m. high; branchlets stout, pubescent when young; leaves with petioles to 25 mm. long, opposite to alternate, entire, oval to oblong or oblanceolate, cuneate at base, acute to acuminate at apex, to 2 dm. long and 6 cm. wide, usually much smaller, dark-green and lustrous above, paler and sometimes pubescent beneath; panicles densely flowered, to 2 dm. long, usually leafy-bracted at base; flowers delicate, white or greenish-white, on slender pedicels, opening with or before the leaves, in loose and drooping graceful panicles from lateral buds in the uppermost leaf axils, functionally unisexual; calyx 4-parted, very small, persistent; calyx lobes triangular; petals 1.5-3 cm. long, about 2 mm. wide, narrowly linear, acute, varying to 5 or 6 in number; stamens 2, subsessile on the base of the corolla; style very short, the stigma notched; drupe purple, with a bloom, ovoid to ellipsoid, fleshy, to 18 mm. long. In damp woods, thickets or on bluffs in e. Tex., Mar.-Apr.; from Fla. to Tex., n. to N.J., e. Pa., W.Va., s. O., s. Mo. and Okla.; spreading from cult. northw.

Those plants with pubescent panicles and pubescent lower surface of leaves are usually referred to var. *maritima* Pursh.

4. LIGUSTRUM L. PRIVET

Deciduous or evergreen shrubs or small trees; leaves opposite, short-petioled, entire; flowers perfect, white or yellowish white, in terminal panicles; calyx campanulate, 4-toothed; corolla salverform, with a tubular base and 4 spreading lobes; stamens 2, enclosed or exerted; fruit a usually black or bluish-black 1- to 4-seeded berrylike drupe.

About 50 species in the Old World, many of which are grown for their ornamental foliage.

- 1. Flowers sessile or subsessile, in clusters to form long cylindrical spikes in panicles; corolla tube about as long as the lobes 1. *L. Quihoui*.
- 1. Flowers distinctly pedicelled, in loose panicles; corolla tube shorter than the lobes 2. *L. sinense*.

1. *Ligustrum Quihoui* Carr. WAX-LEAF LIGUSTRUM. Usually evergreen shrub to 2 m. high, with nearly horizontal branches; leaves very short-petioled, glabrous, coriaceous, dark-green, elliptic to obovate or oblanceolate, obtuse at apex, to 5 cm. long; flowers in whorl-like separate clusters at tips of branches and on paired side-branchlets to form an open panicle to 2 dm. long. A nat. of China that has escaped from cult. and become naturalized in woodlands in n.-cen. and e. Tex.

2. *Ligustrum sinense* Lour. CHINESE PRIVET, TRUENO DE SETO. Shrub to 4 m. high, evergreen in mild winters, with spreading branches; leaves short-petioled, rhombic-elliptic to oblong-elliptic or ovate, cuneate at base, broadly obtuse to acute at apex, dull-green above, pubescent on midrib beneath, to 7 cm. long; flowers in loose pubescent panicles to 1 dm. long; calyx pubescent; fruit subglobose, about 4 mm. in diameter. A nat. of China that often persists along fencerows, in thickets and about old home sites.

5. FORESTIERA Poir.

Shrubs or small trees; leaves opposite or subopposite, the phyllotaxis in some species obscured by the foreshortening of the internodes of the twigs ("spurs" or "short shoots");

leaf blades entire, simple, usually porulose (with darkish minute craters scattered in the epidermis); stipules absent; male and female flowers borne on separate bushes or an occasional flower appearing perfect; flowers inconspicuous, borne in small axillary glomerules, unisexual; sepals minute; corolla absent; *staminate flowers* comprising merely 4 (or 5) minute sepals and 4 (or 5) stamens; *pistillate flowers* comprising usually 4 (or 5) minute sepals, 4 (or 5) staminodia and a central stipitate ovary; ovary one-celled, uniovulate; fruit a slow-maturing drupe, longitudinally ribbed prior to ripening, the mesocarp becoming juicy only very shortly before maturity, the exocarp passing through shades of purple to nearly black and with a whitish bloom, the stone thin-walled and made of a series of longitudinal ribs; endosperm copious.

A genus of North America and Central America and the West Indies, of about 12 inclusive species or up to 20 finely divided ones. Plants of the serrate-leaved species are best keyed out in fruiting condition. Some species are among the most sought-after browse in southern and western Texas, and tend to disappear in over-browsed areas. The ripe drupes are eaten by birds.

1. Leaf margins never toothed; blades usually linear 1. *F. angustifolia*.
1. Leaf margins toothed although the teeth sometimes very small; blades not linear (2)
- 2(1). Leaves firm to subcoriaceous, glabrous, apparently persistent; flowers appearing in summer; southern Edwards Plateau and Stockton Plateau 2. *F. reticulata*.
2. Leaves membranous, deciduous, pubescent or glabrous; flowers vernal or autumnal (3)
- 3(2). Leaf blades mostly more than 35 mm. long, basally acuminate, apically acute or acuminate, usually glabrous; petioles usually 5-11 mm. long; eastern half of Texas 3. *F. acuminata*.
3. Leaf blades mostly less than 35 mm. long, basally acute to acuminate, apically acute to rounded, often pubescent; petioles 2-5 mm. long (4)
- 4(3). Leaf blades essentially glabrous above except for minute lines of hairs along the major nervature, beneath softly pubescent; flowers usually appearing in late summer or early fall and fruits maturing in late fall; eastern fourth of Texas 4. *F. ligustrina*.
4. Leaf blades either totally glabrous on both surfaces or with some pubescence on both; flowers vernal; fruit maturing in summer; more western in distribution 5. *F. pubescens*.

1. *Forestiera angustifolia* Torr. DESERT OLIVE, PANALERO. Rounded shrubs with nodes usually crowded on short shoots or well-separated on elongating branches; elongate branches usually arcuate; branchlets glabrous or puberulent; leaf blades linear, 1-3 cm. long, 3-6 mm. broad, not serrate, entirely glabrous or pubescent on one or both surfaces; flowers borne in spring or often after droughts before the new leaves expand. *F. puberula* Eastw., *F. texana* Cory, *F. texana* var. *Palmeri* Cory. Locally abundant in brush, Rio Grande Plains (in coastal areas n.e. to Chambers Co.), n. and w. to Comal, Kinney, Val Verde, Terrell, Brewster and Presidio cos., usually spring; n. Ver., S.L.P., Zac. and Dgo., n. to Tex. and Chih.

The plants from Presidio County and some of them from the Big Bend region in southern Brewster County have minutely puberulent leaf blades, and correspond to the plant described as *F. puberula* (S.L.P., Zac., Coah., Dgo. and Chih.), but the distinction does not seem sufficient to maintain a separate species, and some of the populations of the Chisos Mts. region are mixed. The plants are sought avidly by browsing stock.

2. *Forestiera reticulata* Torr. NETLEAF FORESTIERA. Shrubs; leaves persistent, shiny, serrate, usually somewhat rhombic, with slightly raised venation. *F. racemosa* Wats., *Gymnanthes texana* Standl. Local in limestone tributary canyons of the s. Edwards Plateau and Stockton Plateau, in Bandera, Edwards, Medina, Real, Terrell, Uvalde and Val Verde cos., summer; S.L.P., N.L., Coah. and Tex.

3. *Forestiera acuminata* (Michx.) Poir. SWAMP PRIVET. Shrubs or trees; leaves deciduous, relatively large for this genus, long-petioled and the blades usually acuminate at both ends, rarely pubescent. Incl. f. *vestita* (E. J. Palm.) M. C. Johnst. Infrequent,

lowland woods, e., s.e. and n.-cen. Tex. and as far s. as Victoria and Refugio cos., spring; s.e. U.S., n. to S.C., Tenn., Ind. and Ill., w. to Tex.

4. *Forestiera ligustrina* (Michx.) Poir. Shrub to 4 m. tall; leaves deciduous, the blades mostly 2.5-4 or 6 cm. long, acute basally, apically acute or usually rounded, serrate, above glabrous except for minute pubescence along the main nerves, beneath softly pubescent. *F. autumnalis* Buckl., *F. Wrightiana* Lundell. Infrequent in woods, sandy soils, e. and s.e. Tex., summer-fall; Ala., Ga., Fla., Tenn. and Tex.

5. *Forestiera pubescens* Nutt. ELBOW-BUSH, SPRING HERALD, STRETCH-BERRY. Rounded shrubs with arcuate branches; leaves deciduous, the blades averaging smaller than those of *F. ligustrina* and rather variable in shape, either totally glabrous (var. *glabrifolia* Shinnery, *F. sphaerocarpa* Torr.) or pubescent on both surfaces (*F. neomexicana* Gray). Locally abundant in open pastures and brushy prairies where not too heavily browsed, n.-cen. and Trans-Pecos Tex., Edwards Plateau and Plains Country, spring; Okla. and Tex. w. and s.w. to Calif., Ariz. and the mts. of Chih.

The plants of Oklahoma and most of Texas, including the mountains of the Trans-Pecos, Coahuila and Chihuahua, have blades only about twice as long as broad and are the more typical *F. pubescens*. Those of the western states and from the margin of Salt Flat in Culberson and Hudspeth counties, Texas, and of canyons on the High Plains country have blades about three times as long as broad and are referable to *F. neomexicana*. But there is complete intergradation in western Texas. Alleged differences in pedicel length are fictitious and differences in pubescence are found even in one population. There is no very meaningful way to recognize two species in this complex. Children are known to chew the fruits of this species with ordinary chewing-gum to produce a sort of "bubble-gum."

FAM. 148. LOGANIACEAE MART.

LOGANIA FAMILY

Herbs, vines, shrubs or trees (extra-Texas) with opposite unlobed leaves and stipules or a stipular line or membrane between them; flowers regular, perfect, 4- or 5-merous, gamopetalous, variously arranged; calyx deeply lobed or with separate sepals; corolla salverform to tubular or campanulate; stamens perigynous, as many as the corolla lobes and alternate with them; ovary 2-celled, free from calyx; fruit a capsule or pod. Includes Buddlejaceae and Spigeliaceae.

Traditionally, about 800 species in 30 or more genera in tropical and warm-temperate regions of both hemispheres.

1. Twining woody climbers with semievergreen leaves; flowers axillary; stigmas 4, the apex of style twice 2-cleft1. *Gelsemium*, p. 1201.
1. Erect or spreading herbs or shrubs; flowers in spikes, cymes or panicles, or sometimes axillary or in forks of branches; stigma single, entire or barely 2-lobed (2)
 - 2(1). Flowers 5-merous; corolla valvate in bud; pods didymous or bilobed (3)
 2. Flowers 4-merous; corolla usually imbricated in bud; pods at most notched at apex (4)
 - 3(2). Style single, jointed in the middle; corolla tubular-funnelform or salverform
.....2. *Spigelia*, p. 1201.
 3. Styles 2, short, converging, united at summit and with a common stigma; corolla urceolate3. *Cynoctonum*, p. 1202.
 - 4(2). Calyx lobed to the base; pod loculicidal; herb with diffusely branched stems and linear entire leaves4. *Polypremum*, p. 1202.
 4. Calyx with the lobes more or less united; pod septicidal; shrubs with leaves broad and often dentate (5)
 - 5(4). Corolla mostly rotate-campanulate; anthers sessile or nearly so in the throat of corolla5. *Buddleja*, p. 1202.
 5. Corolla salverform; stamens exerted; filaments elongated, inserted on middle of corolla tube6. *Emorya*, p. 1204.

1. GELSEMIUM JUSS. YELLOW-JESSAMINE

Three species known; two in North America, another in eastern Asia.

1. *Gelsemium sempervirens* (L.) Jaume St.-Hil. CAROLINA-JESSAMINE, POOR MAN'S ROPE. Smooth and twining shrubby perennial; stems high-climbing, wiry, brownish-red; leaves with petioles about 5 mm. long, ovate to elliptic or lanceolate, semievergreen, to 75 mm. long and 3 cm. wide; stipules minute, deciduous; pedicels scaly-bracted; flowers 5-merous, fragrant, in axillary clusters of as many as 6, sometimes solitary; corolla yellow, funnel-form, 25-35 mm. long; anthers oblong, sagittate; style long, slender; pod elliptic, 2-celled and 2-valved, to 15 mm. long, flattened contrary to the narrow partitions; seeds numerous, winged. Usually in sandy loam on edge of or in open woodlands in e. Tex., Feb.-Apr.; from Fla. to Tex., n. to s.e. Va. and Ark.

2. SPIGELIA L. PINK-ROOT. WORM-GRASS

Herbaceous perennials with opposite leaves united by stipules; flowers solitary or in 1-sided cymose spikes, 5-merous; calyx with slender lobes; corolla tubular-funnelform or salverform, with small lobes at summit; anthers linear; style solitary, hairy above and jointed near middle; fruit a 2-celled twin pod that separates into 2 carpels at maturity from a persistent base.

About 50 species in the Western Hemisphere. Segregated by some authors as the basis for a separate family, the Spigeliaceae.

1. Corolla vivid-red on outer surface, yellow within, about 4 cm. long; in east Texas 1. *S. marilandica*.
1. Corolla white or striped, only occasionally more than 1 cm. long; in west-central and south Texas (2)
- 2(1). Corolla 12 mm. long; most leaves 25 mm. long or more 2. *S. texana*.
2. Corolla 8-10 mm. long; most leaves less than 25 mm. long 3. *S. Lindheimeri*.

1. *Spigelia marilandica* L. INDIAN-PINK. Stems simple and erect, to 8 dm. tall; leaves sessile at the broadly rounded base, ovate to ovate-lanceolate, acute to acuminate at apex, to 1 dm. long and 4 cm. wide below middle; flowers showy, in short simple or forked secund spikes; calyx lobes linear-setaceous, serrulate, about 1 cm. long; corolla elongate-tubular, the tube about 4 cm. long, the short lobes lanceolate; anthers and style exserted. On rich wooded slopes in e. Tex., May-Oct.; from Fla. to Tex., n. to Md., O., Ind., Mo. and Okla.

2. *Spigelia texana* (T.&G.) A. DC. TEXAS PINK-ROOT. Plant spreading, with several stems arising at base, nearly smooth and glabrous, to about 3 dm. tall; leaves ovate to elliptic-lanceolate, sometimes obovate or oblanceolate (especially near base of stem), rather thin, 2.5-5 cm. long, to 2 cm. wide, obtuse to acute at apex, broadly tapering at base; flowers terminal and in the axils of leaves; sepals setaceous-subulate, 1-nerved, about 5 mm. long, the margins serrulate-scabrous; corolla salverform, white, about 12 mm. long; anthers and style included; pods 3-4 mm. high. *Coelostylis texana* T. & G. On wooded slopes and floodplain woods along rivers in s. Tex., June-Aug.; endemic.

3. *Spigelia Lindheimeri* Gray. Plant low and diffusely much-branched from base, to about 15 cm. tall, puberulous-scabrous, the stems usually purplish-tinged near base; leaves ovate-elliptic to linear-lanceolate, to about 35 mm. long and 1 cm. wide, obtuse to acute at apex, tapering at base; flowers terminal and arising in the axil of leaves; sepals linear-lanceolate, about 5 mm. long, the scarious margins conspicuously denticulate; corolla salverform, white or sometimes striped, 8-10 mm. long; anthers and style included; pods about 4 mm. high. *Coelostylis Lindheimeri* (Gray) Small. In open gravelly soil and among boulders and about breaks or in prairies on the Edwards Plateau and in s. Tex., Mar.-Apr.; also n. Mex.

3. CYNOCOTONUM J. F. GMEL.

MITERWORT. HORNPOD

Annual smooth herbs with small stipules between the leaves and small whitish or pink-tinged flowers spiked along one side of the branches of a terminal peduncled cyme; flowers 5-merous; sepals ovate to elliptic, united at base; corolla longer than the calyx, somewhat globose-funnelform with small elliptic several-veined lobes; stamens included; ovary slightly adnate to the bottom of the calyx, 2-celled; capsule exserted, strongly bicornute or mitriform, opening down the inner side of each horn, many-seeded.

About 6 species of warm-temperate regions.

1. Capsule 3-4 mm. high, its outer surface essentially smooth; leaves tapering to a petiolate base, typically narrowly elliptic, thin, at least some 3 cm. long or more 1. *C. Mitreola*.
1. Capsule 2-3 mm. high, its outer surface densely cellular-papillose; leaves sessile, typically broadly oval, firm, rarely more than 2 cm. long 2. *C. sessilifolium*.

1. *Cynoctonum Mitreola* (L.) Britt. Stem simple or laxly slender-branched, to 75 cm. tall; leaves thin, petiolate, ovate-elliptic to elliptic or elliptic-lanceolate, obtuse to acuminate at apex, 2-8 cm. long; cymes on long slender peduncles, their branches loosening in fruit; corolla about twice as long as the calyx; fruiting calyces slightly distant; capsules 3-4 mm. high, the outer surface smooth or rarely with few scattered papillae. *Mitreola petiolata* (Walt.) T. & G. In moist soil in seepage, along ditches and streams, and about ponds and lakes in e. and cen. Tex., w. to Val Verde Co. and s.w. to Victoria Co., May-Oct.; from Fla. to Tex., n. to s.e. Va., Tenn. and Ark.

2. *Cynoctonum sessilifolium* (Walt.) J. F. Gmel. Stem stiffly erect, simple or with few erect branches, to about 5 dm. tall; leaves firm, sessile, oval to elliptic or suborbicular-ovate, bluntly obtuse to abruptly tipped, the margin usually noticeably papillose, rarely more than 2 cm. long and wide; cymes more compact than in *C. Mitreola*; corolla only slightly longer than the usually prominently keeled calyx lobes; fruiting calyces approximate; capsules 2-3 mm. high, the outer surface conspicuously and densely cellular-papillose. On seepage slopes and in bogs and wet savannahs, and along wooded streams, in e. Tex., June-Oct.; from Fla. to Tex., n. to s.e. Va.

4. POLYPREMUM L.

A monotypic genus.

1. *Polypremum procumbens* L. A small diffusely much-branched and spreading more or less scabrous annual or perennial to about 3 dm. high; stems several-ribbed; leaves narrowly linear to subulate, to about 3 cm. long, rarely more than 2 mm. wide, connected at base by a slight stipular line; flowers 4-merous, solitary and sessile in the forks and at the ends of the branches; calyx lobes lanceolate-subulate from a broad scarious-margined base, about 3 mm. long, dorsally keeled; corolla white, almost rotate, bearded in the throat, about as long as sepals, the lobes suborbicular and about 1 mm. long; stamens much-abbreviated, the anthers globular; style very short, the stigma entire and ovoid; capsule ovoid, somewhat compressed, notched at apex, about 2 mm. high, 2-celled, loculicidally 2-valved, many-seeded. In dry sandy fields, on dunes, along roadsides and in openings in flatwoods, characteristically weedy, in the e. two thirds of Tex., Apr.-Nov.; from Fla. to Tex., n. to L.I., N.J., e. Pa. and s.e. Mo.; s. to W.I. and Col.

5. BUDDLEJA L.

BUTTERFLY-BUSH

Deciduous or semievergreen shrubs or rarely small trees (extra-Texas) with a glandular, canescent or tomentose indument, or sometimes essentially glabrous; leaves opposite (in ours), sessile or with petioles connected by a transverse stipular line or more evident stipules, entire to crenate or dentate; the usually small 4-merous perfect flowers racemose or crowded into capitate clusters that are variously disposed; calyx campanulate; corolla

tubular to rotate-campanulate, with ovate to orbicular lobes; anthers sessile or nearly so in throat or tube of corolla; pods globose to ellipsoid, bivalved, septicial.

About 100 species in tropical and warm regions of both hemispheres. Segregated by some authors as the basis for a separate family, the Buddlejaceae.

1. Leaves entire to only remotely and inconspicuously serrulate or denticulate (2)
1. Leaves coarsely and prominently crenate or crenate-dentate (3)
- 2(1). Flowers in a dense raceme; corolla usually purplish, about 15 mm. long
 1. *B. Lindleyana*.
2. Flowers in glomerules in axils of uppermost leaves; corolla greenish-yellow, about 5 mm. long 2. *B. sessiliflora*.
- 3(1). Leaves narrowly oblong to linear-cuneate, 1 cm. wide or less, essentially sessile 3. *B. scordioides*.
3. Leaves typically ovate to triangular-lanceolate or somewhat orbicular, more than 1 cm. wide, more or less tapering at the petiole base (4)
- 4(3). Leaves densely tomentose on both surfaces; only in the Trans-Pecos region
 4. *B. marrubiifolia*.
4. Leaves essentially glabrous on upper surface; endemic to Edwards Plateau in central Texas 5. *B. racemosa*.

1. *Buddleja Lindleyana* Fort. Diffusely branched shrub to 2 m. tall, with 4-angled branches; leaves ovate to lanceolate, acuminate, entire to remotely denticulate, glabrous, to 1 dm. long; flowers in upright rather dense spikes to 2 dm. long; corolla purplish to violet or reddish, about 15 mm. long, with the tube slightly curved; capsules 4-5 mm. long. *Adenoplea Lindleyana* (Fort.) Small. Roadsides and cult. ground in s.e. Tex., summer-fall; nat. of China, cult. and escaped to become naturalized in the Coastal Plain from Fla. to Ga. and Tex.

2. *Buddleja sessiliflora* H.B.K. ΤΕΡΟΖΑΝ. Shrub to 2 m. tall or more, moderately tomentose to glabrate throughout; leaves tapering into the distinct petiole, linear-elliptic to lanceolate or sometimes rhombic-ovate, acuminate, entire to remotely serrulate, rather thin, tomentose to glabrous on lower surface, to at least 12 cm. long and 3 cm. wide; glomerules of flowers in axils of uppermost leaves, 10-15 mm. in diameter, short-pedunculate or often essentially sessile with 2 glomerules combined as one; corolla greenish-yellow, fragrant, about 5 mm. long. *B. Humboldtiana* of Coult. On sand bars and banks and in palm groves along the Rio Grande in Cameron and Hidalgo cos., spring-summer; also s. Ariz. and s. to Oax.

3. *Buddleja scordioides* H.B.K. ESCOBILLA, BUTTERFLY-BUSH. Densely branched aromatic shrub to 12 dm. tall, ferruginous-tomentose throughout; leaves essentially sessile, narrowly oblong to linear-cuneate, obtuse, coarsely crenate, rugose, to 45 mm. long and 1 cm. wide, usually much smaller; flowers minute, greenish-yellow to yellowish, in dense clusters that are sessile in the axils of the uppermost leaves, the pair of clusters united around stem to form a globose densely lanate head to 1 cm. broad. In limestone soil and rocky areas in w. Edwards Plateau and the Trans-Pecos, June-Oct.; N.M. and Tex., s. to Jal., Qro. and Hgo.

4. *Buddleja marrubiifolia* Benth. Much-branched shrub to 15 dm. tall; leaves short-petiolate, oval to suborbicular or rhombic, decurrent at the cuneate base, coarsely crenate, densely and velvety tomentose with the dendritic hairs usually ferruginous, to about 5 cm. long and 25 mm. wide, usually much smaller; flowers in dense globose heads (about 12 mm. in diameter) on a short peduncle, yellow to orange-color or reddish, about 3 mm. long. On limestone ledges and slopes in canyons and arroyos of the s. Trans-Pecos, Mar.-Aug.; Tex. and Chih. s. to S.L.P. Subsp. *occidentalis* Norm. is in w. and cen. Chih.

5. *Buddleja racemosa* Torr. WAND BUTTERFLY-BUSH. Small shrub to 5 dm. tall, laxly branched, often essentially glabrous; leaves with a petiole to 1 cm. long, ovate-oblong to triangular-lanceolate, subtruncate to broadly cuneate and often obscurely hastate at base, obtuse to subacuminate at apex, irregularly crenate-dentate, 5-10 cm. long, to about 3 cm. wide, upper surface green and glabrous or vernicose, simply crystalline-granular on lower surface or also provided with a dense tomentum; flower heads subsessile to pedunculate, to 1 cm. broad, in racemes to 3 dm. long; corolla cream-color, only

slightly exceeding the tomentulose calyx. On rocky banks and in crevices of ledges, s. margin of Edwards Plateau, June-Aug.; endemic.

Those plants in the western part of the range with shorter leaves that are densely fulvous-canescens-tomentose on the lower surface have been segregated as var. *incana* Torr. [subsp. *incana* (Torr.) Norm.] The two races overlap in Bexar and Comal counties.

6. EMORYA TORR.

A monotypic genus.

1. *Emorya suaveolens* Torr. A much-branched and somewhat stellately pulverulent scraggly shrub to 2 m. tall; leaves opposite, with petioles to about 1 cm. long, ovate-dehiscoid, obtuse at apex, subhastate at base, sinuate-dentate with a few coarse teeth, minutely whitish-tomentulose beneath, becoming glabrous above, to about 5 cm. long; flowers 4-merous, fragrant, in a narrow pedunculate thyrsoid panicle; calyx tubular, to 15 mm. long, lobed to about the middle, the lobes linear-subulate; corolla salverform, to 35 mm. long, yellow tipped with green; stamens exserted, the filiform filaments inserted on middle of corolla tube; style long, filiform; pod 2-celled, globose to ellipsoid, septical. In Maravillas Canyon near the Rio Grande in Brewster Co. in the Trans-Pecos, July-Oct.; also n. Mex. (Coah. and N.L.)

FAM. 149. GENTIANACEAE JUSS.

GENTIAN FAMILY

Annual or perennial herbs, glabrous or essentially so, with simple exstipulate entire opposite, whorled or rarely alternate sessile to occasionally long-petioled leaves; flowers solitary or borne in clusters or in simple or compound cymes, 4- to 12-merous, regular, perfect, hypogynous, sympetalous; calyx persistent; corolla tubular, salverform, campanulate or rotate; stamens on the corolla tube, alternate and as many as the lobes; ovary 1-celled or essentially 2-celled by intrusion of 2 parietal placentae; style elongate to obsolete, the stigma entire to prominently 2-cleft; capsule usually 2-valved and septical, many-seeded.

A large world-wide family of about 80 genera and 900 species, mostly in temperate regions. By many authors segregated into 2 families, in which case the genus *Nymphoides*, because of its alternate leaves and valvate aestivation, is placed in the Menyanthaceae.

- 1. Leaves alternate, long-petioled, the blade floating; corolla lobes valvate in bud; plant aquatic8. *Nymphoides*, p. 1210.
- 1. Leaves opposite or whorled, sessile or essentially so; corolla lobes never valvate in bud; plant terrestrial (2)
- 2(1). Corolla lobes imbricate in bud, without appendages or glands; calyx lobes 2 or 4, sometimes foliaceous (3)
- 2. Corolla lobes convolute in bud, with or without appendages or glands; calyx lobes 4 or more, not foliaceous (4)
- 3(2). Calyx 4-parted, the segments lanceolate; corolla deeply 4-cleft, slenderly campanulate; stigma nearly sessile6. *Bartonia*, p. 1209.
- 3. Calyx of 2 foliaceous spatulate sepals; corolla 4-lobed, ellipsoid-campanulate; style definite7. *Obolaria*, p. 1210.
- 4(2). Corolla pink to roseate; style filiform, usually deciduous from capsule; anthers either twisted or prominently curved in age (5)
- 4. Corolla never pink (except in one rare form of *Eustoma grandiflorum*), typically lavender, blue or green-purple; style usually stout and persistent; anthers remaining straight or only slightly recurved (6)
- 5(4). Corolla rotate, the tube conspicuously shorter than the lobes; anthers merely recurved or revolute1. *Sabatia*, p. 1205.
- 5. Corolla salverform, the tube exceeding or equal in length to the lobes; anthers spirally twisted2. *Centaurium*, p. 1207.

- 6(4). Corolla lobes without basal glands or intervening appendages or plaits; style slender, subpersistent, with the stigma conspicuously 2-lipped 3. *Eustoma*, p. 1208.
- 6. Corolla lobes not as above; style short and thick, persistent, with the stigma merely 2-cleft (7)
- 7(6). Corolla lobes with intervening appendages or plaits 4. *Gentiana*, p. 1208.
- 7. Corolla lobes with 2 large elliptic pits or nectariferous glands at the base 5. *Swertia*, p. 1209.

1. SABATIA ADANS.¹⁴⁸

ROSE-GENTIAN

Erect glabrous annual or perennial herbs, with slender leafy stems and mostly cymose paniced flowers; leaves mostly cauline but also basal in some species; flowers perfect, regular, long-pedicelled or sessile; calyx gamosepalous, 5- to 12-parted, the lobes slender; corolla 5- to 12-parted, rotate; stamens 5 to 12; filaments slender, inserted on upper edge of corolla tube and alternate with the lobes; anthers basally attached, soon recurved; style slender; stigmatic branches 2; capsule ovoid to cylindric, with numerous seeds.

A genus of 17 species native to continental North America and the West Indies. The name has often been misspelled "Sabbatia."

- 1. Flowers 7- to 12-merous (2)
- 1. Flowers 5- or rarely 6-merous (3)
- 2(1). Flowers several approximate, sessile or nearly so, subtended by foliaceous bracts; annual 1. *S. gentianoides*.
- 2. Flowers solitary on long peduncles, without bracts; perennial 2. *S. dodecandra*.
- 3(1). Calyx tube very prominently 5-nerved and thinly membranous-winged; lateral nerves of the calyx lobes much more strongly developed than the midnerve; flowers 5-merous; annuals (4)
- 3. Calyx tube smooth or finely nerved and lacking membranous wings; midnerve of the calyx lobes almost equaling or even more strongly developed than the lateral nerves; flowers either 5- or rarely 6-merous; annual or perennial (5)
- 4(3). Leaves and calycine lobes thin and membranous, neither succulent nor heavily cutinized; leaves broadest near the base, usually strongly clasping the stem, the midvein at least prominently elevated beneath; calyx lobes usually 2 to 6 times longer than the calyx tube, generally 4 to 8 times longer than broad; corolla lobes typically equaling or exceeding the calyx lobes, usually longer than 1 cm. and wider than 7 mm.; stigmatic lobes over 5 mm. long; anthers longer than 2 mm. ... 4. *S. campestris*.
- 4. Leaves and calycine lobes thick and succulent, heavily cutinized; leaves broadest above the base, tapering somewhat to the sessile nonclasping base, the venation obscure and flush with the surface; calyx lobes usually less than twice the length of the calyx tube, generally less than 4 times as long as broad; corolla lobes usually equaled or exceeded by the calyx lobes, the corolla lobes usually less than 1 cm. long and narrower than 7 mm.; stigmatic lobes less than 5 mm. long; anthers shorter than 2 mm. 5. *S. arenicola*.
- 5(3). Perennial with elongate rhizomes, sometimes stoloniferous; leaves oblong to narrowly obovate; calyx lobes broadened above the middle 6. *S. calycina*.
- 5. Annual without rhizomes or stolons; leaves suborbicular to cordate-ovate; calyx lobes narrowed above the middle 3. *S. angularis*.

¹⁴⁸ Adapted from R. L. Wilbur in *Rhodora* 57:1-36, 43-72, 78-104. 1955.

1. *Sabatia gentianoides* Ell. Erect strict annual to 5 dm. tall; stem usually unbranched or only slightly branched above the middle; leaves dimorphic, thick, the venation obscure, those of the basal rosette wide-spreading and oblong to orbicular-spatulate, to 3 cm. long and 12 mm. wide; cauline leaves linear, strongly ascending or sometimes appressed to the stem, to 1 dm. long and less than 3 mm. wide; flowers subsessile, 7- to 12-merous, borne singly or in clusters of several at apex of main stem or in axils of uppermost leaves, subtended by 2 conspicuously long linear bracts; calyx tube broadly campanulate, smooth and nerveless, to 8 mm. long, the subulate recurved lobes to 15 mm. long; corolla pink to deep-rose-color; corolla lobes elliptic to oblanceolate or spatulate, obtuse to acute, to 3 cm. long and 1 cm. wide; stigmatic lobes 4-7 mm. long; capsule ovoid, to 10 mm. long and 6 mm. in diameter. In boggy or wet pinelands and savannahs in s.e. Tex., May-Aug.; from N.C., s. to Fla. and Tex.

2. *Sabatia dodecandra* (L.) B.S.P. LARGE MARSH-PINK. Perennial to about 7 dm. high, rhizomatous and stoloniferous, with alternate branches or dichotomous above the middle; leaves narrowly elliptic to lanceolate, 2-5 cm. long, obtuse to acute or subacuminate; flowers 8- to 12-merous; calyx lobes lanceolate, 1-3 mm. wide, conspicuously 3- or 5-nerved; corolla lobes pink or whitish, yellow at the base, narrowly oblanceolate to somewhat spatulate, 15-22 mm. long, 4-9 cm. wide. In s.e. Tex., June-Aug.; from S.C. to Tex.

Our plants are referable to var. *foliosa* (Fern.) Wilbur, characterized by having internodes that are equal to or shorter than the subtending leaves, stolons present, and growing in depressions in open woods, about ponds and on stream margins and in ditches. Var. *dodecandra* is typically coastal where it occurs in brackish habitats on the Atl. coast.

3. *Sabatia angularis* (L.) Pursh. ROSE-PINK, BITTER-BLOOM. Erect annual to 7 dm. tall, with simple strongly 4-angled slightly winged stems or bushy-branched; cauline leaves membranous, the lower suborbicular, the middle and upper cordate-ovate, clasping, 3- to 7-nerved, to 3 cm. long and 25 mm. wide; calyx tube about 1.5 mm. long, the thin lobes narrowed above middle and about 1 cm. long; corolla pink or roseate, delicately fragrant; corolla lobes oblong to obovate or elliptic, obtuse, to about 2 cm. long; stigmatic lobes slender, 3-6 mm. long; capsule to 8 mm. long and 5 mm. wide. In open pine-hardwood flats and edge of woods in e. Tex., May-July; N.Y., w. to Ill. and s. to Fla. and Tex.

4. *Sabatia campestris* Nutt. Erect annual to 5 dm. tall, usually much smaller; stem with few or no branches on lower half but with several simple or forking mostly alternate branches above; leaves membranous, oblong-elliptic to broadly ovate-elliptic, obtuse to acute, broadly clasping stem, to 45 mm. long and 2 cm. wide; calyx tube to 8 mm. long, strongly pentagonal with 5 short wing-angles extending up to the sinuses, its 3-nerved lobes linear-lanceolate and to 25 mm. long; corolla roseate to pale-pink or rarely white; corolla lobes broadly obovate to elliptic, obtuse to acute, to 23 mm. long and 15 mm. wide, their yellow basal spots 3- to 6-lobed with 1 or 2 middle lobes longest; stigmatic lobes greenish, becoming yellow with age, 5-8 mm. long; capsule to 9 mm. long. In moist or dry soil in fields, prairies, cedar-oak flats and along streams in e. half of Tex. and s.w. along the coast, Apr.-July; Ill. and Kan., s. to Tex. and Miss.

5. *Sabatia arenicola* Greenm. Erect or erect-spreading annual, to 3 dm. tall; stems simple or branching from the base upward to form a globose intricate mass; leaves thick-succulent, widely spreading, the venation obscured, varying from elliptic-obovate at base to oblong or ovate-lanceolate above, obtuse, to 25 mm. long and 13 mm. wide, usually much smaller; calyx tube to 8 mm. long, strongly pentagonal due to the thick costae or ribs, the thick lobes triangular-lanceolate and to 15 mm. long; corolla roseate to sometimes white; corolla lobes about as long as or shorter than the calyx lobes, obovate to oblong, obtuse; stigmatic lobes greenish, 2.5-4 mm. long; capsule to 9 mm. long. *S. carnosa* Small. On beaches, depressions in dunes, salt flats, fields and savannahs in s. Tex., Apr.-July; in La., Tex. and n.e. Mex.

6. *Sabatia calycina* (Lam.) Heller. Rigidly erect perennial with a slender or thick rhizome, to 4 dm. tall; stems weak, simple or with either opposite or alternate divergent or somewhat ascending branches; leaves membranous, oblong to narrowly obovate, obtuse to acute, to 1 dm. long and 2 cm. wide; flowers usually borne singly, 5- or 6-merous; calyx tube thin, smooth or with the veins only slightly elevated, to 5 mm. long, its thin foliaceous lobes oblanceolate to spatulate and to 3 cm. long; corolla white or

pale-rose to pink; corolla lobes oblanceolate to spatulate or elliptic, obtuse or acute, to 15 mm. long and 6 mm. wide; stigmatic lobes 4-6 mm. long; capsule to 1 cm. long and 8 mm. in diameter. Ditches and shaded river swamps and bottoms in s.e. Tex., June-July; from s.e. Va., s. to Fla. and Tex.; also Cuba and Hisp.

2. CENTAURIUM HILL CENTAURY

Mostly low and small branching annuals but sometimes tall and showy; flowers light-pink to rose-purple or reddish; calyx 4- or 5-parted, the lobes slender and appressed to the corolla tube; corolla funnelform or salverform, with slender tube and 4- or 5-parted limb; anthers exerted, erect, spirally twisting; style slender, single; stigma capitate or bifid.

A genus of about 45 species in temperate regions of the world.

1. Corolla lobes 7 mm. or more long, about as long as the corolla tube (2)
1. Corolla lobes rarely more than 6 mm. long, much shorter than the corolla tube (4)
- 2(1). Some of the leaves oblong or oblong-elliptic; corolla tube and calyx lobes about equal in length 1. *C. calycosum* var.
calycosum.
2. All leaves typically linear; corolla tube conspicuously exceeding the calyx lobes (3)
- 3(2). Plant without minute glands 2. *C. Beyrichii* var. *Beyrichii.*
3. Plant (especially the leaves) densely covered with minute glands
..... 2. *C. Beyrichii* var.
glanduliferum.
- 4(1). Corolla lobes 2 mm. or more wide; at least some of the cauline leaves oblong or oblong-elliptic 1. *C. calycosum* var.
breviflorum.
4. Corolla lobes less than 2 mm. wide; all cauline leaves linear or rarely very narrowly linear-oblanceolate 3. *C. texense.*

1. *Centaurium calycosum* (Buckl.) Fern. var. *calycosum*. ROSITA. Plant erect, simple or corymbosely branched, to 6 dm. tall, usually much smaller; cauline leaves oblong to oblong-elliptic or sometimes narrowly lanceolate, to 6 cm. long and 13 mm. wide; pedicels equaling or sometimes exceeding the calyx; flowers pink to rose-color, rarely white; corolla tube about equaled in length by the oblong to obovate or oval lobes (7-13 mm. long) and the calyx lobes; seeds light-brown. *Erythraea calycosa* Buckl. Usually in moist soil along streams, in prairies and meadows, and on hillsides in cen. and w. Tex., Apr.-June; from Tex. to Mo., w. to Ut., Nev., Ariz. and n. Mex.

The var. *breviflorum* Shinnery of central and south Texas is distinguished from var. *calycosum* by its smaller corolla lobes (5-7 mm. long) and the calyx lobes (6-10 mm. long) being shorter than the corolla tube. It occurs in similar habitats but is also found in salt marshes along the coast.

2. *Centaurium Beyrichii* (T.&G.) Robins. var. *Beyrichii*. MOUNTAIN PINK. Plant slender, to 3 dm. tall, at length fastigiately branched; cauline leaves linear to very narrowly linear-oblanceolate, to 3 cm. long and 3 mm. wide, the uppermost nearly filiform; pedicels about equal to or shorter than the calyx; flowers numerous, pink; corolla tube equal to or somewhat exceeding in length the elliptic to linear-oblong lobes (7-12 mm. long), about half again the length of the calyx lobes; seeds dark-brown. *Erythraea Beyrichii* T.&G. On rocky open limestone slopes and in seepage on granite boulders from n.-cen. to w. Tex., where it is rare, May-Aug.; Tex. and Ark.

The var. *glanduliferum* Correll, of west Texas, is a small much-branched plant about 15 cm. tall. It is distinguished from var. *Beyrichii* by the occurrence of numerous minute glands, especially on the leaves. It also has blackish or very dark-brown seeds.

3. *Centaurium texense* (Griseb.) Fern. LADY BIRD'S CENTAURY.* Plant erect, corymbosely and diffusely branched above, to 3 dm. tall; cauline leaves linear to rarely linear-lanceolate, to 25 mm. long and about 4 mm. wide, the upper leaves reduced to subulate bracts; pedicels about as long as the calyx; flowers small, light-pink; corolla tube about twice the length of the linear-oblong to oblong-elliptic lobes (6 mm. or less long and to

* See Appendix.

1.5 mm. wide), noticeably exceeding the calyx lobes; seeds light-brown. *Erythraea texensis* Griseb. Usually in dry calcareous soils on hills and barrens but occasionally in depressions on granite, on the Edwards Plateau and Blackland Prairies, June-Aug.; from Tex. n. to Mo.

3. EUSTOMA SALISB. CATCHFLY-GENTIAN

Annual or short-lived perennial, more or less glaucous, with erect or ascending leafy stems from a taproot and usually a rosette; leaves opposite, sessile and clasping the stem, entire; flowers long-pedicelled, showy, solitary or paniculate; calyx deeply cleft, the lobes long-attenuate, keeled; corolla deeply campanulate; corolla lobes erect, convolute in bud, the apex entire or somewhat erose and sometimes apiculate; stamens 5 or 6, inserted on the corolla throat; anthers oblong, versatile, straight or recurved; style slender, sub-persistent, with a prominently two-lipped stigma; capsule ellipsoid, 2-valved, many-seeded.

An American genus of several species, mostly in Mexico.

- 1. Corolla lobes 25 mm. long or less, less than 15 mm. wide 1. *E. exaltatum*.
- 1. Corolla lobes usually more than 30 mm. long, mostly 20 mm. or more wide 2. *E. grandiflorum*.

1. *Eustoma exaltatum* (L.) G. Don. Plants to 7 dm. tall, with one or several stems branched above; basal leaves obovate, the cauline leaves oblong to oblong-elliptic and obtuse to subacute, to 9 cm. long and 3 cm. wide; pedicels to 1 dm. long; calyx lobes to 18 mm. long; corolla blue to deep-lavender or white, the tube about 1 cm. long; corolla lobes oblong-obovate, about twice as long as the tube or rarely to 25 mm. long; style slender, about 5 mm. long; stigma lobes about 2 mm. long; capsule to 2 cm. long. *E. silenifolium* Salisb. In damp places in prairies and fields, often in alkaline or saline soils in s. and w. Tex., June-Oct.; in s. U.S., Mex., Br. Hond. and W.I.

The white-flowered plant has been designated f. *albiflorum* Benke.

2. *Eustoma grandiflorum* (Raf.) Shinners. LIRA DE SAN PEDRO, BLUEBELLS. Plants very similar to *E. exaltatum*, to 7 dm. tall; leaves ovate to elliptic-oblong or elliptic-lanceolate, noticeably 3-veined, to 8 cm. long and 3 cm. wide; pedicels to 6 cm. long; calyx to 3 cm. long, the lobes subulate; corolla variously colored blue-purple, pinkish, white or white and purple-tinged or yellowish; corolla lobes 3-4 cm. long, elliptic-obovate, at least 3 times as long as the tube; capsule to 2 cm. long. *E. russellianum* (Hook.) Sweet. In moist places in prairies and fields and about tanks in most of Tex., June-Sept.; Okla. and Tex., w. to Neb. and Colo., s. to Mex.

Several forms have been segregated based on the following flower-colors: white, f. *Fisheri* (Standl.) Shinners; white with purple-tinged lobes, f. *bicolor* (Standl.) Shinners; pink, f. *roseum* (Standl.) Shinners; yellow, f. *flaviflorum* (Cockl.) Shinners.

4. GENTIANA L. GENTIAN

Annual or perennial (in ours) typically glabrous or puberulent herbs with sessile or subsessile entire leaves and showy flowers; flowers 4- or 5-merous, solitary, racemose or cymose; calyx tube campanulate, obconic or tubular; corolla tubular to funnellform, salverform or campanulate, convolute in bud, often with intermediate plaited folds that bear appendages or teeth at the sinuses; stamens inserted on the tube of the corolla; style short or none, the persistent stigmas 2; capsule ellipsoid, 2-valved, the innumerable seeds either borne on placentae at or near the sutures or covering nearly the entire inner face of the capsule.

A large genus of several hundred species found mostly in temperate and cool regions of the world.

- 1. Corolla 3-5 cm. long, blue or whitish; plant essentially glabrous; east Texas 1. *G. Saponaria*.
- 1. Corolla 2-2.5 cm. long, violet-color; plant more or less glandular-ciliolate; west Texas 2. *G. Btgelovii*.

1. *Gentiana Saponaria* L. BOTTLE-GENTIAN, SOAPWORT-GENTIAN. Perennial with a stout caudex and coarse roots, to 8 dm. tall, the stem glabrous or sometimes slightly puberulent in lines; leaves narrowly elliptic to lanceolate, obtuse to acute or occasionally shortly acuminate, abruptly narrowed at base, to 1 dm. long; involucre of 2 to 4 leaves, the outer to 6 cm. long and 2 cm. wide; calyx lobes firm, oblong to oblanceolate or sometimes lanceolate, ascending, to 12 mm. long; corolla blue or whitish, cylindric-oblanceolate, 3-5 cm. long, 1-1.5 cm. in diameter at the slightly open summit, the rounded to subacute lobes erect and only slightly longer than the appendages. In moist woods, thickets and sandy swamps in s.e. Tex., Sept.-Nov.; from Ga. to e. Tex., n. to N.Y., W.Va., Ind., Wisc. and Minn.

2. *Gentiana Bigelovii* Gray. Perennial, glandular-ciliolate throughout (especially on the nerves, calyx and leaf margins), to 3 dm. tall, the slender erect stem leafy; leaves thickish, oblong to oblong-lanceolate, obtuse, to 35 mm. long and 1 cm. wide; flowers 5-merous, short-pedicelled to sessile in upper axils to form a several- to many-flowered leafy-bracted raceme; calyx nearly regular, the tube to 7 mm. long and the slightly irregular linear-subulate lobes about as long; corolla violet-color, cylindrical-funneliform, nearly closed in anthesis, 2-2.5 cm. long, the short lobes acutish; lobes of the plaits triangular, 2-cleft, acute, about half as long as the corolla lobes. Rocky meadows and slopes of high mts. in w. Tex., Aug.-Oct.; from Colo. to w. Tex., N.M. and Ariz.

5. SWERTIA L. GREEN GENTIAN. ELKWEED

A genus of 50 or more species in North America, Eurasia and Africa.

1. *Swertia radiata* (Kell.) O. Ktze. DEER'S-EARS. Stout perennial with mostly simple stems from a thickened taproot, more or less puberulent throughout, to 18 dm. tall, very leafy; leaves in whorls of 4 to 6, the radical and lower cauline leaves obovate to oblong and to 25 cm. long and 4 cm. wide, the uppermost leaves lanceolate and at length linear; flowers numerous in long cymose panicles, 4-merous; calyx lobes linear-lanceolate and to 15 mm. long; corolla greenish-white flecked or irregularly lined with purple, bearing a setaceous lobed crown near the base; corolla lobes broadly elliptic, abruptly acuminate, about 15 mm. long, with a pair of elongate contiguous and densely fringed glands about the middle; fruit ellipsoid-conic, brownish-vernicose, about 2 cm. long; seeds about 5 mm. long. *Frasera speciosa* Hook. In limestone soil in open pine and pine-fir forests and in canyons in the Guadalupe Mts. of w. Tex., June-Oct. from S.D. and Wash., s. to w. Tex., N.M., Calif. and n.e. Mex.

A good browse that is much eaten by deer.

6. BARTONIA MUHL.°

Plants annual or biennial, herbaceous; stem filiform, often somewhat spiraled or twining, mostly green or yellowish; leaves reduced to subulate scales; inflorescence a terminal panicle or raceme of small white to yellowish or purplish 4-merous flowers; calyx cleft to or near the base; corolla campanulate, the lobes about equaling the tube, imbricate in bud; stamens short, inserted at the sinuses of the corolla; anthers oval; style very short and stout; capsule thick-cylindric, flattened, 2-valved; seeds numerous.

Four species confined to the eastern half of North America.

1. Calyx about 3 mm. long; corolla about 5 mm. long, the lobes lanceolate and tapering to an acute to acuminate apex; capsule shorter than the corolla, the style about 1.5 mm. long 1. *B. paniculata*.
1. Calyx 1.5-2 mm. long; corolla about 2.5 mm. long, the lobes elliptic and obtuse to obtuse-apiculate; capsule usually exceeding the corolla, the style about 0.5 mm. long 2. *B. texana*.

1. *Bartonia paniculata* (Michx.) Muhl. SCREW-STEM. Plant glabrous, to about 4 dm. high, with an erect or somewhat twining or flexuous stem; leaves scalelike, alternate or sometimes opposite below; inflorescence usually a short-branched panicle, elongate; pedicels slender, ascending or divergent, about 1 cm. long; flowers to about 5 mm. long; sepals lanceolate, subacuminate, 2-3 mm. long; petals lanceolate, creamy-white, long-

° See Appendix.

acuminate; capsule ellipsoid, usually much shorter than the corolla, the persistent style about 1.5 mm. long. In sandy bogs and meadows in e. Tex., Aug.-Sept.; mostly along the coast from N.S. and N.J., s. to Fla., Okla. and Tex.

2. *Bartonia texana* Correll. Plant inconspicuous, glabrous, to 3 dm. high; stem slender, usually rigidly erect; leaves scalelike, alternate or rarely subopposite, about 1 mm. long; flowers in a slender lax raceme or panicle; pedicels slender, ascending, to 15 mm. long; calyx 1.5-2 mm. long, the lobes triangular-lanceolate and acute; corolla whitish, about 2.5 mm. long, the lobes elliptic and obtuse to obtuse-apiculate; stamens in sinus of petals; capsule ellipsoidal-subquadrate, usually exceeding the corolla, dehiscent at apex by separation of the style, the persistent style about 0.5 mm. long. On sphagnum moss along wooded stream in Tyler Co., s.e. Tex., Sept.-Oct.; endemic.

7. OBOLARIA L. PENNYWORT

A monotypic genus.

1. *Obolaria virginica* L. Herbaceous and succulent purplish-green smooth perennial with a simple or sparingly branched stem from fleshy-thickened saprophytic roots, rarely more than 10 cm. tall; leaves sessile, opposite, cuneate-obovate, to 15 mm. long and about as wide near the apex, reduced to scales on lower part of stem; flowers solitary or in groups of 3, terminal and axillary, nearly sessile; calyx of 2 spatulate spreading sepals that resemble the leaves; corolla white, 4-merous, marcescent, the elliptic-oblong or eventually spatulate lobes (about 5 mm. long) imbricated in bud; stamens short, inserted at the sinuses of the corolla; style short, persistent, the stigma bifid; capsule ovoid, the solitary cell cruciform, the seeds covering entire face of the walls. In humus of low moist hardwoods in e. Tex., Mar.-Apr.; from Fla. to Tex., n. to N.J., Pa., W.Va., O., Ind. and s. Ill.

8. NYMPHOIDES HILL FLOATING-HEART

Perennial submersed aquatic plants with floating leaves on long petioles that bear near their summit an umbel of flowers and often a cluster of short spurlike roots; calyx 5-parted; corolla almost rotate, 5-parted, the lobes bearing a glandular appendage near the base; style short or none, the persistent stigma 2-lobed; capsule few- to many-seeded, at length bursting irregularly; seeds papillate, the coat hard.

A genus of about 20 species; often placed in the segregate family Menyanthaceae.

1. Petioles slender, sometimes with clusters of roots just below the leaf blade; leaves mostly basal; flowers white, in clusters on the petioles 1. *N. aquatica*.
1. Petioles rather stout, without clusters of roots; leaves mostly from branching stems; flowers yellow, axillary 2. *N. peltata*.

1. *Nymphoides aquatica* (Gmel.) O. Ktze. Plant coarse; leaves mostly basal, suborbicular to reniform, with a deep basal sinus, heavy in texture, smooth and yellowish green on upper surface, dark-punctate or pitted on lower surface, to 15 cm. wide; petiole slender, arising from a cluster of fleshy roots, purple-glandular, to 25 cm. or more long; pedicels to 8 cm. long; calyx to 5 mm. long; corolla white, about 15 mm. broad; capsule elongate, to 15 mm. long; seeds glandular-roughened. *Limnanthemum trachyspermum* Gray. In ponds and sluggish streams in e. Tex., May-July; from Fla. and Tex., n. locally to s. N.J. and Del.

2. *Nymphoides peltata* (Gmel.) O. Ktze. YELLOW FLOATING-HEART. Plant coarse; stem stout, extensively creeping and branching; leaves opposite, subtending the umbel, suborbicular, coarsely undulate-dentate, to about 15 cm. long and wide; pedicel often 6 cm. long or more, stout; calyx lobes elliptic-lanceolate, subobtuse, 1 cm. long or more; corolla bright-yellow, 2-3 cm. broad, its segments somewhat fringed; anthers 4-5 mm. long; capsule strongly beaked, to 25 mm. long; seeds flat, narrowly winged, with fringelike margins. In quiet waters of rivers and streams and on wet sandy shores of lakes in n.-cen. Tex., July-Sept.; introd. from Eur. for cult. but escapes and has become established from N.Y. s. to Tex.

FAM. 150. APOCYNACEAE JUSS.

DOGBANE FAMILY

Trees, shrubs, vines or herbs, often with milky juice; leaves opposite or alternate or occasionally verticillate, entire; flowers regular, perfect; calyx gamosepalous, the 5 usually imbricate lobes mostly parted nearly to the receptacle, frequently bearing various glandular appendages within; corolla gamopetalous, varying from salverform or infundibuliform to urceolate or campanulate, the tube sometimes bearing somewhat conspicuous faucal appendages within, the limb 5-parted, the lobes sinistrorsely or dextrorsely contorted in aestivation; stamens 5, alternate with the corolla lobes in the tube, the introrse anthers 4-celled; ovary bicarpellary, the single style surmounted by a massive stigma of diversified structure; fruit follicular (in ours); seeds naked or comose.

About 180 genera and 1,500 species of cosmopolitan distribution. The family contains many ornamental as well as poisonous plants.

- 1. Leaves alternate (2)
- 1. Leaves opposite or whorled (3)
- 2(1). Intricate much-branched shrub; seeds comose; tube of corolla much shorter than its lobes; rare and local in southern Trans-Pecos1. *Haplophyton*, p. 1211.
- 2. Simple or several-branched perennial herbs; seeds naked; tube of corolla mostly at least equaling its lobes; widespread2. *Amsonia*, p. 1211.
- 3(1). Twining vine3. *Trachelospermum*, p. 1215
- 3. Plant erect or trailing, never twining (4)
- 4(3). Trailing evergreen herb; corolla lavender-blue to reddish-purple4. *Vinca*, p. 1215.
- 4. Erect shrubs or perennial herbs; corolla white to scarlet, never bluish (5)
- 5(4). Corolla less than 1 cm. broad5. *Apocynum*, p. 1216.
- 5. Corolla 2 cm. broad or more (6)
- 6(5). Suffrutescent herb or low shrub to about 3 dm. tall, native; inflorescence simple, bearing as many as 3 large flowers6. *Macrosiphonia*, p. 1217.
- 6. Large shrub or small tree more than 3 dm. tall, introduced as ornamental; inflorescence thyriform, bearing numerous flowers7. *Nerium*, p. 1218.

1. HAPLOPHYTON A. DC.

COCKROACH PLANT

Three species are known, all in this hemisphere. An extract of the dried leaves of these plants when mixed with molasses is said to be an effective poison for such insects as cockroaches, flies, mosquitoes, fleas and lice.

1. *Haplophyton Crooksii* L. Benson. Intricate much-branched shrub to about 6 dm. tall; stems and branches green, more or less puberulent with appressed hairs; leaves short-petioled, predominately alternate, occasionally opposite, lanceolate, obtuse to acute at apex, 15-32 mm. long, 4-10 mm. wide, shortly hispid with pustulate hairs; flowers rather showy, solitary or rarely paired in the upper leaf axils; calyx 5-parted, the linear lobes 3-5 mm. long, essentially equal, not imbricate or scarcely so, without squamellae; corolla bright-yellow, salverform, not appendaged within, 7 mm. long or more, pubescent, the limb equally 5-parted, sinistrorsely contorted, longer than the tube; anthers not connivent, without an enlarged connective, wholly included; ovary apocarpous, without a nectary, containing numerous ovules; follicles terete, elongate; seeds black, 6-7.5 mm. long, somewhat grooved and ridged, commonly with part of the surface with broad papillae resembling pebble-grained leather or at least with the ridges broken instead of continuous, comose at apex. On dry rocky slopes in canyons in Presidio Co. in the Trans-Pecos; from w. Tex. to Ariz. and n. Mex.

2. AMSONIA WALT.¹⁴⁹

BLUE-STAR

Caulесcent herbaceous perennials; leaves alternate or subverticillate, not glandular; inflorescence thyriform, terminal or occasionally lateral, bearing several to many flowers;

¹⁴⁹ Ref.: R. E. Woodson, Jr. in N. Am. Fl. 29(2):126-131. 1938.

calyx 5-parted, the lobes essentially equal, scarcely imbricate, without squamellae; corolla salverform, the limb regularly 5-parted, the lobes sinistrorsely contorted; anthers not connivent, without an enlarged connective, wholly included; ovary apocarpous, without a nectary, containing numerous ovules; follicles terete, continuous or more or less moniliform; seeds numerous, naked, rather corky.

A genus of about 25 species in North America and one in Japan.

1. Distribution in eastern one third of Texas; plant usually with upper leaves broader than those below, rarely with linear leaves; corolla never constricted at orifice; follicles slender, continuous or only very slightly articulate (2)
1. Distribution in western two thirds of Texas; plant with all its leaves or at least those on upper half of stems linear to linear-lanceolate or filiform; corolla very rarely not constricted at orifice (6)
- 2(1). Corolla glabrous externally (3)
2. Corolla pubescent externally (4)
- 3(2). Calyx lobes and bracts glabrous; distribution in extreme southeast Texas 1. *A. glaberrima*.
3. Calyx lobes and bracts commonly long-ciliate; distribution in north- and south-central Texas and the Edwards Plateau 2. *A. ciliata*.
- 4(2). Calyx glabrous; leaves thinly membranaceous, opaque above 3. *A. tabernaemontana*.
4. Calyx more or less pilose; leaves firmly membranaceous or subcoriaceous, lustrous above (5)
- 5(4). Stems geniculate at base, from a creeping rootstock, to about 5 dm. tall; leaves not over 3.5 times as long as wide; corolla lobes mostly but not always longer than the tube; in prairies 4. *A. repens*.
5. Stems erect, from a woody rootstock, usually much more than 5 dm. tall; leaves 4 to 6 times as long as wide; corolla lobes rarely longer than the tube; in wet soils of low woodlands, meadows and ditches 5. *A. illustris*.
- 6(1). Corolla tube not constricted at orifice; leaves, bracts and calyx lobes usually with long loose hairs on margins 2. *A. ciliata*.
6. Corolla tube more or less constricted at orifice; leaves, bracts and calyx lobes not as above (7)
- 7(6). Follicles stout, conspicuously articulate-moniliform; stems densely tomentose with white crinkly hairs 6. *A. arenaria*.
7. Follicles slender, continuous, not articulate; stems glabrous or hirtellous with straight hairs (8)
- 8(7). Corolla tube 15 mm. long or less, only slightly constricted at orifice (9)
8. Corolla tube more than 15 mm. long, conspicuously constricted at orifice (11)
- 9(8). Leaves noticeably dimorphic, those on lower half of stems elliptic-lanceolate, those on upper part of stem linear or linear-lanceolate; distribution Pecos County 7. *A. Tharpii*.
9. Leaves not noticeably dimorphic; distribution west of Pecos County (10)
- 10(9). Corolla lobes 3-5 mm. long; plants glabrous or hirtellous; distribution in southern part of Trans-Pecos Texas 8. *A. Palmeri*.
10. Corolla lobes 5-7 mm. long; plants always hirtellous; distribution El Paso County 9. *A. hirtella*.
- 11(8). Plants glabrous; corolla lobes more than 10 mm. long; distribution in Edwards Plateau and eastern Trans-Pecos regions 10. *A. longiflora*.
11. Plants pubescent or very rarely glabrous; corolla lobes less than 10 mm. long; distribution only in Trans-Pecos region 11. *A. salpignanthera*.

1. *Amsonia glaberrima* Woods. Stems to 8 dm. tall, wholly glabrous; leaves alternate, firmly membranaceous, oblong-elliptic to narrowly lanceolate, to 8 cm. long and 2 cm. wide, acuminate, narrowed at the base, wholly glabrous, opaque on both sides, the

petioles 2-4 mm. long; inflorescence rather diffuse, scarcely surpassing the foliage, bearing several to numerous medium-sized azure flowers; pedicels 3-4 mm. long, glabrous; calyx lobes ovate-triangular, acute, about 1.5 mm. long, glabrous; corolla wholly glabrous externally, the tube 6.5-7 mm. long, about 1 mm. in diameter at the base, somewhat dilated above the insertion of the stamens, not constricted at the orifice, the lobes 6-7 mm. long, glabrous, somewhat spreading; follicles relatively slender, continuous, 8-10 cm. long, glabrous. In dense woods and low pinelands in extreme s.e. Tex., Mar.-May; also La.

2. *Amsonia ciliata* Walt. Stems to 15 dm. tall, from woody stolons, more or less densely pilose to glabrate or glabrous; leaves alternate, sessile or subsessile (at least above), oblong-lanceolate to linear-lanceolate or filiform, to 8 cm. long and 1 cm. wide, attenuate at each end, often rather distinctly heterophyllous, frequently with long weak hairs scattered along margins, the lower leaves broader than the upper; inflorescence barely surpassing the foliage, bearing several to numerous medium-sized azure flowers; pedicels 3-5 mm. long, puberulent to glabrate; calyx lobes ovate-lanceolate to linear-lanceolate, long-acuminate, 1-2 mm. long, glabrous or with a few long weak marginal hairs; corolla glabrous externally, the tube 6-8 mm. long, about 1 mm. in diameter at base, somewhat dilated above the insertion of the stamens, not constricted at the orifice, the lobes 7-8 mm. long, glabrous, somewhat spreading; follicles relatively slender, continuous, 9-11 cm. long, glabrous. On limestone and chalky hills, grasslands, along railroad tracks, in sandy loam of prairies and in cedar brakes on the Edwards Plateau and in n.-cen. and s.-cen. Tex., Mar.-May; from N.C., s. to Fla. and Tex.

Vegetatively, this species is highly variable. The following two variants are known to occur in Texas.

Var. *texana* (Gray) Coult. [*A. texana* (Gray) Heller]. Leaves oblong-lanceolate to essentially elliptic above, narrowly elliptic-lanceolate to linear-lanceolate below, 2-6 cm. long, 3-17 mm. wide.

Var. *filifolia* Woods. [*A. ciliata* var. *tenuifolia* (Raf.) Woods.]. Leaves predominantly verticillate, linear-lanceolate to filiform, 2-5 cm. long, 0.5-4 mm. wide.

3. *Amsonia tabernaemontana* Walt. Stems 3-10 dm. tall; leaves alternate, rather thinly membranaceous, ovate to oblong-elliptic or lanceolate, 6-15 cm. long, to 5 cm. broad, acute to acuminate at apex, obtuse to broadly acute at the base, wholly glabrous to finely puberulent beneath, opaque on both sides, the petioles 3-6 mm. long; inflorescence barely surpassing the foliage, bearing several to numerous azure flowers; pedicels 3-6 mm. long; calyx lobes ovate to ovate-lanceolate, 1-2 mm. long, glabrous; corolla more or less pilose externally, the tube 6-8 mm. long, about 1 mm. in diameter at the base, somewhat dilated above the insertion of the stamens, not constricted at the orifice, the lobes 4-7 mm. long, spreading; follicles relatively slender, continuous, 8-12 cm. long, glabrous. In sandy soil about lakes and along streams in n.e. Tex., Mar.-May; from Pa., s. to Ga. and s.w. to Tex.

Those plants with lanceolate to narrowly oblong-elliptic leaves 6-15 cm. long and 1-2.5 cm. wide have been placed in var. *salicifolia* (Pursh) Woods. (var. *Gattingeri* Woods.)

This species, along with *A. glaberrima*, *A. illustris* and *A. repens*, form an extremely close alliance, and it is questionable as to whether or not they should be maintained as separate species rather than variants of one complex unit. The degree of pubescence or lack of pubescence on the corolla and calyx, that mainly separate these entities, is not an entirely reliable characteristic.

4. *Amsonia repens* Shinnars. Stems usually geniculate at base, from a creeping woody rootstock, to about 5 dm. tall; leaves subsessile to shortly petiolate, crowded, lanceolate to elliptic-lanceolate, acute to acuminate, to 6 cm. long and 3 cm. wide, those on middle of stem not over 3.5 times as long as wide; inflorescence equal to or scarcely exceeding the foliage, bearing numerous light indigo-blue flowers; pedicels to 5 mm. long; calyx pilosulous, the subulate lobes about 2 mm. long; corolla pilose externally, the tube to 9 mm. long, not constricted at orifice, the spreading lobes usually longer than the tube; follicles slender, continuous. On prairies and along railroad tracks in e. Tex., Mar.-May; endemic.

5. *Amsonia illustris* Woods. Stems erect, rather stout, from a woody rootstock, to 12 dm. tall; leaves alternate, subcoriaceous to firmly membranaceous, rather narrowly

lanceolate to elliptic-lanceolate, to 1 dm. long and 3 cm. broad, acute to acuminate, cuneate at the base, glabrous, the upper surface lustrous, the petioles 1-4 mm. long; inflorescence barely surpassing the foliage, bearing numerous pale-blue flowers; pedicels 2-8 mm. long; calyx lobes narrowly lanceolate, acuminate, 1.5-3 mm. long, more or less pilosulous; corolla more or less pilose externally, the tube 6-8 mm. long, about 1 mm. in diameter at the base, slightly dilated at the insertion of the stamens, not constricted at the orifice, the lanceolate lobes 5-10 mm. long, spreading; follicles somewhat articulate to essentially continuous, slender, papyraceous, 8-14 cm. long, glabrous. In wet soil of swamps, meadows, low woodlands, and in streams and ditches in the e. third of Tex., Mar.-June; from s. Mo. and e. Kan. to Tex.

6. *Amsonia arenaria* Standl. Plant stoloniferous and forming large colonies; stems 2-5 dm. tall, tomentose with crinkly hairs; leaves sessile, alternate to subverticillate, very narrowly oblong-lanceolate to subfiliform, 4-6 cm. long, 1-5 mm. broad, tomentulose; inflorescence somewhat condensed, barely surpassing the foliage, bearing several to numerous pale-lead-blue flowers; pedicels 0.5-3 mm. long; calyx lobes linear-subulate, 4-8 mm. long, tomentulose; corolla glabrous externally, the clavate tube 8-11 mm. long, about 1.5 mm. in diameter at the base, somewhat inflated at the insertion of the stamens, sharply constricted at the orifice, the oblong-elliptic lobes 5-10 mm. long and spreading; follicles relatively stout, conspicuously articulate-moniliform, 5-8 cm. long, nearly glabrous or inconspicuously puberulent. In sandy soils and sandhills in extreme w. Tex., Apr.-May; from w. Tex. to s.e. Ariz. and Chih.

This species is readily separated from the superficially similar *A. hirtella* and *A. Palmeri* by its crinkly hairs that form a tomentum on the stems.

7. *Amsonia Tharpia* Woods. Perennial suffrutescent herb; stems from heavy woody rootstock, hirtellous, to 2 dm. tall; leaves subsessile, crowded, with scattered hairs to essentially glabrous, dimorphic, those on lower half of stems elliptic-lanceolate, those above linear to linear-lanceolate, acute to acuminate, to 5 cm. long and 12 mm. wide; inflorescence terminal, few-flowered; flowers on pilose pedicels about 3 mm. long; calyx lobes narrowly lanceolate, acuminate, about 3.5 mm. long, pilose; corolla pale-blue or greenish-white, salverform, the tube about 15 mm. long and noticeably constricted at orifice, the spreading elliptic lobes 6-8 mm. long; stamens inserted about 2 mm. below orifice; follicles short, thick, subfusiform, continuous, glabrous, 25-35 mm. long. On limestone hills in Pecos Co. Apr.-May; endemic.

8. *Amsonia Palmeri* Gray. Stems 3-8 dm. tall, glabrous to pubescent with short spreading hairs; leaves alternate, firmly membranaceous, narrowly oblong-lanceolate to linear-lanceolate, to 7 cm. long and 15 mm. broad, acute to acuminate at apex, obtuse or obtusish at the base, glabrous to somewhat pubescent, the petioles 1-3 mm. long; inflorescence very congested, usually well-surpassing the foliage, bearing several to relatively few small pale-lead-blue flowers; pedicels 1 mm. long to nearly obsolete; calyx lobes lance-triangular, acuminate, 3-5 mm. long, densely pilosulous to nearly glabrate; corolla glabrous externally, the tube 10-18 mm. long, about 1 mm. in diameter at the base, somewhat inflated at the insertion of the stamens, slightly constricted at the orifice, the ovate lobes 3-5 mm. long, slightly spreading to essentially erect; follicles slender, continuous, to 12 cm. long, glabrous or nearly so. In sandy or rocky soil in arroyos, draws and small canyons and on low hills in the Trans-Pecos, Mar.-May; also N.M., Ariz. and n. Mex.

This species, that occurs in the southern half of the Trans-Pecos region, is represented by plants that are entirely glabrous, as in the original description, and by plants that are hirtellous as in *A. hirtella*.

9. *Amsonia hirtella* Standl. Herbaceous perennial from a somewhat thickened woody root, usually densely hirtellous; stems to 5 dm. tall, clustered from the base, erect or slightly ascending, freely branched above, the branches ascending or slightly spreading; leaves alternate to subverticillate above, firmly membranaceous, narrowly oblong-lanceolate to linear-lanceolate, to 7 cm. long and 1 cm. wide, acuminate at apex, narrowed to an inconspicuous petiole or practically sessile; inflorescence dense, relatively few-flowered, mostly surpassing the foliage; pedicels 1-3 mm. long; calyx 4-5 mm. long, densely pubescent throughout, the lobes subulate; corolla salverform, the clavate tube constricted at the mouth, 1-1.7 cm. long, the ovate to ovate-oblong lobes 5-7 mm. long and spreading; follicles terete, 6-8 cm. long, stout, glabrous, continuous. *A. Standleyi* Woods. In Tex. only in El Paso Co., Mar.-May; also N.M., Ariz. and Chih.

10. *Amsonia longiflora* Torr. Stems to 6 dm. tall, from a heavy rootstock, glabrous; leaves alternate to subverticillate, membranaceous, sessile or subsessile, linear-lanceolate to filiform, 2-5 cm. long, 1-3 mm. broad, glabrous; inflorescence condensed, well-surpassing the foliage, bearing relatively few showy pale-blue or white flowers; pedicels 2-5 mm. long; calyx lobes linear-subulate, 6-8 mm. long, glabrous; corolla glabrous externally, the tube 3-4 cm. long, about 1.5 mm. in diameter at the base, somewhat inflated over the stamens, sharply constricted at the orifice, the linear-oblong lobes 11-17 mm. long and spreading or reflexed; follicles relatively slender, continuous, 7-15 cm. long, glabrous. On limestone of mesas, arroyos, ravines and open slopes and in clay shales on hills and flats in the Trans-Pecos, Mar.-June; also s. N.M.

11. *Amsonia salpignanthera* Woods. Stems to 35 cm. tall, from a woody rootstock, more or less densely pilose or very rarely glabrous; leaves alternate to subverticillate, membranaceous, sessile or subsessile, linear-lanceolate to subfiliform, to 5 cm. long and 3 mm. broad, pilose to pilosulous or very rarely glabrous; inflorescence barely surpassing the foliage, greatly condensed, bearing several to numerous showy pale-lead-blue or white flowers; pedicels to 7 mm. long, usually pilosulous; calyx lobes linear-lanceolate, acuminate, 4-6 mm. long, pilosulous; corolla glabrous externally, the tube 2.5-4 cm. long, about 1.5 mm. in diameter at the base, somewhat inflated at the insertion of the stamens, sharply constricted at the orifice, the linear-oblong lobes 5-10 mm. long, spreading; follicles slender, continuous, 7-9 cm. long, glabrous. On limestone hills and in rocky canyons and high valleys in the Edwards Plateau and e. Trans-Pecos, Mar.-May; also Chih.

3. TRACHELOSPERMUM LEM.

CLIMBING DOGBANE

About 30 species, all but the following in the Eastern Hemisphere.

1. *Trachelospermum difforme* (Walt.) Gray. Herbaceous twining plant, glabrous to variously puberulent; leaves opposite, with petioles to 12 mm. long, extremely variable and not infrequently heterophyllous on a single plant, thinly membranaceous, elliptic to obovate-elliptic, occasionally linear-elliptic or suborbicular, to 12 cm. long and 75 mm. broad, acuminate at apex (occasionally very shortly and abruptly so), cuneate to rounded at the base; flowers numerous, small, in alternate-axillary thyriform inflorescences; pedicels 4-7 mm. long; calyx 5-parted nearly to the receptacle; calyx lobes ovate-lanceolate, acuminate, 3-4 mm. long, minutely and rather sparsely barbellate at the tips, bearing within alternate pairs of squamellae; corolla pale-yellow, salverform or subinfundibuliform, the tube 5.5-6.5 mm. long, about 1 mm. in diameter at the base, somewhat inflated at the orifice, the 5 lobes obliquely obovate, 3-4 mm. long, dextrorsely contorted, spreading; anthers connivent and agglutinated to the stigma, with an enlarged narrowly 2-lobed connective; ovary apocarpous, containing numerous ovules, surrounded at the base by 5 separate or more or less concrescent nectaries; stigma fusiform, borne upon an elongate style; follicles 2, slender, terete, obscurely undulate-articulate to essentially continuous, 15-23 cm. long, glabrous; seeds many, truncate, comose. Climbing on trees and shrubs along streams, on the edge of forests and in weedy areas in e. Tex., Apr.-June; from Del. s. to Fla. and Tex., w. to Ill., Ind., Mo. and Okla.

4. VINCA L.

PERIWINKLE

Erect or trailing perennial herbs or subshrubs; leaves opposite, not glandular; flowers solitary in alternate axils of leaves; calyx 5-parted, the narrow lobes essentially equal, without squamellae; corolla infundibuliform or salverform, with cylindrical tube and 5 equal lobes twisted to left, hairy or thickened at throat, not appendaged within; anthers not connivent, the connective produced into a relatively large apical appendage, not appendaged at the base; ovary apocarpous, accompanied by two alternate nectaries of nearly equal size, containing numerous ovules; follicles terete, relatively slender; seeds numerous, naked; subcompressed.

About 7 species native to the Old World.

1. Calyx lobes ciliate; leaves broadly rounded to truncate or subcordate at base
 1. *V. major*.
1. Calyx lobes nonciliate, glabrous; leaves narrowed at base
 2. *V. minor*.

1. *Vinca major* L. Trailing evergreen herb, the flowering stems erect and to 3 dm. tall; leaves long-petiolate, ovate, broadly rounded to subcordate at base, obtuse to subacute at apex, ciliate on margins, to 7 cm. long and 5 cm. wide; flowers blue, 2.5-5 cm. across; calyx lobes narrowly linear, about 1 cm. long, long-ciliate; corolla tube funnelform, about 15 mm. long; follicles about 5 cm. long. In sandy soil along streams, on edge of woods and in open woodlands, mostly in e. and cen. Tex., Feb.-Apr.; a nat. of Euras. that escapes cult.

2. *Vinca minor* L. COMMON PERIWINKLE. Creeping or trailing evergreen herb; leaves with petioles 1-2 mm. long, firmly membranaceous to subcoriaceous, elliptic, 1.5-6 cm. long, 8-25 mm. broad, obtuse to broadly acute at apex, somewhat obtusely cuneate to broadly acute at the base, glabrous, somewhat lustrous above, usually minutely glandular-puberulent; flowers solitary in alternate leaf axils, usually on the suberect branches of early spring; pedicels 15-35 mm. long, glabrous; calyx lobes ovate-lanceolate, acute, to 3 mm. long, glabrous; corolla infundibuliform, bright-blue, rarely white, the tube proper 3-6 mm. long, about 1.5 mm. in diameter at the base, the throat conic to conic-campanulate, 5-7 mm. long, 2-3.5 mm. in diameter; follicles slender, 2-7 cm. long, very rarely produced. Nat. of Euras., widely cult. and naturalized throughout the temp. N. Hemis.

5. APOCYNUM L. DOGBANE. INDIAN HEMP

Herbaceous perennials, reproducing freely by horizontal gemmiferous roots, with branching stems; leaves opposite or rarely verticillate, not glandular, often mucronate-pointed; flowers small and pale, on short pedicels in terminal and axillary cymes; calyx 5-parted nearly to the receptacle, without internal squamellae, the lobes equal, scarcely imbricate; corolla campanulate to urceolate or cylindrical, the tube short, the limb regularly 5-parted, with small sagittate appendages at the base opposite the lobes, dextrorsely contorted; stamens on the very base of corolla; anthers connivent and agglutinated to the stigma, with an enlarged narrowly 2-lobed connective; ovary apocarpous, containing numerous ovules, surrounded at the base by 5 distinct ovoid nectaries; stigma usually virtually sessile, variable in shape but essentially ovoid-fusiform; follicles usually 2, separate or somewhat agglutinated at the tips, slender, terete; seeds numerous, truncate, comose.

About 7 species in North America and 70 elsewhere in temperate and tropical regions. The separation of species in this extremely complex genus is not too satisfactory. We have more or less accepted tradition here.

1. Calyx lobes much shorter than the corolla tube at full anthesis, usually less than one half as long as the tube; corolla usually pink or striped with pink, the lobes typically spreading; topmost inflorescence usually exceeding the foliage or leafy branches (2)
1. Calyx lobes (at least some) about as long as the corolla tube, occasionally some longer than or about two thirds as long as the tube; corolla usually whitish or greenish, the lobes mostly erect or nearly so; topmost inflorescence usually exceeded by the foliage or leafy branches (3)
- 2(1). Leaves drooping; corolla 5 mm. long or longer, the lobes noticeably spreading or even recurved at the apex 1. *A. androsaemifolium*.
2. Leaves spreading or ascending, never drooping; corolla 4-5 mm. long, the lobes only slightly spreading 2. *A. medium*.
- 3(1). Leaves noticeably petiolate or only the very lowest sessile, narrowed to broadly rounded at the base, pubescent to glabrous; bracts of inflorescence scarious and aristate 3. *A. cannabinum*.
3. Leaves sessile or nearly so, the lowest cordate at base and usually clasping the stem, always glabrous; bracts of inflorescence more or less foliaceous and laminate
 4. *A. sibiricum*.

1. *Apocynum androsaemifolium* L. SPREADING DOGBANE. Stems erect or ascending to 5 dm. tall, glabrous, freely and rather dichotomously branched; leaves petiolate, drooping, ovate to oblong-lanceolate, mucronate-tipped, to 1 dm. long and 6 cm. broad, dark-green and glabrous above, paler and glabrous to densely tomentulose beneath; cymes terminal and axillary, flowering simultaneously; flowers fragrant; calyx lobes ovate to ovate-lanceolate, 2-5 mm. long, glabrous or rarely minutely pilosulous, rarely half as long as corolla tube; corolla campanulate, 5-12 mm. long, white or pink with pinkish veins in the tube, widely spreading or reflexed, glabrous externally; follicles linear-cylindric, 6-15 cm. long, pendulous at maturity. In dry thickets and edge of woods in the Trans-Pecos, Apr.-July; from Nfld. to B.C., s. to Ga. and Ariz.

2. *Apocynum medium* Greene. Stems erect or ascending to 5 dm. tall, freely and somewhat dichotomously branched (especially below), glabrous to puberulent; leaves petiolate to subsessile, usually spreading, ovate to oblong-lanceolate, obtuse to acute at apex, or cordate-obovate, to 1 dm. long and 2 cm. broad, membranaceous, entire, mucronate, glabrous to somewhat puberulent above, more or less pilosulous to tomentulose beneath; cymes at tip of leafy branches, the central one flowering first; calyx lobes lanceolate to oblong, 1.5-3 mm. long, glabrous to sparsely pilosulous; corolla campanulate to broadly urceolate or cylindric, 3-6 mm. long, the lobes spreading, white or with pinkish veins; follicles 7-15 cm. long, pendulous at maturity. Dry or moist rocky soil in the Trans-Pecos, June-Aug.; from Nfld., s. to N.C., Tex. and N.M.

Those plants that are completely glabrous and whose corollas are cylindrical and have their tube conspicuously larger than the spread of the limb are separated as var. *floribundum* (Greene) Woods.

3. *Apocynum cannabinum* L. INDIAN HEMP. Plant glabrous to variously pubescent; stems erect or ascending to 1 m. tall, glabrous, with ascending branches; leaves petiolate or the lowermost sometimes subsessile, ascending or only slightly spreading, ovate to oblong-elliptic or lanceolate, rounded to acute and usually apiculate at apex, narrowly cuneate to somewhat rounded at base, to 14 cm. long and 7 cm. broad, glabrous above, glabrous to more or less densely pilosulous or tomentulose beneath; calyx lobes lanceolate to ovate-lanceolate, 3-4 mm. long, glabrous; corolla cylindric to urceolate, 3-6 mm. long, white to greenish, the lobes erect or only slightly spreading; follicles 12-20 cm. long, glabrous, pendulous at maturity. Usually in wet or moist sandy or clayey soil in ditches and along streams and rivers, occasionally in fields and open woodlands in e., cen. and n.-cen. Tex., Apr.-Aug.; throughout the U.S. and s. Can.

Those plants that are entirely glabrous throughout are segregated as var. *glaberrimum* A. DC., while those plants that are more or less tomentulose throughout are segregated as var. *pubescens* (R. Br.) A. DC.

4. *Apocynum sibiricum* Jacq. PRAIRIE DOGBANE. Stems erect or somewhat ascending to 7 dm. tall, glabrous throughout, with ascending branches; leaves sessile or subsessile (especially on the main stem) and often with a cordate-clasping base, those on the upper branches frequently shortly petiolate, ascending or slightly spreading, oblong or oblong-lanceolate to oval or rarely linear to linear-lanceolate, to 14 cm. long and 45 mm. wide, obtuse to rounded or cordate at the base; inflorescence usually dense, the bracts usually conspicuous and more or less herbaceous; calyx lobes lanceolate, 2-4 mm. long; corolla urceolate to shortly cylindric, about as long as broad, 3-5 mm. long, white to yellow or greenish, glabrous externally, the lobes erect or slightly spreading; follicles 4-10 cm. long, glabrous, pendulous at maturity. *A. hypericifolium* Ait., ? *A. Suksdorfii* Greene. Usually in sandy soil along creeks and on dunes, and in arroyos and gullies of badlands in n.-cen. Tex., the Edwards Plateau, Plains Country and Trans-Pecos, Apr.-July; throughout most of N.A.

Those plants with the main stem leaves ovate to oval-oblong and deeply cordate and clasping at the base are segregated as var. *cordigerum* (Greene) Fern., while those plants with very narrow leaves and corolla longer than broad are segregated as var. *salignum* (Greene) Fern.

6. MACROSIPHONIA MUELL. ARG.

ROCK-TRUMPET

Suffrutescent herbs or low shrubs; leaves opposite, or rarely verticillate, shortly petiolate to sessile, glandular at the base of the midrib above; inflorescence terminal, rarely sub-

terminal or lateral, usually 1-flowered, rarely with 2 or 3 flowers; calyx 5-parted nearly to the receptacle, the lobes subequal, more or less foliaceous or petaloid, bearing numerous indefinitely distributed squamellae within; corolla infundibuliform, the limb equally 5-lobed, dextrorsely contorted; anthers connivent and agglutinated to the stigma, the enlarged connective obtusely 2-lobed; ovary apocarpous, containing many ovules, surrounded by 5 separate or somewhat concrescent nectaries; stigma relatively massive, umbraculiform-subglochidiate; fruit follicular; seeds numerous, truncate, comose at the apex.

About 10 species, mainly in tropical America.

1. Corolla tube barely as long as the throat or shorter; leaves linear to narrowly oblong 1. *M. hypoleuca*.
1. Corolla tube much longer than the throat; leaves suborbicular to ovate-elliptic 2. *M. Macrosiphon*.

1. *Macrosiphonia hypoleuca* (Benth.) Muell. Arg. Erect or diffuse suffrutescent herb, 1-3 dm. tall; leaves with petioles 1-2 mm. long, narrowly oblong to linear, to 9 cm. long and 2 cm. broad, acute or rarely acuminate or narrowly obtuse at apex, abruptly rounded to truncate at the base, dark-green and hirtellous to glabrate above, much paler and densely tomentulose beneath; inflorescence bearing 1 to 3 white vespertine flowers, the conspicuous peduncle somewhat shorter than the leaves; pedicels 5-10 mm. long; calyx lobes narrowly oblong-lanceolate, acuminate, 5-10 mm. long, somewhat petaloid, minutely puberulent-tomentulose; corolla infundibuliform, finely floccose-tomentulose externally, the tube proper 1-2.5 cm. long, about 1.25 mm. in diameter at the base, the throat narrowly conic or subtubular, 15-25 mm. long, 5-7.5 mm. in diameter at the orifice, the lobes obliquely obovate, 15-25 mm. long, spreading; follicles stout, continuous or slightly articulate, 9-13 cm. long, finely puberulent-papillate. In rocky igneous soil in Davis Mts. in the Trans-Pecos, July-Sept.; also s. to cen. Mex.

2. *Macrosiphonia Macrosiphon* (Torr.) Heller. FLOR DE SAN JUAN. Erect or somewhat diffuse suffrutescent herb, 1.5-3 dm. tall; leaves with petioles to 1 cm. long, ovate-elliptic to suborbicular, to 65 mm. long and 45 mm. broad, at the apex abruptly obtuse or rounded or infrequently acute to somewhat retuse and mucronulate, obtuse to rounded or subcordate at the base, densely tomentulose on both sides; inflorescence bearing a solitary showy white or pink-tinged vespertine flower, the peduncle obsolete or essentially so; pedicel 2-5 mm. long; calyx lobes lanceolate to ovate, acute to acuminate, 1-2 cm. long, 2-5 mm. broad, conspicuously foliaceous, densely tomentulose; corolla infundibuliform, densely puberulent-papillate externally, the tube proper 3.5-9 cm. long, about 1.5 mm. in diameter at the base, the throat narrowly conic to subtubular, 1-2.5 cm. long, 5-7 mm. in diameter at the orifice, the lobes obliquely obovate, 1.5-3 cm. long, spreading; follicles relatively slender, continuous, 10-15 cm. long, puberulent-papillate to glabrate. On dry rocky open or brushy slopes in the Rio Grande Valley, w. Edwards Plateau and Trans-Pecos, May-Sept.; also n. Mex.

7. NERIUM L.

Several species in the Old World. The leaves and flowers are very poisonous if eaten.

1. *Nerium Oleander* L. COMMON OLEANDER, LAUREL ROSA. Shrub or small tree to 5 m. tall or more, essentially glabrous; leaves opposite or in whorls of 3 or 4, very shortly petiolate, coriaceous, oblong-lanceolate, to 3 dm. long and 35 mm. broad, acuminate, narrowly cuneate at the base, lustrous above; inflorescence subcorymbose, much-surpassing the foliage, bearing few to numerous showy flowers of variable color, ranging from scarlet to yellowish-pink or white, and frequently double; calyx 5-parted, the lobes lanceolate to ovate-lanceolate, acuminate, 4-6 mm. long, somewhat foliaceous; corolla infundibuliform, glabrous externally, the tube proper 8-12 mm. long, about 1.5 mm. in diameter at the base, the throat conic-campanulate, 9-10 mm. long, about 7 mm. in diameter at the orifice, the 5 lobes obliquely obovate to obovate-oblong, 2-2.5 cm. long, spreading; follicles 2, separate, relatively stout, 8-15 cm. long; seeds compressed, densely puberulent, comose at apex. Nat. of the Medit. region and the Orient; cult. and widely naturalized in N.A.

FAM. 151. ASCLEPIADACEAE R. BR.¹⁵⁰

MILKWEED FAMILY

Perennial herbs, vines or shrubs with milky juice; leaves opposite, whorled or sometimes alternate, without stipules; flowers perfect, regular, usually umbellate, commonly 5-merous; calyx deeply lobed, the lobes mostly imbricate; corolla 5-lobed or -cleft, the lobes commonly valvate, in bud; a 5-lobed crown is usually present between the corolla and stamens and is adnate to either or both; stamens 5, inserted on the corolla tube usually near its base, the filaments monadelphous or sometimes distinct; anthers united and tipped with a scarious membrane inflexed on the summit of the stylar disk; pollen grains united into waxlike or granular pollinia; carpels 2, with distinct superior ovaries and styles but united above by the peltate discoid stigma; fruit of 2 follicles (or 1 by abortion); seeds many, compressed, usually with long coma.

About 130 genera and 2,000 species widely distributed but most frequent in warm regions.

1. Stamen column or its base surrounded by 5 separate fleshy-inflated or fleshy-thickened erect or spreading appendages (hoods) (2)
1. Stamen column or its base with 1 or 2 rows of flat thin appendages, or a single entire or lobed fleshy disk or cup (3)
- 2(1). Stems prostrate to erect, not twining; base of corolla without a fleshy disk under the separate appendages1. *Asclepias*, p. 1219.
2. Stems twining, at least towards tips; corolla with a fleshy disk at base under the appendages3. *Sarcostemma*, p. 1236.
- 3(1). Appendages thin and flat, in 2 rows or a single entire or lobed fleshy disk or cup4. *Matelea*, p. 1237.
3. Appendages thin and flat, in 1 row (4)
- 4(3). Corolla funnellform or campanulate, 2-6.2 mm. long; wild herbaceous vines or sometimes weeds2. *Cynanchum*, p. 1234.
4. Corolla rotate, its narrowly oblong lobes about 10 mm. or more long; cultivated woody vine5. *Periploca*, p. 1241.

I. ASCLEPIAS L.¹⁵¹

MILKWEED. SILKWEED

Herbs, rarely fruticose or suffruticose, perennial or rarely annual, usually laticiferous; leaves usually decussate, infrequently whorled or irregularly approximate; inflorescence terminal or interpetiolar, umbelliformly cymose, very rarely (*A. Sperryi*) reduced to a solitary flower; calyx lobes 5, equal, divided nearly to the receptacle, bearing few to many minute glandular squamellae within at the base; corolla rotate, the lobes 5, valvate, equal, reflexed, spreading or rarely erect; gynostegium definitely stipitate to sessile; corona of 5 hoods attached to the column and subtending the connivent anthers; hoods cucullate to clavate with various modifications, more or less stipitate to sessile and deeply saccate at the basal attachment to the column, usually bearing an internal horn or crest; anthers 2-celled, with more or less prominent corneous marginal wings enclosing the 5 stigmatic chambers and with membranaceous apical appendages; pollinia paired and pendulous from the translator arms, flat and uniformly fertile, enclosing granular pollen with thin hyaline intine; anther head peltate, more or less pentagonal; fruit follicular, containing many compressed comose or rarely naked seeds.

About 120 species that are native mostly to the Americas.

1. The complete hoods or only their apical portion widespread from the anther head (2)
1. The hoods erect to suberect, more or less parallel to and contiguous with the anther head (6)
- 2(1). Leaves filiform, less than 5 mm. wide (3)
2. Leaves linear-lanceolate or broader, 1 cm. wide or more (4)

¹⁵⁰ Adapted partly from Lloyd H. Shinners in *Sida* 1(6):358-367, 1964.

¹⁵¹ Adapted from R. E. Woodson, Jr. in *Ann. Missouri Bot. Gard.* 41:1-211, 1954.

- 3(2). Base of hoods abruptly deflexed from the anther head, then ascending to an expanded apex 1. *A. Sperryi*.
3. Hoods ascending-spreading, narrowly acuminate at apex 2. *A. macrotis*.
- 4(2). Hoods narrowly attenuate at apex 9. *A. speciosa*.
4. Hoods blunt at apex (5)
- 5(4). Leaves typically lanceolate to linear-lanceolate, narrowly acuminate at apex; distribution in central and west Texas 3. *A. asperula*.
5. Leaves ovate to oblong-lanceolate, obtuse to shortly acute at apex; distribution in eastern half of Texas 4. *A. viridis*.
- 6(1). Leaves typically broad, suborbicular to ovate-elliptic or elliptic (7)
6. Leaves typically narrow, lanceolate to narrowly triangular-lanceolate or linear-lanceolate to filiform (21)
- 7(6). Leaves amplexicaul, clasping the stem at base (8)
7. Leaves petiolate or at most sessile, not clasping the stem (9)
- 8(7). Gynostegium stipitate; distribution east Texas 5. *A. amplexicaulis*.
8. Gynostegium sessile or essentially so; distribution Trans-Pecos Texas 6. *A. elata*.
- 9(7). In natural position the hoods extending at least a third longer than the anther head (10)
9. Hoods shorter than to only slightly longer than the anther head (14)
- 10(9). Hoods noticeably dilated above the middle, repand to emarginate at the broad apex (11)
10. Hoods not dilated above the middle, rounded and sometimes slightly notched at the apex (12)
- 11(10). Hoods 7-10 mm. long, somewhat spreading at tips; corolla lobes 8-14 mm. long 7. *A. oenotheroides*.
11. Hoods about 5 mm. long, not spreading at tips; corolla lobes 6-7 mm. long 8. *A. Emoryi*.
- 12(10). Corolla greenish-yellow to brownish; hoods broadly rounded at apex 10. *A. obovata*.
12. Corolla orange-color to reddish or reddish-purple, rarely clear-yellow; hoods narrowed at apex (13)
- 13(12). Leaves distinctly opposite, distant; petiole more than 5 mm. long; corolla usually reddish-purple 11. *A. purpurascens*.
13. Leaves irregularly approximate, not distinctly opposite, somewhat crowded; petiole 5 mm. long or less; corolla mainly orange-color or reddish 12. *A. tuberosa*.
- 14(9). Gynostegium sessile (15)
14. Gynostegium stipitate (16)
- 15(14). Plants small, 10 cm. or less high; leaves in several approximate pairs near base of stem; corolla purplish-rose; in Texas confined to the mountains of the Trans-Pecos 13. *A. nummularia*.
15. Plants rather tall, usually much more than 15 cm. high; leaves in 6 or more pairs distributed along stem; corolla pale-green; almost entirely east and north of the Trans-Pecos 14. *A. viridiflora*.
- 16(14). Plants small, to 2 dm. high; leaves crowded in several pairs near base of plant; umbel borne at summit of naked scapose stem 15. *A. scaposa*.
16. Plants rather large, typically much more than 2 dm. high; leaves spread along stem; inflorescence not as above (17)

- 17(16). Leaves orbicular to oblong-subquadrate, leathery, usually broadly emarginate at apex and somewhat truncated at base (18)
- 17. Leaves not as above, slightly rounded to cuneate at base, at most thick-membranous (19)
- 18(17). Leaves persistently pubescent, with more or less straight and parallel margins; hoods broadly 2-lobed at tip, the horns not wholly adnate 16. *A. arenaria*.
- 18. Leaves glabrous at maturity, with broadly rounded lateral margins; hoods entire, the horns wholly adnate 17. *A. latifolia*.
- 19(17). Corolla lobes about 3 mm. long; leaves tapering to an acute to acuminate apex; gynostegium with a long slender stipe 18. *A. texana*.
- 19. Corolla lobes 7-10 mm. long; leaves more or less rounded and apiculate at apex; gynostegium with a short stout stipe (20)
- 20(19). Leaves somewhat glaucous and essentially glabrous on lower surface; corolla white; hoods angular on each side near base; horns shorter than hoods 19. *A. variegata*.
- 20. Leaves permanently pubescent on lower surface; corolla pale-yellowish-green and often flushed with orange-color; hoods not angular near base; horns longer than the hoods 20. *A. tomentosa*.
- 21(6). In natural position the hoods extending at least a third longer than the anther head (22)
- 21. Hoods shorter than to only slightly longer than the anther head (27)
- 22(21). Stems prostrate on ground; leaves truncate to shallowly cordate at base 21. *A. prostrata*.
- 22. Stems erect or ascending, not prostrate; leaves rounded to cuneate at base (23)
- 23(22). Hoods noticeably dilated above the middle, repand to emarginate at the broad apex (24)
- 23. Hoods not dilated above the middle, rounded to acutish at apex (25)
- 24(23). Hoods 7-10 mm. long, somewhat spreading at tips; corolla lobes 8-14 mm. long 7. *A. oenotheroides*.
- 24. Hoods about 5 mm. long, not spreading at tips; corolla lobes 6-7 mm. long 8. *A. Emoryi*.
- 25(23). Leaves irregularly approximate, not distinctly opposite, somewhat crowded, more or less pubescent; inflorescences on short peduncles, scarcely if at all surpassing the leaves 12. *A. tuberosa*.
- 25. Leaves distinctly opposite, distant, glabrous; inflorescence on a long naked peduncle (26)
- 26(25). Hoods acute to obtuse at apex; leaves ovate to lanceolate 22. *A. rubra*.
- 26. Hoods broadly rounded at apex; leaves linear-lanceolate 23. *A. lanceolata*.
- 27(21). Leaves filiform to linear-filiform, all of them 4 mm. wide or less (28)
- 27. Leaves ovate or broadly elliptic to linear or linear-lanceolate, typically most of them more than 5 mm. wide (34)
- 28(27). Hoods sharply erose or 2-lobed at apex (29)
- 28. Hoods entire at apex, not erose or lobed (30)
- 29(28). Gynostegium with a short stout stipe; distribution in the Trans-Pecos 24. *A. quinquedentata*.
- 29. Gynostegium sessile; distribution northeast Texas 25. *A. stenophylla*.
- 30(28). Gynostegium sessile; hoods deeply saccate and excurrently auriculate at the base, broadly truncate or retuse at apex 26. *A. Engelmanniana*.
- 30. Gynostegium distinctly stipitate; hoods not as above (31)

- 31(30). Leaves opposite or very rarely 3 at some nodes ... 27. *A. linearis*.
 31. Leaves verticillate or spirally approximate (32)
 32(31). Plants small, mostly less than 25 cm. high; leaves numerous, crowded, spirally approximate; distribution Texas Panhandle 28. *A. pumila*.
 32. Plants tall, mostly 30 cm. or more high; leaves verticillate; distribution mostly south of the Panhandle (33)
 33(32). Leaves more or less heterophyllous at the nodes, rather lax and spreading, often longer than 8 cm.; stems usually with dwarf vegetative branches bearing reduced opposite leaves; distribution west Texas 29. *A. subverticillata*.
 33. Leaves all similar at the nodes, usually rather strictly ascending; stem without dwarf branches; distribution eastern half of Texas 30. *A. verticillata*.
 34(27). Gynostegium sessile or *A. involucrata* with very short stout stipe (35)
 34. Gynostegium with a rather slender distinct stipe (37)
 35(34). Plants small, 25 cm. tall or less, the stems spreading; hoods usually slightly exceeding the anther head 31. *A. involucrata*.
 35. Plants usually more than 30 cm. tall, the stems erect; hoods rarely equal in length to anther head (36)
 36(35). Corolla reddish-purple or violet-color; hoods 1.5-2 mm. long, with very prominent marginal auricles somewhat longer than the broadly obtuse median lobe ...
 32. *A. brachystephana*.
 36. Corolla pale-green; hoods 4-5 mm. long, not as above . 14. *A. viridiflora*.
 37(34). Hoods obovate, without horns 33. *A. longifolia*.
 37. Hoods oblong to quadrate, with conspicuous acicular horns that more or less arch over the anther head (38)
 38(37). Corolla usually bright-crimson or scarlet, the lobes 5-10 mm. long
 34. *A. curassavica*.
 38. Corolla white to bright-pink, the lobes 3-5 mm. long (39)
 39(38). Inflorescences usually paired at the upper nodes, solitary below; flowers typically bright-pink 35. *A. incarnata*.
 39. Inflorescences solitary at the upper nodes; flowers white, the corolla occasionally tinged with purple on outer surface (40)
 40(39). Follicles erect on erect pedicels; seeds comose; distribution central and west Texas 18. *A. texana*.
 40. Follicles pendulous; seeds naked; distribution southeast Texas
 36. *A. perennis*.

1. *Asclepias Sperryi* Woods. Low suffruticose perennial; stems clustered from the rootstalk and branching repeatedly and rather fastigiately, very slender, 1-3 dm. tall, very minutely puberulent to essentially glabrous; leaves opposite, sessile, filiform, 6-8 cm. long, about 1 mm. wide, glabrous, revolute; inflorescences lateral at few of the uppermost nodes, sessile, 1- (or very rarely 2-) flowered; pedicels filiform, about 5 mm. long, glabrous; flowers rather small; calyx lobes ovate, about 2 mm. long; corolla rotate, pale-greenish-yellow, more or less tinged with purple without, the lobes about 5 mm. long; gynostegium sessile, pale-greenish-yellow or white, occasionally somewhat tinted with purple; hoods tubiform, about 4 mm. long, the base abruptly deflexed from the anther head, thence with ascending broadly expanded tips; crest wholly adnate, low; anther head very broadly cylindrical, about 1 mm. long and 2.5 mm. broad; follicles erect on deflexed pedicels, very narrowly fusiform, gradually attenuate, 5-7 cm. long, about 4 mm. thick, smooth, glabrous; seeds oval, about 5 mm. long, the white coma about 25 mm. long. Limestone ledges and slopes, open places among grass in the Trans-Pecos, Apr.-June; also n. Coah.

This is one of the oddest of American milkweeds, not only because of the peculiar floral structure but because of the extreme reduction of the inflorescence.

2. *Asclepias macrotis* Torr. Suffrutescens perennial; stems densely clustered from the rootstalk, repeatedly and rather fastigiately branching, very slender and twiggy (rather resembling an *Ephedra*), 1-3 dm. tall, very inconspicuously puberulent in decurrent lines

from the nodes, glabrate at maturity; leaves opposite, sessile, filiform to acicular, 3.5-8 cm. long, 1-4 mm. broad, revolute, glabrous; inflorescences solitary and lateral from the upper nodes, few- to several-flowered; peduncles slender, 2-10 mm. long; pedicels very slender, about 1 cm. long; flowers rather small; calyx lobes ovate, 2-3 mm. long; corolla pale-greenish-yellow, slightly tinged with purple without, the lobes about 5 mm. long; gynostegium subsessile, cream-color or yellowish; column about 0.5 mm. long and 2 mm. broad, ovate-lanceolate; hoods very narrowly acuminate, 4-6 mm. long; horn strongly adnate, much shorter than the hood, ascending, usually minutely pilosulose at the tip; anther head truncately conic, about 1 mm. long and 2 mm. broad; follicles erect on deflexed pedicels, very narrowly fusiform, long-apiculate, 4-7 cm. long, 5-7 mm. thick, smooth, inconspicuously pilosulose to glabrate; seeds oval, about 6 mm. long, the white or pale-tawny coma 25-35 mm. long. Dry hills and mesas in the Trans-Pecos, June-Sept.; from N.M. and adj. Colo. to Okla., Tex., Ariz. and Coah.

3. *Asclepias asperula* (Dcne.) Woods. Low herbaceous perennial from very stout rootstalks; stems usually clustered from the rootstalk, ascending or somewhat decumbent, simple, rather stout, 2-6 dm. tall, minutely and rather roughly pilosulose; leaves irregularly approximate, shortly petiolate, lanceolate to linear-lanceolate, narrowly acuminate at apex, acute to obtuse at base, 1-2 dm. long, 1-3 cm. broad, firmly membranaceous, usually more or less conduplicate, minutely and usually rather sparsely pilosulose; petioles 3-7 mm. long; inflorescences terminal and solitary, usually many-flowered and very crowded, sessile to long-pedunculate; peduncles obsolete to 1 dm. long, minutely and rather sparsely pilosulose, rather stout; pedicels more slender, 15-25 mm. long, minutely tomentulose; flowers rather large; calyx lobes ovate to ovate-lanceolate, 4-5 mm. long, minutely pilosulose or puberulent; corolla rotate, pale-yellowish-green, sometimes slightly flushed with purple without, the lobes 9-12 mm. long; gynostegium sessile; hoods broadly clavate-falciform, abruptly deflexed from the anther head, thence with ascending bluntish but tapering tips, 8-10 mm. long, greenish-cream to rather dark-purple; anther head very depressed, about 2 mm. long and 5 mm. broad; follicles erect on deflexed pedicels, rather narrowly fusiform, gradually attenuate, 4-13 cm. long, 1-2.5 cm. thick, smooth, minutely pilosulose; seeds oval, 7-8 mm. long, the pale-tawny coma about 3 cm. long.

The following two phases of this species are found in Texas.

1. Inflorescences usually obviously and rather long-pedunculate; hoods usually rather dark-purple; leaves usually linear-lanceolate subsp. *asperula*.
1. Inflorescences sessile or subsessile; hoods usually greenish-cream-color; leaves usually more broadly lanceolate subsp. *capricornu*.

Subsp. *asperula* occurs mostly in w. Tex. where it is found on flats, sandy and rocky hillsides, and in desert swales, mesquite, oak and juniper areas, Mar.-Nov.

Subsp. *capricornu* (Woods.) Woods. occurs mostly in cen. Tex. where it is found in prairies, plains, pastures, and on limestone or clay hills, Mar.-July. *Acerates decumbens* (Nutt.) Dcne., *Asclepiodora decumbens* (Nutt.) Gray, *Asclepias decumbens* (Nutt.) K. Schum., *A. capricornu* Woods., *A. asperula* var. *decumbens* (Nutt.) Shiners.

4. *Asclepias viridis* Walt. ANTELOPE-HORN. Low herbaceous perennial from a stout subfusiform rootstalk; stems erect, ascending or more or less decumbent, usually simple or branched from the caudex, rather stout, to 6 dm. tall, essentially glabrous; leaves irregularly approximate, shortly petiolate, ovate to oblong-lanceolate, shortly acute to obtuse at apex, acute to broadly rounded at base, 4-13 cm. long, 1-6 cm. broad, firmly membranaceous, yellowish-green, essentially glabrous; petioles 3-10 mm. long; inflorescences terminal and solitary or more usually also lateral at few to several of the uppermost nodes, several- to many-flowered, crowded, pedunculate; peduncles 3-6 cm. long, minutely and scatteringly puberulent; pedicels rather slender, 1-3 cm. long, very minutely and sparsely puberulent; flowers large and rather showy; calyx lobes lanceolate, 4-5 mm. long, essentially glabrous; corolla rotate, pale-green, the lobes 13-15 mm. long and usually with ascending tips; gynostegium sessile, pale-purplish-rose; hoods abruptly deflexed from the anther head and with rather shortly ascending rounded clavate tips, 4-6 mm. long; anther head broadly truncate-conic, about 2 mm. long and broad; follicles erect on deflexed pedicels, broadly fusiform to ovoid, greatly inflated, shortly apiculate, 6-13 cm. long, 2-3 cm. broad, minutely puberulent to glabrate; seeds oval, about 7 mm. long, the

white or pale-tawny coma about 4 cm. long. *Asclepiodora viridis* (Walt.) Gray. Glades, prairies, dry hillsides, and dry pine barrens in e. half of Tex., Mar.-Sept.; from Tenn. to Fla., w. to Neb. and Tex.

5. *Asclepias amplexicaulis* Sm. Herbaceous perennial; stems stout, simple, to 1 m. tall, glabrous; leaves opposite, sessile, broadly ovate or oval to oblong-lanceolate, broadly rounded to obtuse and frequently mucronate at apex, broadly cordate and amplexicaul at base, rather thickly membranaceous or subcoriaceous, more or less glaucous, usually crispate; inflorescences terminal and solitary, rarely lateral also from the uppermost node, usually many-flowered; peduncles stout, 1-3 dm. long, shorter when lateral; pedicels rather stout, 2-5 cm. long; flowers rather large; calyx lobes lanceolate, 3-5 mm. long, glabrous; corolla reflexed-rotate, greenish and more or less deeply suffused with purple or rose, the lobes 9-11 mm. long; gynostegium pale-purple or rose, rather shortly stipitate; column cylindrical, about 2 mm. long, 2.5-3 mm. broad; hoods tubular-cucullate, rather indistinctly dentate to essentially entire, about 5 mm. long; horn adnate below the middle, rather stoutly acicular, about half longer than the hood, broadly arching over the anther head; anther head broadly cylindrical, 3-3.5 mm. long, about 3 mm. broad; follicles erect on deflexed pedicels, rather narrowly falcate-fusiform, 10-16 cm. long, 1-2 cm. thick, smooth, glabrous and rather glaucous; seeds broadly oval, 6-9 mm. long, the pale-tawny coma 4-6 cm. long. Open woods, prairies, old dunes, spreading to clearings, meadows, pastures, roadsides and railways, chiefly in sandy or gravelly soil, in the e. third of Tex., s. to the Rio Grande Plains, Apr.-June; from N.H., s. to Fla., w. to Neb. and Tex.

6. *Asclepias elata* Benth. Herbaceous perennial; stems rather stout, simple, 3-7 dm. tall, glabrous, glaucous; leaves opposite, sessile, very broadly oval to oblong, very broadly obtuse to rounded at apex, broadly cordate at base, 7-14 cm. long, 2.5-7 cm. broad, glabrous, very glaucous; inflorescences terminal or subterminal and usually lateral from few of the uppermost nodes, several- to many-flowered, rather long-pedunculate; peduncles relatively stout, glabrous or very inconspicuously pilosulose in opposed lines; pedicels more slender, 1.5-3 cm. long, densely white-tomentulose; flowers rather large; calyx lobes ovate, 3-4 mm. long; corolla pale-green or greenish-white, the lobes 8-12 mm. long; gynostegium sessile, greenish-white to cream; hoods saccate at the base, compressed-rhomboid, 4-6 mm. long, truncate, somewhat deflexed from the anther head, the crest wholly adnate and about as long as the hood; anther head broadly truncate-conic, about 3 mm. long and 4 mm. broad; follicles erect on deflexed pedicels, fusiform, rather narrowly apiculate, 8-12 cm. long, 1-2.5 cm. thick, smooth, very inconspicuously pilosulose to glabrate; seeds oval, about 7 mm. long, the pale-tawny coma 25-45 mm. long. *A. glaucescens* H.B.K. Dry rocky slopes in open pine, juniper or oak woods in canyons in the Trans-Pecos, June-Sept.; from w. Tex. to Ariz., s. through Mex. to Guat.

7. *Asclepias oenotheroides* Cham. & Schlecht. **HIERBA DE ZIZOTES.** Low herbaceous perennial; stems clustered from the thick rootstalk, ascending or decumbent, moderately stout, more or less branched from the base or simple, to 45 cm. long, minutely puberulent; leaves opposite, rather long-petiolate, rhombic-ovate to oblong-lanceolate, obtuse to acute at apex, acute to broadly obtuse at base and abruptly cuneate to the petiole, 4-12 cm. long, 1-6 cm. broad, firmly membranaceous, pale-green, minutely puberulent particularly beneath; petioles 1-2 cm. long; inflorescences lateral and solitary from few to several of the upper nodes, very shortly pedunculate or sessile, several-flowered; peduncles 1-2 cm. long or nearly obsolete, minutely puberulent; pedicels rather slender, 15-25 mm. long, minutely puberulent; flowers mediocre; calyx lobes ovate-lanceolate, 3-4 mm. long, minutely puberulent; corolla reflexed-rotate, greenish-white or yellow, the lobes 8-14 mm. long; gynostegium very shortly stipitate, pale-greenish-cream; column broadly obconic, about 1.5 mm. long and 2.5 mm. broad; hoods narrowly obovate-flabellate, 7-10 mm. long, conspicuously narrowed to a narrowly laminate stipe from somewhat above the middle, the tip broadly laminate and minutely erose or repand; horn adnate to near the tip of the hood, the free portion falciform and incurved, usually accompanied by a smaller posterior appendage; anther head truncate-conic, about 3 mm. long and 4-5 mm. broad; follicles erect on deflexed pedicels, broadly fusiform or ovoid, shortly apiculate, 7-9 cm. long, 1.5-2 cm. broad, smooth, minutely pilosulose to glabrate; seeds oval, 6-8 mm. long, the pale-tawny coma 2-2.5 cm. long. *A. longicornu* Benth., *A. Lindheimeri* Engelm. & Gray. Rocky, chiefly clay soil in llanos, mesas and hills, in dunes, salt marshes, fields and

thickets, along roadsides in much of w. half of Tex., flowering throughout the year; also N.M., s. to C.A.

8. *Asclepias Emoryi* (Greene) Small. Low herbaceous perennial; stems usually clustered from the rootstalk, ascending or decumbent, rather slender, more or less branched from the base or simple, 1-2 dm. long, minutely puberulent; leaves opposite, rather long-petiolate, rhombic-ovate to narrowly oblong-lanceolate particularly above, obtuse to narrowly acute at apex, acute to obtuse at base and abruptly cuneate into the petiole, 4-8 cm. long, to 4 cm. broad, firmly membranaceous, pale-green, minutely puberulent particularly beneath; petioles 1-1.5 cm. long; inflorescences lateral and solitary from few to several of the upper nodes, shortly pedunculate to sessile; peduncles obsolete to 2 cm. long, densely puberulent; pedicels rather slender, 1-2 cm. long, minutely puberulent; flowers rather small; calyx lobes lanceolate, 3-4 mm. long, minutely puberulent; corolla reflexed-rotate, dingy-greenish-yellow, the lobes 6-7 mm. long; gynostegium very shortly stipitate or essentially sessile, pale-greenish-cream; column broadly obconic, about 1 mm. long and 1.5 mm. broad; hoods oblanceolate, about 5 mm. long, conspicuously narrowed to a narrowly laminate stipe from near the tip, the tip laminate and rather deeply emarginate; horn wholly adnate to the sinus and more or less linguiform, enclosing the hood from above (rarely ascending); anther head truncate-conic, about 1.5 mm. long and broad; follicles erect on deflexed pedicels, more narrowly fusiform, rather narrowly attenuate, 6-9 cm. long, 1-1.5 cm. broad, minutely puberulent to glabrate; seeds broadly oval, about 8 mm. long, the pale-tawny coma 25-35 mm. long. Sandy prairies and dry plains, spreading to roadsides and railways in w.-cen. and s. Tex., Mar.-Oct.; also n.e. Mex.

9. *Asclepias speciosa* Torr. SHOWY-MILKWEED. Herbaceous perennial; stems usually very stout, simple, 6-10 dm. tall, densely white-tomentose generally; leaves opposite, shortly petiolate, broadly ovate or oval to rather narrowly oblong or ovate-lanceolate, usually very broadly obtuse to rounded at apex, rather rarely acute, very broadly obtuse to rounded and sometimes broadly and shallowly cordate at base, 6-20 cm. long, 3-14 cm. broad, firmly membranaceous, very densely white-tomentose beneath, more or less glabrate above; petioles to 15 mm. long; inflorescences lateral and solitary at few to several of the upper nodes, several- to many-flowered, densely white-tomentose throughout; peduncles rather stout, to 1 dm. long; pedicels 2-3 cm. long; flowers very large and showy; calyx lobes lanceolate, 5-6 mm. long, very densely white-tomentose; corolla purplish-rose, the lobes 1-1.5 cm. long; gynostegium pale-rose or pinkish-cream, subsessile; column very broadly obconic, about 1 mm. long and 3 mm. broad; hoods very narrowly ovate-lanceolate, gradually attenuate at apex, widely spreading, 1-1.4 cm. long; horn adnate toward the base, falciform-acicular, sharply incurved, very much shorter than the hoods; anther head broadly truncate-conic, about 3 mm. long and 4.5 mm. broad; follicles erect on deflexed pedicels, broadly or rather narrowly fusiform, abruptly or gradually attenuate, 9-12 cm. long, 2-3 cm. broad, densely spiny to smooth, very densely white-tomentose; seeds oval, 6-9 mm. long, the white coma 3-4 cm. broad. Widely tolerant to habitat and becoming weedy in cult. fields, roadsides and railways on the High Plains in Tex., May-Sept.; from s. Man. to B.C., Minn. and Tex., w. to the Pac. Coast.

This species has the most massive flowers of any milkweed.

10. *Asclepias obovata* Ell. Herbaceous perennial from a rather deep slender rootstalk; stems rather stout, simple or branching infrequently, 1.5-5 dm. tall, softly tomentulose; leaves opposite, shortly petiolate, quite variable in size and outline, the lowermost usually broadly oval to oblong or quadrate, becoming narrower and smaller above, broadly acute to rounded at apex, obtuse to rounded or truncate at base, 3-8 cm. long, 1-4 cm. broad, firmly membranaceous, densely tomentulose particularly beneath; petioles to 1 cm. long; inflorescences terminal, solitary or also lateral from the uppermost few nodes, several- to rather many-flowered, subsessile to very shortly pedunculate, densely tomentulose; peduncles obsolete to about 5 mm. long; pedicels rather stout, 8-10 mm. long; flowers rather large; calyx lobes ovate-lanceolate, 4-5 mm. long, pilosulose; corolla reflexed-rotate, pale-greenish-yellow, the lobes 9-10 mm. long; gynostegium shortly stipitate, pale-greenish-orange; column obconic, about 1.5 mm. long and 2 mm. broad; hoods broadly oblong-oval, rounded and sometimes notched at apex, about 6 mm. long; horn basally adnate, rather narrowly falciform, sharply incurved, about as long as the hoods; anther head truncately conic, about 3 mm. long and 4 mm. broad; follicles erect on deflexed

pedicels, more or less tomentose, to 12 cm. or more long, fusiform. Sandy oak and pine woods, spreading to savannahs, fields and roadsides, in s.e. Tex., May-Sept.; from S.C. to Fla. and w. to Tex.

11. *Asclepias purpurascens* L. PURPLE-MILKWEED. Herbaceous perennial; stems rather stout, simple, 4-10 dm. tall, minutely pilosulose when young, becoming glabrate; leaves opposite, petiolate, broadly ovate or oval to ovate- or oblong-lanceolate, obtuse to acute at apex, obtuse to broadly rounded at base and very shortly and abruptly cuneate into the petiole, 6-18 cm. long, 3-10 cm. broad, firmly membranaceous, dark-green and glabrate above, paler and densely and generally puberulent below; petioles to 25 mm. long; inflorescences terminal and solitary or paired, several- to rather many-flowered; peduncles rather slender, 1.5-9 cm. long, minutely puberulent; pedicels slender, 2-3.5 cm. long, minutely puberulent; flowers rather large and very showy; calyx lobes ovate-lanceolate, 3-4 mm. long, minutely puberulent; corolla deep-rose, reflexed-rotate, the lobes 7-10 mm. long; gynostegium deep-rose, very shortly stipitate; column obconic, 1.5-2 mm. long, 2.5-3 mm. broad; hoods oblong-elliptic, acute to acuminate, 6-7 mm. long; horn about half-adnate, falciform and sharply incurved, much shorter than the hoods; anther head truncately conic, about 2 mm. long and 3 mm. broad; follicles erect on deflexed pedicels, narrowly fusiform, gradually attenuate, 10-16 cm. long, 1-2 cm. thick, smooth, minutely puberulent to glabrate; seeds oval, 5-6 mm. long, the white coma 35-45 mm. long. Thickets and open woods, prairies and fields, spreading to roadsides and railways, in n.e. Tex., Apr.-July; from s. Ont. and N.E., s. to Va. and Tex.

12. *Asclepias tuberosa* L. BUTTERFLY-WEED, ORANGE MILKWEED, CHIGGER-FLOWER. Herbaceous perennial from a deep woody rootstalk; stems rather stout and clustered from the crown, usually branching only at the inflorescence, to 9 dm. tall, conspicuously hirsutulous or hispid generally; leaves irregularly approximate, usually crowded, rather shortly petiolate, extremely variable, very narrowly lanceolate to very broadly oblanceolate, rounded to acuminate at apex, cuneate to broadly cordate at base, 3-11 cm. long, to 3 cm. broad, firmly membranaceous and occasionally irregularly crisped-revolute, more or less conspicuously hirsutulous particularly beneath; petioles 1-5 mm. long; inflorescence of 1 to several terminal and subterminal helicoid branches bearing few to numerous umbelliform cymes at the nodes of the more or less reduced and usually opposite leaves, the cymes several- to many-flowered; flowers moderately large; calyx lobes lance-trigonal, 2-3 mm. long, minutely hirsutulous; corolla reflexed-rotate, usually orange or occasionally reddish, yellow or red, the lobes 7-8 mm. long; gynostegium usually orange, rarely yellow; column narrowly obconic, about 2 mm. long and 1.5 mm. broad; hoods cucullate, lanceolate, 4-5 mm. long; horn basal, narrowly acicular, slightly longer than the hoods, gradually arching over the anther head; anther head cylindrical, about 2 mm. long and broad; follicles erect on deflexed pedicels, narrowly fusiform, 8-15 cm. long, 1-1.5 cm. broad, smooth, pilosulose; seeds broadly oval, 5-7 mm. long, the white coma 3-4 cm. long. A frequent and widespread species, in prairies, dry fields, thickets, open woods, canyons, and on dunes and hillsides throughout much of the state but especially in the e. two thirds, Apr.-Sept.; throughout most of e. half of U.S.

The following two phases of this species are found sympatrically in Texas.

1. Leaves typically deeply cordate at base subsp. *interior* Woods.
1. Leaves typically obtuse to truncate at base, varying to slightly cordate
..... subsp. *terminalis* Woods.

13. *Asclepias nummularia* Torr. YERBA DE CUERVO. Diminutive herbaceous perennial, more or less subscapose in appearance because of the decumbent habit and the long peduncles; stems usually several clustered from the rootstalk, decumbent to ascending, usually frequently branched, rarely simple, relatively slender and apparently more or less ancipitous or laterally compressed, 4-10 cm. long, finely tomentulose above to glabrate below; leaves opposite, subsessile or very shortly petiolate, in 2 to 3 closely approximate pairs, very broadly ovate or suborbicular to ovate-lanceolate, broadly rounded to acute at apex, broadly rounded and somewhat cordate to obtuse at base, 1.5-4 cm. long, 1-4 cm. broad, firmly membranaceous or somewhat subsucculent, more or less glaucous, finely subarachnoid-tomentulose particularly beneath, infrequently glabrate; inflorescences terminal and subterminal at the uppermost nodes, few- to several-flowered, long-peduncu-

late, minutely tomentulose; peduncles 2-6 cm. long, slender; pedicels very slender, 1.5-3 cm. long; flowers rather small; calyx lobes ovate, about 2 mm. long, purplish, finely pilosulose; corolla reflexed-rotate, purplish-rose, the lobes 3-5 mm. long; gynostegium pale-rose, shortly stipitate; column broadly obconic, about 0.5 mm. long and 2.5 mm. broad; hoods broadly obovate, broadly obtuse or rounded at the tip, about 3 mm. long; horn strongly adnate, very broadly falciform or reduced to a rather low crest about as long as the hood or somewhat shorter; anther head truncately conic, 2-2.5 mm. long, 3-3.5 mm. broad; follicles erect on deflexed pedicels, very broadly fusiform, shortly apiculate, 5-6 cm. long, 1.5-2 cm. broad, smooth, finely tomentulose to glabrate; seeds oval, about 6 mm. long, the pale-tawny coma about 25 mm. long. Rocky hillsides, arid grassland, dry ravines, in gravel or clay, in the Trans-Pecos, Mar.-June; from w. Tex., s. Ariz. and n. Mex.

14. *Asclepias viridiflora* Raf. Herbaceous perennial; stems usually rather stout, simple, rarely branching at the base, often zigzag above, to 9 dm. tall, inconspicuously puberulent to glabrate; leaves opposite to irregularly approximate, shortly petiolate to sessile, extremely variable, suborbicular to linear, 4-13 cm. long, 1-6 cm. broad, firmly membranaceous, inconspicuously puberulent to glabrate; petioles obsolete to 1 cm. long; inflorescences subterminal and solitary and usually lateral at few to many of the upper nodes, usually many-flowered, crowded and hemispherical, puberulent; peduncles obsolete to 15 mm. long, rather stout; pedicels more slender, 1-2 cm. long; flowers moderately large; calyx lobes ovate-lanceolate, 3-4 mm. long, minutely puberulent; corolla reflexed-rotate, pale-green, the lobes 6-7 mm. long; gynostegium sessile, pale-green; hoods deeply saccate, oblongish, 4-5 mm. long, nearly equaling the anther head; anther head 3-4 mm. long; follicles erect on deflexed pedicels, narrowly fusiform, long-attenuate, 7-15 cm. long, 1.5-2 cm. thick, finely puberulent to glabrate; seeds oval, 6-7 mm. long, the pale-tawny coma 3-5 cm. long. *Acerates viridiflora* (Raf.) Pursh. Glades, prairies, plains and rocky or sandy hillsides, spreading to old fields and roadsides, local and infrequent throughout most of Tex., Apr.-Aug.; from e. Can., s. to Ga., w. to Mont. and Ariz., also Coah.

Although the flowers are quite uniform in this species the leaves are tremendously variable.

15. *Asclepias scaposa* Vail. Small subscapose herbaceous perennial from a fleshy napiform rootstalk; stems simple or sparingly branched from the base, slender, to 2 dm. tall, minutely and generally puberulent or pilosulose; leaves opposite, petiolate, broadly oval to oblong-elliptic, obtuse to acute at apex, obtuse to rounded at base, 2-6 cm. long, to 25 mm. broad, membranaceous, generally pilosulose above and below; petioles to 4 cm. long; inflorescences terminal, solitary, several- to many-flowered; peduncle relatively stout, 7-17 cm. long; pedicels slender, 1-2 cm. long; flowers rather small; calyx lobes lance-trigonal, about 2 mm. long, minutely pilosulose; corolla reflexed-rotate, livid-rose or purplish, the lobes 4-5 mm. long; gynostegium shortly stipitate, cream-color flushed with purple or rose; column obconic, 1-1.5 mm. long and broad; hoods tubular-cucullate, erose-dentate, 2-3 mm. long; horn acicular and ascending, somewhat longer than the hood and strongly adnate to it, entire; anther head about 1.5 mm. long and 2 mm. broad; follicles erect on deflexed pedicels, narrowly fusiform, about 5 cm. long and 5-7 mm. thick, smooth, minutely pilosulose; seeds unknown. Dry, sunny, gravelly openings among scrub oaks, and on mt. sides and flats in s. Trans-Pecos, Mar.-May; from w. Tex. and s. N.M. to n.-cen. Mex.

16. *Asclepias arenaria* Torr. Herbaceous perennial; stems relatively stout, to 8 dm. tall or more, simple or branching infrequently, densely tomentulose; leaves opposite, petiolate, very broadly obovate-oval and more or less subquadrate, broadly rounded and more or less retuse at apex, truncate or broadly rounded and occasionally somewhat cordate at base, rather uniform in shape and size, 6-9 cm. long, 4-8 cm. broad, firmly membranaceous, concolorous, more or less generally white-tomentulose particularly beneath; petioles to 13 mm. long; inflorescences lateral and solitary at several to many of the upper nodes, rather many-flowered; peduncles obsolete to about 3 cm. long, densely tomentulose; pedicels rather stout, 1-2 cm. long, densely white-tomentulose; flowers rather large; calyx lobes ovate-lanceolate, 6-7 mm. long, densely and minutely white-tomentulose; corolla reflexed-rotate, pale-green, the lobes 9-10 mm. long; gynostegium shortly stipitate, white or cream; column obconic, about 2 mm. long and 3.5 mm.

broad; hoods more or less broadly 2-lobed at the tip, subquadrate; horn about half-adnate, rather narrowly falciform, sharply incurved, somewhat longer than the hood; anther head truncately conic, about 3 mm. long and 4 mm. broad; follicles erect on deflexed pedicels, rather broadly fusiform and shortly apiculate, 7-9 cm. long, 15-25 mm. broad, finely tomentulose to glabrate; seeds broadly oval, about 11 mm. long, the pale-tawny coma about 25 mm. long. Sandy soil, spreading to roadsides, mostly in the Plains Country of n. Tex., s. to Galveston and Brewster cos., June-Sept.; from S.D. to Tex., w. to Colo., N.M. and Chih.

The characteristic broad 4 lobes of the hoods apparently consist of two marginal auricles, with the median lobe broadly retuse, as in the leaves.

17. *Asclepias latifolia* (Torr.) Raf. Herbaceous perennial; stems stout, simple or infrequently branching, 2-6 dm. tall, minutely tomentulose when very young, soon becoming glabrate; leaves opposite, very shortly petiolate, very broadly oval-obovate to obovate-subquadrate, broadly rounded and frequently somewhat retuse at apex, very broadly rounded and frequently somewhat cordate at base, 4-16 cm. long, 4-13 cm. broad, firmly membranaceous and somewhat coriaceous, concolorous and somewhat glaucous, minutely white-tomentulose generally when very young, soon glabrate; petioles about 5 mm. long; inflorescences lateral at several to numerous of the upper nodes, sessile or very shortly pedunculate, many-flowered; peduncles obsolete to 15 mm. long; pedicels rather slender, 2.5-3 cm. long, minutely white-tomentulose; flowers rather large; calyx lobes ovate-lanceolate, about 4 mm. long; corolla reflexed-rotate, pale-green, sometimes tinted purplish without, the lobes 11-12 mm. long; gynostegium shortly stipitate, greenish-white; column broadly obconic, about 2 mm. long and 3 mm. broad; hoods subquadrate, truncate or broadly retuse, about 4 mm. long; horn wholly adnate, very broadly falciform, sharply incurved, somewhat longer than the hood; anther head about 3 mm. long and 4 mm. broad, truncately conic; follicles erect on deflexed pedicels, broadly fusiform, shortly apiculate, 6-8 cm. long, 1.5-3 cm. broad, smooth, essentially glabrous; seeds oval, about 7 mm. long, the pale-tawny coma about 2 cm. long. Mixed prairies, badlands and high plains, spreading to roadsides and railways in w. and n.w. Tex., May-Sept.; from s.w. Neb. and Tex., w. to s. Ut. and s.e. Calif.

18. *Asclepias texana* Heller. Herbaceous perennial, becoming somewhat shrubby at the base after several years; stems slender, to 5 dm. tall, usually branching, inconspicuously pilosulose in decurrent lines from the nodes; leaves opposite, petiolate, broadly oval to narrowly oblong-elliptic, obtuse to acuminate at apex, obtuse or rarely attenuate at the base, 2-7 cm. long, to 35 mm. broad, thinly membranaceous, finely puberulent upon the midrib and veins beneath; petioles to 1 cm. long, minutely pilosulose; inflorescences solitary at the uppermost nodes, several- to many-flowered; peduncles slender, 1-2 cm. long; pedicels 1-1.3 cm. long, finely puberulent; flowers small; calyx lobes narrowly lanceolate, 1.5-2 mm. long, minutely puberulent; corolla reflexed-rotate, white, the lobes about 3 mm. long and widely spreading; gynostegium long-stipitate, white; column cylindric, about 1.5 mm. long and 0.7 mm. wide at the base; hoods cucullate, about 2 mm. long, rounded at the tip; horn basal, narrowly acicular, nearly twice as long as the hood, slightly incurved over the anther head; anther head about 2.5 mm. long; follicles erect on erect pedicels, narrowly fusiform, 9-12 cm. long, smooth, glabrous; seeds broadly oval, about 8 mm. long, the white coma about 2 cm. long. Canyons, arroyos and rocky hills in the Edwards Plateau and Trans-Pecos, May-Aug.; also n. Mex.

19. *Asclepias variegata* L. WHITE-FLOWERED MILKWEED. Herbaceous perennial from a fleshy fusiform rootstalk; stems rather slender, simple, 3-12 dm. tall, inconspicuously pilosulose in decurrent lines from the nodes; leaves opposite, petiolate, broadly oval, broadly rounded and apiculate to obtuse or broadly acute at apex, very broadly obtuse or rounded at base, 8-15 cm. long, 4-9 cm. broad, dark-green and glabrous above, glaucous and very sparsely pilosulose beneath; petioles 1-2 cm. long; inflorescences usually solitary and terminal, occasionally also lateral from very few of the uppermost nodes, rather many-flowered and very compactly hemispherical; peduncles rather slender, 1-7 cm. long; pedicels 1-3 cm. long; flowers rather large and showy; calyx lobes ovate, about 3 mm. long; corolla rotate, white, the lobes 7-8 mm. long; gynostegium white except for the purple column, shortly stipitate; column obconic, about 1.5 mm. long and 2-2.5 mm. broad; hoods cucullate, conduplicate and inflated, very broadly obovate, about

2.5 mm. long; horn adnate toward the base, falciform and sharply inflexed, much shorter than the hood; anther head about 2 mm. long and 3 mm. broad; follicles erect on deflexed pedicels, narrowly fusiform, gradually apiculate, 10-15 cm. long, 1.5-2 cm. thick, glaucous, minutely pilosulose; seeds oval, about 5 mm. long, the white coma 25-45 mm. long. *Biventaria variegata* (L.) Small. Thickets and open woods, usually in sandy or rocky soil in e. Tex., Apr.-July; from Conn., s. to n. Fla., s. Mo. and Tex.

One of the most beautiful of all milkweeds.

20. *Asclepias tomentosa* Ell. Herbaceous perennial; stems rather stout, simple or branching infrequently, 2-7 dm. tall, softly and rather inconspicuously appressed-puberulent; leaves opposite, petiolate, variable in outline and size, typically oblong or oval to oblong-lanceolate or obovate, usually obtuse to acute or rounded and somewhat retuse at apex, broadly acute to rounded at base, 4-9 cm. long, 1.5-5 cm. broad, firmly membranaceous, dark-green above, pale beneath, softly and generally puberulent particularly below; petioles about 1 cm. long; inflorescences lateral and solitary at several or numerous of the upper nodes, sessile or subsessile, several- to many-flowered; pedicels 1.5-2 cm. long, softly puberulent; flowers rather large; calyx lobes lanceolate, 3-6 mm. long; corolla pale-yellowish-green, somewhat flushed with orange without, the lobes 9-10 mm. long; gynostegium yellowish-cream, very shortly stipitate; column obconic, about 1.5 mm. long and 3 mm. broad; hoods obovate-subquadrate, truncate, about 4 mm. long; horn wholly adnate, falciform, sharply incurved, longer than the hood; anther head truncately conic, 3.5-4 mm. long and 5-6 mm. broad; follicles erect on deflexed pedicels, narrowly fusiform, 10-12 cm. long, about 1 cm. broad, smooth, softly puberulent to glabrate; seeds broadly oval, about 1 cm. long, the pale-tawny coma about 45 mm. long. Sandy soil in fields and pine barrens, in s.e. Tex., May-July; from N.C., s. to Fla. and Tex.

21. *Asclepias prostrata* Blackwell. Herbaceous perennial from thick woody crowns; stems prostrate, simple or branched near base, 1-4 dm. long, 1-2 mm. thick, conspicuously pilosulose distally, eventually glabrate; leaves opposite, pseudodistichous by twisting of stems, triangular to deltoid-lanceolate, 15-35 mm. long, 5-20 mm. broad, very shallowly cordate (proximal leaves) or truncate at base, acute (or the most proximal leaves obtuse) at apex, marginally entire and on drying crispate, membranous, firm, minutely pilose on both surfaces, grayish-green, dull; petioles 1-3 mm. long; umbels axillary, mostly 5-flowered; peduncles 5-12 mm. long, pilosulose; pedicels 1-2 cm. long, pilosulose; calyx lobes lanceolate, 4-5 mm. long, dorsally minutely pilosulose; corolla reflexed-rotate, greenish-white to rose-color; corolla lobes 12-15 mm. long, narrowly obovate or broadly oblanceolate; gynostegium long-stipitate, cream-colored suffused with rose-color; column conic, about 3.5 mm. long and 2 mm. broad; hoods obovate and slightly flabellate, 7-8 mm. long, narrowed below (above the midpoint) to a spongy-solid and somewhat laminate stipe, basally with laminate auricles; horn compressed-clavate, with an acicular horn inflexed over the anther head, slightly shorter than the hood and wholly adnate to it; anther head cylindrical, 4 mm. long and 4.5 mm. broad; follicles erect on deflexed pedicels, obliquely ellipsoid, about 55 mm. long and 2 cm. thick, verrucose and pubescent; seeds broadly oval, 7-8 mm. long, the white coma to 2 cm. long. In red sandy loam in the Rio Grande Plains in s. Tex., June-Aug.; also Tam.

22. *Asclepias rubra* L. Herbaceous perennial; stems rather slender, 4-10 dm. tall, simple, glabrous or very inconspicuously pilosulose in decurrent lines from the nodes; leaves opposite, sessile or subsessile, broadly ovate to narrowly lanceolate, acute to acuminate at apex, rounded to somewhat cordate at base, 5-16 cm. long, to 65 mm. broad, firmly membranaceous, glabrous, dark-green above, glaucous beneath; inflorescences terminal and lateral from the uppermost nodes, commonly paired when terminal, several- to many-flowered; peduncles 3-10 cm. long; pedicels 1-1.5 cm. long; flowers moderately large; calyx-lobes lance-trigonal, about 3 mm. long, glabrous; corolla reflexed-rotate, dull-red to purplish or lavender, the lobes 8-9 mm. long; gynostegium stipitate, usually pinkish-cream or purplish; column cylindrical, about 2 mm. long and broad; hoods lanceolate, acute, 6-7 mm. long; horn basal, narrowly acicular, somewhat shorter than the hoods, gradually arching over the anther head; anther head narrowly conic, about 3 mm. long and broad, with entire or very inconspicuously notched wings; follicles erect on deflexed pedicels, rather narrowly fusiform, 8-12 cm. long and 15 mm. thick, smooth, glabrous; seeds broadly oval, about 7 mm. long, the white coma about 4 cm. long. Bogs,

marshes, wet meadows and low pine barrens in e. Tex., May-Aug.; from N.J., s. to Ga., Ala., La. and Tex.

23. *Asclepias lanceolata* Walt. Herbaceous perennial from rather tuberous rootstalks; stems relatively slender, simple, 5-12 dm. tall, glabrous or essentially so; leaves opposite, linear-lanceolate, narrowly acuminate at apex, acute to obtuse at the base, 7-25 cm. long, to 17 mm. broad, firmly membranaceous, glabrous, somewhat glaucous beneath; inflorescences terminal, solitary or paired, few-flowered; peduncles 15-75 mm. long; pedicels 1-2 cm. long; flowers moderately large; calyx lobes lance-trigonal, 2.5-4 mm. long; corolla reflexed-rotate, dull-red, the lobes 9-10 mm. long; gynostegium stipitate, yellow, orange or reddish; column cylindrical, about 2 mm. long and 1.5 mm. broad; hoods broadly oblong, rounded at the tip, 5-6 mm. long; horn basal, narrowly acicular, somewhat shorter than the hood, arching over the anther head; anther head narrowly conic, about 3 mm. long and 2.5 mm. broad, the wings conspicuously spurred at the base; follicles erect on deflexed pedicels, narrowly fusiform, 8-10 cm. long, about 1 cm. thick, smooth, glabrous; seeds broadly oval, about 1 cm. long, the coma about 35 mm. long. Incl. var. *paupercula* (Michx.) Fern. Brackish to fresh marshes, wet pine barrens and low glades in s.e. Tex., May-Aug.; from s. N.J., s. to Fla. and w. to Tex.

24. *Asclepias quinqueidentata* Gray. Herbaceous perennial from rather deep tuberous rootstalks; stems relatively slender, simple above, branching rather cespitosely below, the basal branches usually dwarf and sterile, 1.5-3 dm. tall, minutely and generally puberulent, rarely glabrate; leaves opposite, sessile or subsessile, linear to filiform, 4-9 cm. long, 1-2 mm. broad, minutely and scatteringly pilosulose or puberulent; inflorescences subterminal from several of the uppermost nodes, few-flowered; peduncles rather slender, 1-8 cm. long; pedicels slender, 1.5-2 cm. long; flowers rather small; calyx lobes lance-trigonal, about 2 mm. long, minutely pilosulose to glabrate; corolla reflexed-rotate, pale-green, usually flushed with rose or purple without, the lobes 5-6 mm. long; gynostegium shortly stipitate, greenish-white; column narrowly obconic, about 1 mm. long and 1.5 mm. broad; hoods cylindrical-cucullate, sharply erose, about 3 mm. long; horns completely adnate to the hoods and about half longer than they, ascending and scarcely arching; anther head cylindrical, about 2 mm. long and broad; follicles erect on deflexed pedicels, narrowly fusiform, 7-10 cm. long, 5-8 mm. thick, smooth, minutely puberulent; seeds oval, 5-7 mm. long, the pale-tawny coma 3-4 cm. long. Rocky hills and arroyos in w. Tex., June-Aug.; from w. Tex. to s. Ariz. and n. Mex.

25. *Asclepias stenophylla* Gray. Herbaceous perennial from subnapiform tuberous rootstalks; stems rather slender, simple, to 8 dm. tall, very minutely puberulent to glabrate; leaves irregularly approximate, sessile, linear, 6-14 cm. long, 2-4 mm. broad, rather strictly ascending, firmly membranaceous, very minutely and scatteringly puberulent to glabrate; inflorescences lateral at few to several of the uppermost nodes, several-flowered, subsessile to very shortly pedunculate; peduncles obsolete to 1 cm. long, minutely puberulent; pedicels very slender, 5-8 mm. long, minutely puberulent; flowers rather small; calyx lobes lanceolate, 2-3 mm. long, minutely puberulent; corolla rotate, pale-greenish-white or yellow, the lobes about 6 mm. long; gynostegium sessile, pale-greenish cream-color or white; hoods saccate and strongly adnate to the column, conspicuously excurrent-auriculate at the base, oblong-elliptic, 3-4 mm. long, the tip deeply 2-lobed; horn or crest wholly adnate to form a third lower median lobe; anther head broadly truncate-conic, about 2 mm. long and broad; follicles erect on erect pedicels, very narrowly fusiform and gradually attenuate, 9-12 cm. long, about 7-8 mm. thick, minutely pilosulose to glabrate; seeds oval, 5-6 mm. long, the pale-tawny coma 3-3.5 cm. long. *Acerates angustifolia* (Nutt.) Dcne. Prairies and limestone glades, mainly in n.e. Tex., s. to Harris Co., June-Aug.; from s.w. Mo., w. to S.D., e. Colo. and Tex.

26. *Asclepias Engelmanniana* Woods. Herbaceous perennial; stems rather stout, simple or branching infrequently from the caudex, 6-12 dm. tall, glabrous or essentially so; leaves irregularly approximate, sessile, linear, 12-18 cm. long, 1.5-3 mm. broad, rather laxly spreading or reflexed, more or less canaliculate, firmly membranaceous or somewhat subsucculent, glabrous; inflorescences lateral from several to many of the upper nodes, many-flowered and very crowded, subsessile to shortly pedunculate; peduncles obsolete to about 2 cm. long, relatively stout, very inconspicuously appressed-puberulent; pedicels rather slender, about 1 cm. long, inconspicuously appressed-puberulent; flowers rather small; calyx lobes ovate-lanceolate, about 3 mm. long, essentially glabrous; corolla

reflexed-rotate, pale-green and more or less flushed with purple without, the lobes about 5 mm. long; gynostegium sessile; hoods deeply saccate and excurrently auriculate at the base, broadly truncate or broadly retuse at the tip, about 3 mm. long, without a horn; anther head depressed-spheric, about 2.5 mm. long and 3 mm. broad; follicles erect on deflexed pedicels, narrowly fusiform, gradually attenuate, 8-12 cm. long, about 15 mm. thick; seeds oval, about 7 mm. long, the pale-tawny coma about 3 cm. long. *Acerates auriculata* Engelm., *Asclepias auriculata* (Engelm.) Holz., not H.B.K. Prairies and swales, open sandy hillsides, draws, washes and bottoms in w. two thirds of Tex., e. to Hays Co., May-Sept.; from Neb., s. to Tex., Coah. and Ariz.

27. *Asclepias linearis* Scheele. Herbaceous perennial from rather short and superficial rootstalks; stems slender, 2-5 dm. tall, usually branching only at the base, inconspicuously pilosulose in decurrent lines from the nodes; leaves opposite, sessile or subsessile, linear, 3-9 cm. long, 1-4 mm. broad, membranaceous, glabrous or minutely puberulent along the midrib beneath; inflorescences solitary at several or many of the upper nodes, several-flowered; peduncles slender, 1-1.5 cm. long; pedicels 5-7 mm. long; flowers small; calyx lobes lance-trigonal, about 2 mm. long, minutely puberulent; corolla reflexed-rotate, greenish-white, the lobes 3-4 mm. long; gynostegium long-stipitate, white; column cylindrical, about 1 mm. long and 0.5 mm. broad; hoods cucullate, subquadrate, about 1.5 mm. long; horn basal, narrowly acicular, somewhat longer than the hood, gradually arching over the anther head; anther head about 1.5 mm. long and slightly narrower; follicles erect on erect pedicels, narrowly fusiform, 5-10 cm. long, smooth, glabrous; seeds broadly oval, about 5 mm. long, the white coma about 2 cm. long. *A. verticillata* var. *linearis* (Scheele) Pollard. Dry prairies in s. Tex., May-Nov.; endemic.

28. *Asclepias pumila* (Gray) Vail. Herbaceous perennial from rather deep rootstalks; stems cespitose from the crown, simple or branching infrequently below ground level, relatively slender, to 3 dm. tall, minutely puberulent generally; leaves spirally approximate and very crowded or the lowest occasionally verticillate, sessile, filiform and strictly ascending, 2-4 cm. long and about 1 mm. broad, usually strongly revolute, glabrous or essentially so; inflorescences subterminal, corymbosely clustered at the uppermost nodes, several-flowered; peduncles 1-1.5 cm. long; pedicels slender, about 1 cm. long; flowers small; calyx lobes lance-trigonal, about 1 mm. long, scatteringly pilosulose to nearly glabrous; corolla reflexed-rotate, white or faintly suffused with rose or yellowish-green, the lobes 2-3 mm. long; gynostegium narrowly stipitate, greenish-white; column cylindrical, about 1 mm. long and broad; hoods cucullate, broadly oval, about 1.5 mm. long; horn basal, narrowly acicular, almost twice longer than the hood and gradually arching over the anther head; anther head cylindrical, about 1.25 mm. long and 1 mm. broad; follicles erect on erect pedicels, narrowly fusiform, 4-8 cm. long, about 6 mm. broad; seeds broadly oval, 4-6 mm. long, the white coma about 25 mm. long. In sandy soil, mesquite prairies and limestone buttes in the High Plains of n.w. Tex., June-Sept.; from N.D., s. to Tex. and N.M., w. to Wyo.

This plant is known to be poisonous to livestock.

29. *Asclepias subverticillata* (Gray) Vail. Herbaceous perennial from rather stout woody rootstalks; stems to 12 dm. tall, almost invariably with sterile dwarf microphyllous branches, occasionally simple, more or less puberulent in decurrent lines from the nodes, occasionally quite glabrous; leaves predominantly 3 to 5 in whorls but occasionally opposite above on the flowering stems, shortly petiolate, linear, 2-13 cm. long, 1-4 mm. broad, membranaceous, glabrous to inconspicuously pilosulose, those of the sterile dwarf branches opposite and much-reduced and giving the plant a heterophyllous aspect; petioles 1-2 mm. long; inflorescences usually solitary at the upper nodes, rarely paired, several- to many-flowered; peduncle slender, 1.5-3 cm. long; pedicels slender, 5-8 mm. long; flowers relatively small; calyx lobes narrowly trigonal, 1.5-2 mm. long, inconspicuously pilosulose to glabrate; corolla reflexed-rotate, white, rarely slightly suffused with greenish-purple, the lobes 3-5 mm. long; gynostegium narrowly stipitate, white; column cylindrical, about 1 mm. long and slightly narrower; hoods cucullate, oval, about 1.5 mm. long; horn basal, narrowly acicular, somewhat longer than the hoods, gradually arching over the anther head; anther head cylindrical, about 1.5 mm. long and broad; follicles erect on erect pedicels, narrowly fusiform, 5-9 cm. long and 6-8 mm. thick, smooth, glabrous or inconspicuously pilosulose; seeds broadly oval, 7-8 mm. long, the white coma about 2 cm. long. *A. galioides* of Am. auth. Sandy and rocky plains and flats

in the w. half of Tex., especially in the Trans-Pecos, May-Sept.; from Tex., w. to Ut., Colo., Ariz. and n. Mex.

This plant is known to be very poisonous to livestock.

30. *Asclepias verticillata* L. Herbaceous perennial from rather short superficial root-stalks; stems slender, to 9 dm. tall, simple or rarely with short sterile branches, more or less puberulent in decurrent lines from the nodes, rarely glabrate; leaves chiefly 3 or 4 in whorls, rarely opposite in part, sessile or subsessile, linear, 1.5-7 cm. long, about 1.5 mm. broad, membranaceous, glabrous or essentially so, usually somewhat revolute; inflorescences solitary or paired at the upper nodes, few- to many-flowered; peduncles slender, 1.5-3 cm. long; pedicels slender, 6-8 mm. long; flowers small; calyx lobes narrowly trigonal, 1.5-2.5 mm. long, sparsely pilosulose to glabrous; corolla reflexed-rotate, greenish-white, occasionally somewhat flushed with purple without, the lobes about 3.5 mm. long; gynostegium narrowly stipitate, greenish-white; column narrowly cylindrical, about 1 mm. long and somewhat narrower; hoods cucullate, subquadrate, about 1.5 mm. long; horn basal, narrowly acicular, about twice as long as the hood and arching gradually over the anther head; anther head cylindrical, about 2 mm. long and somewhat narrower; follicles erect on erect pedicels, narrowly fusiform, 7-10 cm. long and 5-8 mm. thick, smooth, glabrous; seeds oval, about 5 mm. long, the white coma about 25 mm. long. Prairies, thickets, and open woods, usually in rather dry soil, also in dunes and spreading to roadsides and fence corners, in e. half of Tex., Apr.-Aug.; from e. Can., s. to Fla. and w. to N.D. and Tex.

31. *Asclepias involucrata* Torr. Low herbaceous perennial from woody subfusiform rootstalks; stems clustered from the rootstalk, ascending or more or less decumbent, rather slender, branching repeatedly, to 25 cm. long, minutely and generally puberulent; leaves irregularly approximate, sessile or subsessile, narrowly lanceolate, very narrowly acuminate at apex, acute to obtuse at base, to 12 cm. long and 1 cm. broad, firmly membranaceous and somewhat conduplicate, inconspicuously pilosulose particularly beneath; inflorescences terminal and usually also from the few uppermost nodes, sessile, several- to few-flowered; pedicels 15-25 mm. long, minutely puberulent; flowers rather small; calyx lobes ovate-lanceolate, 3-4 mm. long; corolla reflexed-rotate, pale-whitish-green or pink, tinged purple without, the lobes 5-7 mm. long; gynostegium shortly stipitate, white with purplish keels; column obconic, 1-1.5 mm. long and 1.5-2.5 mm. broad; hoods ovate, acute, 3-4 mm. long; horns adnate toward the base, falciform, incurved or ascending, about as long as the hood; anther head truncate-conic, about 2 mm. long and 3 mm. broad; follicles erect on deflexed pedicels, stoutly fusiform, shortly apiculate, 4-7 cm. long, 1.5-2 cm. broad, very inconspicuously pilosulose to glabrate; seeds oval, 6-8 mm. long, the pale-tawny coma 2-3 cm. long. Dry gravelly hills, prairie flats and arroyos in the High Plains, Apr.-May; from Tex. to Ariz. and adj. Ut., Colo. and Kan., also n. Mex.

32. *Asclepias brachystephana* Torr. Herbaceous perennial; stems clustered from the rootstalk, rather slender, branching repeatedly toward the base, 1-4 dm. tall, minutely tomentulose when young, soon becoming glabrate; leaves opposite, shortly petiolate, lanceolate to linear-lanceolate, narrowly acuminate at apex, acute to rounded at base, 6-12 cm. long, to 12 mm. broad, firmly membranaceous, more or less conduplicate, minutely white-tomentulous when young, soon becoming glabrate; petioles 3-10 mm. long; inflorescences lateral and solitary at the upper nodes, shortly pedunculate, several- to many-flowered; peduncles rather slender, to 3 cm. long, conspicuously white-tomentulose; pedicels very slender, 1-2 cm. long, conspicuously white-tomentulose; flowers rather small; calyx lobes ovate, about 2 mm. long, minutely puberulent; corolla reflexed-rotate, reddish-purple or violet, the lobes 5-6 mm. long; gynostegium sessile or subsessile, pale-rose or cream; hoods saccate, 1.5-2 mm. long, with very prominent marginal auricles somewhat longer than the broadly obtuse median lobe; horn adnate about midway, linguiform, somewhat longer than the hood; anther head truncately conic, about 2 mm. long and 3 mm. broad; follicles erect on deflexed pedicels, broadly fusiform, rather gradually apiculate, 6-9 cm. long, 1-2 cm. thick, minutely puberulent to glabrate, longitudinally striate; seeds oval, about 7 mm. long, the pale-tawny coma 2-3 cm. long. Sandy and rocky plains, dry flats, gullies and stream banks, spreading to fields and roadsides, often eaten by livestock on overgrazed range, in w. Edwards Plateau and Trans-Pecos, May-Sept.; from w. Tex. to Ariz., s. to cen. Mex.

33. *Asclepias longifolia* Michx. Herbaceous perennial from a stout rather tuberous rootstalk; stems rather slender, simple, 2-7 dm. tall, minutely pilosulose; leaves irregularly approximate, sessile or subsessile, linear-lanceolate, gradually acuminate at apex, attenuate at base, 6-18 cm. long, 2-10 mm. broad, minutely pilosulose to glabrate; inflorescences terminal and solitary and lateral from few of the uppermost nodes, several- to many-flowered, rather lax and hemispherical, pedunculate; peduncles slender, 2-6 cm. long, rarely obsolete, minutely pilosulose; pedicels very slender, 1.5-2 cm. long, minutely pilosulose; corolla reflexed-rotate, pale-greenish-white, liberally tinted with purple (particularly without), the lobes about 5 mm. long; gynostegium shortly but definitely stipitate, greenish-white tinted with purple below; column about 1.5 mm. long and 1 mm. broad; hoods deeply saccate, obovoid, about 2 mm. long, without a horn, much lower than the anther head; anther head about 1.5 mm. long and broad; follicles erect on deflexed pedicels, narrowly fusiform, long-attenuate, minutely pilosulose, 8-12 cm. long, about 1 cm. thick; seeds rather broadly oval, about 1 cm. long, the white coma about 35 mm. long. Flatwoods, swamps, savannahs and low pinelands in e. Tex., Apr.-July; from Del. to Fla. and w. to Tex.

34. *Asclepias curassavica* L. VEINTTUNILLA. Herbaceous annual; stems 3-12 dm. tall, frequently rather woody toward the base, simple or branched, minutely arachnid-tomentulose when young, soon glabrate; leaves opposite, petiolate, elliptic-lanceolate, acute to acuminate at apex, acute to obtuse at base, 5-12 cm. long, 1-3 cm. broad, minutely pilosulose when very young, soon glabrate, thinly membranaceous; petioles to 1 cm. long; inflorescences solitary at the upper nodes, several- to many-flowered; peduncles 3-6 cm. long; pedicels 1-2 cm. long; flowers rather large and showy; calyx lobes narrowly lanceolate, 2-3 mm. long; corolla reflexed-rotate, bright-crimson, rarely yellow or white, the lobes 5-10 mm. long; gynostegium long-stipitate, deep-yellow; column cylindric or conic, 2-3 mm. long and 1 mm. broad at the base; hoods cucullate, distinctly stipitate, broadly oblong, rounded at the tip, 3-5 mm. long; horn basal, narrowly acicular, 4-5 mm. long, slightly incurved over the anther head; anther head cylindrical, 2-3 mm. long, 1.5-2.5 mm. broad; follicles erect on erect pedicels, narrowly fusiform, 6-10 cm. long, smooth, glabrous; seeds broadly oval, 5-7 mm. long, the white coma 2-3 cm. long. In moist or wet soil in s. Tex., Apr.-Aug.; an almost ubiquitous waif of the trop. and subtrop. of Am., also widely introd. in the trop. of the Old World.

35. *Asclepias incarnata* L. SWAMP-MILKWEED. Herbaceous perennial from rather short and superficial rootstalks; stems usually fairly stout, 4-15 dm. tall, simple to copiously branched; leaves opposite or very rarely certain nodes condensed to form a false whorl, petiolate, ovate-elliptic to linear-lanceolate, acute to acuminate at apex, obtuse to somewhat cordate at base, 5-15 cm. long, to 4 cm. broad, membranaceous; petioles to 1 cm. long; inflorescences usually paired at the upper nodes, solitary below, several- to many-flowered; peduncles 1.5-7 cm. long; pedicels 1-1.5 cm. long; flowers rather small; calyx lobes linear-oblong, 1-1.5 mm. long, pilosulose; corolla bright-pink or rarely white, reflexed-rotate, the lobes 3-4 mm. long; gynostegium paler pink or rarely white; column cylindric, 1-1.5 mm. long, about 1 mm. wide; hoods cucullate, rounded at the tip, about 1.5 mm. long; internal horn narrowly acicular, slightly incurved over the stigma head, somewhat longer than the hood; anther head about 1.5 mm. long; follicles erect on erect pedicels, fusiform, long-attenuate, 7-9 cm. long, to 12 mm. thick, smooth, glabrous to generally pilosulose; seeds broadly oval, 7-10 mm. long, the white coma about 2 cm. long. In moist or wet soil about water-bodies and in marshes from the Plains Country to s.-cen. Tex., June-Oct.; from e. Can., s. to Fla. and w. to Ut. and N.M.

The following two phases of this species are found sympatrically in Texas.

1. Plant scatteringly and inconspicuously pubescent to essentially glabrous; stems usually repeatedly branching; leaves usually rather narrowly oblong- to linear-lanceolate, the apex gradually acuminate, the base obtuse to truncate, rather long-petiolate var. *incarnata*
(var. *longifolia* Gray).
1. Plant generally and conspicuously pubescent; stems simple or branching infrequently; leaves ovate- to broadly oblong-elliptic, the apex acute to abruptly acuminate, the base rounded to somewhat cordate, infrequently broadly obtuse, rather short-petiolate var. *pulchra* (Ehrh.) Fern.

36. *Asclepias perennis* Walt. Herbaceous perennial from rather short and superficial rootstalks; stems slender, 3-5 dm. tall, usually branching only from the base, very inconspicuously pilosulose in decurrent lines from the nodes or essentially glabrous; leaves opposite, elliptic-lanceolate to narrowly oblong or broadly oval to ovate-elliptic, acuminate at apex, attenuate at the base, 5-14 cm. long, to 15 mm. broad, thinly membranaceous, glabrous; petioles to 15 mm. long; inflorescences solitary at the uppermost nodes, several- to many-flowered; peduncles slender, 1-4 cm. long; pedicels 1-1.3 cm. long, usually somewhat suffused with purple; flowers small; calyx lobes oblong-elliptic, about 1 mm. long, sparsely and minutely pilosulose; corolla reflexed-rotate, white and usually suffused with pale-pink, the lobes 3-4 mm. long; gynostegium stipitate, white; column cylindric, about 1 mm. long and wide; hoods cucullate, rounded at the tip, about 2 mm. long, slightly longer than the anther head; horn basal, narrow-acicular, somewhat longer than the hoods, slightly arching over the anther head; follicles pendulous on deflexed peduncles, rather broadly ovoid-fusiform with a rather long apical beak, 4-7 cm. long, 1-2.5 cm. broad, smooth, glabrous; seeds broadly oval, about 15 mm. long, without a coma. Low swampy ground, frequently with bald cypress, alluvial woods, sloughs and ditches mostly in s.e. Tex., Apr.-Aug.; from S.C., s. to Fla. and w. to Tex., s. Mo., Ill. and s.w. Ind.

2. CYNANCHUM L.

Small to large twining vines, with anther, fruit and seed characters similar to those in *Asclepias*; leaves opposite; inflorescences axillary, abbreviated, few- to many-flowered; corolla funnelform to campanulate, white to yellowish or yellow-green, small; appendages of crown thin and flat, in one row.

About 150 species mostly in the warmer regions of both hemispheres.

1. Leaf blades 1 cm. or more wide, with cordate base (2)
1. Leaf blades less than 1 cm. wide, with narrowed to rounded-truncate base (3)
- 2(1). Peduncle mostly shorter than petiole of subtending leaf; appendages nearly as long as the corolla, deeply divided into linear segments (resembling staminodes) 1. *C. laeve*.
2. Peduncle about as long as or longer than petiole of subtending leaf; appendages less than two thirds as long as the corolla, broadly oblong with toothed or lobed summit 2. *C. unifarium*.
- 3(1). Flowers rather numerous, terminating naked peduncles longer than the pedicels; corolla lobes glabrous within; leaf blades narrowly linear to linear-lanceolate, the larger ones 4-9 cm. long 3. *C. angustifolium*.
3. Flowers solitary or few, peduncles very short or absent; corolla lobes pilose or pubescent within; leaf blades lanceolate to oblong-elliptic, 1-4 cm. long (4)
- 4(3). Corolla lobes minutely puberulent within; appendages narrowly lanceolate to ovate and acuminate, slightly longer than the stamen column 4. *C. Maccartii*.
4. Corolla lobes conspicuously pilose within; appendages linear-lanceolate to linear-filiform, 1.5 to 2 times as long as the stamen column (5)
- 5(4). Corolla 3.6-5.2 mm. long 5. *C. barbigerum* var. *barbigerum*.
5. Corolla 2.8-3.2 mm. long 5. *C. barbigerum* var. *breviflorum*.

1. *Cynanchum laeve* (Michx.) Pers. BLUE-VINE, SAND-VINE. Twining vine to 3 m. long or more, glabrescent or somewhat puberulent; leaves with a petiole to 45 mm. long, triangular-lanceolate to deltoid, to 8 cm. long and 5 cm. wide, deeply cordate with the rounded basal lobes separated by a wide sinus, acute to shortly acuminate at apex; flowers white, sweet-scented, in peduncled umbelliform clusters or abbreviated racemes in axils of the leaves; peduncle mostly shorter than petiole of subtending leaf; sepals ovate-elliptic, with scarious margins, puberulent, about 2 mm. long; corolla about 6 mm.

long; appendages nearly or about as long as the corolla, deeply divided into linear segments; follicles slender, lanceolate in outline, smooth, somewhat angled, to 15 cm. long and 3 cm. thick. *Enslentia albida* Nutt., *Ampelamus albidus* (Nutt.) Britt. In silty clay or sand in low moist woods or fields, often weedy and climbing on shrubs or fences, from n.-cen. to the coast in s.-cen. Tex., Aug.-Sept.; from Pa. to Ind., Mo. and Kan., s. to Ga. and Tex.

2. *Cynanchum unifarium* (Scheele) Woods. TALAYOTE. Twining vine to 3 m. or more long, glabrescent or sparsely puberulent; leaves with petioles to 5 cm. long, broadly ovate to ovate-lanceolate or triangular-lanceolate, to 9 cm. long and 7 cm. wide, deeply cordate with the rounded basal lobes separated by a wide sinus, abruptly acute to long-acuminate at apex; flowers cream-color or greenish-white, in racemes in the axils of the leaves; peduncle usually about as long as or longer than petiole of subtending leaf; sepals elliptic-lanceolate, acute, about 2.5 mm. long and 1 mm. wide, puberulent; petals fleshy, somewhat dilated on each side near the strongly recurved apex, obtuse, about 3.5 mm. long and 1.3 mm. wide; appendages oblong-quadrate, usually 3-lobulate at apex; follicle lanceolate in outline, smooth, to 1 dm. long and 25 mm. thick. *Rouliniella unifaria* (Scheele) Vail, *Cynanchum Palmeri* (Wats.) Blake, *C. Watsonianum* Woods. In scrub forests and thickets, climbing over trees and shrubs, mainly on the Edwards Plateau and in the Rio Grande Plains and Trans-Pecos, May-Oct.; also n.e. Mex.

3. *Cynanchum angustifolium* Pers. Vine slender, glabrous, somewhat succulent, twining, to 1 m. or more long; leaves short-petioled, narrowly linear, acute, to 8 cm. long and 5 mm. wide; peduncles slender, mostly shorter than the leaves; cymes several-flowered; calyx 2-2.5 mm. long, the lobes ovate-lanceolate to lanceolate and acute; corolla purplish or greenish-white, 6-8 mm. broad, the lobes ovate and acuminate; crown lobes 1.5-2 mm. long, retuse; follicles slender, to 7 cm. long and 5 mm. thick. *Lyonia palustris* (Pursh) Small, *Seutera palustris* (Pursh) Vail, *Cynanchum palustre* (Pursh) Heller. Climbing over shrubs and herbs in and on the edge of salt marshes and in moist sandy soils, local along the Gulf Coast, May-Aug.; from N.C. to Fla. and Tex.; also Bah. I. and W.I.

4. *Cynanchum Maccartii* Shinnars. Twining glabrous much-branched vine; leaves shortly petiolate, linear to linear-lanceolate, acute to acuminate at apex, cuneate or sometimes rounded at base, dark-green above, pale-green beneath, to 5 cm. long and 1 cm. wide, usually less than 3 cm. long and 5 mm. wide; corymbs nearly sessile, to 10-flowered; pedicels 3 mm. long or less; calyx lobes less than 1 mm. long, acutish; corolla fleshy-thickened, greenish-white or cream-colored, about 2 mm. long, open-campanulate; corolla lobes linear-oblong, acutish, strongly recurved, densely puberulent on inner surface; appendages narrowly lanceolate to ovate-lanceolate, longer than the stamen column; follicles slender, smooth, to about 4 cm. long. *Metastelma Palmeri* Wats., non *C. Palmeri* (Wats.) Blake. On rocky bluffs and in pasturelands in the Rio Grande Plains and on the Edwards Plateau, May-Oct.; also n.e. Mex.

5. *Cynanchum barbigerum* (Scheele) Shinnars. Glabrous or sparsely puberulent intricately twining vine; stems wiry, much-branched; leaves with slender petioles to 8 mm. long, subcoriaceous, linear to linear-oblong or elliptic-lanceolate, obtuse-apiculate to acute or acuminate at apex, broadly rounded at base, in drying with somewhat revolute margins, to 5 cm. long and 12 mm. wide, usually much smaller; corymbs subsessile or on a peduncle to 1 cm. long, as many as 5-flowered; pedicel 3-4 mm. long, subtended by a minute bract; calyx lobes ovate, about 1 mm. long, glabrous; corolla fleshy-thickened, white or creamy-white, open-campanulate, 2.8-5.2 mm. long, lobed to near base; corolla lobes linear to linear-lanceolate, strongly recurved above middle, glabrous on outer surface, densely long-pilose on inner surface; appendages linear-lanceolate to linear-filiform, as much as twice as long as stamen column; follicle smooth, narrowly lanceolate in outline, long-attenuate, to 5 cm. long. *Metastelma barbigerum* Scheele. Trailing over boulders and climbing on herbs and shrubs in open woodlands and on open slopes on the Edwards Plateau and in the Rio Grande Valley, w. to the Trans-Pecos, Mar.-July; also n.e. Mex.

The var. *breviflorum* Shinnars differs from var. *barbigerum* solely in its smaller flowers, as shown in the key.

3. SARCOSTEMMA R. BR.¹⁵²

Suffrutescent dextrorsely twining or trailing vines, the stem simple to much-branched; leaves usually laminate, sometimes reduced to scales, usually with one or more glands on the ventral surface of the midrib at the base; stipules minute; inflorescences extra-axillary, umbelliform (in ours), terminating a naked peduncle; calyx 5-lobed nearly to the base, adnate to the corolla; usually with 1 to many alternate or indefinitely distributed squamellae within; corolla 5-lobed, rotate-subcampanulate; stamens 5, the filaments coherent to form a column, usually produced at their insertion upon the corolla to form a patelliform crown-ring often completely adnate to the corolla or to the filaments directly below the anthers, each filament bearing an inflated vesicular segment (crown-vesicle) directly below the anther; anthers 2-celled, the membranous dorsal appendage ovate to deltoid; follicle fusiform to obclavate; seeds unequally biconvex or flattened, with a micropylar coma.

A world-wide genus of about 10 species.

1. Stems rather densely puberulent with curved-appressed hairs; leaves typically with crisped margins, often purple-tinged; sepals narrowly lanceolate, usually more than 3 times as long as wide 1. *S. crispum*.
1. Stems glabrescent to densely pilose; leaves with entire margins, green; sepals ovate to lanceolate, usually less than 3 times as long as wide (2)
- 2(1). Stems usually densely pilose with spreading hairs; sepals 4-6 mm. long, pubescent on both surfaces 2. *S. Torreyi*.
2. Stems glabrescent or only sparsely puberulent with curved-appressed hairs; sepals 2-3 mm. long, pubescent on back only (3)
- 3(2). Leaf blades broadly to narrowly ovate-lanceolate to triangular-lanceolate, cordate at base, mostly less than 3 times as long as wide ... 3. *S. cyanchooides* var. *cyanchooides*.
3. Leaf blades linear-lanceolate to linear, hastate to rounded-cuneate at base, usually much more than 3 times as long as wide 3. *S. cyanchooides* var. *Hartwegii*.

1. *Sarcostemma crispum* Benth. Stems twining or trailing, green or gray, rather densely puberulent with curved-appressed hairs, simple or sparsely branched; leaves with petioles to 8 mm. long, narrowly lanceolate to linear, acuminate at apex, cordate to hastate or truncate at base, usually strikingly undulate-crispate or rarely not crispate, to 1 dm. long and 3 cm. wide, subcoriaceous, puberulent; inflorescences umbelliform, as many as 7-flowered; peduncle to 3 cm. long, shorter than the subtending leaves; bracts linear, minute; pedicels to 2 cm. long; calyx lobes narrowly lanceolate, 3-6 mm. long, copiously puberulent on both surfaces; squamellae solitary or rarely paired; corolla rotate-subcampanulate, greenish-purple without, purple within, the tube 1 mm. long; corolla lobes ovate-elliptic, obtuse, to about 1 cm. long, puberulent without, glabrous within, irregularly short-ciliate; ring of the crown thin, revolute, scarcely adnate to the column; follicles narrowly fusiform, long-attenuate, to 12 cm. long and 2 cm. thick, puberulent, finely striate. *Philibertella crispa* (Benth.) Vail, *Funastrum crispum* (Benth.) Schltr. In rocky soils on hills and on open-wooded slopes, often trailing over shrubs, in cen. and w. Tex., May-Aug.; from Colo. through Tex., N.M. and s. Ariz. to cen. Mex.

2. *Sarcostemma Torreyi* (Gray) Woods. Stems twining or trailing, gray or green, densely pilose with spreading hairs, sparsely branched; leaves with petioles to 15 mm. long, triangular-lanceolate, acute to acuminate at apex, cordate at base with the lobes descending, to 4 cm. long and 25 mm. wide below middle, subcoriaceous, densely pilose on both surfaces, with one or more glands on the midrib at the base; inflorescences umbelliform, as many as 10-flowered; peduncle to 35 mm. long, pilose; bracts linear, 1-2 mm. long; pedicels to 16 mm. long, pilose; calyx lobes ovate-lanceolate, 4-6 mm. long, puberulent on both surfaces; squamellae solitary or rarely paired; corolla rotate-subcampanulate, cream-colored with a purple spot at the base and a median purple spot on each lobe; corolla lobes ovate, acute, to about 1 cm. long, minutely puberulent without,

¹⁵² Adapted partly from R. W. Holm in Ann. Missouri Bot. Gard. 37:447-560. 1950.

glabrate within, fimbriate-ciliate; ring of the crown fleshy, adnate to the base of the crown-vesicles that are 2.5 mm. long; follicles fusiform, long-attenuate, about 8 cm. long and 12 mm. thick, pilose, finely striate. *Philibertella Torreyi* (Gray) Vail, *Funastrum Torreyi* (Gray) Schltr. On dry hillsides and scrubby woodland associations in the Chisos Mts. of the Trans-Pecos, May-Aug.; also in n. Mex.

3. *Sarcostemma cynanchoides* Dcne. Stems twining or trailing to 1 m. or more long, much-branched, glabrous to sparsely puberulent; leaves with petioles to 2 cm. long, broadly to narrowly ovate-lanceolate to triangular-lanceolate or linear to linear-lanceolate, acute to acuminate at apex, cordate to hastate or rounded-cuneate at base, to 6 cm. long and 35 mm. wide; thin-membranaceous, sparsely puberulent on both surfaces, with one or more glands on the midrib at the base; inflorescences umbelliform, as many as 20-flowered; peduncle slender, to 55 mm. long; bracts linear, minute; pedicels slender, to 17 mm. long; calyx lobes ovate to ovate-linear, 2-3 mm. long, pilosulose without, glabrous within; squamellae absent to solitary or paired; corolla rotate-subcampanulate, greenish-white to purple or pinkish, the tube 1-2 mm. long; corolla lobes ovate, acute to acuminate, 5-7 mm. long, glabrous within, fimbriate-ciliate; ring of the crown thin, revolute, not adnate to the base of the crown-vesicles that are 1.5 mm. long; follicles fusiform, to 7 cm. long, lanceolate in outline, attenuate above, puberulent. In sandy or rocky soils, usually climbing on shrubs, in the w. half of Tex., Apr.-Aug.; from Okla. and Tex., w. to Ut. and Calif., s. to cen. Mex.

Var. *cynanchoides* [*Funastrum cynanchoides* (Dcne.) Schltr., *Philibertella cynanchoides* (Dcne.) Vail] is widespread in the western half of Texas and it typically has broadly triangular-lanceolate leaves, whereas var. *Hartwegii* (Vail) Shinnars (*S. heterophyllum* of auth.), with linear to linear-lanceolate leaves, occurs only in the Trans-Pecos. Few specimens have been seen that are intermediate between these two varieties. The flowers of var. *cynanchoides* are also usually greenish-white while those of var. *Hartwegii* are usually purplish or pinkish.

4. MATELEA AUBL.

Herbaceous perennials or shrubby plants with slender simple or branched usually twining stems; leaves opposite, cordate, petiolate; flowers 5-merous, few to many in pairs or in pedunculate to sessile umbellate clusters that arise between the petioles; calyx commonly somewhat glandular within; corolla greenish to dark-purple, sometimes noticeably reticulate-veined, rotate to campanulate, sometimes spreading-reflexed, the lobes convolute in bud; crown typically small, annular or cupuliform, in the throat of the corolla; anthers partly hidden under the flattened stigma, openly transverse; follicle turgid, smooth or mostly muricate with soft warty processes, sometimes angular; seed with a coma.

A genus of about 130 species that are native to warm temperate and tropical regions of the Western Hemisphere.

1. Stems prostrate to suberect, not at all twining (2)
1. Stems twining, at least toward tips (5)
- 2(1). Peduncles absent (pedicels attached directly in leaf axils); stamen column with a single lobed fleshy disk around base (3)
2. Peduncles well-developed; stamen column surrounded by a double row of thin appendages (4)
- 3(2). Pedicels shorter than or equaling the adjacent petioles; corolla usually densely pubescent on inner surface1. *M. biflora*.
3. Pedicels (except lowest) exceeding the adjacent petioles; corolla glabrous on inner surface2. *M. cynanchoides*.
- 4(2). Outer appendages wider than long, slightly shorter to slightly longer than the stamen column, truncate to shallowly 3-lobed at summit3. *M. brevicoronata*.
4. Outer appendages longer than wide, slightly to much longer than the stamen column, prominently 2-pronged or 2-pointed at summit or rarely some of them single-pointed4. *M. parviflora*.

- 5(1). Flowers at middle and upper leaf axils on peduncles shorter than the pedicels or without peduncles; plants small, semitrailing or low-climbing (6)
- 5. Flowers all on elongate peduncles; medium to large climbing vines (10)
- 6(5). Corolla 3-4 mm. long 5. *M. parvifolia*.
- 6. Corolla 6-13 mm. long (7)
- 7(6). Peduncles present except in uppermost leaf axils, 1- to 5-flowered; corolla broadly campanulate or tubular on lower half (8)
- 7. Peduncles absent or essentially so; flowers solitary or paired, short-pedicelled; corolla rotate, not tubular (9)
- 8(7). Corolla more than 7 mm. long, the lobes glabrous on inner surface; crown usually shorter than stamen column, shallowly 5-lobed at most 8. *M. producta*.
- 8. Corolla 6-7 mm. long, the lobes densely pubescent on inner surface; crown at least twice as long as stamen column, deeply 5-lobed 9. *M. texensis*.
- 9(7). Crown (appendage around stamen column) saucer-shaped, fleshy-thickened, entire to shallowly 5-lobed 6. *M. sagittifolia*.
- 9. Crown deeply 5-parted, the thin oblong-quadrate appendages about 2 mm. long 7. *M. radiata*.
- 10(5). Corolla with tubular lower half 8. *M. producta*.
- 10. Corolla with a campanulate base or completely rotate (11)
- 11(10). Corolla lobes oblong-lanceolate to linear, not reticulate-veined (12)
- 11. Corolla lobes ovate to oval, conspicuously reticulate-veined on at least part of upper surface (13)
- 12(11). Peduncle and pedicels subequal in length; sepals glabrous or very sparsely ciliate at apex; plants not glandular 10. *M. gonocarpa*.
- 12. Peduncle much longer than the pedicels; sepals both hispid and short-pubescent; plants glandular 11. *M. decipiens*.
- 13(11). Plant invested by both long spreading hairs and short glandular-puberulence; peduncle longer than the subtending petiole; corolla glabrous on inner surface 12. *M. reticulata*.
- 13. Plant sparsely invested only with short curved hairs; peduncle shorter than the subtending petiole; corolla densely puberulent on inner surface 13. *M. edwardsensis*.

1. *Matelea biflora* (Raf.) Woods. Plant spreading-pilose and glanduliferous throughout; stems several from a thickened rootstock, simple or sparsely branched; leaves with petioles to 25 mm. long, suborbicular-ovate to broadly triangular-ovate, subtruncate to deeply cordate at base, broadly obtuse to acute at apex, to 5 cm. long and 3 cm. wide; flowers borne in pairs in axil of leaf, without a peduncle; pedicel to 1 cm. long; calyx lobes ovate, about 3 mm. long; corolla rotate, reddish-purple to dark-brown, about 13 mm. in diameter, lobed to near base; corolla lobes elliptic-oblong, obtuse, densely white-pubescent on the inner surface; stamen column with a single lobed fleshy disk around base; follicle muricate, ellipsoid, to 1 dm. long and 25 mm. thick. *Vincetoxicum biflorum* (Raf.) Heller. In clayey, rocky or sandy soils in grasslands and open woodlands in n.-cen. Tex., s. to e. Edwards Plateau and n.w. to the South Plains, Mar.-June; also Okla.

2. *Matelea cynanchoides* (Engelm.) Woods. Plant spreading-pilose and more or less glanduliferous throughout, malodorous; stems several from a thickened rootstock, simple or sparsely branched, ascending or spreading; leaves subsessile or with a petiole to 1 cm. long, suborbicular-ovate to broadly ovate-lanceolate, shallowly to deeply cordate at base, rounded to acute at apex, to 45 mm. long and 4 cm. wide; flowers borne in pairs in axil of leaf, without a peduncle; pedicel to 1 cm. long; calyx lobes ovate to elliptic, about 3 mm. long; corolla rotate, brownish to dark-maroon, 8-12 mm. in diameter, lobed to near base; corolla lobes ovate to ovate-elliptic, obtuse, marginate, pubescent to glabrescent on dull outer surface, glabrous and vernicose-appearing on inner surface; stamen column with a single lobed fleshy disk around base; follicle ellipsoid, more or less muricate, to 8 cm.

long and 25 mm. thick. *Vincetoxicum cynanchoides* (Engelm.) Heller. In sandy soil mostly in open woodlands in n.e. Tex., s. to the Gulf Coast and w. to the South Plains, Apr.-Aug.; also Okla.

3. *Matelea brevicoronata* (Robins.) Woods. Plant shaggy white-pubescent throughout with spreading or crinkly hairs; stems several from a slender-thickened rootstock, simple or very sparsely branched, spreading-prostrate; leaves subsessile or with petioles to 1 cm. long, suborbicular-ovate to ovate-lanceolate, truncate to broadly rounded or rarely shallowly cordate at base, acute to shortly acuminate at apex, to 4 cm. long and 3 cm. wide; peduncle slender, to 8 cm. long, supporting one or more clusters of small greenish flowers; pedicel less than 5 mm. long, subtended by a linear bract about 2 mm. long; calyx lobes linear-oblong, obtuse, about 2.5 mm. long; corolla rotate, lobed to near base; corolla lobes distinctly marginate, pubescent over the entire surface or sometimes glabrous, ovate-elliptic, obtuse, mostly wide-spreading, 3-4 mm. long, 1.5-2 mm. wide; outer appendages about as long as the stamen column; follicles ovoid-ellipsoid, to 7 cm. long and 3 cm. thick. *Gonolobus parviflorus* var. *brevicoronatus* Robins., *Vincetoxicum brevicoronatum* (Robins.) Vail. In sandy or gravelly soils in fields and open woodlands in the lower Rio Grande Plains, Mar.-Oct.; apparently endemic.

This species is represented by two distinct variants. Plants found in red sands in Webb County differ from those found elsewhere in having smaller, less pubescent, leaves, and corollas that are completely glabrous on the inner surface. With further study it may become necessary to segregate this plant as a separate entity.

4. *Matelea parviflora* (Torr.) Woods. Plant more or less white-pilose throughout with spreading hairs, malodorous; stems several from a thickened rootstock, simple or sparsely branched, prostrate-spreading; leaves with a petiole to 15 mm. long, suborbicular-ovate to broadly ovate-lanceolate, broadly rounded to truncate or shallowly cordate at base, broadly obtuse to acute at apex, to 55 mm. long and about as broad; peduncle slender, to 7 cm. long, supporting an interrupted raceme or several scattered clusters of small greenish flowers; pedicels to 5 mm. long; calyx lobes linear-oblong to elliptic-lanceolate, obtuse, 2-3 mm. long; corolla lobed to near base; corolla lobes ovate to linear-oblong or elliptic, obtuse, strongly reflexed, distinctly marginate, puberulent only at very base on inner surface, 3-5 mm. long; outer appendages exceeding the stamen column; follicles ellipsoid, puberulent, more or less muricate, to 9 cm. long and 2 cm. thick. *Vincetoxicum parviflorum* (Torr.) Heller. In sandy soil in prairies, mesquite plains and in open woodlands in the Rio Grande Plains, Mar.-Aug.; apparently endemic.

5. *Matelea parvifolia* (Torr.) Woods. Viny shrub with twining stems to 4 dm. long or more, more or less puberulent throughout with minute recurved hairs; leaves with slender petioles to 15 mm. long, deep-green, subcoriaceous, triangular-ovate to narrowly triangular-lanceolate, truncate to cordate or hastate at base, obtuse to acute at apex, to 23 mm. long and 18 mm. wide near base; flowers solitary or sometimes 2 in the leaf axils, short-pedicelled; calyx lobes about 1.5 mm. long; corolla reddish-black to dark-purple, deeply lobed, rotate; corolla lobes ovate, obtuse, spreading, 3-4 mm. long, white-puberulent below middle on inner surface; the fleshy 5 lobes of crown ovate, shorter than the stamen column; follicles puberulent, smooth to sparsely muricate, lanceolate in outline, attenuate, 5-7 cm. long. *Gonolobus parvifolius* Torr. On rocky ledges and slopes in the Trans-Pecos, Jan.-Apr.; from w. Tex. to Calif. and n. Mex.

6. *Matelea sagittifolia* (Gray) Woods. Viny shrub with twining stems to 3 dm. long or more, subglabrous to somewhat sparsely puberulent throughout with minute recurved-appressed hairs; leaves with petioles to 5 mm. long, subcoriaceous, narrowly to broadly triangular-lanceolate, cordate-sagittate at base, acute at apex, to 18 mm. long and 6 mm. wide across base; flowers one or two in the leaf axils, short-pedicelled; calyx lobes linear to linear-lanceolate, obtuse, 2.5-3 mm. long; corolla greenish, deeply lobed to near base; corolla lobes scarcely spreading, linear to linear-spatulate, obtuse to rounded at apex, 7-10 mm. long, 1.5-1.8 mm. wide; crown saucer-shaped, entire to very shallowly and inconspicuously 5-lobed; follicles not seen. *M. Woodsonii* Shinnery, *Gonolobus sagittifolius* Gray. In sandy and rocky areas in grasslands and open woodlands, rare in the Rio Grande Plains, Edwards Plateau and Trans-Pecos, Mar.-May; endemic.

7. *Matelea radiata* Correll. Slender twining vine; stem puberulent with appressed hairs; leaves opposite, with a slender puberulent petiole 5 mm. long or less, narrowly triangular-

lanceolate, thickish, shallowly sagittate to subcordate at the base, acute at apex, to 22 mm. long and 7 mm. wide at base, sparsely puberulent to essentially glabrous, the margins somewhat revolute; flower solitary in leaf axils, commonly with a second flower aborted in bud, on a much-abbreviated combined peduncle-pedicel that is shorter than the subtending petiole; sepals triangular-lanceolate, acute at apex, very sparsely puberulent on the outer surface, about 2.5 mm. long; corolla rotate; apparently reddish-brown, glabrous; corolla lobes united near base, spreading-radiate, linear-oblong, obtuse at apex, about 7 mm. long (to base) and 2 mm. wide; appendages of crown about 2 mm. long, oblong-quadrate, broadly concave-emarginate at the truncate apex, with a flangelike keel arising at the base on the ventral surface and often extended to well above the middle; fruit unknown. Known only from the Rio Grande Plains, June-July; endemic.

8. *Matelea producta* (Torr.) Woods. Intricately twining vine, malodorous, usually more or less pubescent or puberulent and somewhat glandular throughout; stems several from a thickened rootstock, mostly simple; leaves with petioles to 35 mm. long, triangular-ovate to triangular-lanceolate, deeply cordate at base to form a broad sinus, rather abruptly contracted above into an acuminate-attenuate apex, pubescent to subglabrous, to 9 cm. long and 5 cm. wide; peduncle axillary, usually shorter than the petiole of subtending leaf, rarely to 5 cm. long, supporting as many as 5 clustered flowers; calyx lobes ovate-elliptic to lanceolate, subobtuse to acute, pubescent, to about 6 mm. long; corolla greenish or brownish, to 13 mm. long, pubescent on outer surface, 5-lobed to about the middle; corolla lobes oblong-elliptic, obtuse, about 2.5 mm. wide; crown saucer-shaped, about equal to or shorter than the stamen column, subentire to very shallowly 5-lobed, the lobes with blunt ligules on their inner surface; follicles ellipsoid, smooth, glabrous, to 1 dm. long and 2 cm. thick. In rocky open soil, usually twining on other plants, in the Trans-Pecos, May-Sept.; from w. Tex. to s. Ariz. and n. Mex.

9. *Matelea texensis* Correll. Intricately twining vine, densely short-pubescent and more or less glandular throughout; stems several from a slender-thickened rootstock, simple, to at least 5 dm. long; leaves with petioles to 15 mm. long, broadly ovate to triangular-lanceolate, deeply cordate at base, abruptly contracted above into an acuminate-attenuate apex, to 45 mm. long and 25 mm. wide; flowers several, clustered on an axillary peduncle that is about as long as the pedicels; calyx lobes linear-lanceolate, acute, 2-3 mm. long; corolla campanulate, 6-7 mm. long, deeply 5-lobed to below the middle; corolla lobes linear-oblong to linear-lanceolate, obtuse to subacute, strongly recurved, about 1.5 mm. wide, densely hairy on their inner surface; crown about 2 mm. high, twice as long as the stamen column, deeply lobed into 5 rounded appendages, the appendages with a linear deflexed ligule on their inner surface; follicles unknown. Rare in the Trans-Pecos, in igneous soils, June-Aug.; endemic.

10. *Matelea gonocarpa* (Walt.) Shinnery. Stems pubescent with spreading hairs, wiry, twining; leaves with slender spreading-pubescent petioles that exceed the axillary inflorescences, usually ovate-elliptic to oblong-quadrate, to 15 cm. long and 1 dm. wide, pale on lower surface, cordate at base with the sinus usually narrow, abruptly acute to short-acuminate at apex; flowers numerous in an umbelliform cluster on a peduncle about as long as the pedicels, in bud conical and somewhat twisted; calyx lobes glabrous or only ciliate at apex, lanceolate, 3-4 mm. long; corolla brownish-purple to greenish-purple, lobed to near base; corolla lobes spreading, linear-lanceolate, obtuse to subacute, glabrous, to 14 mm. long; crown nearly rotate, much shorter than the stamen column, coarsely toothed around the margin; follicles glabrous, sharply angled, to 12 cm. long. *Vincetoxicum gonocarpum* Walt., *Gonolobus gonocarpos* (Walt.) Perry. High-climbing on trees and shrubs mostly along wooded streams and in thickets in e. half of Tex., May-July; from s.e. Va. to s. Mo., s. to Fla. and Tex.

11. *Matelea decipiens* (Alex.) Woods. Plant more or less pubescent with spreading hairs and glandular-puberulence throughout; stems stout, twining; leaves with stout petioles that are subequal to the axillary inflorescences, broadly ovate to subrotund, cordate at base with a narrow rounded sinus, abruptly acute to short-acuminate at the apex, to 15 cm. long and wide; flowers numerous in short-branched umbelliform clusters on a peduncle that is much longer than the pedicels; calyx lobes ovate-lanceolate to lanceolate, about 3 mm. long, pubescent throughout; corolla brownish-purple, lobed to near base, in bud conical; corolla lobes linear-oblong to linear-lanceolate, sometimes

widest above middle, to 15 mm. long, glabrous to puberulent on inner surface; crown thin-textured, more or less marginally erose-toothed, about as long as the stamen column; follicle angular. *Gonolobus decipiens* (Alex.) Perry. In sandy soils in open woodlands in e. Tex., Apr.-June; from S.C. to La., Tex., Okla. and Mo.

12. *Matelea reticulata* (Gray) Woods. Twining vine; stems slender, wiry, adorned with long spreading hairs and a short glandular-puberulence; leaves opposite, with a stoutish spreading-pubescent and glandular petiole to 55 (usually about 30) mm. long, orbicular-ovate to ovate, deeply cordate at base with the lobes often incurved, acute to short-acuminate at apex, to 11 cm. long and 8 cm. wide; peduncle usually about as long as or exceeding the subtending petiole, spreading-pubescent and glandular, supporting a few-flowered umbelliform inflorescence; calyx lobes ovate-lanceolate, acuminate, 3-4 mm. long, long-pubescent; corolla rotate, greenish, reticulate-veined throughout, glabrous on inner surface, lobed to well below the middle, 1-1.5 cm. across; corolla lobes rhombic-ovate to broadly obovate, rounded at apex; stamen column about 1.5 mm. long, the crown shallow; follicle sparingly muricate, lanceolate in outline, to 15 cm. long, brownish. *Vincetoxicum reticulatum* (Gray) Heller. In sandy or rocky soil in open woodlands, along fencerows and in thickets, climbing on other plants, in cen., s. and w. Tex., Apr.-Oct.; also n.e. Mex.

13. *Matelea edwardsensis* Cortell. PLATEAU MILKVINE. Twining vine; stem slender, sparsely short-pubescent with curved or appressed hairs; leaves opposite, sparsely short-pubescent; petioles slender, to 6 cm. long; blade thin, ovate, deeply cordate at the base with the lobes incurved and the sinus truncate to subtruncate at its base across the petiole, acute to abruptly short-acuminate at apex, to 75 mm. long and 7 cm. wide, dark-green on upper surface, pale-green on lower surface; peduncle axillary, much-abbreviated, to 12 mm. long, greatly exceeded by the subtending petiole, short-pubescent, supporting about 6 flowers in an umbelliform inflorescence; pedicels slender, to 1 cm. long; sepals triangular-lanceolate, acuminate, short-pubescent, about 3 mm. long; corolla broadly campanulate, lobed to below the middle; corolla lobes oval, rounded at apex, greenish, with parallel dark green veins below the middle and with reticulate veins above and along the margins to the sinuses, sparsely short-pubescent on outer surface, densely white-puberulent on inner surface, about 8 mm. long (to base) and 4 mm. wide; crown with 5 short distinct rounded spreading appendages, each appendage with a central ventral keel; follicle spiny, lanceolate in outline, long-attenuate at apex, about 1 dm. long. In stony or gravelly soils in open woodlands, climbing on trees and shrubs on the Edwards Plateau, Apr.-May; endemic.

5. PERIPLOCA L. SILK-VINE

About 10 species of the Mediterranean region, Africa and Asia.

1. *Periploca graeca* L. Plant twining; stems to 5 m. long; leaves opposite, petiolate, ovate-lanceolate to oblong, to 1 dm. long; flowers purple-brown, in long-peduncled terminal cymes, 2-2.5 cm. wide; corolla rotate, deeply lobed, the narrowly oblong corolla lobes densely villous on the upper side; crown rotate, adnate to base of corolla, its margin prolonged into 5 short rounded lobes opposite the petals and 5 long ascending linear appendages alternate with the petals; stamens villous on back; follicles linear-cylindric, divaricate. A nat. of Eur.; cult. and escaped in our region.

FAM. 152. CONVOLVULACEAE JUSS.¹⁵³

MORNING GLORY FAMILY

Annual or perennial herbs, vines or shrubs (trees south of our area); leaves alternate, simple or compound, entire, toothed or lobed (wanting in *Cuscuta*), without stipules; flowers axillary or terminal, solitary or cymose, perfect, 5-merous; sepals 5, equal or unequal (often overlapping laterally), separate or united in basal portion; corolla gamopetalous, regular (rarely with curved tube or slightly irregular limb), 5-angled to

¹⁵³ Contributed by Lloyd H. Shinnery; excluding *Cuscuta*.

deeply 5-lobed; stamens epipetalous; ovary 2- (occasionally 1- or 3- to 5-) celled, free from the calyx; fruit a 1- to several-seeded capsule (indehiscent in some species).

About 1,600 species in about 30 to 50 genera, in tropical (chiefly) and temperate regions of both hemispheres.

1. Leafless parasitic annual twiners, not ground-rooting by flowering time 11. *Cuscuta*, p. 1255.
1. Leafy or leafy-bracted ground-rooting annual or perennial twiners, trailers, erect herbs or shrubs (2)
 - 2(1). Stigmas linear or oblong, more than twice as long as broad (3)
 2. Stigmas globose to reniform or flat-topped, as broad as long or broader (minute and scarcely larger than style in some species) (5)
 - 3(2). Corolla nearly rotate when fully expanded, 5-18 mm. across 4. *Evolvulus*, p. 1244.
 3. Corolla funnelform to campanulate, 16-80 mm. across (4)
 - 4(3). Calyx not enclosed by large bracts; stigmas linear, flattened 7. *Convolvulus*, p. 1246.
 4. Calyx enclosed by 2 large bracts; stigmas oblong, slightly or not flattened 8. *Calystegia*, p. 1246.
 - 5(2). Corolla shorter than or up to twice as long as calyx, with prominent lobes one third to three fourths its total length, the lobes as long as wide or longer (6)
 5. Corolla more than twice as long as the calyx, shallowly lobed (lobes broader than long) or merely angled (8)
 - 6(5). Leaf blades orbicular-ovate to orbicular-reniform, cordate, becoming long-petioled 1. *Dichondra*, p. 1242.
 6. Leaf blades elliptic to oblong-lanceolate or reduced to small bracts, very short-petioled or sessile (7)
 - 7(6). Corolla yellow-green, shorter than calyx, its lobes about as long as wide; stems trailing, sometimes rooting at lower nodes 2. *Petrogenia*, p. 1243.
 7. Corolla white, nearly twice as long as calyx, its lobes much longer than wide; stems erect or with decumbent base 3. *Cressa*, p. 1243.
 - 8(5). Style usually 2-branched (rarely 1 branch suppressed); stigmas minute, little larger than diameter of style (9)
 8. Style unbranched; stigmas small to large (10)
 - 9(8). Corolla white or lavender, 10-25 mm. long; sepals 3-7 mm. long; inflorescences long-peduncled 5. *Stylisma*, p. 1244.
 9. Corolla bluish purple, about 30-40 mm. long; sepals 10-12 mm. long; peduncle barely developed, the solitary flowers on pedicels shorter than calyx 6. *Bonamia*, p. 1245.
 - 10(8). Stigma with 2 reniform to elliptic thick but flattened lobes 9. *Jacquemontia*, p. 1247.
 10. Stigma globose and undivided or with 2 or 3 subglobose lobes 10. *Ipomoea*, p. 1247.

1. DICHONDRA FORST. & FORST. F.

PONY-FOOT

Creeping or trailing perennials; leaves long-petioled; blades orbicular-ovate to orbicular-reniform, entire; flowers very small, axillary, solitary or paired, long-pedicelled; sepals 5, united at base; corolla shallowly funnelform, deeply 5-lobed, light-green or white; fruit indehiscent or dehiscent, 2- or 4-seeded.

About 15 species, in tropical and warm-temperate regions of both hemispheres.

1. Plants of central, south and east Texas; fruit deeply 2-lobed, indehiscent (2)
1. Plants of Trans-Pecos mountains; fruit not 2-lobed, dehiscent (4)

- 2(1). Pedicel straight; calyx lobes 2 or 3 times as long as wide 1. *D. carolinensis*.
- 2. Pedicel abruptly recurved near summit; calyx lobes 1.5 to 2 times as long as wide (3)
- 3(2). Calyx 1.5-2 mm. long in flower (to 2.5 mm. in fruit); creeping stems mostly less than 1 mm. thick 2. *D. micrantha*.
- 3. Calyx 2.5-3.2 mm. long in flower (to 3.8 mm. in fruit); creeping stems 1-2 mm. thick 3. *D. recurvata*.
- 4(1). Leaf blades silvery-gray with dense appressed pubescence 4. *D. argentea*.
- 4. Leaf blades yellowish to grayish-green, pubescence relatively loose and thin 5. *D. brachypoda*.

1. *Dichondra carolinensis* Michx. Rooting at the nodes, mat-forming, 1-12 cm. high, sparsely pubescent; pedicels one third to two thirds as long as petioles in flower; corolla nearly as long as calyx, light-green. *D. repens* var. *carolinensis* (Michx.) Choisy. Damp open ground, roadsides and lawns, cen. and e. Tex., Mar.-June; e. and n. to Fla. and Va.

2. *Dichondra micrantha* Urban. Rooting at the nodes, mat-forming, 1-6 cm. high, sparsely pubescent; pedicels one fourth to one half as long as petioles; corolla as long as calyx or slightly longer, white. Damp ground and lawns, s. Tex., Apr.-May; adj. Mex., W.I., Pac. Is., e. Asia.

3. *Dichondra recurvata* Tharp & M. C. Johnst. Rooting at the nodes, mat-forming, 2-17 cm. high, rather sparsely pubescent; pedicels one tenth to one half as long as petioles; corolla nearly one third longer than calyx. Gravelly or sandy open oak woods, cen. Tex., Mar.-May; endemic.

4. *Dichondra argentea* H. & B. SILVER PONY-FOOT. Trailing and rooting at lower nodes, mat-forming, 1-5 cm. high, densely appressed-pubescent; pedicels one sixth to one half as long as petioles; corolla nearly twice as long as calyx, whitish. Dry rocky slopes, Trans-Pecos mts., May-Aug.; also Mex.

5. *Dichondra brachypoda* Woot. & Standl. NEW MEXICO PONY-FOOT. Trailing and rooting at nodes, 2-18 cm. high, rather densely pubescent; pedicels one tenth to one third as long as petioles; corolla about one fourth longer than calyx, whitish. Damp or shady rocky ground, Trans-Pecos mts., July-Aug.; also Ariz., N.M. and Mex.

2. PETROGENIA I. M. JOHNST.

One species.

1. *Petrogenia repens* I. M. Johnst. Trailing woody-based perennial, densely appressed-pubescent throughout; stems usually many, sometimes rooting at lower nodes, 1-5 dm. long; leaves very short-petioled; blades entire, elliptic to oblong-elliptic, 6-14 mm. long; flowers axillary, solitary, subsessile; calyx unequally 5-parted, the lobes laterally overlapping (inner ones narrower); corolla 3-3.5 mm. long, shorter than calyx, greenish-yellow, campanulate, 5-lobed; stamens included; styles 2, united at base, filiform; stigmas capitate; capsule 2-celled, 4-seeded, enclosed by calyx. Dry rocky limestone slopes, Brewster and Terrell cos., Apr.-Aug.; also adj. Mex.

3. CRESSA L.

Low densely appressed-pubescent perennials with deep vertical or oblique branching rhizomes, forming colonies; aboveground stems erect or partly decumbent, freely branched; leaves sessile, small, entire; flowers axillary, solitary, short-pedicelled; calyx bracteolate; sepals 5, united at base, laterally overlapping, elliptic; corolla white, funnel-form to subsalverform, 5-lobed, exceeding calyx; stamens exerted; styles 2; stigma capitate; capsule 1- to 4-seeded.

About 6 species of warm-temperate to tropical regions of both hemispheres.

1. Leaf blades well-developed, broadly elliptic to lanceolate, the larger 5-12 mm. long and 1.5-6 mm. wide, those on main stems crowded and overlapping 1. *C. depressa*.
1. Leaf blades very reduced, at flowering time the plant usually with only small bracts 1-4 mm. long and 0.6-2.8 mm. wide, those on main stems widely spaced 2. *C. nudicaulis*.

1. *Cressa depressa* Goodd. Plant densely leafy, gray-pubescent, 8-25 cm. tall. *C. truxillensis* H.B.K. var. *vallicola* (Heller) Munz. In depressions or damp alkaline soil in Trans-Pecos (one specimen from Calhoun Co. on the Gulf Coast, perhaps mislabelled as to locality), Apr.-July; w. to Calif.; Mex.

2. *Cressa nudicaulis* Griseb. LEAFLESS CRESSA. Plant at first with a few very small leaves, appearing leafless or nearly so at flowering time, with bracts only, 7-20 cm. tall. *C. aphylla* Heller. Coastal cos. from San Patricio Co. s., Apr.-May or Sept.; also Arg.

4. EVOLVULUS L

Low perennials with erect to prostrate stems; leaves sessile or subsessile, entire; flowers axillary, solitary or in few-flowered cymes; sepals 5; corolla rotate to shallowly funnel-form, 5-angled or -lobed, blue or lavender to white; styles 2, each with 2 branches; stigmas filiform; ovary 1- or 2-celled; capsule 1- to 4-seeded.

About 100 species, tropical to temperate regions of both hemispheres.

1. Corolla 5-8 mm. across, bluish-white to deep blue 1. *E. alsinoides*.
1. Corolla 8-18 mm. across, white to lavender (2)
- 2(1). Leaf blades densely pilose on both surfaces with loosely appressed to spreading hairs 2. *E. Nuttallianus*.
2. Leaf blades densely pubescent beneath with closely appressed hairs and commonly some loose ones as well, glabrous or loosely pilose above 3. *E. sericeus*.

1. *Evolvulus alsinoides* L. OJO DE VÍBORA. Stems erect to prostrate, pilose, 6-60 cm. long; leaves rather densely pilose on both surfaces, 4-20 mm. long, 2-8 mm. wide; peduncles exceeding the leaves; pedicels exceeding the calyxes.

Var. *hirticaulis* Torr. Stem hairs both widely spreading and appressed; leaf blades elliptic or ovate to oblong-lanceolate, spreading-pilose. Incl. var. *adscendens* (House) v. Ooststr. and var. *debilis* (H.B.K.) v. Ooststr. Cen., s. and w. Tex., all year s., June-Aug. elsewhere.

Var. *angustifolia* Torr. Stem hairs mostly appressed; leaf blades oblong-lanceolate to linear, loosely appressed-pilose. Incl. var. *acapulcensis* (Willd.) v. Ooststr. Trans-Pecos mts., June-Aug.; also Mex.

2. *Evolvulus Nuttallianus* R. & S. Stems erect or partly decumbent, 5-25 cm. long, usually many from a divided or short-creeping root, densely pilose; leaf blades lanceolate to elliptic-oblong, 6-20 mm. long, 1-8 mm. wide, exceeding the flowers; peduncles absent; pedicels shorter than calyxes; corolla lavender to almost white. *E. pilosus* Nutt., *E. mollis* Small. Rocky or sandy ground, throughout except e. Timber Belt., Apr.-July (-Sept.); Ariz. to Mont. and Tenn.

3. *Evolvulus sericeus* Sw. Stems erect to prostrate, 6-35 cm. long, densely appressed-pilose; leaf blades elliptic to linear (upper usually much narrower than lower), 1-3 cm. long, 1-8 mm. wide, usually exceeding the flowers; peduncles very short (except in the rare f. *pedunculatus* v. Ooststr.); pedicels shorter than calyxes; corolla white. Incl. var. *discolor* (Benth.) Gray. Sandy or silty ground, cen., w. and s. Tex., Apr.-Oct.; Calif. to Fla., s. to Arg.

5. STYLISMA RAF.

Perennials with prostrate or ascending straight or twining stems; leaves short-petioled or sessile, entire; inflorescences axillary, peduncled; flowers solitary or few; sepals 5;

corolla funnellform to campanulate, shallowly 5-lobed or -angled, white or lavender; stamens 5, included or exerted; style branches 2, sometimes short or unequal (rarely 1 obsolete); stigmas capitate, minute; capsule 1- to 4-seeded.

Six species, confined to southeastern United States.

- 1. Filaments glabrous or nearly so (2)
- 1. Filaments densely spreading-pilose in lower portion (3)
- 2(1). Corolla lavender; style divided halfway or more ... 1. *S. aquatica*.
- 2. Corolla white; style with branches less than 2 mm. long or undivided 4. *S. Pickeringii* var. *Pattersonii*.
- 3(1). Sepals glabrous on back 2. *S. humistrata*.
- 3. Sepals pilose on back 3. *S. villosa*.

1. *Stylisma aquatica* (Walt.) Raf. Stems prostrate or twining, short-pubescent, to 15 dm. long; leaves short-petioled; blades oblong-elliptic or oblong-lanceolate, truncate or slightly cordate at base, densely short-pubescent on both surfaces, 1-3 cm. long, 3-10 mm. wide; peduncles exceeding leaves; pedicels shorter than calyxes; corolla lavender, 10-15 mm. long. *Breweria aquatica* (Walt.) Gray, *B. Michauxii* Fern. & Schub., *Bonamia aquatica* (Walt.) Gray, *B. Michauxii* (Fern. & Schub.) K. A. Wils. Sandy open ground, especially damp places, rare in s.e. Tex., May-June; Tex. to Ark., Fla. and N.C.

2. *Stylisma humistrata* (Walt.) Chapm. Stems prostrate or twining, sparsely to densely pubescent, to 25 dm. long; leaves short-petioled; blades oblong-elliptic to oblong-lanceolate, the larger slightly cordate at base, sparsely to rather densely pubescent (especially beneath), 1-6 cm. long, 6-30 mm. wide; peduncles exceeding leaves; pedicels shorter than calyxes; corolla white, 16-20 mm. long, *Breweria humistrata* (Walt.) Gray. In sandy soil in usually dry open woods, e. Tex., June-Aug.; Fla. w. to Ark. and Tex., n. to Va.

3. *Stylisma villosa* (Nash) House. Stems prostrate or twining, densely pubescent, to 2 m. long; leaves short-petioled; blades narrowly oblong-elliptic or oblong-lanceolate, rounded-truncate at base, densely pubescent on both surfaces, 1-5 cm. long, 5-20 mm. wide; peduncles exceeding leaves; pedicels shorter than or equaling calyxes; corolla white, about 2 cm. long. *Breweria villosa* Nash, *Bonamia villosa* (Nash.) K. A. Wils. Loose sand, cen. coastal cos., May-June; also Fla.

4. *Stylisma Pickeringii* (Torr.) Gray var. *Pattersonii* (Fern. & Schub.) Myint. Stems trailing or reclining on other plants, inconspicuously though rather densely pubescent, to 2 m. long; leaves sessile or nearly so; blades linear, usually pubescent beneath, glabrous above, 2-6 cm. long, 1-5 mm. wide; peduncles equaling or exceeding leaves; pedicels shorter to longer than calyxes; sepals densely pubescent on back; corolla white, 10-18 mm. long. *S. Pattersonii* (Fern. & Schub.) G. N. Jones, *Breweria Pickeringii* var. *Pattersonii* Fern. & Schub. Sandy open ground, e. and cen. Tex., May-Sept.; Tex. to Kan., Ia., Ill. and La.

6. BONAMIA THOU.

Between 35 and 40 species in tropics and subtropics of both hemispheres.

1. *Bonamia ovalifolia* (Torr.) Hallier f. Perennial from woody base; stems spreading-ascending, densely pubescent, to 5 dm. long; leaves very short-petioled; blades sub-orbicular to oblong-elliptic, entire, rounded to faintly cordate at base, felty-pubescent on both surfaces, 15-25 mm. long, 1-2 cm. wide; flowers axillary, solitary; peduncles barely developed, less than one half as long as pedicels; sepals 5, elliptic-ovate, somewhat leathery, densely pubescent, laterally overlapping, 10-12 mm. long; corolla funnellform-campanulate, 3.5-5 cm. long, blue-purple; style 2-branched; stigmas capitate; capsule 1- to 4-seeded. *Breweria ovalifolia* (Torr.) Gray. In sand, known only from Brewster Co., July-Nov.; also adj. Mex.

7. CONVULVULUS L

Annual or perennial; stems ascending to trailing or twining; leaves petioled or sessile, entire or lobed; flowers axillary, solitary or in loose or congested cymes, both peduncled and pedicelled; calyx with small slender bracts or usually none; corolla funnelform or funnelform-campanulate, 5-angled or very shallowly 5-lobed, white or variously colored; ovary 2-celled; style simple; stigmas 2, linear, more or less flattened, slightly acute; capsule 2- to 4-seeded.

Over 200 species, chiefly in warm-temperate regions of both hemispheres, the majority Old World.

1. Calyx 3-5 mm. long, inconspicuously pubescent or glabrate; perennial from often deep creeping root, forming extensive beds 1. *C. arvensis*.
1. Calyx 6-12 mm. long, densely pubescent; perennial from taproot, sometimes divided at summit but not creeping 2. *C. equitans*.

1. *Convolvulus arvensis* L. BINDWEED, POSSESSION VINE. Stems trailing or twining, to 1 m. long or more, glabrous to rather densely but loosely pubescent; petioles much shorter than to equaling blades; blades highly variable in shape, from oblong-elliptic or deltoid-ovate to narrowly oblong, commonly indented at base and with spreading basal lobes, otherwise entire, glabrous or more or less pubescent (especially beneath), mostly 1-7 cm. long, 6-40 mm. wide; flowers solitary, on peduncles slightly shorter to longer than the leaves; pedicels slightly or much shorter than peduncles, about 1 to 3 times as long as calyxes; sepals elliptic-orbicular, glabrate or loosely pubescent, scarious-margined; corolla open-funnelform, open during morning, white or occasionally pink or lavender-pink, outside with broad vertical bands or wholly tinged pinkish or brownish-lavender. *Strophocaulos arvensis* (L.) Small. Roadsides, railroads, fields, gardens and waste places, Panhandle to cen. and w. Tex.; introd. and spreading, to be expected elsewhere, late Apr.-Sept.; nat. of Euras., now of world-wide distribution.

2. *Convolvulus equitans* Benth. Stems prostrate or twining, to 2 m. long, densely pubescent; petioles mostly one fourth to three fourths as long as blades; blades extremely variable in shape, ovate-elliptic to triangular-lanceolate or narrowly oblong with projecting bases, usually strongly indented at base, entire (rarely) or variously toothed or lobed or both, densely pubescent on both surfaces with loosely appressed hairs, 1-7 cm. long, 2-40 mm. wide; flowers solitary (occasionally in 2's, rarely 3's); peduncles about one half to one and one half times as long as leaves; pedicels much shorter than peduncles, shorter than or to twice as long as calyxes; calyx densely pubescent; sepals often with slightly shouldered to strongly auricled bases; corolla funnelform with rather narrow tubular base, 5-angled (the angles often prolonged as slender points), 1.5-3 cm. long, white to pink, often with red center. *C. hermannioides* Gray, *C. incanus* of auth., not Vahl. Prairies or disturbed ground, especially in rocky or sandy soil, throughout except e. Timber Belt, Feb. (s.) or Apr.-Oct.; Tex. to Kan., Colo., Ariz. and Mex.

8. CALYSTEGIA R. BR. HEDGE-BINDWEED

About 30 species, chiefly in temperate regions of both hemispheres.

1. *Calystegia sepium* (L.) R. Br. Perennial from creeping rhizomes; stems trailing and twining, to 2 m. long; leaves long-petioled; blades abruptly contracted to deeply cordate at base, acuminate at apex; flowers axillary, solitary or paired; peduncle at first much shorter (later becoming longer) than leaves, 1-flowered; floral bracts 2, elliptic-ovate, laterally overlapping, 12-25 mm. long, about twice as long as calyx and concealing it; corolla funnelform, 5-angled, 4-8 cm. long, white; ovary commonly 1-celled; style simple; stigmas oblong to linear, scarcely or not flattened, obtuse; capsule mostly 2- to 4-seeded. *Convolvulus sepium* L.

Var. *fraterniflora* (Mack. & Bush) Shinn. Leaf blades deltoid-ovate to oblong-ovate, glabrous to rather densely pubescent on both surfaces, mostly 4-8 cm. long, 2.5-5 cm. wide, the basal lobes rather widely spreading with the broad sinus open. *C. fraterniflora*

(Mack. & Bush) Brummitt, *Convolvulus fraterniflorus* Mack. & Bush, *C. septium* var. *fraterniflorus* Mack. & Bush. Stream banks, rare in far n. and n.e. Tex. (known only from Ochiltree, Cooke and Anderson cos.), May-Oct.; cen. U.S.

Var. *repens* (L.) Gray. Leaf blades narrowly deltoid-ovate to deltoid-lanceolate, usually densely soft-pubescent on both surfaces (rarely glabrate), mostly 4-9 cm. long, 2.5-5 cm. wide at base, rather abruptly contracted above base to an oblong-lanceolate main portion 1-2 cm. wide, the basal lobes directed backward (parallel with petiole) or somewhat spreading with the sinus narrow to moderately broad. *Convolvulus septium* var. *repens* (L.) Gray. Rare on Gulf Coast and lower Rio Grande, July; Gulf and Atl. coasts, rarely inland.

9. JACQUEMONTIA CHOISY

About 120 species, tropical and subtropical regions of both hemispheres.

1. *Jaquemontia tamnifolia* (L.) Griseb. Annual, flowering while small and erect; stem and branches becoming elongate and twining, to 2 m. long, sparsely to densely pilose; leaves moderately long-petioled; blades ovate or elliptic-ovate, acute, mostly 3-12 cm. long, 2-9 cm. wide, pilose on margins and sometimes sparsely so on surfaces, the larger ones cordate at base; peduncles at first shorter (ultimately longer) than the leaves; flowers many, in a nearly capitate axillary leaf-bracted cyme; sepals 5, separate, lance-linear, hispid-pilose, about two thirds as long as corolla; corolla blue, funnellform-campanulate, 5-angled, 12-16 mm. long; stamens 5; style simple; stigmas 2, more or less flattened, elliptic or oblong; capsule 4-seeded. *Thyella tamnifolia* (L.) Raf. Roadsides, stream beds, cult. or disturbed ground, e. Tex., July-Oct.; s.e. U.S. to Braz.

10. IPOMOEA L. MORNING GLORY

Annual or perennial herbs or woody vines, shrubs or trees; stems erect to trailing, creeping or twining and climbing; leaves sessile to long-petioled, simple or palmately compound (in one species pinnately cut almost to midrib, appearing compound), entire or toothed or shallowly to deeply lobed; flowers axillary or terminal, solitary to numerous; peduncles and pedicels various; sepals 5, commonly laterally overlapping; corolla 5-angled or shallowly 5-lobed, salverform to funnellform or campanulate, usually large, variously colored, usually open for less than 24 hours (morning, daytime or night); stamens included or exserted; ovary 1- to 3-celled; style simple; stigma globose or with 2 or 3 globose lobes; capsule 1- to several-seeded, variously dehiscent or (a few species) indehiscent.

Over 600 species (often referred to 6 to 10 unsatisfactorily distinguishable genera), warm-temperate and tropical regions of both hemispheres. (Incl. *Batatas*, *Calonyction*, *Exogonium*, *Merremia*, *Mina*, *Operculina*, *Pharbitis*, *Quamoclit*, *Turbina*.)

See explanation at end of key.

1. Corolla more or less strongly salverform, the long narrow tube only slightly widened to near or above middle, rather abruptly flaring near summit, at mid-level 3-7 mm. in diameter, the maximum breadth at summit (corolla rim) 5 to 20 times as great as mid-level diameter (2)
1. Corolla funnellform to campanulate, with short to rather long tube gradually expanding from below middle (but often more sharply flaring near summit), at mid-level 4-20 mm. in diameter, the maximum breadth at summit (corolla rim) 2 to 5 times as great as mid-level diameter (9)
- 2(1). Corolla 6-14 cm. long, lavender or white (partly green outside); flowers open during night and first part of morning (3)
2. Corolla 2-3.5 cm. long, red to orange or yellow (very rarely all white); flowers open all morning or all day (5)
- 3(2). Sepals obtuse3. *I. Tuba*.
3. Sepals with abrupt prominent soft-spiny tips (4)

- 4(3). Corolla white with vertical green bands outside; sepals 14-28 mm. long
 1. *I. alba*.
4. Corolla lavender or pinkish lavender; sepals 8-13 mm. long
 2. *I. muricata*.
- 5(2). Leaf blades divided more than halfway to midrib, with narrowly linear to lanceolate acute segments (6)
5. Leaf blades entire, angled or shallowly to deeply 3- to 7-lobed, the lobes broad or narrow but obtuse (7)
- 6(5). Leaf blades all pinnately cut almost to midrib, the segments narrowly linear (about as wide as narrowly margined midrib), the leaf appearing pinnately compound 4. *I. Quamoclit*.
6. Leaf blades more or less palmately cut, not divided to midrib, the segments lanceolate 5. *I. × multifida*.
- 7(5). Calyx 4-4.5 mm. long 7. *I. hederifolia*.
7. Calyx (5-) 6-8 mm. long (8)
- 8(7). Leaf blades entire or angled-toothed 6. *I. coccinea*.
8. Leaf blades (some or all) distinctly 3- to 7-lobed 8. *I. cristulata*.
- 9(1). Pedicels and peduncles with reflexed hairs (sometimes also some spreading ones) (10)
9. Pedicels and peduncles glabrous or with widely spreading to ascending hairs or soft spreading to slightly down-curved prickles (15)
- 10(9). Sepals soft-pilose or pubescent on back with slender hairs
 9. *I. acuminata*.
10. Sepals hispid-pilose on back, the hairs (at least those toward pedicel) with swollen bases (11)
- 11(10). Perennial with tough or stout root usually divided at summit and producing several main stems (12)
11. Annual with slender to somewhat coarse taproot producing one main stem (13)
- 12(11). Body of outer sepals cordate- or triangular-ovate, 6-12 mm. wide
 10. *I. pubescens*.
12. Body of outer sepals ovate-lanceolate to narrowly lanceolate, 3-9 mm. wide
 11. *I. Lindheimeri*.
- 13(11). Sepals with slightly narrowed green tips shorter to slightly longer than body ..
 14. *I. purpurea*.
13. Sepals with very narrow elongate green tips much longer than body (14)
- 14(13). Sepals abruptly narrowed, the long subacute tips strongly spreading or curved .
 13. *I. hederacea*.
14. Sepals gradually narrowed, the long acute tips suberect, straight, scarcely spreading
 12. *I. Nil*.
- 15(9). Anthers large and strongly spirally twisted when flowers have opened (16)
15. Anthers large or small, straight or merely slightly curved (17)
- 16(15). Sepals with broadly rounded obtuse tips; corolla white
 33. *I. pinnatifida*.
16. Sepals rounded but with abrupt short sharp points; corolla white with purple-red center 32. *I. sinuata*.
- 17(15). Leaf blades divided to base, the lobes or leaflets narrow (18)
17. Leaf blades entire or with broad or irregular lobes, not divided to base (23)
- 18(17). Sepals hispid-pilose on back 15. *I. barbatisepala*.
18. Sepals glabrous or merely warty-roughened on back (19)
- 19(18). Outer sepals ovate-oblong, less than twice as long as wide (20)
19. Outer sepals oblong to oblong-lanceolate, more than twice as long as wide (21)

- 20(19). Corolla 4-6 cm. long16. *I. cairica*.
 20. Corolla 1.5-2.3 cm. long17. *I. Wrightii*.
 21(19). Corolla 4-9 cm. long18. *I. tenuiloba*.
 21. Corolla 1-3 cm. long (22)
 22(21). Corolla 2-3 cm. long; perennial with woody-tuberous root
19. *I. capillacea*.
 22. Corolla 1-1.5 cm. long; annual with slender taproot ... 20. *I. costellata*.
 23(17). Stems rooting at nodes, long-creeping (24)
 23. Stems not rooting at nodes, trailing to erect or twining and climbing (25)
 24(23). Leaf blades mostly irregularly lobed; sepals oblong-lanceolate, much longer
 than wide21. *I. stolonifera*.
 24. Leaf blades entire except for notched apex; sepals suborbicular, nearly as wide
 as long or wider22. *I. Pes-caprae*.
 25(23). Leaf blades linear-lanceolate to narrowly rhombic- or ovate-lanceolate, with
 narrowed base (26)
 25. Leaf blades triangular to cordate-ovate or sagittate, with truncate or indented
 base (27)
 26(25). Leaf blades linear-lanceolate; petioles on flowering branches 2-8 mm. long
23. *I. leptophylla*.
 26. Leaf blades narrowly rhombic- or ovate-lanceolate; petioles on flowering branches
 (except terminal portion) 10-25 mm. long24. *I. Shumardiana*.
 27(25). Sepals with prominent white or pale scarious or subscarious margins (28)
 27. Sepals not with prominent white or pale scarious or subscarious margins (30)
 28(27). Sepals oblong-lanceolate, slightly contracted or rounded-auricled at base;
 woody vine36. *I. corymbosa*.
 28. Sepals triangular-lanceolate, not contracted or auricled at base; herbaceous vines (29)
 29(28). Corolla 1.5-2.5 cm. long; sepals more or less warty-roughened on back; native
 in Trans-Pecos mountains34. *I. cardiophylla*.
 29. Corolla 6-9 cm. long; sepals smooth on back; cultivated
35. *I. tricolor*.
 30(27). Sepals finely gray-pubescent on back; plant an erect coarse perennial herb
 or shrub38. *I. fistulosa*.
 30. Sepals glabrous or hispid-pilose or softly prickly on back; plant trailing or
 twining (31)
 31(30). Sepals about equal in length (32)
 31. Sepals markedly unequal in length, the outer three fourths to five sixths as long as
 the inner (37)
 32(31). Sepals suborbicular, obtuse or broadly rounded at apex (sometimes very
 inconspicuously notched or mucronate)29. *I. amnicola*.
 32. Sepals elliptic to oblong-lanceolate, strongly mucronate or acute to acuminate (33)
 33(32). Petioles and stems with slightly fleshy spreading (but often downwardly
 curved) prickles or bristles37. *I. melanotricha*.
 33. Petioles and stems glabrous or with slender to ascending hairs (34)
 34(33). Sepals hispid on back with widely spreading hairs .15. *I. barbatissepala*.
 34. Sepals glabrous or with slender ascending hairs (35)
 35(34). Sepals 15-22 mm. long in flower; corolla 5.5-9 cm. long
 9. *I. acuminata*.
 35. Sepals 6-13 mm. long in flower; corolla 1.8-5.5 cm. long (36)
 36(35). Corolla 28-55 mm. long30. *I. trichocarpa*.
 36. Corolla 18-23 mm. long31. *I. lacunosa*.

- 37(31). Corolla white with purple-red center 25. *I. pandurata*.
 37. Corolla all lavender-pink to red-purple (38)
 38(37). Sepals distinctly short-awned; cultivated 26. *I. Batatas*.
 38. Sepals merely mucronate or subacute to obtuse; wild (39)
 39(38). Leaf blades acuminate 27. *I. sagittata*.
 39. Leaf blades broadly acute or subacute 28. *I. rupicola*.

NOTE: The species are arranged in artificial groups, to reduce repetition in the descriptions and make possible some identification of fruiting material.

GROUP 1.

Annual or perennial glabrous (but often fleshy-prickly) vines; leaf blades cordate, entire or angled-dentate; flowers large; sepals in nos. 1 and 2 with soft spinelike tips; corolla salverform.

1. *Ipomoea alba* L. MOONFLOWER. High-climbing annual; leaf blades cordate-ovate, acute or acuminate, those on flowering shoots 8-20 cm. long, 7-15 cm. wide; peduncles 1- to several-flowered; pedicels thickened toward summit; corolla white with green vertical bands outside. *I. Bona-nox* L., *Calonyction aculeatum* (L.) House, *C. Bona-nox* (L.) Bojer. Commonly cult., June-Nov.; nat. of trop. Am.

2. *Ipomoea muricata* (L.) Jacq. PURPLE MOONFLOWER. Similar to preceding except for smaller flowers with pinkish-lavender or light-purple corollas. *Calonyction muricatum* (L.) G. Don. Occasionally cult., June-Nov.; nat. of trop. Am.

3. *Ipomoea Tuba* (Schlecht.) G. Don. RAILROAD VINE. Perennial, trailing or low-climbing; leaf blades cordate-orbicular to cordate-ovate, acute to short-acuminate; peduncles rather short, 1- to few-flowered; sepals obtuse; corolla white. *I. violacea* L. in part, *nom. conf.* Sandy beaches, known only from Jefferson Co., Oct.-Nov.; also Fla. and W.I.

GROUP 2.

Annual, glabrous or nearly glabrous vines; leaf blades entire or angled-lobed to deeply divided; peduncles elongate, 1- to many-flowered; flowers small, open all day; sepals with soft spinelike tips; corolla salverform, red (sometimes with yellow center, rarely all yellow), 2-4 cm. long, to 3 cm. broad.

4. *Ipomoea Quamoclit* L. CYPRESS VINE. Rather low-climbing; leaves short-petioled; blades oblong-elliptic in outline, pinnately cut into many narrowly linear segments about as wide as the narrowly margined midrib; peduncles 1- to few-flowered; corolla deep-red. *Quamoclit pennata* Bojer, *Q. Quamoclit* (L.) Britt. Cult.; once collected presumably wild in Brazos Co., July-Nov.; nat. of s.e. U.S.

5. *Ipomoea* × *multifida* (Raf.) Shinn. Leaf blades broadly ovate or ovate-oblong in outline, deeply cut (mostly two thirds to three fourths to midrib or base) into many narrowly lanceolate segments; corolla deep-red, throat changing to yellow. *I.* × *Sloteri* (Nieuw.) v. Ooststr. (Hybrid of *I. Quamoclit* and *I. coccinea*.) Cult., July-Nov.; of garden origin.

6. *Ipomoea coccinea* L. SCARLET CREEPER. Low-climbing vine; leaf blades ovate, shallowly to deeply cordate, entire or angled-toothed, acuminate, those on flowering branches 3-7 cm. long, 3-7 cm. broad; peduncles 1- to several-flowered; corolla orange-red or red with yellow tube. *Quamoclit coccinea* (L.) Moench. Commonly cult., seeding itself and tending to escape, July-Nov.; nat. of s.e. U.S.

7. *Ipomoea hederifolia* L. Similar to *I. coccinea*; leaf blades variable, commonly quadrate-ovate to quadrate-reniform in outline, 3-lobed. *I. coccinea* var. *hederifolia* (L.) Gray, *Quamoclit hederifolia* (L.) G. Don. Damp thickets near the coast, Orange Co. to Matagorda Co., also cult. and escaped inland, July-Nov.; Fla. to Tex.; W.I. and Mex.

8. *Ipomoea cristulata* Hallier f. Similar to *I. coccinea*; leaf blades distinctly lobed, often deeply dissected. In canyons, Trans-Pecos mts., also cult., Aug.-Oct.; Tex. to Ariz. and cen. Mex. This species and *I. hederifolia* have been generally confused with *I. coccinea* and pass for it in cultivation.

GROUP 3.

Annual or perennial vines; leaf blades mostly cordate-ovate in outline, entire or shallowly to deeply lobed; peduncles and pedicels with reflexed hairs (except in *I. barbatisepala* and sometimes *I. acuminata*); corolla funnelform, blue or purple to red or white.

9. *Ipomoea acuminata* (Vahl) R. & S. Low- to high-climbing perennial vine, glabrous or pubescent; leaf blades cordate-ovate, acuminate, entire to deeply 3-lobed, glabrous to densely soft-pubescent beneath, those on flowering shoots 4-16 cm. long, 3-12 cm. wide; peduncles long, several- to many-flowered; sepals narrowly ovate-lanceolate, acuminate; corolla red-purple, 6-9 cm. long. *I. cathartica* Poir., *I. congesta* R. Br., *I. Leari* Paxt., *I. mutabilis* Lindl., *Pharbitis cathartica* (Poir.) Choisy. Damp thickets and waste ground, s. Tex.; also cult., Mar.-Nov.; Fla. to Tex.; W.I., Mex., S.A. and Old World. All Texas collections are of the form with pilose stems and densely soft-pubescent leaves and sepals.

10. *Ipomoea pubescens* Lam. Low-climbing or trailing gray-pubescent perennial vine; leaf blades cordate-ovate to suborbicular in outline, those on flowering shoots 3-7 cm. long and wide, deeply 3- to 7-lobed (rarely subentire), the lobes ovate-lanceolate to narrowly lanceolate and commonly narrowed toward base; peduncles 1- to several-flowered; corolla reddish-purple, 4-6 cm. long. *I. heterophylla* Ort. Rocky slopes and dry stream beds, Trans-Pecos mts., July-Sept.; w. Tex. to Ariz. and Mex.; also n. S.A.

11. *Ipomoea Lindheimeri* Gray. Similar to *I. pubescens*; sepals narrower, long-acuminate; corolla blue-lavender, sometimes with pale or white center, 6-10 cm. long. *Pharbitis Lindheimeri* (Gray) Small. Rocky ground, especially in draws, ravines and stream bottoms, Edwards Plateau to Trans-Pecos, Apr.-Oct. endemic.

12. *Ipomoea Nil* (L.) Roth. MORNING GLORY. Annual low- to high-climbing vine; stems moderately to densely pilose; leaf blades cordate-ovate to oblong-ovate in outline, mostly 3-lobed (often hastate), acuminate, those on flowering shoots 3-16 cm. long, 2.5-15 cm. wide; peduncles short to long, 1- to several-flowered; sepals hispid-pilose on back; corolla variously colored (chiefly red, purple or blue, often with white center), 5-8 cm. long or more. *Pharbitis Nil* (L.) Choisy. Commonly cult., July-Nov.; nat. probably of Braz., early introd. around the world. Japanese Imperial morning glories are descended from this species.

13. *Ipomoea hederacea* Jacq. Similar to *I. Nil*; leaf blades cordate-ovate, entire or usually 3-lobed; peduncles 1- to few-flowered; corolla lavender to blue with white center in wild plants, varying to purple or red in cult. forms, 3-5 cm. long (slightly larger in cult.). Incl. var. *integriuscula* Gray, *I. barbiger* Sims. Gravel bars, stream banks, fields and disturbed ground, e. Tex. w. to West Cross Timbers s. to Rio Grande, locally up river to Big Bend, also commonly cult. and locally escaped, July-Nov.; s.e. U.S. to W.I. and Mex.

14. *Ipomoea purpurea* (L.) Roth. Similar to *I. Nil* and especially *I. hederacea*; corolla blue-purple to red or white, 4-6 cm. long (slightly larger in cult.); July-Nov.

Var. *purpurea*. Leaf blades cordate, entire. *Pharbitis purpurea* (L.) Voigt. Commonly cult., locally escaped in waste places and disturbed ground; nat. of s.e. U.S.

Var. *diversifolia* (Lindl.) O'Donell. Leaf blades (some or all) 3-lobed. Canyons and stream banks, w. Edwards Plateau and Trans-Pecos mts., rare; Tex. to Ariz. and Mex.

15. *Ipomoea barbatisepala* Gray. Low-climbing glabrous (except sepals) annual vine; leaf blades orbicular-ovate in outline, deeply 5- or 7-lobed, the lobes lanceolate and narrowed toward base; peduncles rather short, 1- or 2-flowered; sepals hispid-pilose on back, with elongate narrowly linear tips; corolla light-rosy-purple, about 2-2.5 cm. long. Type collected by Charles Wright in 1849 near El Paso, the only Tex. record; w. Tex. to Ariz.

GROUP 4.

Glabrous annual or perennial vines or erect herbs with palmately compound leaves (or blades so deeply cut as to appear compound); peduncles 1- to few-flowered; corolla pale-lavender-pink to red-purple.

16. *Ipomoea cairica* (L.) Sweet. Low-climbing vine; leaflets 3 to 7, rhombic to lanceolate, acute or obtuse and mucronate, 2-6 cm. long, the lowest often 2-lobed;

peduncles rather short and thick; sepals broadly oblong-elliptic, obtuse. Collected in heavy soil, San Patricio Co., also cult., July; nat. of Afr.

17. *Ipomoea Wrightii* Gray. Vegetative parts and sepals as in *I. cairica*; peduncles slender, short at first and on youngest branches, becoming very elongate and spirally twisted or coiled. *I. heptaphylla* (Roxb.) Voigt, illegit. name, *I. spiralis* House, *I. pulchella* of auth., not Roth. Alluvial or damp silty or clayey soil, locally abundant in cen. and s. Tex., June-Oct.; nat. probably of India, now widespread in warm countries around the world.

18. *Ipomoea tenuiloba* Torr. Low twining perennial; leaves short-petioled; leaflets narrowly linear; peduncles 1-flowered; sepals oblong-lanceolate, acuminate; corolla pale-pink, 5-8 cm. long. Slopes and summits, Trans-Pecos mts., July-Sept.; w. Tex. to Ariz. and Mex.

19. *Ipomoea capillacea* (H.B.K.) G. Don. Perennial from underground tuber; stems ascending to erect, 8-50 cm. long; leaves sessile; segments or leaflets usually 5, narrowly linear, 5-15 mm. long; peduncles short, filiform, 1-flowered; sepals broadly lanceolate, acute; corolla reddish-purple, 3-4 cm. long. *I. muricata* Cav., not (L.) Jacq., *I. patens* (Gray) House, *I. muricatisepala* Matuda. Dry slopes, Trans-Pecos mts., rare, July-Sept.; w. Tex. to Ariz., s. to n.w. S.A.

20. *Ipomoea costellata* Torr. Low annual from slender taproot; stems at first erect, in age trailing and slightly twining, 12-50 cm. long; leaves sessile or subsessile; leaf segments 5 to 9, narrowly linear or linear-lanceolate, 7-25 mm. long; peduncles rather long, slender, 1- or 2-flowered; sepals oblong-lanceolate, acute, scarious-margined; corolla pale-lavender or pink, 1-1.2 cm. long. Rocky slopes, Trans-Pecos mts., July-Sept.; w. Tex. to Ariz.

GROUP 5.

Glabrous perennials of sandy coastal dunes and beaches; stems prostrate and rooting at nodes, not twining; leaf blades rather fleshy or leathery; sepals elliptic-oblong or orbicular; corolla large.

21. *Ipomoea stolonifera* (Cyr.) Gmel. BEACH MORNING GLORY. Leaf blades varying from oblong-ovate or broadly short-oblong and entire with obtuse to truncate or emarginate apex to deeply and unequally 3- to 7-lobed, 2-4 cm. long, 1-4 cm. wide; peduncles 1-flowered; sepals elliptic-oblong; corolla white with yellow center, 4.5-7 cm. long. *I. littoralis* (L.) Boiss., not Bl. Beaches and dunes along Gulf Coast, Apr.-Nov.; warm regions around the world.

22. *Ipomoea Pes-caprae* (L.) Sweet var. *emarginata* Hallier f. RAILROAD VINE, GOAT-FOOT MORNING GLORY. Leaf blades suborbicular, entire but more or less deeply notched at apex, 4-10 cm. long and wide; peduncles 1- or usually several-flowered; sepals elliptic-orbicular; corolla rosy or purple, 5-7 cm. long. Incl. subsp. *brasiliensis* (L.) v. Ooststr. Beaches and dunes along Gulf Coast, June-Nov.; warm regions around the world.

GROUP 6.

Glabrous or pubescent perennials (except *I. lacunosa*); stems erect to trailing or twining; leaf blades linear-lanceolate to cordate-ovate, entire or lobed; sepals markedly unequal in length (except *I. amnicola*); corolla small to large, funnellform or funnellform-campanulate, white to red-purple.

23. *Ipomoea leptophylla* Torr. BUSH MORNING GLORY. Glabrous, decumbent to erect, bushy-branched, to 1.2 m. tall; petioles 1-7 mm. long; leaf blades linear-lanceolate, 3-9 cm. long, 2-8 mm. wide; peduncles short, stout, 1- to several-flowered; sepals elliptic-orbicular-ovate; corolla lavender-pink with dark center or all purple-red, 6-9 cm. long. Sandy prairies or disturbed ground, Panhandle to Edwards Plateau, e. to Clay Co., s.w. to Winkler Co., late May-July; Tex. to Neb., Colo. and N.M.

24. *Ipomoea Shumardiana* (Torr.) Shinn. Glabrous, trailing or ascending to twining; petioles 5-36 mm. long; leaf blades deltoid-ovate to narrowly ovate-lanceolate, 3-8 cm. long, 1-4 cm. wide; peduncles 1- to several-flowered; sepals oblong-elliptic to oblong-orbicular; corolla pink to white with purple-red center, 5-8 cm. long. *I. Carletoni* Holz.;

has been incorrectly referred to *I. longifolia* Benth.; believed by Robert Pearce to be a hybrid of *I. leptophylla* and *I. pandurata*. Sandy or sandy clay prairies, rare, Red River (Cooke Co.) s. to Edwards Plateau, June-Aug.; also Okla.

25. *Ipomoea pandurata* (L.) Mey. WILD POTATO. Glabrous or pubescent, trailing or twining and low-climbing from woody tuberous root; petioles 1-8 cm. long; leaf blades cordate or cordate-ovate, often with indented sides and almost 3-lobed, 3-10 cm. long, 2-9 cm. wide, glabrous to densely soft-pubescent beneath; peduncles 1- to several-flowered; sepals oblong-elliptic; corolla white with purple-red center, 5-8 cm. long. Thickets, fields and roadsides, e. Tex. w. to Bexar, Blanco and Johnson cos., June-Sept.; s.e. U.S.

26. *Ipomoea Batatas* (L.) Lam. SWEET POTATO, YAM. Glabrous, trailing or twining, from soft-tuberous root; leaf blades highly variable, deltoid-ovate in outline, mostly indented at base, entire to deeply 3- or 5-lobed, 4-10 cm. long and wide; peduncles 1- to several-flowered; sepals oblong-lanceolate, acuminate; corolla pink to purplish, 4-7 cm. long. Cult., especially in e. Tex., May-Sept.; known only as a cult. plant, originating in trop. Am.

27. *Ipomoea sagittata* Poir. Glabrous, tightly twining, low-climbing, from creeping root; leaf blades deeply sagittate, deltoid-lanceolate to narrowly ovate-lanceolate in outline, entire, 4-10 cm. long, 1-5 cm. wide (across base); peduncles 1-flowered; sepals oblong-elliptic, apex broadly rounded with an abrupt small point; corolla red-purple, 6-9 cm. long. Beaches and dunes along Gulf Coast, rarely inland up Rio Grande to Val Verde Co., Apr.-Oct.; Tex. to Fla. and W.I.; also w. Medit., where probably an early introd.

28. *Ipomoea rupicola* House. Glabrous, trailing or low-climbing; petioles with small fleshy points; leaf blades cordate-ovate to ovate-oblong, often with indented sides, entire or occasionally lobed-toothed toward base, 3-9 cm. long, 2-7 cm. wide; peduncles 1- to few-flowered; sepals oblong-elliptic to oblong-ovate, subacute; corolla purple to lavender-pink with dark center, 7-9 cm. long. Rocky open ground, Rio Grande Valley from Hidalgo and Duval cos. to Big Bend, June-Oct.; also adj. Mex.

29. *Ipomoea amnicola* Morong. Glabrous, twining, low-climbing, from creeping root; leaf blades cordate-ovate, entire, 2-6 cm. long, 2-7 cm. wide; peduncles several- to many-flowered, rather short; sepals oblong-orbicular; corolla white with purple-red center, 2-4 cm. long. Fields, ditch banks and roadsides, common in lower Rio Grande Valley, locally n. to Bexar Co., Apr.-July; nat. of Parag., introd. in s. Tex., adj. Mex. and n. S.A.

30. *Ipomoea trichocarpa* Ell. Perennial but flowering first year, from branched root, twining and low-climbing; leaf blades very variable, cordate-ovate in outline, entire to deeply 3- or 5-lobed, 2-8 cm. long, 1.5-7 cm. wide; peduncles 1- to several-flowered; sepals oblong-elliptic, acuminate; corolla rosy-lavender to purple-rose with dark center (rarely white), 2.8-5.5 cm. long. *I. commutata* R. & S., *I. carolina* (L.) Pursh, not L.; has been incorrectly referred to the related tropical species *I. triloba* L. and *I. trifida* H.B.K. Thickets, fields, roadsides and disturbed ground, June-Oct.

Var. *trichocarpa*. Sepals hispid-pilose, at least on margins; stem and leaves glabrous to moderately densely hispid-pilose. Common in e. third of Tex. (but absent from cos. near Red River), local w. to Medina and Menard cos.; s.e. U.S.

Var. *Torreyana* (Gray) Shinnery. Sepals glabrous; stem and leaves glabrous. Common in cen. Tex., from Dallas, Throckmorton, Sutton and Val Verde cos. to lower Rio Grande Valley, rare in e. Tex. (Cass and Nacogdoches cos., perhaps introd.); also Mex.

31. *Ipomoea lacunosa* L. Annual from slender taproot, sparsely to rather densely hispid-pubescent, twining and low-climbing; leaf blades variable, cordate-ovate to deltoid-ovate in outline, entire or angled-toothed or 3-lobed, 2-10 cm. long, 1.5-9 cm. wide; peduncles 1- or 2-flowered; sepals oblong-elliptic, acuminate; corolla white (rarely rosy), 1.8-2.3 cm. long. Damp thickets, stream banks and ditches, common in e. Tex., w. and s. to Tarrant, Travis and Matagorda cos., Sept.-Oct.; s.e. U.S.

GROUP 7.

Perennial vines; leaf blades deeply lobed or compound; sepals oblong-elliptic to suborbicular; corolla large, white or white with purple-red center; anthers large, spirally twisted.

32. *Ipomoea sinuata* Ort. ALAMO VINE, CORREHUELA DE LAS DOCE. Trailing to low-climbing; stem and petioles glabrous or spreading-pilose; leaf blades ovate-orbicular in outline, 4-15 cm. long and wide, palmately deeply 5- or 7-lobed, the lobes dentate to pinnatifid, obtuse; peduncles 1- or 2-flowered; sepals oblong-elliptic, mucronate; corolla white with purple-red center, 3.5-5 cm. long. *I. dissecta* (Jacq.) Pursh, not L., *Merremia dissecta* (Jacq.) Hallier f., *Operculina dissecta* (Jacq.) House. Stream banks, open ground and disturbed places, s.-cen. Tex. (Travis to Galveston and Val Verde cos. and s.), also cult., May-Nov.; Tex. and Fla. to W.I., Mex. and S.A.

33. *Ipomoea pinnatifida* (H.B.K.) G. Don. Glabrous, low-climbing; leaf blades orbicular-ovate to oblong-ovate in outline, 3-11 cm. long, 2-9 cm. wide, mostly deeply subpinnately 5- or 7-lobed, the lobes rhombic-elliptic to narrowly lanceolate, usually dentate or again lobed; peduncles 1- or 2-flowered; sepals elliptic-orbicular; corolla white, 3-5 cm. long. *I. ornithopoda* Robins., *Operculina pinnatifida* (H.B.K.) O'Donell. Pastures and open or brushy ground, Nueces Co. southw., rare, July-Sept.; also Mex.

GROUP 8.

Annual or perennial vines, glabrous or (*I. corymbosa* sometimes) pubescent; leaf blades entire; peduncles 1- to many-flowered; sepals with prominent white or pale borders; corolla funnelform.

34. *Ipomoea cardiophylla* Gray. Glabrous low-climbing annual; leaf blades cordate; peduncles 1- or 2-flowered; sepals ovate-lanceolate, acute, warty-wrinkled or roughened on back; corolla blue-purple, about 2-3 cm. long. Trans-Pecos mts., local, Aug.-Oct.; endemic.

35. *Ipomoea tricolor* Cav. MORNING GLORY. Glabrous annual high-climbing vine; leaf blades cordate, acuminate, 5-15 cm. long, 4-12 cm. wide; peduncles several- to many-flowered; sepals ovate-lanceolate, acute; corolla blue or purple to red or white or multicolored, 5-9 cm. long. Commonly cult., July-Oct.; nat. of Mex.

36. *Ipomoea corymbosa* (L.) Roth. CHRISTMAS VINE. Woody high-climbing vine, glabrous or rarely with leaf blades densely pubescent beneath; leaf blades broadly to narrowly cordate-ovate; peduncles many-flowered; sepals oblong-elliptic or oblong-lanceolate, mucronate; corolla white, 2-3 cm. long. *I. sidaefolia* (H.B.K.) Choisy, *Turbina corymbosa* (L.) Raf. Reported from Tex. by Small, but there is no voucher specimen, possibly cult. in extreme s. Tex., Dec.-Feb.; trop. Am., naturalized in s. Fla.

GROUP 9.

Robust annual high-climbing vines, with fleshy soft prickles or bristles; leaf blades suborbicular in outline, deeply 5- to 9-lobed; corolla large, funnelform-campanulate.

37. *Ipomoea melanotricha* Brandeg. Glabrous except for spreading soft prickles on stem and petioles and blackish bristles on sepals; corolla red-purple, 7-9 cm. long. Cult. in Brownsville area; nat. of Mex.

GROUP 10.

Sprawling to erect perennial herb or shrub, glabrous to upper petioles, inflorescence and sepals minutely pubescent; leaf blades narrowly ovate-lanceolate, acuminate, entire, with shallowly to deeply cordate base; flowers terminal, cymose-panicled; corolla large, lavender with dark center.

38. *Ipomoea fistulosa* Mart. SHRUBBY MORNING GLORY. Cult. as far n. as Dallas, where freezing to the ground, becoming to 2 m. tall in growing season; established as an escape in lower Rio Grande Valley, where an arborescent shrub to 5 m. tall; leaf blades 7-30 cm. long, 4-15 cm. wide; corolla 6-9 cm. long. *I. crassicaulis* (Benth.) Robins. All year; nat. of trop. Am., widely cult. and escaped n. to Fla. and Tex.

11. CUSCUTA L.¹⁵⁴

DODDER. LOVE-VINE

Plants leafless and rootless, herbaceous, parasitic; stems yellowish or orange-color, filiform, fleshy-herbaceous, glabrous, twining; flowers small (mostly 2-6 mm. long), sessile or short-pedicellate, in few- to many-flowered cymose clusters, commonly 5-merous but sometimes 3- or 4-merous; perianth parts mostly united; corolla campanulate to cylindric, shallowly or deeply lobed; stamens inserted in the throat of the corolla, alternating with the usually longer lobes; scalelike toothed, fringed or fimbriate appendages commonly present at base of the corolla tube opposite the stamens; ovary 2-celled, stigmas linear to capitate; fruit a capsule, indehiscent or sometimes opening with a regular or irregular line of circumscission near the base; embryo acotyledonous, filiform or more or less enlarged at one end.

About 170 species, mostly in the Americas. Some species may exhibit a host preference, but most will grow upon a wide range of herbaceous or woody plants including pteridophytes and grasses. A few species show a predilection for cultivated crop plants, especially legumes and flax, and sometimes cause considerable damage. While commonly considered to be wholly parasitic, many species show evidences of chlorophyll in the stems, flowers or maturing fruits and are, therefore, at least partly autophytic. Additional vernacular names to those above are "angel's hair," "tangle gut," "witches' shoelaces," "devil's gut," "strangle vine."

- 1. Styles coherent; flowers sessile; infrastamineal scales represented by wings; capsules to 1 cm. long24. *C. exaltata*.
- 1. Styles entirely separate and distinct from each other; capsules much less than 1 cm. long (2)
- 2(1). Capsules not circumscissile (that is, not separating in a regular line of cleavage), when forcibly separated either coming away entirely or breaking very irregularly (3)
- 2. Capsules circumscissile (that is, easily separating near the base in a more or less regular line of cleavage) (22)
- 3(2). Calyx gamosepalous; inflorescence not markedly bracteate or congested (4)
- 3. Calyx deeply divided to form distinct or nearly distinct sepals; inflorescence with numerous bracts, loose or mostly compact (19)
- 4(3). Styles short and subulate; interstylar aperture comparatively large; calyx lobes commonly unequal (5)
- 4. Styles longer and slightly (if at all) subulate (6)
- 5(4). Flowers mostly 5-parted1. *C. obtusiflora* var. *glandulosa*.
- 5. Flowers mostly 3- or 4-parted2. *C. Polygonorum*.
- 6(4). Flowers 3- or 4-parted; withered corolla capping the capsule3. *C. Cephalanthi*.
- 6. Flowers 5-parted; withered corolla not capping the capsule (7)
- 7(6). Calyx conspicuously 5-angled by the projecting lobes where they overlap at the sinuses4. *C. pentagona*.
- 7. Calyx not obviously 5-angled (8)
- 8(7). Capsules depressed-globose or globose, not at all ovoid or evidently thickened about the style bases, commonly about as wide as long or wider (9)
- 8. Capsules globose-ovoid, mostly more or less thickened about the style bases (13)
- 9(8). Corolla lobes half to three fourths as long as the tube; edges of the calyx lobes often more or less revolute9. *C. suaveolens*.
- 9. Corolla lobes about as long as the tube; edges of the calyx lobes not revolute (10)

¹⁵⁴ Adapted from Truman G. Yuncker in C. L. Lundell, Flora of Texas III:123-150. 1943.

- 10(9). Calyx with hornlike spurs 8. *C. Runyonii*.
10. Calyx lacking spurlike projections (11)
- 11(10). Calyx lobes overlapping at the base; withered corolla about the lower part of the smooth capsule 5. *C. campestris*.
11. Calyx lobes scarcely overlapping; withered corolla surrounding the capsule which is typically papillate about the top (12)
- 12(11). Calyx and pedicels not papillate 6. *C. glabrior* var. *glabrior*.
12. Calyx and pedicels papillate 7. *C. glabrior* var. *pubescens*.
- 13(8). Corolla lobes acute, with inflexed tips (14)
13. Corolla lobes obtuse (17)
- 14(13). Flowers commonly smooth; calyx lobes oval-ovate, obtuse; capsules mostly 1- or 2-seeded 10. *C. decipiens*.
14. Flowers fleshy, papillate; calyx lobes triangular-ovate to lanceolate, acute; capsules mostly 2- to 4-seeded (15)
- 15(14). Flowers mostly 4-parted; infrastamineal scales represented by wings that are shorter than the corolla tube 13. *C. Coryli*.
15. Flowers 5-parted; infrastamineal scales well-formed, reaching the filaments (16)
- 16(15). Calyx lobes triangular-ovate 11. *C. indecora* var. *indecora*.
16. Calyx lobes lanceolate 12. *C. indecora* var. *longisepala*.
- 17(13). Withered corolla about the top of the capsule 16. *C. Gronovii* var. *calyptrata*.
17. Withered corolla not at the top of the capsule (18)
- 18(17). Calyx lobes mostly about half as long as the corolla tube 14. *C. Gronovii* var. *Gronovii*.
18. Calyx lobes mostly about as long as the corolla tube ... 15. *C. Gronovii* var. *latiflora*.
- 19(3). Flowers pedicellate, loosely paniculate; sepals and bracts oval-orbicular-ovate 17. *C. cuspidata*.
19. Flowers sessile, in dense compact clusters (20)
- 20(19). Bracts and sepals oblong-lanceolate or oval, loose, more or less squarrose, commonly with recurved tips 20. *C. glomerata*.
20. Bracts closely appressed to the flowers, not squarrose or with curved tips (21)
- 21(20). Sepals and bracts acute 18. *C. squamata*.
21. Sepals and bracts obtuse 19. *C. compacta*.
- 22(2). Flowers 4-parted; infrastamineal scales and calyx not reaching the filaments; calyx papillate 23. *C. leptantha*.
22. Flowers 5-parted; infrastamineal scales mostly reaching the filaments; calyx not papillate, about equaling or surpassing the corolla tube (23)
- 23(22). Calyx lobes triangular-ovate, obtuse, commonly dorsally carinate; flowers subsessile or short-pedicellate 21. *C. applanata*.
23. Calyx lobes triangular-ovate-lanceolate, acute to acuminate; pedicels commonly as long as or longer than the flowers that are in loose umbellate cymes 22. *C. umbellata*.

1. *Cuscuta obtusiflora* H.B.K. var. *glandulosa* Engelm. Flowers 1.5-2 mm. long from base to corolla sinuses, 5-merous, commonly with numerous enlarged pellucid glandlike cells, subsessile in scattered moderately open glomerate-cymose clusters; calyx lobes nearly enclosing the corolla tube, commonly unequal (one smaller than the others), ovate, obtuse, scarcely overlapping at base; corolla lobes somewhat shorter than the tube, ovate

to ovate-oblong, obtuse to acutish, upright to spreading; scales about reaching the filaments, oblong, fringed about the top, sometimes bifid or truncated; styles stoutish and subulate, shorter than or about equaling the ovary; capsule depressed-globose, interstyler aperture large, the withered corolla remaining at the base. *C. glandulosa* (Engelm.) Small. Occasional throughout Tex. but most frequent in the s.e. section; also the Gulf States, W.I., Mex. and S.A.; most frequently on species of *Polygonum* but also on other plants as *Justicia americana*.

2. *Cuscuta Polygonorum* Engelm. SMARTWEED DODDER. Flowers 1-1.5 mm. long from base to corolla sinuses, mostly 3- or 4-merous, subsessile in compact glomerulate clusters; calyx lobes triangular-ovate, often unequal, not overlapping at base, as long as or longer than the corolla tube; corolla lobes triangular, acute, upright, as long as or longer than the tube; scales oblong, about reaching the filaments or commonly shorter, mostly bifid, the processes mostly few and near the top; styles shorter than the ovary, becoming subulate and divergent; capsule globose or obpyriform, commonly depressed, appearing cubical about the maturing seeds, interstyler aperture large and rhombic. From N.E. and Ont., w. and s.w. to Neb., Ark. and Tex. (*vide* Small); mostly on species of *Polygonum* but also on species of *Penthorum*, *Impatiens*, *Lycopus* and others.

3. *Cuscuta Cephalanthi* Engelm. BUTTON-BUSH DODDER. Flowers about 2 mm. long from base to corolla sinuses, 3- or 4-merous, rarely 5-merous, with numerous pellucid glandlike cells, sessile or subsessile in spicate or paniculately cymose clusters, frequently originating endogenously in the regions of the haustoria, the clusters at first open but soon becoming compact as the capsules mature; calyx shorter than the corolla tube, deeply divided, the ovate-oblong lobes obtuse and slightly overlapping at the base, the margins often minutely irregular; corolla lobes much shorter than the tube, ovate, obtuse, erect to spreading; scales narrowly oblong, about reaching the filaments, fringed with scattered processes; styles slender, about equal to or slightly longer than the ovary; capsule depressed-globose or globose, commonly only 1 or 2 seeds maturing, more or less lopsided when but one seed matures, the walls thin, capped by the withered corolla that is easily removed. From Me. and Va., w. to Wash. and Calif., less frequently s. to Mex., rare in n.-cen. Tex.; parasitic on a wide variety of woody and herbaceous hosts including species of *Salix*, *Boehmeria*, *Vicia*, *Justicia*, *Teucrium*, *Physostegia*, *Cephalanthus*, *Vernonia*, *Solidago*, *Aster* and *Sonchus*.

4. *Cuscuta pentagona* Engelm. Flowers 1-1.5 mm. long from base to corolla sinuses, the protruding capsules soon causing the flowers to appear larger, commonly with pellucid glandlike cells, with pedicels about as long as the flowers or commonly somewhat shorter, in loose cymose clusters; calyx mostly about as long as and loose about the corolla tube; calyx lobes broadly ovate, obtuse, commonly as broad as or broader than long, often unequal, widely overlapping at the sinuses to form 5 conspicuous angles; corolla lobes lanceolate, about as long as or slightly longer than the tube, spreading or reflexed, the acute tips inflexed; scales ovate-oblong, reaching the filaments, prominently fringed; styles slender, about equal to or slightly shorter than the ovary; capsule mostly more or less depressed-globose to somewhat ovoid, frequently longer than wide, the withered corolla remaining about the lower part. Frequent in the e. part of the U.S., w. to Okla., Tex., Colo., Mont. and Calif.; parasitic on species of *Justicia*, *Euphorbia*, *Ceanothus*, *Hibiscus*, *Tecoma*, *Solidago*, *Aster*, *Ambrosia*, *Anthemis*, *Artemisia* and many others.

5. *Cuscuta campestris* Yunck. FIELD DODDER. Flowers to about 2.5 mm. long from base to corolla sinuses, appearing much larger when in fruit, smooth or with scattered pellucid glandlike cells, with pedicels mostly shorter than the flowers, in glomerate-cymose clusters; calyx lobes about as long as the corolla tube, overlapping at the base but not markedly angled at the sinuses, ovate to oval-ovate, commonly as long as wide, obtuse; corolla lobes triangular to sublanceolate, about as long as the tube, spreading to reflexed, often granulate, the acute tips inflexed; scales reaching the filaments, ovate-oblong, abundantly fringed; style slender to slightly subulate, as long as or longer than the ovary; capsule depressed-globose, the withered corolla remaining about the lower half. *C. arvensis* Engelm. Distributed over the range of the genus; parasitic on a great variety of mostly herbaceous hosts including species of *Gilia*, *Justicia*, *Xanthium*, *Penthorum*, *Mirabilis*, *Ludwigia*, *Erigeron*, *Trifolium* and *Medicago*.

6. *Cuscuta glabrior* (Engelm.) Yunck. var. *glabrior*. Flowers about 2 mm. long from base to corolla sinuses, white or often reddish, commonly with numerous pellucid gland-

like cells, subsessile or mostly with pedicels no longer than the flowers or rarely longer, in compact or loose globular-cymose clusters; calyx lobes as long as or somewhat shorter than the corolla tube, ovate to oval-ovate, commonly not overlapping at base, the sinuses often obtusish; corolla lobes triangular to sublanceolate, smooth or commonly more or less papillate, about as long as the tube, spreading to reflexed, the acute to acuminate tips inflexed; scales reaching the filaments, oblong-spatulate, abundantly fringed; styles as long as or somewhat longer than the ovary that is more or less scabrous-papillate; capsule depressed-globose, the interstyler aperture large, often with numerous pellucid glandlike cells, scabrous-papillate at least above the middle, rarely smooth, sometimes easily breaking loose from the calyx and thus may be mistaken as circumscissile, surrounded by the withered corolla. Frequent in Tex., ranging from N.M. to Okla. and La., s. into n.e. Mex.; parasitic on a variety of mostly herbaceous hosts including species of *Amaranthus*, *Schrankia*, *Lespedeza*, *Dalea*, *Petalostemum*, *Croton*, *Oenothera*, *Gaura*, *Evolvulus*, *Convolvulus*, *Gilia*, *Verbena*, *Plantago*, *Aster*, *Ambrosia*, *Vicia*, *Bifora*, *Liatris*, *Phyllanthus*, *Lupinus*, *Asclepias*, *Justicia*, *Campsis*, *Condalia* and *Lesquerella*.

7. *Cuscuta glabrior* var. *pubescens* (Engelm.) Yunck. All parts of the flower (including ovary and capsule) and pedicel more or less densely papillate; otherwise similar to var. *glabrior*.

8. *Cuscuta Runyonii* Yunck. Stems smooth or often with scattered papillae near the inflorescences; flowers white or cream-white, drying yellow or reddish, 5-merous, mostly 2-3 mm. long from base to corolla sinuses, with numerous pellucid glandlike cells, with pedicels varying in length but commonly about equal to or somewhat longer than the flowers, in loose umbellate cymes of 2 to 5 or 6 flowers that are also somewhat umbellately arranged; bracts mostly 1-1.5 mm. long, ovate-oblong to triangular, acute, with a short obtuse saccate protuberance near the base; calyx lobes triangular to somewhat ovate, obtuse to acutish, not overlapping at base, about reaching the corolla sinuses or shorter, each with a prominent spurlike protuberance at the base and also frequently with a somewhat smaller one toward the apex; corolla lobes triangular-ovate to lanceolate, about as long as the tube or shorter, reflexed, acute to acuminate with the tips inflexed, papillate; scales prominent, oblong to subspatulate, reaching the filaments, profusely fimbriated; styles slender, equal to or longer than the ovary; capsule depressed-globose, smooth or papillate, enveloped by the withered corolla. Apparently endemic in the Rio Grande Plains and Valley of s. Tex.; host plants include species of *Dalea*, *Thamnosma*, *Spermolepis*, *Nama*, *Coldenia*, *Dyschoriste*, *Erigeron*, *Aster*, *Plantago*, *Melampodium*, *Parthenium* and *Xanthocephalum*.

9. *Cuscuta suaveolens* Sér. Flowers 2-4 mm. long from base to corolla sinuses, with numerous yellow pellucid glandlike cells, with pedicels commonly shorter than or infrequently longer than the flowers, in loose racemose- or paniculate-cymose clusters; calyx lobes shorter than the corolla tube, triangular-ovate, obtuse or acutish, scarcely overlapping at base, margins often revolute, sinuses obtusish; corolla lobes mostly half to three fourths as long as the tube, triangular-ovate, the upright acute tips inflexed; scales about reaching the filaments, ovate-oblong, fringed with medium-length processes; styles slender or slightly subulate, about equal to or sometimes longer than the ovary; capsule globose, mostly 2- to 4-seeded, enveloped by the withered corolla. A nat. of S.A. that has become widely distributed as a contaminant of seeds of *Medicago sativa*; parasitic on a variety of host plants but in the U.S. it is almost always found on *Medicago* and sometimes on *Lupinus*.

10. *Cuscuta decipiens* Yunck. Flowers about 2.5 mm. long from base to corolla sinuses, white or reddish, somewhat fleshy, often with pellucid glandlike cells; subsessile or with pedicels up to nearly as long as the flowers, in loose cymose clusters; calyx lobes shorter than the corolla tube, ovate to oval-ovate, scarcely overlapping at base, obtuse or rarely acutish; corolla lobes shorter than the tube, spreading or reflexed, oval- to triangular-ovate, sparingly serrulate toward the acute or infrequently obtusish inflexed tips; scales more or less spatulate, reaching the filaments or somewhat shorter, fringed with numerous processes; styles slender and mostly shorter than the ovary; capsule globose-ovoid, usually asymmetrical, somewhat umbonate, surrounded by the withered corolla. Rare in the Trans-Pecos, s. to Zac. and Coah.; parasitic on species of *Zinnia* and *Dyssodia*.

11. *Cuscuta indecora* Choisy var. *indecora*. PRETTY DODDER. Flowers variable in size, to 3 mm. long from base to corolla sinuses, white, fleshy, smooth or mostly granulate to

papillate-hispid, with pedicels commonly about as long as or shorter than the flowers or infrequently longer, in loose or rather dense paniculately cymose clusters; calyx lobes mostly shorter than the corolla tube, triangular-ovate, slightly overlapping at base, acute to obtusish; corolla lobes shorter than the tube, upright to spreading, triangular-ovate, inflexed at the acute tip; scales reaching the filaments, oblong to subspatulate, abundantly fringed; styles slender or slightly subulate, about as long as the ovary; capsule depressed-globose, thickened about the interstyler aperture, surrounded by the withered corolla which is eventually split by the enlarging capsule. Abundant in the s. states from Fla. to Calif., n. through the cen. states to Minn., Mich. and S.D., also in n. Mex., the W.I. and S.A.; parasitic on a wide range of herbaceous and woody hosts including species of *Eriogonum*, *Polygonum*, *Clematis*, *Cocculus*, *Fallugia*, *Acacia*, *Sesbania*, *Pithecellobium*, *Petalostemum*, *Prosopis*, *Rhus*, *Condalia*, *Malvastrum*, *Sapindus*, *Solidago*, *Datura*, *Adolphia*, *Cissus*, *Opuntia*, *Cephalanthus*, *Brickellia*, *Chilopsis*, *Vernonia*, *Aster*, *Baccharis*, *Iva*, *Pluchea*, *Ratibida*, *Borrchia*, *Helianthus*, *Lechea*, *Thelesperma*, *Campanula*, *Lesquerella*, *Gilia*, *Celtis*, *Coldenia*, *Eryngium* and *Carlowrightia*.

The size of the flowers, length of the pedicels and the proportionate size of the calyx vary greatly, sometimes even on the same specimen. Most of the flowers are more or less granulate because of the lenticular outer surface of the cells and occasional specimens are papillate-hispid.

12. *Cuscuta indecora* var. *longisepala* Yunck. This variety has the characteristics of the var. *indecora* with the exception of the calyx lobes that are lanceolate and mostly longer than the corolla tube.

13. *Cuscuta Coryli* Engelm. HAZEL DODDER. Flowers fleshy, papillate, 1.5-2 mm. long from base to corolla sinuses, mostly 4-merous, with pedicels shorter or longer than the flowers, in cymose-paniculate clusters, sometimes the flowers originate endogenously in the region of the haustoria and form dense glomerate clusters about the stem of the host; calyx lobes about as long as the corolla tube, triangular-ovate, acute, scarcely overlapping at base; corolla lobes about as long as the tube, triangular-ovate to lanceolate, upright, the acute tips inflexed; scales mostly reduced to toothed wings on either side of the filament attachment, rarely free and bifid or toothed; styles slightly subulate, mostly about as long as the ovary, becoming divergent in fruit; capsule globose, enveloped by the withered corolla the interstyler aperture rather large and thickened. From Mont. and Ariz. eastw.; parasitic on a large variety of herbaceous and woody hosts including species of *Salix*, *Carya*, *Rhus*, *Ceanothus*, *Lechea*, *Daucus*, *Callicarpa*, *Stachys*, *Symphoricarpos*, *Solidago*, *Aster* and *Helianthus*.

14. *Cuscuta Gronovii* R. & S. var. *Gronovii*. Flowers mostly 2-3 mm. long from base to corolla sinuses, rarely smaller or larger, commonly with few to many pellucid glandlike cells, with pedicels varying in length but mostly shorter than the flowers, rarely longer, in loose or dense paniculately cymose clusters, occasionally endogenously formed; calyx lobes commonly reaching to about the middle of the corolla tube, mostly oval-ovate, sometimes suborbicular or oblong, obtuse, overlapping at base, margins more or less uneven; corolla lobes shorter than the tube, mostly oval-ovate, obtuse, spreading; scales shorter than the corolla tube or reaching the filaments, oblong, deeply fringed about the upper part, more shallowly so towards the base and on the bridge; styles stoutish and sometimes somewhat subulate, mostly shorter than or about equal to the ovary, occasionally longer; capsule mostly globose-conic to obpyriform, surrounded by the withered corolla. The most common species of *Cuscuta* found throughout the cen. and n.e. states and the W.I., w. nearly to the Rocky Mts., commonly in low wet areas where it grows on a great variety of hosts including species of *Boehmeria*, *Helianthus*, *Myrica*, *Solidago*, *Salix*, *Hypericum* and *Lycopus*; occasionally reported as damaging ornamentals or other nonweedy hosts.

15. *Cuscuta Gronovii* var. *latiflora* Engelm. The flowers are commonly smaller than in var. *Gronovii*, the calyx lobes are more oblong-oval and less overlapping at the base and reach the corolla sinuses, the corolla tube is broadly campanulate with the throat wider than the tube which tapers towards the base and ordinarily is borne at the base of the maturing and thus protruding naked capsule.

16. *Cuscuta Gronovii* var. *calyprata* Engelm. In this variety the corolla tube is commonly somewhat longer than in var. *Gronovii* and with the lobes less than half as long as the tube, when mature the capsule carries the withered corolla about the top; otherwise similar to the var. *Gronovii*.

17. *Cuscuta cuspidata* Engelm. Flowers membranous in texture, about 3 mm. long from base to corolla sinuses, sessile or commonly pedicellate in loose paniculate clusters, the whole inflorescence more or less bracteate; calyx shorter than the corolla tube, of distinct or very slightly united segments, subtended by one or more ovate-orbicular obtuse to acutish sometimes cuspidate bracts, or these rarely lacking; calyx segments ovate-orbicular, obtuse to acutish and cuspidate, the margins commonly thin and serrulate, sometimes globular-thickened along the median line, broadly overlapping; corolla lobes oval-oblong to subovate, shorter than the funnellform tube, commonly more or less acute and somewhat cuspidate, occasional lobes serrate near apex, sometimes obtuse, commonly with a line of pellucid glandlike cells along the middle, spreading; scales shorter than the corolla tube, oblong, fringed with medium-length processes; styles slender, much longer than the ovary; capsule subglobose, with a thickened ridge or collar about the interstyler aperture, commonly with glandlike cells, enveloped at the top by the withered corolla. Through the cen. states from Ut. and Colo., e. to s.w. Ind.; parasitic on a number of different species of herbaceous hosts but seems to prefer members of the Compositae including species of *Ambrosia*, *Baccharis*, *Helianthus*, *Iva* and *Liatris*.

18. *Cuscuta squamata* Engelm. Flowers about 3 mm. long from base to corolla sinuses, sessile, in scattered few- to several-flowered glomerules, or these densely clustered about the host, subtended by 2 to several ovate acute often cuspidate serrulate closely appressed bracts that are mostly shorter than the calyx; calyx lobes distinct or nearly so, ovate, acute, often cuspidate, closely appressed and widely overlapping at base, commonly serrulate, with pellucid glandlike cells along the middle; corolla lobes ovate-lanceolate or slightly oblong, acute, sometimes cuspidate, shorter than the tube, spreading to reflexed, more or less glandular along the middle; scales about reaching the filaments, oblong, fringed with medium-length processes; styles slender, longer than the ovary; capsule globose to subconic, more or less umbonate, carrying the withered corolla about the top. Rare in the Trans-Pecos, Plains Country and Hardin Co. in s.e. Tex.; also s. N.M. and n. Mex.; parasitic usually on various weedy species of Compositae.

19. *Cuscuta compacta* Juss. Flowers often greenish, to 4.5 mm. long from base to corolla sinuses, sessile or rarely short-pedicellate, in few- to several-flowered scattered glomerules, or these commonly closely clustered about the host, frequently originating endogenously and forming a dense ropelike cluster about the stem of the host, subtended by 2 to several ovate-orbicular fleshy tightly appressed bracts; calyx deeply divided; calyx segments distinct or nearly so, broadly overlapping, fleshy, cupped, rounded, obtuse, tightly appressed about corolla, the margins fringed with short slender filamentous processes; corolla lobes spreading to reflexed, much shorter than the tube, oval-oblong, rounded, obtuse, sometimes fringed with short filamentous processes; scales reaching the filaments, fringed with long processes, small secondary scales often present on the bridge between the larger ones; styles mostly longer than the ovary; capsule globose-conic, upper part with glandlike cells and capped by the withered corolla, thickened at the top about the interstyler aperture. Extending from N.E. to Fla. and w. to Mo., Ark. and Tex.; parasitic on a wide range of herbaceous and woody hosts including species of *Carya*, *Alnus*, *Magnolia*, *Sassafras*, *Lindera*, *Rubus*, *Rosa*, *Rhus*, *Ilex*, *Acer*, *Vitis*, *Cissus*, *Clethra*, *Vaccinium*, *Tecoma*, *Cephalanthus*, *Lycopus*, *Myrica* and *Boehmeria*.

20. *Cuscuta glomerata* Choisy. Stems disappearing early from between the dense stramineous ropelike floral masses (to 5 cm. thick) that are wound tightly about the stem of the host; flowers 4-5 mm. long from base to corolla sinuses, commonly originating endogenously and breaking forth into 2 parallel rows on opposite sides of the stem, sessile, subtended and surrounded by numerous lanceolate scarious serrate or lacerate more or less cymbiform bracts with recurved or sometimes coiled acute tips; calyx segments distinct, about as long as the corolla tube, similar in shape to the bracts, serrate, acute or rather obtusish, the tips spreading but not recurved; corolla lobes much shorter than the cylindrical tube, spreading to reflexed, oblong-lanceolate, commonly acute to obtusish, occasionally mucronate, mostly with glandlike cells along the middle; scales about reaching the filaments, oblong, fringed about the upper part, more sparingly so along the sides; style slender and much longer than the ovary; capsule globose-umbonate or flask-shaped, with a prominent collar about the base of the styles, carrying the withered corolla at the top. Throughout the Prairie States from s.w. Mich. and Ind., s. to Miss. and

w. to the Dakotas, Neb., Kan., Okla. and Tex., s. to the Edwards Plateau; parasitic on numerous herbaceous and woody species from a wide range of genera but exhibiting some preference for weedy members of the Compositae including species of *Vernonia*, *Liatris*, *Solidago*, *Aster*, *Silphium*, *Ambrosia*, *Helianthus* and *Helenium*.

21. *Cuscuta applanata* Engelm. Flowers 1.5-2 mm. long from base to corolla sinuses, membranous or somewhat fleshy, commonly with pedicels shorter than the flowers, in dense glomerulate clusters, or these looser and paniculately cymose; bracts small, obtuse; calyx about as long as the corolla tube and commonly loose about it; calyx lobes broadly triangular-ovate, obtusish, overlapping at base, often irregularly keeled in the median part and below the sinuses down onto the pedicels or (in some specimens) the keel may be lacking; corolla lobes about as long as the tube, spreading, ovate-lanceolate, with slightly irregular margins, obtusish or acute; scales reaching the filaments, oblong, fringed; styles slender, often somewhat longer than the ovary; capsule depressed-globose, somewhat angled about the seeds, slightly thickened and raised about the interstyler aperture, readily circumscissile to leave the obcordate dissepiment in the persistent calyx, surrounded by the withered corolla. Rare in the Trans-Pecos; s.w. U.S. and Mex.; parasitic on various herbaceous hosts including species of *Boerhaavia*, *Chamaesaracha* and *Ambrosia*.

22. *Cuscuta umbellata* H.B.K. Flowers stramineous, smooth or infrequently slightly papillate, commonly with some pellucid glandlike cells, mostly 2-2.5 mm. long from base to corolla sinuses, rarely much longer, with pedicels varying in length from shorter than to much longer than the flowers, in dense or loose compound cymose clusters, the ultimate umbellate divisions of 3 to 7 flowers; calyx lobes scarcely overlapping, triangular-ovate to sublanceolate, acute to acuminate, smooth or slightly papillate, the margins even or sometimes irregular; scales reaching the filaments, oblong-subspatulate, fringed with medium-length processes; styles slender and longer than the ovary; capsule depressed-globose, with a thickened collar about the interstyler apertures, commonly easily circumscissile but some specimens tardily so, surrounded by the withered corolla. Incl. var. *reflexa* (Coul.) Yunck. Mainly in the Trans-Pecos and Rio Grande Plains; s. U.S., the W.I., Mex. and n. S.A.; parasitic on a wide range of mostly low herbaceous hosts including species of *Polygonum*, *Atriplex*, *Suaeda*, *Amaranthus*, *Tidestromia*, *Alternanthera*, *Boerhaavia*, *Sesuvium*, *Trianthema*, *Portulaca*, *Tribulus*, *Kallstroemia*, *Euphorbia* and *Siphonoglossa*.

23. *Cuscuta leptantha* Engelm. Flowers to about 2 mm. long from base to corolla sinuses, mostly 4-merous, with pedicels as long as or longer than the flowers, in loose umbellate clusters; calyx much shorter than the corolla tube, campanulate, somewhat fleshy and papillose; calyx lobes slightly or not at all overlapping at base, triangular-ovate, acute; corolla somewhat fleshy and papillose (at least in the lower part); corolla lobes spreading to reflexed, nearly as long as the tube, lanceolate, acute; scales reaching to about the middle of the corolla tube, oblong, sometimes truncated, fringed with short processes; styles slender, much longer than the ovary; capsule globose, slightly umbonate, 2- to 4-seeded, easily and regularly circumscissile, carrying the withered corolla about the top. From s. Tex. to N.M. and along the Gulf of Calif.; parasitic on low herbs, especially species of *Euphorbia*.

24. *Cuscuta exaltata* Engelm. Stems fleshy, to 3 mm. thick; flowers about 4 mm. long from base to corolla sinuses, sessile or subsessile in spicate-paniculate clusters, the parts thick and fleshy, each flower subtended by an oval-ovate obtuse bract; calyx nearly enclosing the corolla, deeply divided; calyx lobes ovate-orbicular, concave, broadly overlapping, rounded at apex; corolla-lobes oval-ovate to suborbicular, much shorter than the tube, overlapping at base, upright to spreading, the apex rounded; scales half to two thirds as long as the corolla tube, represented by 2 wings (one on either side of the filament attachment), toothed along the upper part but often these may be free at the top and dentate or emarginate; styles about as long as the ovary, mostly of equal length, partially or completely united but easily separating when teased; capsule globose-ovoid to conic, enlarging to 1 cm. in length, carrying the withered corolla at the top, regularly circumscissile. With the exception of one collection from e. Fla. apparently confined to Tex.; parasitic on woody hosts, including species of *Juglans*, *Quercus*, *Ulmus*, *Rhus*, *Vitis* and *Diospyros*.

FAM. 153. POLEMONIACEAE JUSS.¹⁵⁵

PHLOX FAMILY

Perennials, biennials, annuals or rarely subshrubs; leaves either all alternate or opposite, or opposite below and becoming alternate up the stem, undivided to pinnately compound or rarely palmately dissected or lobed, the margin entire to toothed; inflorescence of sparse cymes or glomerules in corymbose or paniculate disposition, sometimes a solitary flower; flowers regular or sometimes irregular; sepals 5, partly united into a herbaceous or scarious calyx; petals 5, convolute in bud, partly united into a rotate, campanulate, funnelform or salverform corolla; stamens 5, partly adnate to the corolla tube; carpels 3, superior, united up to the linear stigmas; fruit usually a trilocular capsule, dehiscent loculicidally; seeds one to many in each cell, rounded, angulate or rarely winged, in some species becoming viscid when wet.

About 300 species in 15 genera, mostly in North America.

1. Calyx wholly herbaceous and accrescent; leaves alternate, pinnately compound with broad entire leaflets1. *Polemonium*, p. 1262.
1. Calyx partly or mostly scarious; leaves not as above (2)
- 2(1). Calyx closely accompanied by multiple veiny bracts; leaves undivided, coarsely toothed, opposite below passing to alternate upward; corolla irregular5. *Loeselia*, p. 1267.
2. Calyx not closely accompanied by multiple bracts (3)
- 3(2). Leaves all alternate (4)
3. Leaves all opposite or opposite below and becoming alternate up the stem (6)
- 4(3). Bracts mostly subtending individual flowers; corolla often salverform, lacking a distinct expanded throat2. *Ipomopsis*, p. 1263.
4. Bracts mostly subtending flower groups; corolla usually with a distinct throat (5)
- 5(4). Leaf tip foliose or (if subacerose) the calyx not woolly3. *Gilia*, p. 1265.
5. Leaf tip acerose; calyx woolly4. *Eriastrum*, p. 1267.
- 6(3). Annuals; leaves palmately parted or undivided, the segments or blade narrowly linear6. *Linanthus*, p. 1267.
6. Perennials or annuals; leaves undivided, entire or essentially so, broadly elliptic-oblong to subulate7. *Phlox*, p. 1268.

1. POLEMONIUM L.

JACOB'S LADDER

About 40 species, mostly in the Northern Hemisphere.

1. *Polemonium pauciflorum* Wats. Perennial to 5 dm. tall, musky-glandular above, the stem sparsely to copiously branched; leaves alternate, to 15 cm. long, with basally expanded petiole and oblong pinnately compound blade; leaflets 11 to 21, the terminal confluent, to 25 mm. long and 6 mm. wide; flowers paired or solitary, projecting horizontally, the peduncle to 45 mm. long; sepals at anthesis about 15 mm. long, enlarging in fruit, united one third their length, tapering to a callous tip; corolla yellowish or greenish, often suffused with purple, funnelform, the tube to 3 cm. long and the limbs to 1 cm. long; stamens zygomorphic, about equaling the corolla tube, pilose at the short-adnate base; stigmas exceeding the anthers; seeds usually fusiform and angulate, several in each cell of capsule. *P. Hinckleyi* Standl. In wooded canyons of Davis Mts. in the Trans-Pecos, July-Aug.; also s. Ariz. and n. Chih.

Our plant has been segregated as subsp. *Hinckleyi* (Standl.) Wherry primarily on the basis of its thinner stem-pubescence and longer sepals than in subsp. *pauciflorum*.

¹⁵⁵ Adapted from E. T. Wherry in C. L. Lundell, *Flora of Texas* I:283-321. 1966.

2. IPOMOPSIS MICHX.

Perennials, biennials, annuals or subshrubs; leaves alternate, usually extending well up the stem, undivided or pinnately dissected or lobed, the tips firm and sharp; flowers often individually bracted, solitary or in sparse glomerules, grouped in stout or slender panicles; sepals sharp-tipped, partly united by scarious membranes; petals red, pink, lavender or white, partly united to form a usually salverform regular or slightly irregular corolla that lacks a definitely expanded throat; stamens usually adnate unevenly well up the corolla tube; seeds elongate and angulate or rarely ovoid, often waxy and becoming viscid when wet.

About 25 species, many of which are in southwestern United States.

- 1. Plants small annuals; corolla regular, lavender to white, the tube 6-8 mm. long (2)
- 1. Plants subshrubs, perennials, biennials or occasionally annuals; corolla varying widely in symmetry, size and color (3)
- 2(1). Leaves distributed more or less uniformly up the stem, asymmetrically dissected above the middle into few linear segments 9. *I. pumila*.
- 2. Leaves aggregated at stem base and tip, almost symmetrically cut above the middle into few lobes 10. *I. polycladon*.
- 3(1). Subshrub; flowers in glomerules at tip of branches, purple-blotched, pink or white; corolla tube 5-7 mm. long (4)
- 3. Herbaceous though firm-textured; inflorescence a leafy panicle; corolla tube 10-40 mm. long (5)
- 4(3). Plant 2.5-5 dm. tall; most leaves undivided 1. *I. Wrightii*.
- 4. Plant 1-2 dm. tall; most leaves dissected 2. *I. Havardii*.
- 5(3). Panicle stout; flowers paired or solitary at tip of branches, lavender to white (6)
- 5. Panicle long and slender; flowers in glomerules (7)
- 6(5). Corolla tube 25-40 mm. long, the lobes 8-12 mm. long 3. *I. longiflora*.
- 6. Corolla tube 15-25 mm. long, the lobes 5-7 mm. long .. 4. *I. laxiflora*.
- 7(5). Corolla purple to pink; basal rosette moderately developed 5. *I. Thurberi*.
- 7. Corolla red, yellow-mottled on face; basal rosette well-developed (8)
- 8(7). Leaf segments filiform; petal lobes blunt 8. *I. rubra*.
- 8. Leaf segments linear; petal lobes pointed (9)
- 9(8). Sepals united less than half their length of around 8 mm., the broadly subulate blade tapering uniformly 6. *I. aggregata*.
- 9. Sepals united over half their length of around 5 mm., the blade abruptly contracted to a subulate tip 7. *I. arizonica* subsp. *texana*.

1. *Ipomopsis Wrightii* (Gray) Gould. Subshrub to 5 dm. tall, the appressed-pilose stems bearing above the middle multiple simple branches; leaves undivided, linear, to 25 mm. long, sometimes with a few basal leaves sparsely pinnatifid; glomerules few-flowered, at branch tips, with large ciliate bracts; sepals 4-6 mm. long, united to about the middle, the blade ciliate and awned; corolla salverform, obscurely irregular, the tube 5-7 mm. long and the white to lavender lobes 3-4 mm. long; stamens adnate well up the tube, uneven, exerted, the filament curved; stigmas exceeding the anthers; seeds 3 or 4 in each cell, viscid when wet. *Gilia Wrightii* Gray, *Navarretia Wrightii* (Gray) O. Ktze. On dry rocky slopes in the Trans-Pecos, summer; a large variant also in Colo. and Ut.

2. *Ipomopsis Havardii* (Gray) V. Grant. Subshrub to 2 dm. tall and broad, villous-pubescent; leaves to 15 mm. long, 1- or 2-pinnately dissected above middle into few narrowly linear segments, passing to undivided above; sepals 5-7 mm. long, united to about the middle, the subulate blade awned; corolla salverform, irregular, the tube 6-8 mm. long and the purple-blotched or pink lobes 3-6 mm. long; stamens unevenly adnate

well up the tube, exerted, the filament curved; stigmas exceeding the anthers; seeds numerous, not affected when wet. *Loeselia Havardii* Gray, *Gilia Havardii* Gray, *Navarretia Havardii* (Gray) O. Ktze. On dry hillsides in the Trans-Pecos, Mar.-Oct.; endemic.

3. *Ipomopsis longiflora* (Torr.) V. Grant. Much-branched biennial or annual to 6 dm. tall, firm-textured and nearly glabrous; leaves distant, to 4 cm. long, dissected into 7 narrowly linear segments, passing to undivided above; flowers paired or solitary, the peduncle to 35 mm. long, often arising from the axil of a linear bract on leafy branches disposed in a stout panicle; calyx dotted with short-stalked glands; sepals 5-8 mm. long, united to well above the middle, the broad-subulate blade long-awned and pilose within; corolla salverform, with slender tube 2.5-4 cm. long; corolla lobes white or lavender, obtuse or apiculate, 8-12 mm. long; stamens adnate unevenly up the tube, 2 or 3 often exerted; stigmas somewhat exceeding the anthers; seeds several in each cell, angulate, viscid when wet. *Gilia longiflora* (Torr.) G. Don. On dry sandy or rocky soil in w. half of Tex., Mar.-Oct.; from Okla. and Tex., w. to s. S.D. and cen. Mex.

4. *Ipomopsis laxiflora* (Coult.) V. Grant. Resembling *I. longiflora* but more delicate with smaller parts; mostly less than 4 dm. tall with leaves at most 5-segmented and less than 3 cm. long; peduncle usually less than 15 mm. long; sepals 6 mm. long; corolla tube 25 mm. long and lobes about 5 mm. long. *Gilia Macombii* Gray var. *laxiflora* Coult. In similar habitats with similar range to *I. longiflora*.

5. *Ipomopsis Thurberi* (Gray) V. Grant. Biennial or short-lived perennial to 75 cm. tall, finely pubescent; leaves to 5 cm. long, dissected into 7 linear segments, passing to undivided above; flowers in glomerules in a long slender panicle; sepals about 7 mm. long, united to about the middle, the blade awn-tipped; corolla salverform, regular, the tube 25-35 mm. long and the purple lobes to 8 mm. long and 5 mm. wide; stamens unevenly long-exserted; styles pilose; stigmas exceeding the anthers; seeds several in each cell, viscid when wet. In Tex. known only from El Paso Co., summer; from w. Tex. to Ariz. and n. Mex.

6. *Ipomopsis aggregata* (Pursh) V. Grant. Coarse biennial with conspicuous basal rosette and firm simple stems to 2 m. tall, moderately glandular-pubescent; leaves numerous, to 5 cm. long, dissected into narrowly linear segments; inflorescence a long slender panicle of sparse glomerules; sepals 6-9 mm. long, united to below the middle, the broadly subulate blade tapering to a short awn; corolla bright-red, salverform, the tube 2-3 cm. long, the lobes 8-10 mm. long and acute; stamens unevenly adnate up the tube, sometimes with 1 or 2 exerted; stigmas exceeding the anthers; seeds many in each cell, angulate, viscid when wet. On dry rocky slopes in the Trans-Pecos, summer-fall; from B.C. to Calif., n. Mex. and w. Tex.

7. *Ipomopsis arizonica* (Greene) Wherry subsp. *texana* (Greene) Wherry. Similar to *I. aggregata* but the sepals are 4.5-6.5 mm. long and united to about or above the middle, with an abruptly contracted blade. *Gilia texana* (Greene) Woot. & Standl., *Ipomopsis aggregata* var. *texana* (Greene) Shinnery. Similar habitat, blooming season and distribution to *I. aggregata* in Tex.; from Colo. to e. Calif., w. Tex. and n. Mex.

8. *Ipomopsis rubra* (L.) Wherry. TEXAS PLUME, STANDING CYPRESS. Coarse biennial with noticeable basal rosette and simple stem to about 2 m. tall, sparsely pubescent, without glands; leaf segments filiform; sepals 8-9 mm. long, united to below the middle, the broadly subulate blade obscurely awned; corolla tube stout, 2-2.5 cm. long; corolla lobes about 9 mm. long and 5 mm. wide, somewhat obtuse to subacute; seed coat swelling but scarcely becoming viscid when wet. *Gilia rubra* (L.) Heller. In sun or partial shade in dry sandy or rocky ground in cen. and e. Tex., summer-fall; from Tex., e. to Fla. and n. to N.C.

This plant has some of the showiest flowers of any species of plant found in Texas.

9. *Ipomopsis pumila* (Nutt.) V. Grant. Finely pubescent annual to 2 dm. tall, branched from base; leaves to 3 cm. long, asymmetrically dissected above middle into 3 or 5 linear spine-tipped segments; flowers solitary or in sparse glomerules that are subtended by woolly-based leafy bracts; sepals 5-7 mm. long, united to the middle or above the middle, with a conspicuous awn-tip; corolla salverform, the tube 7-9 mm. long, the lavender or white lobes about 3 mm. long and 2 mm. wide; stamens adnate up to the tube summit, the free filament curved, short-exserted; stigmas exceeding the anthers; seeds few, viscid when wet. *Gilia pumila* Nutt. Among sparse shrubs in semiarid lands in w.-cen. and far w. Tex., spring; from w. Neb. and s. Wyo., s. to Ut., N.M. and Tex.

10. *Ipomopsis polycladon* (Torr.) V. Grant. A minutely glandular and sparsely villous spreading-branched annual to 1 dm. tall and 2 dm. broad; leaves mainly in a basal cluster but with a few reduced ones at stem nodes and tip, to 25 mm. long, divided above middle into few sharp-tipped segments; flowers in dense glomerules at branch tips, with 3-lobed bracts; sepals 5-6 mm. long, united to about the middle, short-awned; corolla salverform, the tube 3-6 mm. long, the lavender lobes 1-2 mm. long; stamens adnate to tube summit, barely exerted; stigmas equal to the anthers; seeds mostly 2 in each cell, fusiform, viscid when wet. *Gilia polycladon* Torr. Among sparse shrubs in semiarid lands in the Trans-Pecos, spring; from w. Colo. to Ut., s. to Tex. and Chih.

3. GILIA R. & P.

Perennials, biennials or annuals; leaves alternate, borne mainly below mid-stem, pinnately toothed or dissected, the segments herbaceous or rarely subaceroso; flowers in bracted glomerules, unevenly paired or solitary, terminating paniculately disposed branches; sepals partly united, separated and bordered by scarious membranes; petals violet-blue to lavender, often with yellow throat, partly united to a regular rotate to funnel-salverform corolla; stamens even to moderately uneven; seeds viscid when wet.

About 60 species in western North America and South America.

- 1. Corolla funnel-salverform, lavender; plant a delicate annual (2)
- 1. Corolla rotate-campanulate, violet-blue to lavender; plant perennial or (when annual or biennial) heavy-textured (3)
- 2(1). Flowers borne along branches; corolla 8-15 mm. long, the throat elongate; capsule longer than broad5. *G. flavocincta* subsp. *australis.*
- 2. Flowers borne mainly at branch tips; corolla 4-8 mm. long, the throat short; capsule broader than long6. *G. mexicana.*
- 3(1). Petiole of major leaves long and slender; leaf blade and its segments broad, incised-toothed; duration various1. *G. incisa.*
- 3. Petiole of major leaves short and winged or none, or the leaf segments narrow (4)
- 4(3). Sepals united for only one fourth to one third their length, 4-6 mm. long; corolla inconspicuous; leaves pinnatifid into narrow segments2. *G. Stewartii.*
- 4. Sepals united for one third to two thirds their length; corolla showy (5)
- 5(4). Basal leaves persistent, obovate, pinnatifid into about 6 pairs of broad coarse-toothed segments4. *G. ludens.*
- 5. Basal leaves ranging from persistent to short-lived, variously pinnatifid into coarse to fine segments (6)
- 6(5). Sepals 7-9 mm. long; branches widely spreading; herbage glabrescent to moderately glandular; segments of many leaves coarse; corolla 15-25 mm. across3a. *G. rigidula* subsp. *insignis.*
- 6. Sepals 5-7 mm. long; branches moderately spreading to congested; herbage copiously glandular; segments of upper leaves fine; corolla 8-15 mm. across (7)
- 7(6). Segments of lower leaves few, broad and flat, the upper ones subaceroso3b. *G. rigidula* subsp. *rigidula.*
- 7. Segments of lower leaves (like the upper ones) few to numerous, all subaceroso3c. *G. rigidula* subsp. *acerosa.*

1. *Gilia incisa* Benth. A minutely glandular firm-textured perennial, biennial or annual to 5 dm. tall; leaves to 6 cm. long and 15 mm. wide, long-petioled; blade unsymmetrically incised, often pinnate at base and conspicuously reduced up the stems; flowers solitary or unevenly paired on peduncles to 35 mm. long; sepals about 4 mm. long, united to about or below the middle, the scarious membranes running extended up as blade

margins; corolla tube 3-4 mm. long, the lavender to whitish lobes about 8 mm. long and spreading to a subrotate limb 10 mm. across; stamens subuniform, short-exserted; stigmas exceeding the anthers; seeds few in each cell, narrowly winged. *G. Lindheimeriana* Scheele. On gravelly or sandy slopes in the s.w. half of Tex., spring; Tex. and N.M. s. to Hgo.

2. *Gilia Stewartii* I. M. Johnst. Woody-based minutely glandular biennial or short-lived perennial to 3 dm. tall; basal leaves to 5 cm. long, bipinnately dissected, forming an early-withering rosette; stem leaves pinnately dissected into mostly linear segments, noticeably reduced upward; flowers paired or solitary on peduncles to 3 cm. long; sepals 4-5 mm. long, united to well below the middle, the scarios membranes extending up as narrow blade margins; corolla 8-10 mm. long, lavender; petals only shortly united, their blades 2.5-5 mm. wide; stamens short-exserted; stigmas exceeding the anthers; seeds numerous, minute. On rocky open slopes in the Trans-Pecos, spring; also Mex.

3a. *Gilia rigidula* Benth. subsp. *insignis* Brand. Glabrescent spreading-branched woody-based perennial to 4 dm. tall and broad; lower leaves numerous, to 4 cm. long and 15 mm. wide, obscurely petioled; blade asymmetrically dissected into few coarsely dentate segments, rapidly reduced above; flowers in sparse glomerules or solitary on peduncles to 4 cm. long; sepals 7-9 mm. long, with distinct awn-tip, united to about the middle or slightly below the middle, the scarios membranes extended up as broad blade margins; corolla 18-25 mm. long, opening in sunlight to a rotate violet-blue limb with yellow eye; stamens 8-10 mm. long, the filaments short-adnate, the large anthers sagittate; stigmas exceeding the anthers; seeds numerous, minute. *G. insignis* (Brand) Cory & Parks. On dry rocky slopes, rare in the Trans-Pecos, spring; also Coah.

3b. *Gilia rigidula* subsp. *rigidula*. A fine-glandular spreading-branched perennial to 25 cm. tall; lower leaves to 35 mm. long, unsymmetrically dissected into few oblong often dentate segments that pass to linear or filiform segments above; flowers laxly glomerate to solitary, on peduncles to 25 mm. long; sepals 5-7 mm. long, obscurely awned, united to about or below the middle, the scarios membranes running up as blade margins; corolla 8-15 mm. long, opening in sunlight to a rotate violet-blue limb with yellow eye; stamens 5-7 mm. long, the filaments short-adnate and the anthers sagittate; stigmas exceeding anthers; seeds small. In dry rocky and sandy land in w. half of Tex., blooming in spring and sometimes again in fall; from Tex. to Colo., Ariz. and s. to Dgo.

3c. *Gilia rigidula* subsp. *acerosa* (Gray) Wherry. This entity differs from subsp. *rigidula* in its more compact habit, being mostly under 1 dm. tall, the leaves to 2 cm. long and with the segments subulate and rather sharp-tipped. *G. acerosa* (Gray) Britt. Most frequent in n.w. Tex.; also w. Neb. to Ariz. and Son.

4. *Gilia ludens* Shinnars. Resembling *G. rigidula* in many respects but differs from that species primarily in developing a persistent rosette of obovate leaves that are pinatifid into about 6 pairs of broad coarse-toothed segments. Rio Grande Plains in Duval, Jim Wells and Webb cos., spring; endemic.

5. *Gilia flavocincta* A. Nels. subsp. *australis* (A. & V. Grant) Day & V. Grant. Winter annual with lax basal rosette, to 3 dm. tall, the herbage flocculent-hairy toward base and passing upward to sparse-glandular or glabrous; stems few or solitary; leaves extending to above mid-stem, to 3 cm. long, 1- or 2-pinnately lobed, the length of the linear lobes over 3 times the rachis width; inflorescence elongate; flowers in unsymmetrical 2- to 4-flowered glomerules on glabrous or sparse-glandular pedicels to 14 mm. long; sepals 3-4.5 mm. long, united to above the middle, the tip acute; corolla funnel-salverform, lavender with yellow throat, the short tube plus the long throat 8-15 mm. long and the lobes 3-6 mm. long; stamens subequal, short-exserted; stigmas near anthers; capsule broadly ovoid. *G. ophthalmoides* Brand subsp. *australis* A. & V. Grant. In dry sandy land in extreme w. Tex., spring; from Tex. across N.M. into Ariz.

6. *Gilia mexicana* A. & V. Grant. Habit similar to *G. flavocincta* but differing in its well-developed compact rosette, stems often multiple, inflorescence chiefly terminal, corolla relatively small (4.5-7.5 mm. long) with the tube and part of the throat included in calyx, and the capsule narrowly ovoid. Rare in w. tip of Tex., spring; Tex., N.M., Ariz. and Chih.

4. ERIASTRUM WOOT. & STANDL.

About 15 species in western North America.

1. *Eriastrum diffusum* (Gray) Mason. Spreading-branched annual to 1 dm. tall and 15 cm. broad, glabrous except at the base and around the inflorescence; leaves few, alternate, to 35 mm. long, the lower leaves asymmetrically dissected into 3 filiform segments, the upper leaves undivided; glomerules woolly, exceeded by 3- to 5-parted bracts; sepals 5-6 mm. long, uneven in length, united to about the middle, with sharp awn-tip; corolla regular to irregular, salverform, the tube expanded upward into a throat, the tube about 6 mm. long, the throat 1-2 mm. long, the lavender to white lobes 2-3 mm. long; anthers and stigmas reaching the tube orifice; seeds few to one in each cell, ovoid, brown, often viscid when wet. On dry slopes in the Trans-Pecos, spring; from w. Tex. to s. Calif. and n. Mex.

Eriastrum filifolium (Nutt.) Woot. & Standl. (*Gilia filifolia* Nutt.), of the California coast, has been mistakenly reported from Texas.

5. LOESELIA L.

Subshrubs, perennials or annuals with pubescent herbage; leaves opposite below and either nearly so throughout or passing to alternate upward, undivided, ovate to oblong or lanceolate, serrate to dentate; flowers in lax glomerules or solitary, axillary; calyx usually scarious, accompanied by toothed veiny bracts; corolla funnelform to salverform, irregular; corolla lobes purple, red, pink or white; stamens irregular, adnate well up the corolla tube, exserted; stigmas usually exceeding the anthers; seeds viscid when wet.

About 10 species from southwestern United States to South America.

1. Corolla pink, about 15 mm. long; bracts ovate 1. *L. scariosa*.
1. Corolla red, about 25 mm. long; bracts elliptic 2. *L. mexicana*.

1. *Loeselia scariosa* (Mart. & Gal.) Walp. Branched subshrub to 5 dm. tall; leaves to 25 mm. long and 1 cm. wide, sharply dentate with aristate teeth; inflorescence 1- to 3-flowered; bracts ovate, imbricated, aristate-toothed, green- to bronzy-reticulate, the areoles scarious; sepals coarsely toothed; corolla tube about 1 cm. long, pubescent on outer surface; corolla lobes pink with a white base, about 4 mm. long and 3 mm. wide; filaments adnate to above mid-tube, pilose. *L. Greggii* Wats. Rare on rocky slopes in the Trans-Pecos, fall; also in Mex. s. to Pue.

2. *Loeselia mexicana* (Lam.) Brand. Similar to *L. scariosa* but differing in leaves to 35 mm. long, the flowers solitary, corolla red and the tube about 2 cm. long with lobes 8 mm. long. Rare in the s. Trans-Pecos; also over much of Mex.

6. LINANTHUS BENTH.

About 35 species in western North America.

1. *Linanthus Bigelovii* (Gray) Greene. Nearly glabrous annual to 3 dm. tall; leaves opposite, mostly linear and undivided but a few lower ones sometimes palmately 3-parted, to 3 cm. long; flowers solitary or paired, subtended by a pubescent linear bract in stem forks; sepals somewhat uneven, about 1 cm. long, united nearly to tip by conspicuous broad membranes; corolla funnel-salverform, about 15 mm. long, white with bronze stripes, vespertine; stamens uniform, shortly adnate, the elongate anthers deep-included; styles less than half united; seeds angulate, swelling when wet. *Gilia Bigelovii* Gray. Among scattered shrubs on dry rocky slopes in far w. Tex., spring; from Tex. to Calif.

Linanthus aureus (Nutt.) Greene of New Mexico westward has been reported from Texas but no material has been seen from the state. It may occur in the Trans-Pecos, and may be distinguished from *L. Bigelovii* by its diffusely branched stem, palmately parted leaves with linear to oblanceolate divisions mostly less than 1 cm. long, diurnal flowers with turbinate calyx and broadly funnelform corolla with a usually bright-yellow limb.

7. PHLOX L. PHLOX

Subshrubs, perennials or annuals, the herbage pubescent with glandular or glandless hairs or rarely glabrous; leaves all opposite or opposite below passing to alternate upward, undivided, broadly elliptic to ovate or subulate, entire or nearly so; flowers in variously grouped glomerules or cymes or solitary; sepals united for three eighths to three fourths their length by scarious membranes, the lobes often pubescent within and cuspidate to aristate; petals united to form a salverform regular corolla, the lobes obtuse to apiculate or notched, purple, red, pink, lavender, white or rarely yellow; stamens markedly uneven; seeds one or rarely several in each cell, ellipsoidal, unchanged when wet.

A genus of 50 or more species in America. When the ranges of annual Phloxes overlap hybridization may occur. In our area *P. cuspidata* and *P. Drummondii* frequently form hybrid swarms that are readily recognized in the field.

- 1. Styles exceeding the sepals, the united part elongate . . . 12. *P. carolina* subsp. *angusta*.
- 1. Styles shorter than sepals, the united part only slightly or not exceeding the stigmas (2)
- 2(1). Habit subshrubby; petal lobes notched (3)
- 2. Habit perennial or annual (4)
- 3(2). Petal lobe about as broad as long; leaves mostly linear 1. *P. oklahomensis*.
- 3. Petal lobe longer than broad; leaves mostly subulate . . . 2. *P. nivalis*.
- 4(2). Corolla tube constricted at orifice; cells multiovulate (5)
- 4. Corolla tube not constricted; cells usually uniovulate (8)
- 5(4). Annual; most leaves alternate 6. *P. Roemeriana*.
- 5. Perennial; most leaves opposite (6)
- 6(5). Pubescence glandless; calyx membranes subcarinate; leaves narrowly linear 5. *P. triovulata*.
- 6. Pubescence mostly glandular; calyx membranes flat or wrinkly (7)
- 7(6). Nodes few; leaves narrowly to broadly linear, some over 5 cm. long 3. *P. mesoleuca*.
- 7. Nodes numerous; leaves narrowly elliptic to lanceolate, none over 4.5 cm. long 4. *P. nana*.
- 8(4). Perennial; leaves mostly opposite (9)
- 8. Annual; leaves opposite below passing to alternate upward (10)
- 9(8). Leaves relatively broad; sepals barely awned 7. *P. divaricata* subsp. *Laphamii*.
- 9. Leaves relatively narrow; sepals definitely awned 8. *P. pilosa*.
- 10(8). Plant delicate with relatively fine pubescence and small parts; petal lobes mostly less than 7 mm. wide 11. *P. cuspidata*.
- 10. Plant robust with relatively coarse pubescence and large parts; petal lobes mostly over 7 mm. wide (11)
- 11(10). Major leaves less than 10 times as long as broad; corolla tube usually more than 1.4 cm. long 9. *P. Drummondii*.
- 11. Major leaves more than 10 times as long as broad; corolla tube 1-1.4 cm. long 10. *P. glabriflora*.

1. *Phlox oklahomensis* Wherry. Spreading subshrubby perennial to 2 dm. tall and broad; leaves linear to lanceolate, subevergreen, ciliate and the upper pilose, to 6 cm. long and 5 mm. wide; the herbage copiously pubescent with hairs varying from fine-glandular to glandless flowers in sparse cymes; sepals 7-10 mm. long, united to about the middle, the blades broad-subulate and cuspidate, the membranes flat to somewhat plicate; corolla tube

8-12 mm. long; corolla lobes lavender, pink or white, sometimes with paired striae at base of lobe, obovate, 8-10 mm. long and broad, with a terminal notch to 4 mm. deep; styles 2-3 mm. long, united to about the middle; ovules and seeds often 2 in each cell. *Phlox bifida* Beck var. *induta* Shinnars. In sandy woods in n.e. Dallas Co., spring; from s. Kan. to n.w. Okla. and s. to Tex.

2. *Phlox nivalis* Lodd. subsp. *texasensis* Lundell. Subshrub with long decumbent persistent leafy shoots and erect deciduous flowering shoots to 3 dm. tall; leaves on sterile shoots subulate and on fertile shoots short-lanceolate and to 25 mm. long, the herbage pubescent; hairs fine-glandular to glandless; flowers mostly 3 to 6 in cymes; sepals 6-10 mm. long, cuspidate, united to about the middle, the membrane flat or wrinkly; corolla tube 11-17 mm. long; corolla lobes to 12 mm. long and 7 mm. wide, shallowly notched or rarely entire; styles 3-4 mm. long, united for less than half their length; ovule and seed usually solitary. *P. texensis* (Lundell) Lundell. In open grassy pinelands in s.e. Tex., spring; endemic.

3. *Phlox mesoleuca* Greene. Moderately glandular-pubescent perennial varying markedly in stature and leaf-size from year to year in relation to climatic conditions, to about 6 dm. tall, with about 5 nodes below the inflorescence; major leaves narrowly to broadly linear, to 9 cm. long and 5 cm. wide; flowers in sparse cymes, the pedicels to 45 mm. long; sepals 13-18 mm. long, united to about the middle, the membranes flat or wrinkly; corolla tube 12-18 mm. long, constricted at orifice, sparsely pilose to glabrous; corolla lobes 11-14 mm. long and to 1 cm. wide, entire or erose, purple to pink, white or rarely pale-yellow, often with a conspicuous white eye; styles 2-4 mm. long, less than half united; ovules often 2 or 3 in each cell. On rocky slopes in the Trans-Pecos, blooming throughout its growing season; from Tex. to e. Ariz. and n. Mex.

4. *Phlox nana* Nutt. Apparently derived from *P. mesoleuca* but differs in the copiously glandular herbage, less than 3 dm. tall with 6 to 12 close-set nodes; major leaves narrowly elliptic to lanceolate and to 45 mm. long and 5 mm. wide; pedicels rarely over 15 mm. long. It has about the same range and occurs in similar habitats as *P. mesoleuca*.

5. *Phlox triovulata* Torr. Apparently derived from *P. mesoleuca* but differs in having pubescence of long glandless hairs, the calyx membranes often plicate-carinate. It has the same range and occurs in similar habitats as *P. mesoleuca*.

6. *Phlox Roemeriana* Scheele. GOLD-EYE PHLOX. Showy winter annual to 35 cm. tall; leaves oblanceolate and opposite below but passing upward to lanceolate and alternate, eglandular-pubescent and ciliate, the largest to 5 cm. long and 1 cm. wide; flowers in asymmetric cymes, the herbage coarsely eglandular-pilose; pedicels to 35 mm. long; sepals 11-17 mm. long, united to below the middle, the lobes linear with obscure costa and membranes flat; corolla tube constricted at orifice, glabrous, 9-13 mm. long, the apiculate lobes averaging 14 mm. long and 11 mm. wide, purple, pink or rarely white with a conspicuous yellow eye; stamens included; styles 1.5-2 mm. long, united to about or below the middle, the stigmas below the anthers; seeds 3 to 5 in each cell. On dry rocky slopes and limestone barrens on the Edwards Plateau and adj. High Plains of Tex., spring; endemic.

7. *Phlox divaricata* L. subsp. *Laphamii* (Wood) Wherry. Perennial with subevergreen decumbent sterile shoots, sending up flowering shoots to 45 cm. tall, with about 6 well-spaced nodes; sterile shoot-leaves elliptic, to 5 cm. long and 25 mm. wide; fertile shoot-leaves broadly to narrowly lanceolate, smaller; inflorescence a compound cyme, its herbage minutely glandular; sepals 7-11 mm. long, united to about or below the middle, the lobes barely awned; corolla tube 12-18 mm. long, glabrous; corolla lobes lavender to white, averaging 13 mm. long and 8 mm. wide, the tip obtuse or apiculate but never notched; stamens deep in tube; styles 1.5-3 mm. long, about half-united, the stigmas adjacent to some anthers. Incl. var. *Laphamii* Wood. In humus-rich woodland soil along the e. Tex. border, spring; from e. S.D. to Wisc., Tex. to w. Fla.

8. *Phlox pilosa* L. Herbaceous perennial, in our region to 6 dm. tall and with 7 to 15 nodes, the occasional sterile shoots erect; leaves linear, passing upwards to lanceolate, to 12.5 cm. long near mid-stem and to 1 cm. broad near inflorescence base; flowers in small cymes aggregated into an ample panicle; longest pedicels to 2 cm. long; sepals 8-15 mm. long, united to about or below the middle, the lobes with a terminal awn to 3 mm. long; corolla tube 1-2 cm. long, varying from pubescent with glandular or eglandular hairs to

glabrous; corolla lobes purple, pink, lavender or white, 8-16 mm. long, obtuse to apiculate; styles 1.5-4 mm. long, about half-united, the stigmas below the anthers; cells normally uniovulate. In various habitats in e. to s.w. Tex., spring.

This species is markedly variable and is here divided into several taxa based on the following key characters.

1. Pubescence copious, glandular at least upward (2)
1. Pubescence sparse or obsolete (4)
- 2(1). Sepals subulate with the awn 1.5-3 mm. long8a. subsp. *pilosa*.
2. Sepals linear-subulate with the awn 1-2 mm. long (3)
- 3(2). Stem tending to be simple and moderately glandular8b. subsp. *latisejala*.
3. Stem tending to be branched and copiously glandular8c. subsp. *riparia*.
- 4(1). Hairs fine, glandular upward; sepal awn averaging 2 mm. long; corolla relatively small, the tube averaging 12 mm. long and the lobes 10 mm. long8d. subsp. *detonsa*.
4. Hairs coarse, eglandular; sepal awn averaging 1 mm. long; corolla relatively large, the tube averaging 17 mm. long and the lobes 12 mm. long8e. subsp. *pulcherrima*.

8a. *Phlox pilosa* subsp. *pilosa*. Herbage glandular, at least upward; major leaves 4-8 cm. long and 3-9 mm. wide; sepals 8-12 mm. long, the lobes subulate with an awn 1.5-3 mm. long; corolla tube 1-1.6 cm. long, varying from pubescent to glabrous without correlation with other characters. In the e. third of Tex. (Harris, Austin, Burnet and Williamson cos.); from Wisc. to Conn., s. to Fla. and Tex.

8b. *Phlox pilosa* subsp. *latisejala* Wherry. Stem pilose, to 45 cm. tall, the upper herbage glandular; major leaves to 6 cm. long and 8 mm. wide; sepals 8-12 mm. long, with a 1-2 mm. terminal awn, the blade linear-subulate and foliaceous with obscure costa and plicate membranes; corolla tube 11-17 mm. long, pilose; corolla lobes 1-1.2 mm. long; styles 3-4 mm. long, about half united. *P. pilosa* var. *aspera* (E. Nels.) Wherry. In open woods on dry slopes and less commonly in grassland, often over calcareous rocks, on and near the Edwards Plateau; endemic.

8c. *Phlox pilosa* subsp. *riparia* Wherry. Creeping woody rhizome well-developed, producing multiple erect or ascending often branched stems to 3 dm. tall with often crowded nodes, densely pubescent with many hairs glandular; leaves opposite and linear below, passing to lanceolate and alternate upward, the major ones to 45 mm. long and 8 mm. wide; inflorescence compact; sepals linear-subulate, the awn 1-2 mm. long and membranes somewhat plicate-carinate; corolla tube 1-1.5 cm. long, often glandular-pubescent. *P. villosissima* (Gray) Whiteh. On gravel deposits along streams and on talus slopes on and near the Edwards Plateau; endemic.

8d. *Phlox pilosa* subsp. *detonsa* (Gray) Wherry. Inflorescence-herbage sparsely glandular-pubescent passing to glabrous; stem and all except the uppermost leaves glabrous; measurements as in subsp. *pilosa*. In woods and thickets in e. Tex.; also e. to Ga. and Fla.

8e. *Phlox pilosa* subsp. *pulcherrima* Lundell. Pubescence of long coarse eglandular hairs, often sparse or even obsolete; major leaves to 12.5 cm. long; sepal awn averaging 1 mm. long. In grasslands and open pinelands in e. Tex.; from Tex. to La. and n. to s.w. Ind.

9. *Phlox Drummondii* Hook. Pubescent annual varying with environment from 1 to 5 dm. tall and from simple to branched; leaves opposite, subpetiolate and relatively narrow at 3 to 5 nodes, passing to alternate, sessile or clasping and broader upward; flowers in asymmetric glomerules of 2 to 6, grouped in a somewhat spiral inflorescence; sepals 7-12 mm. long, united for one third their length; corolla tube 1-2 cm. long, pubescent or exceptionally glabrous; styles 2-3 mm. long, united to about or below the middle, the stigmas below anthers; ovules normally solitary in the cells. In grasslands and open woodlands in neutral to moderately acid sandy soils in e. Tex., rare westw. and n.w., spring.

This species is highly variable and is here divided into several taxa based on the following key characters.

1. Stems relatively stout, tall and branched; leaves short and broad; corolla-hue varying markedly within colonies; introduced cultivars9c. var. *peregrina*.
1. Stems not markedly stout, tall or branched; corolla-hue varying little within colonies (except in manifest hybrids); native plants (2)
- 2(1). Corolla-hue bright-red, with dark-red eye-ring or star, the pigment persistent; corolla tube averaging 16 mm. long9b. subsp. *wilcoxiana*.
2. Corolla-hue purple, the pigment fugacious (3)
- 3(2). Eye pale with at most a narrow-rayed purple star; range northern (4)
3. Eye well-filled by a dark-red star or ring; range southern (5)
- 4(3). Herbage sparsely or not glandular; major leaves 4 to 5 times as long as wide; corolla tube 13-15 mm. long9d. subsp. *Mcallisteri*.
4. Herbage copiously glandular; major leaves 6 to 7 times as long as wide; corolla tube 18-22 mm. long9e. subsp. *Johnstonii*.
- 5(3). Corolla tube 12-16 mm. long; major leaves about 7 times as long as wide9a. subsp. *Drummondii*.
5. Corolla tube mostly 14-19 mm. long, rarely shorter; major leaves about 10 times as long as wide9f. subsp. *Tharpia*.

9a. *Phlox Drummondii* subsp. *Drummondii*. Major leaves 5 to 10 (averaging 7) times as long as wide; sepals 7-10 (averaging 8.5) mm. long; corolla tube pilose, 12-16 mm. long; corolla-hue purple, the eye nearly filled by a dark-red ring or star. In s.-cen. Tex., s. of a line connecting Guadalupe and Brazos cos., extending from the former down to San Patricio-Jackson, and from the latter to Austin-Harris cos.

9b. *Phlox Drummondii* subsp. *wilcoxiana* (Bogusch) Wherry. Major leaves 5 to 10 (averaging 7) times as long as wide; sepals 8-11 mm. long; corolla tube pilose, 15-17 mm. long; corolla-hue intense red, the eye filled with a dark-red ring or star. Incl. var. *wilcoxiana* (Bogusch) Whiteh., *P. Goldsmithii* Whiteh. Nat. in an area bounded by lines connecting Comal, Milam, Jackson and Goliad cos.

9c. *Phlox Drummondii* var. *peregrina* Shinnars. Stem tending to be stouter, taller and more branched than the above two subspecies that are supposed to have produced var. *peregrina* through hybridization; major leaves about 5 times as long as broad; corolla tube 15 mm. long; corolla-hue highly variable, from red to pink, purple, violet, lavender, white and even pale-yellow, with occasional monstrosities. Escaped from gardens and planted for roadside beautification in many parts of Tex.; escaped in many warm-temp. regions throughout the world.

9d. *Phlox Drummondii* subsp. *Mcallisteri* (Whiteh.) Wherry. Herbage not glandular or sparsely so; many leaves 4 to 5 times as long as wide; pedicels to 15 mm. long; sepals 8-11 mm. long; corolla tube 13-15 mm. long; corolla-hue light purple, with pale eye marked by a slender-rayed purple star. Incl. var. *Mcallisteri* (Whiteh.) Shinnars. Mainly in n.e. Tex., w. to Wichita Co. and s. to Leon Co.

9e. *Phlox Drummondii* subsp. *Johnstonii* (Wherry) Wherry. Stem branching; herbage pubescent throughout, with many of the hairs gland-tipped; leaves to 6 cm. long, with many 6 to 7 times as long as wide; sepals 8-10 mm. long; corolla tube slender, 18-22 mm. long, glandular-pilose; corolla-hue pink, with faintly striate pale eye. *P. Johnstonii* Wherry. Endemic in sandy open soil in a small area in n.w. Tex.

9f. *Phlox Drummondii* subsp. *Tharpia* (Whiteh.) Wherry. Stem simple or sparingly branched; leaves narrowly oblanceolate passing to linear-elliptic, the major ones averaging 10 times as long as wide; corolla tube to 2 cm. long; corolla-hue purple, with red eye-star. *P. Tharpia* Whiteh. Endemic in s.w. Tex. from Maverick and Dimmit e. to Bexar cos.

10. *Phlox glabriflora* (Brand) Whiteh. RIO GRANDE PHLOX. Villous-pubescent low annual, with multiple decumbent basal branches; leaves opposite at 4 or 5 nodes, passing to alternate upward, the major leaves ribbonlike, to 8 cm. long and mostly less than one tenth as wide; flowers in sparse asymmetric glomerules, the pedicels to 2 cm. long; sepals 7-12 mm. long, united for slightly less than half their length, tipped with an awn 0.5-1 mm. long; corolla tube 9-14 mm. long; corolla-hue light-purple to pink, with pale eye, at most faintly striate. Along the Gulf Coast and the lower Rio Grande Valley, extending inland to Atascosa and Duval cos.

The following two taxa are known.

1. Corolla tube glabrous; range Duval and Jim Hogg to Kleberg and Cameron cos.10a. subsp. *glabriflora*
1. Corolla tube pilose; range (with the preceding) Webb and Duval to Kenedy and Hidalgo, and isolated Atascosa to Aransas and Calhoun cos. [*P. Drummondii* var. *littoralis* Cory, *P. littoralis* (Cory) Whiteh., *P. Drummondii* subsp. *glabriflora* var. *littoralis* (Cory) Erbe & B. L. Turner]10b. subsp. *littoralis* (Cory) Wherry.

11. *Phlox cuspidata* Scheele. Delicate sparsely pubescent annual, varying with environment from 5 to 55 cm. tall, simple to branched; leaves opposite and oblanceolate at 4 to 6 nodes, passing to alternate and elliptic to linear upward, to 35 mm. long and 8 mm. wide; flowers in sparse asymmetric glomerules in a somewhat spiral cyme; pedicels to 6 mm. long; sepals finely glandular, 7-10 mm. long, one third to one half united, tipped with an awn 1-1.5 mm. long; corolla tube 8-15 mm. long, pilose with some hairs glandular; limb purple to pink with faintly striate pale eye; styles 1.5-2.5 mm. long, united to about or below the middle. In moderately acid sandy loam soils in grasslands and open oak woodlands, over much of e. Tex. except the pinelands, spring; also adj. Okla.

This taxon is divisible into three variants, the differentiating characters of which are given in the following key.

1. Leaves mostly less than 3 mm. wide; corolla tube 9 mm. long, the lobes 3 mm. wide11c. var. *humilis* Whiteh.
1. Leaves in part over 3 mm. wide (2)
- 2(1). Corolla tube 11-15 mm. long, the lobes 11 mm. long and 8 mm. wide11a. var. *grandiflora* Whiteh.
2. Corolla tube 9-12 mm. long, the lobes 7 mm. long and 5 mm. wide11b. var. *cuspidata*.

12. *Phlox carolina* L. subsp. *angusta* Wherry. Glabrescent perennial to 9 dm. tall; leaves linear to narrowly oblong-lanceolate, the lower ones to 15 cm. (rarely 17.5 cm.) long and 1 cm. wide, rapidly reduced in size and widely spaced above middle of plant; flowers short-pedicelled in a compound cyme; sepals 6-8 mm. long, united to above middle, separated by weak membranes that early become plicate, scarcely awn-tipped; corolla tube glabrous, to about 2 cm. long, the limb purple; anthers in part exerted; styles elongate, united nearly throughout, the stigmas equal to the anthers. Rare in meadows in n.e. Tex., spring; chiefly in the Coastal Plain from S.C. to Fla., Ill. and La.

FAM. 154. HYDROPHYLLACEAE R. BR.¹⁵⁶

WATERLEAF FAMILY

Herbs, less commonly shrubs, with alternate or opposite entire to variously divided or compound exstipulate leaves; flowers regular, perfect, 5-merous, gamopetalous, cymose to solitary; calyx deeply lobed; corolla tubular to rotate but usually campanulate; stamens epipetalous, as many as the corolla lobes and alternate with them, usually with a pair of scales at the base of each filament; ovary 1- or 2-celled, usually free from calyx; fruit a few- to many-seeded capsule.

About 300 species in 18 genera, chiefly in the warm-temperate regions of North America and South America.

1. Aquatic or marsh herbs; capsules truly bilocular; styles quite distinct6. *Hydrolea*, p. 1279.
1. Terrestrial herbs; capsule unilocular, often somewhat divided by intrusion of placenta; style solitary but usually shallowly lobed to bipartite (2)

¹⁵⁶ Contributed by Lincoln Constance.

- 2(1). Leaves entire; stamens unequal and/or unequally inserted; placentation axial ... 5. *Nama*, p. 1276.
2. Leaves variously toothed, lobed or divided; stamens equal and subequally inserted; placentation parietal (3)
- 3(2). Flowers numerous in scorpioid and often congested cymes; placentae narrow ... 4. *Phacelia*, p. 1274.
3. Flowers solitary or several in loose simple non-scorpioid clusters; placentae broad and lining capsule (4)
- 4(3). Herbage viscid and scented; ovules borne on both axial and abaxial faces of placentae ... 3. *Eucrypta*, p. 1274.
4. Herbage neither viscid nor scented; ovules borne only on axial face of placentae (5)
- 5(4). Auriculate appendages alternating with calyx lobes; corolla exceeding calyx; seeds provided with an elaiosome ... 1. *Nemophila*, p. 1273.
5. Calyx unappendaged; corolla shorter than or equaling calyx; seeds without elaiosomes ... 2. *Ellisia*, p. 1273.

1. NEMOPHILA NUTT.

BABY BLUE-EYES

Annual herbs with alternate, oblong to orbicular, pinnately lobed or divided leaves and large blue or purplish or small white flowers; calyx with 5 auriculate appendages, accrescent in fruit; corolla subrotate to campanulate, exceeding calyx; stamens included, a pair of scales at the base of each filament (or these rarely obsolete); style cleft about one half; capsule globose, 1- to 4-seeded; seeds subglobose or ovoid, regularly pitted, and provided with a reduced but persistent elaiosome.

Approximately 11 species; 2 in eastern, 9 in western North America.

1. Corolla showy, 10-30 mm. broad, blue or purplish; terminal flowers often cymose; capsule equaled or exceeded by the strongly accrescent calyx ... 1. *N. phacelioides*.
1. Corolla inconspicuous, to 5 mm. broad, white; flowers all solitary; capsule exceeding the weakly enlarged calyx ... 2. *N. microcalyx*.

1. *Nemophila phacelioides* Nutt. Stems rather stout, hirsute or glabrate; leaves oblong, 6-8 cm. long and 2.5-5 cm. wide, pinnately divided with 9 or 11 ovate divisions; flowers showy, solitary on axillary pedicels or in a terminal cyme; capsule 5-9 mm. in diameter. Sandy soil, usually in open woodlands in e. and s.e. Tex., Mar.-May; from Ark. and Okla. to s.e. Tex.

2. *Nemophila microcalyx* (Nutt.) Fisch. & Mey. Stems weak, sparsely hispid; leaves ovate to orbicular, 1-3.5 cm. long and 1-2.5 cm. wide, pinnately divided with 3 or 5 obovate divisions; flowers small, solitary; capsule 3-5 mm. in diameter. Damp woods, e. Tex., Mar.-May; from Fla. to Tex., n. to Va., Tenn., Ark. and Mo.

2. ELLISIA L.

AUNT LUCY

Monotypic in temperate North America.

1. *Ellisia Nyctelea* L. Delicate annual herb; stems very slender, retrorsely hispid; leaves mostly alternate, oblong to ovate, 3-8 cm. long and 1-3 cm. wide, pinnately divided into 7 to 13 oblong divisions; flowers small, white or bluish, solitary or several in a terminal cyme; calyx normally unappendaged, accrescent in fruit; corolla narrowly campanulate, shorter than to about equaling the calyx; stamens included, a pair of minute scales at the base of each filament; styles cleft less than one third; capsule globose, usually 4-seeded, 5-6 mm. in diameter, exceeded by the strongly accrescent subrotate calyx; seeds globose, regularly reticulate, without an elaiosome. Damp soil, often in woodlands, or weedy along roadsides and in cult. land, reportedly introd. in Tex.; from N.Y. and Pa. s. to Va., w. to Mich. and Okla. and as a weed as far w. as Sask., Wyo., and N.M.

3. EUCRYPTA Nutt.

Two or three species of southwestern United States and adjacent Mexico.

1. *Eucrypta micrantha* (Torr.) Heller. Viscid scented annual herb; stems weak and diffuse, often glandular; leaves mostly alternate, oblong to oval, 1-3 cm. long and 5-20 mm. wide, pinnatifidly divided into 7 or 9 oblong or spatulate lobes; flowers only 2-4 mm. broad, white or blue, clustered terminally; corolla campanulate, exceeding the calyx; scales 0 but a V-shaped fold between each filament pair; capsule globose to ovoid, 2-3 mm. in diameter; seeds 7 to 15, homomorphic and transversely corrugated. Damp shade, often about rocks, El Paso Co., Feb.-May; w. to Ariz., s.e. Calif. and adj. Mex.

4. PHACELIA Juss.

Perennial, biennial or annual herbs with prevalently alternate, simple to variously divided leaves and usually conspicuous blue to lavender or white flowers borne in scorpioid cymes; calyx unappendaged, accrescent in fruit, or not; corolla tubular to rotate, usually exceeding the calyx; stamens included or exerted, a pair of scales at the base of each filament or these sometimes obsolete and the filament bases dilated (or a gland bordered by parallel flaps between each filament pair); style shallowly bifid to nearly bipartite; capsule globose to ovoid, 2- to very many-seeded; seeds oblong to globose, terete to flattened, reticulate, pitted or transversely corrugated, sometimes excavated on each side of a salient ridge.

A polymorphic American genus of perhaps 200 species, mostly of the western United States and adjacent Mexico.

1. Delicate and mostly nonglandular annuals; corolla scales 0 but a gland bordered by parallel flaps between each filament pair; ovules 4 to 14 to each placenta; seeds not excavated (*Cosmanthus*) (2)
1. Robust, viscid, and scented annuals, biennials or perennials; corolla scales paired at base of each filament, glands 0; ovules 2 or rarely more to each placenta; seeds excavated on each side of a salient ridge (*Crenulatae*) (6)
- 2(1). Branches, pedicels and summit of ovary essentially glabrous 5. *P. glabra*.
2. Branches, pedicels and summit of ovary conspicuously pubescent (3)
- 3(2). Basal leaves forming a conspicuous rosette, shallowly toothed or lobed; fruiting pedicels usually strictly erect, short in comparison with calyx 1. *P. strictiflora*.
3. Basal leaves scarcely rosulate, pinnate or pinnatifid; fruiting pedicels spreading-ascending to reflexed, slender (4)
- 4(3). Stem leaves all or nearly all petiolate; pubescence sparse 3. *P. laxa*.
4. At least upper stem leaves sessile; pubescence dense (5)
- 5(4). Stem leaves dentate or shallowly lobed; ovules 6 to 12 to each placenta; seeds usually 10 to 15 2. *P. patuliflora*.
5. Stem leaves deeply lobed to pinnatifid; ovules usually 4 to each placenta; seeds 6 to 8 4. *P. hirsuta*.
- 6(1). Ovules 10 to 12 to each placenta; seeds more than 4 6. *P. infundibuliformis*.
6. Ovules regularly 2 to each placenta; seeds no more than 4 (7)
- 7(6). Stamens included or equaling corolla; corolla 3-4 mm. long and broad; calyx conspicuously glandular 7. *P. coerulea*.
7. Stamens conspicuously exerted (8)
- 8(7). Corolla narrow, funnellform or salverform, 5-7 mm. long and broad; seeds not corrugated (9)
8. Corolla broader, campanulate; seeds corrugated or not (10)

- 9(8). Basal leaves oblong to narrowly ovate, 7-25 mm. wide; corolla funnelform, 5-6 mm. long; seeds oval 8. *P. integrifolia*.
9. Basal leaves broadly ovate to orbicular, 30-70 mm. wide; corolla salverform, 6-7 mm. long; seeds oblong 9. *P. robusta*.
- 10(8). Leaves 1- to 2-pinnate or pinnatifid; seeds without transverse corrugations (11)
10. Leaves sinuate-dentate or crenately lobed; seeds transversely corrugated (12)
- 11(10). Corolla lobes crenulate or dentate; calyx lobes oval, hispid
..... 10. *P. Popei*.
11. Corolla lobes essentially entire; calyx lobes narrow, softly hirsute
..... 11. *P. congesta*.
- 12(10). Inflorescence cymose or paniculate; corolla 5-6 mm. long and broad
..... 12. *P. intermedia*.
12. Inflorescence thyrsoid; corolla 7-8 mm. long, 6-7 mm. broad
..... 13. *P. texana*.

1. *Phacelia strictiflora* (Engelm. & Gray) Gray. Hirsute or hirsutulous annual, branching or simple from a basal rosette; leaves oblong to oval, 1-6 cm. long, 5-30 mm. wide, with 1 to 6 pairs of teeth or lobes, the cauline leaves sessile; flowers purplish-lavender, rotate-campanulate, 8-20 mm. broad; capsule globose-ovoid, 3-6 mm. in diameter; seeds 10 to 20. Sandy soil of woods and fields, cen. and e. Tex., Mar.-May; e. to Ala., n. to Okla.

Several varieties are distinguishable on the basis of pubescence, leaf lobing and shape of calyx. The following key distinguishes these, all of which occur sympatrically in Texas.

1. Basal leaves bright-green, glabrate beneath, persistently rosulate; calyx of lower flowers disproportionately enlarging in fruit var. *Lundelliana* Const.
1. Basal leaves grayish, pubescent beneath, the rosettes withering early; calyx of all flowers enlarging subequally (2)
- 2(1). Pubescence loosely spreading; calyx lobes broad .. var. *strictiflora*.
2. Pubescence appressed; calyx lobes narrow (3)
- 3(2). Stem leaves crowded, deeply saliently lobed, the lobes acute
..... var. *connexa* Const.
3. Stem leaves rather remote, subpinnatifid, with obtuse lobes
..... var. *Robbinsii* Const.

2. *Phacelia patuliflora* (Engelm. & Gray) Gray. Densely hirsute to finely strigulose, branching, frequently decumbent annual, without an evident basal rosette; leaves oblong to broadly oval, 2-10 cm. long, 1-4 cm. wide, pinnately lobed to pinnatifid with 1 to 7 pairs of lobes, the cauline leaves mostly sessile; flowers lavender to purplish-violet, often white-centered, broadly campanulate 8-20 mm. broad; capsule globose, 4-6 mm. in diameter; seeds 10 to 15. Var. *teucrifolia* (I. M. Johnst.) Const. (*P. teucrifolia* I. M. Johnst.) is distinguished by its rather stiffly ascending branches and fruiting pedicels and acute calyx lobes. Sandy soil of woodlands and alluvial terraces, cen. and s.e. Tex., Mar.-May; s. to adj. Mex.

3. *Phacelia laxa* Small. Diffuse, sparsely hirsute annual; leaves oblong-oval to oval, 2-8 cm. long, 12-35 mm. wide, pinnate or pinnatifid with 1 or 2 pairs of small basal leaflets and a much larger terminal leaflet or lobe, the cauline leaves mostly prominently petiolate; flowers pale-bluish-lavender with a whitish center, broadly campanulate, 8-12 mm. broad; capsule globose, 3-5 mm. in diameter; seeds 4 to 8. *P. prostrata* Brand. Moist heavy soil of shaded alluvial thickets, s.e. Tex., Mar.-May; endemic.

4. *Phacelia hirsuta* Nutt. Densely pubescent, erect or ascending annual; leaves oblong, 2-4.5 cm. long, 8-25 mm. wide, pinnate or pinnatifid with 2 to 4 pairs of lobes; flowers bluish-lavender with a whitish center, rotate-campanulate, 8-13 mm. broad; capsule subglobose, 3.5-4 mm. in diameter; seeds 6 to 8. Sandy soil of borders and openings in deciduous woods, n.e. Tex., Mar.-May; La. to Tex., n. to s. Mo. and s.e. Kan.

5. *Phacelia glabra* Nutt. Glabrescent, slightly succulent, erect or ascending annual; leaves oblong to oblong-oval, 1.5-4 cm. long, 5-15 mm. broad, pinnate or pinnatifid with

2 to 4 pairs of lobes; flowers bluish-lavender with a whitish center, rotate-campanulate, 5-12 mm. broad; capsule globose, 3-4 mm. in diameter; seeds 4 to 8. Sandy loam of prairies and borders of deciduous woods in n.e. Tex., Mar.-May; n. to Ark. and e. Okla.

6. *Phacelia infundibuliformis* Torr. Rather stout viscid-canescens branched annual; basal leaves oblong, 3.5-10 cm. long, 25-65 mm. wide, pinnate and the leaflets often petiolulate or pinnatifid, the cauline often petiolate; flowers purplish, funnellform, 6-7 mm. long and 5-6 mm. broad; capsule oblong, 5 mm. long; seeds usually 8 to 15, not corrugated. Rock crevices along the upper Rio Grande of w. Tex.; Tex., N.M. (?), Coah. and Chih.

7. *Phacelia coerulea* Greene. Slender viscid many-stemmed annual; leaves broadly ovate to oblong-ovate, 3-8 cm. long, 1-2.5 cm. wide, shallowly cleft to pinnatifid, the cauline often long-petiolate; flowers blue or white, campanulate; capsule ovoid, 2-3 mm. long; seeds 4, corrugated. *P. invenusta* Gray. Rocky slopes in extreme w. Tex., Mar.-May; w. to Ariz. and s.e. Calif., s. to Chih.

8. *Phacelia integrifolia* Torr. Stout viscid mostly unbranched annual or biennial; basal leaves oblong to narrowly ovate, 2-7 cm. long, 7-25 mm. wide, crenate to shallowly pinnatifid, the cauline usually sessile; flowers purplish-lavender, funnellform; capsule ovoid-globose, 3.5 mm. long; seeds 4, not corrugated. *P. arenicola* Brandeg. Rocky or sandy soil, particularly gypsum or limestone, in w. and n. Tex., Mar.-May; n. to Okla. and Kan., w. to Ut. and Ariz., s. to Chih.

9. *Phacelia robusta* (Macbr.) I. M. Johnst. Stout viscid mostly unbranched annual or biennial; basal leaves broadly ovate to orbicular, 3-15 cm. long, 3-7 cm. wide, irregularly crenate to shallowly lobed, the cauline often petiolate; flowers pink or pale-lavender, salverform; capsule ovoid-globose, 3-4 mm. long; seeds 4, not corrugated. *P. integrifolia* var. *robusta* Macbr. The relationship of this to the preceding taxon deserves further study. Rocky places in the mts. of w. Tex. to n. Tex. (?), May-Aug.; s. to Coah. and Chih.

10. *Phacelia Popei* T. & G. Low diffuse viscid-pubescent annual, branching from base; leaves narrowly oblong, 2-15 cm. long, 1-3 cm. wide, 1- to 2-pinnate with linear or lanceolate divisions; flowers blue to purplish [var *similis* (Woot. & Standl.) J. Voss] or white (var. *Popei*), campanulate, 3.5-7 mm. long and broad; capsule globose, 2 mm. in diameter; seeds 4, not corrugated. Sandy or rocky soil, often limestone or gypsum, w. Tex., Apr.-May; Tex., N.M. and Chih.

11. *Phacelia congesta* Hook. Diffuse or erect, variously pubescent and usually somewhat viscid annual or biennial; leaves ovate, 3-10 cm. long, 3-4 cm. wide, 1- to 2-pinnate or pinnatifid; flowers blue or purplish, or white (var. *rupestris* Macbr.), campanulate, 5-7 mm. long and 3-6 mm. broad; capsule ovoid, 2-3 mm. long; seeds 4 or 2 (var. *dissecta* Gray), not corrugated. Sandy, gravelly or rocky soil, distributed almost throughout the state except e. Tex., Mar.-June; Tex., N.M., Ariz., Chih., Coah. and N.L.

12. *Phacelia intermedia* Woot. Viscid erect annual, branching from base or simple; leaves lanceolate to oblong, 3-14 cm. long, 5-20 mm. wide, crenately lobed, the lobes again crenate; flowers purplish, campanulate, 6 mm. long and broad; capsule globose, 3-3.5 mm. in diameter; seeds 4, corrugated. Perhaps only a phase of the widespread and variable *P. crenulata* Torr. Sand, gravel and rocky slopes, sometimes on limestone, w. Tex., Feb.-Apr.; w. to N.M., Ut. and Ariz.

13. *Phacelia texana* J. Voss. Stout erect glandular-viscid biennial, with small ascending branches; leaves narrowly lanceolate to oblong, 8-12 cm. long, about 2 cm. wide, coarsely sinuate-dentate; flowers purplish to pink, campanulate, 7-8 mm. long, 6-7 mm. broad; capsule globose, 2.5-3 mm. in diameter; seeds 4, oblong, transversely corrugated. Except for the corrugated seeds, this closely resembles *P. integrifolia* and *P. robusta*. On clay shale in the Trans-Pecos, Mar.-May; endemic.

5. NAMA L.

Low, pubescent annual or occasionally perennial herbs with mostly alternate, essentially entire leaves and conspicuous or inconspicuous white to purplish-violet flowers in non-scorpioid terminal cymes or solitary; calyx usually divided nearly to base, unappendaged, little-acrescent; corolla tubular to broadly funnellform or campanulate, usually exceeding calyx; stamens included, usually unequal and unequally inserted, filament base usually

mm. wide; flowers lavender, solitary or in small terminal clusters; calyx lobes linear, 4-5 mm. long; corolla tubular-funnelform, 6-8 mm. long; stamen bases dilated into free-margined, toothed scales much shorter than the free filament; seeds yellow, reticulate. Rock crevices in the mts. of extreme w. Tex., July-Sept.; endemic.

3. *Nama serpylloides* Hemsl. Prostrate, diffusely branched, subsericeous perennial, the slender, leafy branches 1-4 dm. long; leaves mostly opposite, obovate or obovate-spatulate, somewhat revolute, 7-15 mm. long and 2-4 mm. wide; flowers pink, solitary or paired; calyx lobes linear, 2-3 mm. long; corolla funnelform-campanulate, 5-10 mm. long; stamen bases slightly dilated into narrowly free-margined scales much shorter than the free filament and extending to base of corolla; seeds brown, shallowly pitted. Gravelly soil of brushland, s. Tex., Mar.-Apr.; also Coah.

4. *Nama parvifolium* (Torr.) Greenm. Prostrate, diffusely branched, subsericeous annual or perennial, the slender leafy branches 2-20 cm. long; leaves alternate or opposite at least toward tips of branches, oblanceolate to obovate, somewhat revolute, 5-24 mm. long, 3-10 mm. wide; flowers pink or purplish, 1 or 2 in leaf axils; calyx lobes linear-lanceolate, 5-7 mm. long; corolla funnelform-campanulate, 7-12 mm. long; stamen bases slightly dilated into narrowly free-margined scales much shorter than the free filament and extending to base of corolla; seeds brown, shallowly pitted. Rocky limestone slopes of Rio Grande Plains and Edwards Plateau, Apr.-July; also Tam. and N.L.

5. *Nama jamaicense* L. Prostrate or ascending, strigose-hirsute, leafy annual, branching from base, the branches 1-5 dm. long; leaves alternate, spatulate to obovate, 15-80 mm. long, 5-35 mm. wide, plane, conspicuously decurrent at base to form a winged stem; flowers white, usually solitary in upper leaf axils; calyx lobes linear or linear-spatulate, enlarging and adherent to ovary in fruit; corolla nearly tubular, 6-7 mm. long; stamen bases dilated into free-margined scales shorter than the free filament; seeds brown, finely alveolate. Moist places under shrubs and elsewhere in e. and s.e. Tex., Apr.-July; e. to Fla. and s. to W.I. and C.A.

6. *Nama stenocarpum* Gray. Prostrate to ascending or erect sparsely hirsute annual, branching from base, the leafy branches 1-3 dm. long; leaves alternate, oblong to spatulate, 1-4 cm. long, 2-10 mm. wide, often undulate, sometimes clasping; flowers lavender, solitary or paired at nodes; calyx lobes linear-spatulate, 4-7 mm. long, calyx tube adnate to the inferior ovary; corolla tubular-campanulate, 5-7 mm. long, little longer than calyx; stamen bases dilated into free-margined scales about equaling the free filament; seeds yellowish, finely alveolate. Mud of poorly drained clay soil in s. and s.e. Tex., Mar.-May; w. to Ariz. and Calif., s. to adj. Mex.

7. *Nama undulatum* H.B.K. Prostrate or ascending, villous-hirsute, glandular annual, branching from base, the branches 1-3 dm. long; leaves alternate, oblong-lanceolate to spatulate, 15-20 mm. long, 2-12 mm. wide, undulate, often clasping; flowers pink, clustered in few-flowered terminal and lateral cymes; calyx lobes linear-spatulate, enlarging but free in fruit; corolla funnelform-campanulate, 6-9 mm. long; stamen bases dilated into free-margined scales about equaling the free filament and extending to base of corolla; seeds yellow, finely alveolate. Gravelly soil in brushland and elsewhere from the Rio Grande Plains and Edwards Plateau to the Trans-Pecos, June-Aug.; s. to cen. Mex. and in Chile and Arg.

8. *Nama torynophyllum* Greenm. Prostrate, matted, leafy, densely villous annual, with very short branches; leaves alternate, spatulate, revolute and spoon-shaped, 1 cm. long, 1.5-4 mm. wide; flowers white or pinkish, numerous, arranged singly along the branches; calyx lobes linear-spatulate, 3-3.5 mm. long; corolla tubular, 3-4 mm. long; stamen bases not dilated, the adnate portion much shorter than the free filament; seeds brown, shallowly pitted. Gravel bars along the Rio Grande and tributaries in Brewster Co., Feb.-Apr.; also Coah.

9. *Nama Havardii* Gray. Erect, villous, leafy, persistent annual, stoutly branching from near base, 1.5-4 dm. tall; leaves alternate, oblong to oval-spatulate, strongly revolute to plane, petiolate, 2-4 cm. long, 4-13 mm. wide; flowers pale-pink or white, numerous in small terminal and lateral clusters; calyx lobes linear-spatulate, 6-9 mm. long; corolla funnelform-campanulate, 8-12 mm. long; stamen bases dilated into broadly free-margined scales much longer than the free filament; seeds brown, shallowly pitted. Gravelly bars, washes and slopes in the Big Bend area of w. Tex., Apr.-June; endemic.

10. *Nama Stevensii* C. L. Hitchc. Grayish-strigose, erect or ascending annual, usually branched from base and forming dense rounded clumps; leaves alternate, linear-lanceolate, strongly revolute, sessile, 1-3 cm. long, 1-3 mm. wide; flowers lavender, in small axillary clusters usually exceeded by the leaves; calyx lobes linear-lanceolate, 5-8 mm. long, corolla funnelform-campanulate, 8-10 mm. long; stamen bases dilated into narrowly free-margined scales about equaling the free filament; seeds yellow, alveolate. Perhaps only a gypsophilous phase of *N. hispidum*. On sandy gypsum soils of the Rolling Plains and Trans-Pecos, May-July; also Okla.

11. *Nama hispidum* Gray. Strigose-hispid and hirsute erect or ascending annual, freely branched from base or only above, 1-5 dm. tall; leaves prevalently alternate, linear-oblong to obovate, plane to strongly revolute, mostly narrowed at base, 1-7 cm. long and 1-8 mm. wide; flowers pink to bright-purple, solitary or in small terminal clusters; calyx lobes linear-lanceolate, 4-7 mm. long; corolla funnelform-campanulate, 8-15 mm. long; stamen bases scarcely dilated, the adnate portion shorter than the free filament; seeds yellow, finely alveolate. A widespread and extremely variable species; the described varieties, based on habit and foliar characters, are confused. In sand and on gravelly soil in diverse habitats almost throughout Tex., Mar.-July; n. to Okla., w. to Ariz. and Calif.

12. *Nama dichotomum* (R. & P.) Choisy. Erect or ascending, sparsely leafy, usually dichotomously branching annual 5-20 cm. tall; leaves alternate, linear to narrowly oblanceolate or spatulate, plane, petiolate, 1-3 cm. long, 2-5 mm. wide; flowers pale-lavender, borne singly or in pairs in the upper branches; calyx lobes linear to narrowly spatulate, 5-10 mm. long; corolla tubular-campanulate, about 5 mm. long; stamen bases dilated into free-margined scales shorter than the free filament; seeds brown, prominently large-pitted. Gravelly summit of Mt. Livermore, Jeff Davis Co., 8,000 ft. elev., Aug.-Sept.; w. to Colo., N.M. and Ariz.; highlands of Mex. and in temp. S.A.

6. HYDROLEA L.

Annual or perennial, usually spiny, aquatic or marsh herbs with alternate entire leaves and corymbose or cymose blue flowers; calyx unappendaged, not conspicuously accrescent; corolla rotate-campanulate, exceeding or equaling the calyx; stamens included or exserted; corolla scales 0; styles distinct; capsule ovoid or globose, many seeded, often dehiscing irregularly; seeds minute, striate or rugose.

Approximately 20 species, pantropical, but predominantly subtropical America.

1. Plants essentially glabrous; leaves lanceolate; flowers in small axillary clusters, the calyx essentially glabrous 3. *H. uniflora*.
1. Plants conspicuously pubescent; leaves oblong to ovate; flowers in terminal clusters, the calyx hirsute (2)
- 2(1). Foliage and inflorescence finely hirtellous; anthers slightly exserted 1. *H. ovata*.
2. Foliage and inflorescence hirsute and usually glandular; anthers included 2. *H. spinosa*.

1. *Hydrolea ovata* Choisy. Stout erect spiny hirtellous perennial; leaves 3-6 cm. long, 15-25 mm. wide; flowers showy, 15-25 mm. broad; sepals shorter than corolla. Edges of ponds and streams in e. and s.e. Tex., Sept.-Oct.; La. to Tex., n. to Miss. and Ark.

2. *Hydrolea spinosa* L. Stout erect usually very spiny perennial, hirsute and usually glandular; leaves 3-12 cm. long, 5-30 mm. wide; flowers showy, 1-1.5 cm. broad; sepals shorter than corolla. Cameron Co., June; s. to Mex., W.I., and C.A. and S.A.

3. *Hydrolea uniflora* Raf. Slender weakly erect spiny glabrous perennial; leaves 5-8 cm. long, 1.5-2 cm. wide; flowers rather inconspicuous, 1-1.5 cm. broad; sepals equaling corolla. *H. affinis* Gray. Edges and shallow water of ponds and streams in e. and s.e. Tex., Sept.-Oct.; n. to Ark., Mo. and s. Ill.

A colony of plants found in Red River County represents what is undoubtedly the product of crossing between *H. uniflora* and *H. ovata*. The plants are strikingly intermediate between these two species in pubescence and corolla.

FAM. 155. BORAGINACEAE JUSS.¹⁵⁷

BORAGE FAMILY

Plants herbaceous, shrubby or arborescent, usually bristly; leaves simple, alternate; flowers perfect, regular, solitary or cymose; cymes glomerate-racemose or spicate, frequently unilateral and coiled (scorpioid), usually with bracts between, to one side of, or opposite the flowers; calyx usually deeply lobed, somewhat irregular; corolla 5-lobed, commonly with folds or saccate-intruded appendages in the throat; stamens 5, borne on the corolla tube alternate with the lobes; ovary superior, bicarpellate, usually 4-ovulate, entire or lobed, becoming tough or bony at maturity; fruit commonly breaking up into 4 single-seeded lobes (achenelike mericarps) or remaining intact but the mesocarp becoming fleshy and the fruit thus drupaceous; style lobed or entire, seated in the pericarp at the apex of the fruit or borne between the fruit lobes (nutlets) on the receptacle, or on an upward prolongation thereof (gynobase); endosperm absent or scarce.

The classification of this large family is based primarily upon the structure of the fruit. In many cases it is very difficult to recognize the genus and almost impossible to obtain a precise identification of the species if the specimens lack mature fruiting structures. *Cordia* and *Ehretia* are now commonly placed in the segregate family Ehretiaceae. Numerous species are cultivated as ornamentals, notably in the genera *Heliotropium* (heliotrope), *Anchusa*, *Echium*, and *Myosotis* (forget-me-not).

1. Ovary entire or shallowly lobed, the style terminal (2)
 1. Ovary deeply 4-lobed, the style borne on the gynobase and arising between the lobes of the ovary (6)
 - 2(1). Style cleft twice, the four branches each bearing a stigma1. *Cordia*, p. 1281.
 2. Style cleft or divided once or simple or none (3)
 - 3(2). Style distinctly cleft or divided (4)
 3. Style simple, very short or absent; stigma annular-peltate, surmounted by a conical or cylindrical, simple or lobed appendage (5)
 - 4(3). Style shallowly cleft or two-lobed2. *Ehretia*, p. 1282.
 4. Style deeply cleft or divided to the base3. *Coldenia*, p. 1282.
 - 5(3). Fruit with a fleshy mesocarp; large shrubs4. *Tournefortia*, p. 1285.
 5. Fruit dry, without a fleshy mesocarp; herbaceous or small subshrubs5. *Heliotropium*, p. 1285.
- 6(1). Mericarps spreading apart at maturity, attached to the gynobase by their apical ends; attachment scar (areola) not extending below middle of the ventral surface of the mericarp (7)
 6. Mericarps more or less erect and parallel at maturity, attached basally, basilaterally or medially to the gynobase (8)
 - 7(6). Dorsal surface of mericarp without glochidiate prickles; mericarps with a cupulate margin6. *Omphalodes*, p. 1291.
 7. Dorsal surface of mericarp armed with glochidiate prickles; mericarps with a raised margin or the margin indistinct or absent7. *Cynoglossum*, p. 1291.
 - 8(6). Mericarps attached medially or basilaterally, if nearly basal, the attachment scar always small or with a substipitate prolongation (9)
 8. Mericarps attached basally to the broad, low gynobase; attachment scar large and broad, sometimes surrounded by a low rim (14)
 - 9(8). Mericarps conspicuously armed with glochidiate prickles (10)
 9. Mericarps smooth or roughened, lacking glochidiate prickles (11)
 - 10(9). Pedicels erect or ascending in fruit; racemes bracteate; mericarps attached to the subulate gynobase all along their ventral keel, free near the base; plants mostly annuals8. *Lappula*, p. 1292.

¹⁵⁷ Adapted from I. M. Johnston in C. L. Lundell, *Flora of Texas* I:123-221. 1964. See Appendix.

10. Pedicels recurved or deflexed in fruit; racemes naked or sparsely bracted; mericarps attached medially to the broadly pyramidal gynobase by a broad areola; plants mostly perennials or biennials 9. *Hackelia*, p. 1293.
- 11(9). Corolla lobes convolute in bud; in ours the calyx tube with spreading uncinat hairs; mericarps smooth, attached near the base, the scar very small 12. *Myosotis*, p. 1302.
11. Corolla lobes imbricate in bud; calyx tube with straight hairs; mericarps mostly roughened (excepting a few species in *Cryptantha*), variously attached (12)
- 12(11). Mericarps without a ventral keel, but with a closed or narrowly open ventral groove extending most of the length of the mericarp, the groove forked at the base or ending in a depressed areola 10. *Cryptantha*, p. 1294.
12. Mericarps with a ventral keel, not grooved (13)
- 13(12). Annuals; corolla bright-orange or yellow, throat open or constricted; mericarp with an elevated carunclelike inframedial attachment scar lying below the ventral keel 11. *Amsinckia*, p. 1301.
13. Perennials; corolla blue to whitish, throat closed by appendages; mericarp with a broad inframedial areola or with a substipitate basal prolongation of the ventral keel 13. *Antiphytum*, p. 1303.
- 14(8). Corolla irregular, the upper lobes usually longer than the lower ones; stamens not all equal in length 17. *Echium*, p. 1311.
14. Corolla regular; stamens all equal in length (15)
- 15(14). Corolla lobes acute or acuminate, erect; style long-exserted 16. *Onosmodium*, p. 1309.
15. Corolla lobes rounded or obtuse, ascending or spreading or recurved; style included or short-exserted (16)
- 16(15). Inside of corolla throat without guide lines; stipitate glands or faucal appendages or both present, scattered or localized in groups 14. *Lithospermum*, p. 1304.
16. Inside of corolla throat with 5 well-developed elongate, vertical guide lines consisting of crowded hairs and stipitate glands 15. *Buglossoides*, p. 1309.

1. CORDIA L.

Trees or shrubs; leaves small to large, usually evidently petiolate, margin entire, crenate, serrate or rarely even lobulate; cymes ebracteate, mostly corymbose; flowers homomorphic or heterostyled or functionally more or less unisexual (functionally male flowers with style and stigmas much reduced or completely undeveloped); corolla campanulate to funnelform, small to large, white, yellow, orange, or red, usually 5-merous but occasionally 4- to 8-merous, lobes ascending to recurved, tube short to long, cylindrical or expanding; stamens exserted or included, filaments often hairy towards the base, usually well-developed; style terminal on ovary, dichotomous, a simple column at base, then dividing into two branches which in turn fork to produce the four ultimate branches each bearing a stigma; stigmas 4, clavate to spatulate or capitate; fruit a drupe with watery or glutinous mesocarp or rarely without fleshy mesocarp and hence a nut; endocarp bony, 1- to 4-seeded; seeds without endosperm; cotyledons plicate.

About 250 species of tropical or warm temperate trees and shrubs having the majority of its species and its center of greatest diversity in America.

1. Large shrub or tree over 1 m. tall; leaf margin entire or minutely toothed; corolla 35 mm. or more long 1. *C. Boissieri*.
1. Small shrub less than 1 m. tall; leaf margin coarsely serrate or sinuately toothed or lobed; corolla less than 20 mm. long 2. *C. podocephala*.

1. *Cordia Boissieri* A. DC. ANACAHUTTE. Shrub or small tree to 8 m. tall and with a trunk to 2 dm. in diameter, the thick bark gray and ridged; leaves with a petiole to 4 cm. long, thick, firm, ovate to lance-ovate, to 2 dm. long and 15 cm. wide, rounded to shallowly cordate at base, broadly obtuse to acute apex, scabrous on upper surface, softly

tomentose on lower surface; flowers heterostylic, crowded into 6- to 8-flowered cymes that are grouped into a corymbose inflorescence; calyx tube cupulate or cylindric, 8-16 mm. long, the teeth acute; corolla funnellform, white with a yellow throat, 35-45 mm. long, the lobes rounded and crispate-erose; fruit ovoid, 2-3 cm. long, reddish-brown, shiny, the flesh sweet. In thickets, chaparral, fencerows, on gravelly slopes and along stream banks of the Rio Grande Plains and brushlands of extreme s. Tex. (n. to Jim Hogg, Hidalgo and Willacy cos.), throughout the year; Tex. s. to Coah., Tam., N.L. and S.L.P.

Often planted as an ornamental as far north as Corpus Christi and San Antonio but tending to freeze back in cold winters.

2. *Cordia podocephala* Torr. Small fruticose perennial, from a woody reddish-brown root; stems few, erect, simple or with few strictly ascending branches, 3-6 dm. tall, 1-2 mm. thick, antrorsely strigose; leaves to 9 cm. long and 25 mm. wide, narrowly lanceolate to oblanceolate or sometimes somewhat ovate, acute to obtuse at apex, the base acute and contracted into a short petiole, pinnately veined, strigose on both surfaces and paler on the lower surface, the margin coarsely serrate or sinuately toothed or lobed; inflorescence a globose dense head before anthesis, 5-10 mm. thick, on a naked peduncle to 18 cm. long, terminal on the shoot or extra-axillary along the leafy stem; calyx strigose, just before opening 3-4 mm. long, ovoid, the apex obtusely pointed, lobes triangular, valvate, with the tip sharply acute but not appendaged; corolla white, delicate, 12-18 mm. long, funnellform, coarsely emarginate; drupe included and tightly invested by the saclike calyx. On rocky hills and outcrops, in wooded arroyos, on mesquite plains, and similar situations in s. Tex. (n. to Bexar and Medina cos.), May-Oct.; Tex., Tam., N.L. and Coah.

2. EHRETIA L.

This genus consists of about 50 species in Africa, southern Asia, the East Indies and several in America.

1. *Ehretia Anacua* (Teran & Berl.) I. M. Johnst. SUGARBERRY, KNOCK-AWAY, ANACUA. Tree to 15 m. tall, usually with multiple trunks and thick furrowed bark separating into thin gray or reddish scales, the foliage somber-green, evergreen or seasonally partially deciduous in northern parts of its geographic range; leaves distinctly petiolate, elliptic to ovate or less commonly broadly lanceolate, 3-12 (usually 3-6) cm. long and 1.5-8 (usually 2-3) cm. wide, the margin entire or rarely coarsely toothed above the middle, frequently somewhat revolute, rounded to obtuse at base, at apex usually obtuse and frequently with the very tip apiculate, upper surface bearing abundant mineralized disks from which arise short stout sharply pointed minute antrorsely appressed hairs that make the surface decidedly scabrous, lower surface paler than the above surface and thinly velvety or glabrous except for short slender scattered hairs along the midrib and veins and for the hair clusters in the axils of the principal veins; inflorescence terminal on the younger leafy twigs, 1.5-7 cm. long; flowers fragrant; calyx lobed almost to the base, the lobes lanceolate, slightly unequal with the abaxial one largest, at anthesis lobes 2.5-3.5 mm. long and 0.5-1 mm. broad, almost doubling in size at maturity; corolla white, 6-7 mm. long, becoming 2.5-4 mm. broad at summit, the lobes ovate or elliptic; drupe orange-color or dark-yellow, globose, 5-8 mm. thick, containing 2 hemispheric stones (each 2-seeded) surrounded by a thin juicy edible flesh. *E. elliptica* A. DC. In thickets, forests, palm groves and open forests, along fencerows and brushlands in s. Tex. (n. to Hays and Travis cos.), June-Oct.; also Tam. and N.L.

Often planted as an ornamental as far north as Dallas where it may die back in excessively cold winters.

3. COLDENIA L.

Herbaceous or suffruticose plants with slender, forking, usually prostrate or widely spreading stems; leaves small and numerous, subsessile or petiolate; flowers generally extra-axillary, along leafy twigs or at the forks of the branches, sometimes glomerate, commonly opening late in the afternoon; corolla mostly small, with cylindric or ampliate tube and spreading lobes, throat naked or sometimes appendaged; style terminal on ovary,

short to long, bilobed or biparted; stigmas 2, not conspicuously differentiated from the style branch; fruit dry, pyramidal or hemispheric or more or less obviously 4-lobed, dividing into usually 4 single-seeded achenelike mericarps; mericarps more or less broadly united ventrally or joined to a central prolongation of the receptacle.

Except for a single Old World species, the remaining 19 are entirely confined to arid regions of America.

1. Plant a small erect bush; flowers and fruit aggregated into dense globose clusters terminating the leafy branches and branchlets; bracts inconspicuous, simulating the filiform, plumose, very elongate calyx lobes; fruit normally maturing only a single ovule 1. *C. Greggii*.
1. Plant low and spreading, usually prostrate; flowers and fruit borne in the leaf axils or mixed among leaves in leaf clusters borne along the leaf-bearing branches and branchlets (2)
 - 2(1). Fruit nearly globose, unlobed, at maturity breaking apart into quarter sections, each quarter forming a mericarp; leaf blades commonly elliptic or ovate; plant pallid, tomentose 2. *C. canescens*.
 2. Fruit deeply 4-lobed, the lobes joined only by their inner angle, each lobe forming a mericarp (3)
 - 3(2). Leaves with a slender elongate petiole, half to nearly as long as the usually elliptic or ovate blade, not conspicuously broadened, thickened and indurate below the middle; plant pallid, tomentose (4)
 3. Leaves with a narrow elongate blade borne on a short broadened ovate or triangular petiole which is always thickened and indurate in age (5)
 - 4(3). Corolla in the bud minutely glandular, but otherwise glabrous 3. *C. mexicana* var. *mexicana*.
 4. Corolla in the bud distinctly villulose, not at all glandular or only very sparsely and inconspicuously so; corolla perhaps averaging smaller than in the typical form and the older stems possibly becoming somewhat more fruticulose 3a. *C. mexicana* var. *tomentosa*.
- 5(3). Corolla bud bearing abundant minute stipitate glands, otherwise glabrous; attachment scar on mericarp entirely closed or opened only above the middle; leaves usually cinereous, blade as broad or slightly broader than the broad petiole, lower surface not entirely covered by the inrolled margins 4. *C. gossypina*.
5. Corolla bud villulose, or rarely also sparsely glanduliferous; attachment scar on mericarps open for its entire length or at least below the middle; leaves usually green, the blade usually very slender and narrower than the broad base of the petiole, only the midrib on the lower surface not covered by the strongly inrolled leaf margins 5. *C. hispidissima*.

1. *Coldenia Greggii* (T. & G.) Gray. Shrub more or less globose, 1-3 dm. but at times 5 dm. or more tall, becoming much-branched, very twiggy and compact in age; leaves numerous, shortly petiolate, ovate to elliptic, 5-9 mm. long, 2.5-6 mm. wide, usually densely tomentulose and pale on the lower surface, usually pale or slightly tawny and densely tomentulose with an admixture of stout coarse usually appressed hairs on upper surface; flower clusters 1-2 cm. in diameter; calyx sessile, eventually with the mature fruit tightly embraced by the base of the lobes detaching and the whole calyx functioning as a means of wind dissemination, the lobes very slender and elongate, subulate-filiform, decidedly unequal, 5-9 mm. long, plumose with an abundance of very slender long spreading hairs and bearing also minute inconspicuous gland-tipped hairs, usually somewhat smoke-colored or more or less purplish at maturity; corolla pink to magenta, 6.5-8 mm. in total length; fruit at maturity lance-ellipsoidal, 2-2.5 mm. long, 1-1.2 mm. thick near the middle, by abortion always one-celled and one-seeded, thin-walled (not at all bony!), indehiscent, dorsal side usually lustrous and above the middle sparsely hispidu-

lous, ventral side bearing dull pale papery tissue representing the three aborted cells of the fruit. Usually found only on and about exposures of limestone in the Trans-Pecos, Mar.-Aug.; also N.M., e. Chih., w. and s. Coah., to n. Zac. and Dgo.

2. *Coldenia canescens* DC. OREJA DE FERRO. Plant from a woody taproot, suffrutescent, to 1 dm. tall and 3 dm. thick, the usually numerous leaf stems and branches pallid, tomentose; leaves numerous, shortly petiolate, ovate to elliptic or elliptic-lanceolate, obtuse or broadly acute at the ends, 7-15 mm. long, 2.5-9 mm. broad, thickish, the margins narrowly somewhat revolute, densely pale tomentose on lower surface, with a thinner tomentum intermingled with short stiffish usually appressed hairs that arise from discoid or thickened bases on upper surface; calyx sessile, persistent, at anthesis 3-4 mm. long, the lobes about as long as the corolla tube, unequal, united above the base; lobes of the fruiting calyx lanceolate, usually long-attenuate, 4-7 mm. long, below the middle 1-1.5 mm. broad and scarious margined, and tightly embracing the ovoid-globose fruit almost to its apex; corolla 5-6 (-8) mm. in total length, pink, rose or rarely white, the broadly rounded lobes 1.8-3 (-4.5) mm. broad and 1.5-2 (-3.5) mm. long, the margins frequently erose; fruit at maturity glabrous or hairy, 2.5-3 mm. in diameter, 2-2.5 mm. high, the pericarp marked by 4 equispaced longitudinal grooves. In the Trans-Pecos, e. to Mitchell and Tom Green cos. and s.e. to Hidalgo Co., Mar.-Aug.; also s. N.M. and Mex. (extending s. to the states of Hgo. and Qro.).

A very pronounced calciphile, growing on limestone, caliche or rocky calcareous soils.

It is quite possible that the more western plant (Calif. to N.M., s. to n. Mex.), segregated as var. *subnuda* I. M. Johnst., may be found in Brewster and Presidio cos. It is a coarser and less depressed plant with usually larger, more rounded, greener leaves, and a more sparsely tomentose indument that contains coarser, more spreading hairs.

3. *Coldenia mexicana* Wats. var. *mexicana*. Plant forming mats from a woody taproot, tomentose, usually pale, 2-5 dm. broad, the older stems fruticulose but never very strong and rigid; leaves white tomentose, clustered, borne mostly on short branchlets along the main stem and branches, thickish, veinless, elliptic to somewhat ovate or broadly lanceolate, to 1 cm. long and 6 mm. broad, acute to broadly obtuse at both ends, the margins revolute, both surfaces white tomentose, the upper surface also sparsely hispid (discoid bases of bristles hidden in the tomentum); calyx sessile, firmly affixed, at anthesis 4-4.5 mm. long, the lobes slender, gradually attenuate, villose and sparingly hispidulous; corolla pink to magenta, 7-9 mm. in total length, the lobes rounded and spreading, 2-2.5 mm. long and 2.3-3.2 mm. broad; nutlets to 1.4 mm. long and 0.9 mm. thick, dusky, back convex, papillate. Usually on or about exposures of Upper Cretaceous beds and most commonly on silty or only moderately rocky soils in the Trans-Pecos, Apr.-June; from Tex., s. and s.e. across Coah.

3a. *Coldenia mexicana* var. *tomentosa* (Wats.) I. M. Johnst. Usually in areas of Upper Cretaceous beds and most frequently on rocky soils w. of the lower Pecos in s. Val Verde and Terrell cos., Apr.-July; s. through Coah.

4. *Coldenia gossypina* (Woot & Standl.) I. M. Johnst. Plant forming mats 2-4 dm. broad from a woody taproot, the young branchlets densely villulose; leaves clustered mostly on very short branchlets along the main stems and branches, oblong or oblanceolate, to 8 mm. long and 2 mm. broad, in age detaching from the persistent petiole; upper leaf surface cinereous, bearing spreading pungent bristles arising from a thickened mineralized base and also a fine villulose indument composed of small pallid slender hairs; lower leaf surface only partially covered by the loosely revolute leaf margins, villulose and usually retrorsely so along the lower half of the prominent midrib; calyx sessile, at anthesis 3-3.5 mm. long, permanently affixed, the lobes lanceolate, densely short-villose and hispidulous; corolla pink to magenta, 7-8 mm. in total length, the lobes rounded, up to 2 mm. long and 3 mm. broad; nutlets dusky, ovoid, to 1.2 mm. long and 0.8 mm. broad below the middle, covered with grayish vesicular papillae of unequal size. Usually on gypseous soils in the Trans-Pecos and along the Rio Grande n.w. to El Paso, Apr.-July; Tex., N.M., Chih. and Coah.

5. *Coldenia hispidissima* (T. & G.) Gray. Plants forming matted growths 2-4 dm. in diameter spreading from a woody taproot, the younger branchlets villulose-hispidulous with minute spreading or retrorse hairs and sometimes with pungent bristles; leaves clustered mostly on very short branchlets along the main stems, usually linear but rarely ovate or elliptic, to 1 cm. long and 1 mm. wide, usually distinctly narrower than the

indurated petiole base, the upper surface usually green and bearing scattered spreading pungent hairs that arise from bulbous or discoid bases; calyx sessile, broadly and permanently attached in a leaf axil, at anthesis about 3 mm. long; calyx lobes narrowly lanceolate, villous-ciliate below the middle, frequently terminated by a stiff bristle, the back minutely hispidulous, at maturity with a thickened slightly prominent midrib; corolla usually pink, about 7.5 mm. in total length, the lobes rounded and spreading, about 2 mm. long and 3 mm. broad; mericarps ovoid, usually only one or two maturing, to 1.4 mm. long and 1 mm. broad below the middle, papillate or vesicular-papillate. Usually on gypsum or strongly gypseous soils in the Trans-Pecos and e. of the Pecos River through Loving, Ward and Crane cos. to Ector and Irion cos., May-Aug.; also widely distributed in N.M.

4. TOURNEFORTIA L.

A genus of about 150 species composed chiefly of scandent shrubs and occurring mainly in the American tropics.

1. *Tournefortia volubilis* L. Twining vine; stems slender, frutescent, sparsely and minutely strigose or tomentulose when young; leaves lanceolate to ovate or elliptic, pinnately veined, to 9 cm. long and 4 cm. broad, with a slender petiole 5-13 mm. long, base acute to rounded, apex acute or attenuate, above glabrous or minutely strigose, below paler and more densely hairy; inflorescence terminal or not infrequently lateral, bearing 3 to 10 very slender scorpioid cymes 3-8 cm. long; calyx 5-fid, about 2 mm. long, borne on a very short stout pedicel, the lobes cuneate; calyx in fruit with much-thickened pedicels and slightly enlarged lobes, embracing base of drupe, persistent, not falling with fruit; corolla greenish-yellow, the tube 2-3 mm. long, strigose outside, the lobes linear, 1-2 mm. long, spreading, broad only at the base; stamens included; fruit a drupe; exocarp white, with 1 to 3 black spots on the side, blackening on drying; endocarp usually roughly 2- or 3-lobed (2- or 3-seeded) or simple and 1-seeded. In open forests climbing on trees and in arroyos in Cameron Co., Feb.-July; from n. S.A., n. through the W.I., C.A. and Mex. to Fla. and southernmost Tex.

A very variable species in leaf shape and indument.

5. HELIOTROPIMUM L.

TURNSOLE. HELIOTROPE

Annual or perennial, herbaceous or more or less shrubby plants; leaves small to large, sessile or petiolate; cymes unilateral and generally distinctly scorpioid, with or without bracts; corolla white, yellow or purple, variable in form, throat frequently pubescent inside; anthers included, filaments extremely short; style present or absent; stigma usually frustrumlike or conic, mostly sterile, receptive only in a band around the base; fruit dry, at maturity breaking up into 4 1-seeded or 2 2-seeded mericarps; seeds usually with a thin endosperm.

About 250 species widely represented in the warmer parts of the world. The species are particularly numerous in arid regions.

1. Mature fruit breaking up to form 2 mericarps, each one 2-seeded; leaves evidently veined; cymes bractless (2)

1. Mature fruit breaking up into 4 1-seeded mericarps; leaves may or may not be evidently veined; cymes with or without bracts (5)

2(1). Stems and younger parts glanduliferous; corolla tube very hairy inside; an escape from gardens1. *H. amplexicaule*.

2. Stems and younger parts not glanduliferous; native species (3)

3(2). Mericarps with two seminiferous cells and no sterile ones, the surface warty with pale minute vesicular epidermal appendages; corolla tube sparsely but distinctly strigose inside; plant erect, fruticulose, from a taproot2. *H. angiospermum*.

3. Mericarps with two seminiferous cells and one or more sterile cells, the surface densely fine hairy, more or less velvety; corolla tube glabrous inside; plants herbaceous, rhizomatous, the stems spreading (4)

- 4(3). Plant with simple hairs; leaf blades ovate to broadly lanceolate or somewhat cordate, 3-6 cm. long, 1-4 cm. wide; veins numerous, evident, branched; fruit with a corky mesocarp; each mericarp with a single sterile cell 3. *H. molle*.
4. Plant with malpighiaceae hairs on stems and leaves; leaf blades lanceolate, 2-4.5 cm. long, rarely more than 1 cm. wide; veins few or none, obscure, always simple; fruit lacking a corky mesocarp; each mericarp with 3 sterile cells of which the 2 larger are partially filled with corky tissue 4. *H. glabriusculum*.
- 5(1). Plant very succulent, glabrous, usually glaucous (6)
5. Plant not succulent, hairy, never glaucous (7)
- 6(5). Corolla white, the limb 1.5-3 mm. in diameter; leaves 8 mm. wide or less 5. *H. curassavicum* var. *curassavicum*.
6. Corolla white and often purple-tinged at throat, the limb 5-10 mm. in diameter; leaves to 17 mm. wide 5. *H. curassavicum* var. *obovatum*.
- 7(5). Plant perennial (Doubtful cases should be keyed under both alternatives) (8)
7. Plant annual (10)
- 8(7). Corolla greenish-yellow, tubular, the lobes elongate, attenuate, acute; stigmatic head elongate, cylindric; anthers not coherent; plant bushy, fruticose; inflorescence bractless 6. *H. Torreyi*.
8. Corolla white, funnelform, the lobes broad; stigmatic head short; anthers with tips coherent; plants not noticeably fruticose and bushy (9)
- 9(8). Plants rhizomatous, the parts above ground renewed annually; inflorescence with a few inconspicuous bracts; leaves green, 10-24 mm. long, 2-5 mm. wide 7. *H. Greggii*.
9. Plants with a prostrate shrubby caudex; inflorescence abundantly leafy-bracted; leaves small, usually gray, very numerous and usually crowded and overlapping, usually 3-5 mm. long and 0.7-1 mm. wide 8. *H. confertifolium*.
- 10(7). Cymes bractless; leaves usually with evident veins (11)
10. Cymes with leafy bracts; leaves veinless or the veins few and obscure (13)
- 11(10). Throat of corolla pubescent just below the limb; corolla lobes narrow and acute; mericarps coarsely strigose 9. *H. procumbens*.
11. Throat of corolla glabrous; the shallow corolla lobes broad and rounded; mericarps glabrous or at most very finely strigose or puberulent (12)
- 12(11). Fruit 2-lobed, with lobes widely divergent; mericarps smooth, strongly ribbed 10. *H. indicum*.
12. Fruit 4-lobed, the lobes not widely divergent; mericarps strongly tuberculate 11. *H. europaeum*.
- 13(10). Corolla lobes longer than broad and narrowed below the middle; fruiting calyx with slender pedicels 2-10 mm. long; stigmatic head slender and elongate, borne on a very short style 12. *H. tenellum*.
13. Corolla lobes broader than long or only obscurely developed; fruiting calyx pedicels short and stout or none, usually evidently less than 5 mm. long; stigmatic head short and stout (14)
- 14(13). Fruit not compressed laterally, radially 4-lobed; style stout, 0.6-0.9 mm. long; stigmatic head lacking a conspicuous terminal tuft of hairs; southern Texas 13. *H. texanum*.
14. Fruit strongly compressed laterally, 2-lobed; styles slender and elongate, 2.5-4 mm. long; stigma bearing a conspicuous terminal tuft of hairs (15)
- 15(14). Corolla limb 15-20 mm. in diameter, pentangular in outline, obscurely and very broadly if at all lobed; flowers apparently scattered along the elongate leafy stems 14. *H. convolvulaceum*.

15. Corolla limb 6-17 mm. in diameter, star-shaped, the lobes triangular and acute; flower and fruit crowded into readily delimited racemose inflorescences 5-10 cm. long, forming the outer half of the leafy branchlets produced by the main stem and its primary branches; coastal plain of southern Texas . . 15. *H. racemosum*.

1. *Heliotropium amplexicaule* Vahl. Perennial from a deep woody root, 2-5 dm. tall, more or less abundantly and minutely pubescent and sometimes sparsely villous or hispid; stems usually several from the root, ascending or decumbent, loosely and ascendingly branched; leaves oblong to oblanceolate, to 9 cm. long and 18 mm. wide, acute to rounded at apex; inflorescence terminal on the leafy branches or lateral and extra-axillary, forked, consisting of a cluster of 2 to 5 scorpioid cymes; peduncle naked, 1-10 cm. long; calyx sessile, evidently shorter than corolla tube, usually glandular-pubescent, persistent, the lobes nearly equal, linear to lanceolate, at anthesis 2.5-5 mm. long, spreading after fall of fruit; corolla funnelform, blue or purple or rarely white, the limb 4-8 mm. in diameter, the lobes short and broad, the tube well-developed, about 5 mm. long; fruit glabrous, 1.5-2.5 mm. high, 2-3 mm. long, slightly compressed laterally. Frequently cult., occurring erratically in fields and waste places, Apr.-Aug.; nat. of Arg. and Urug., now widely adv. and escaped.

2. *Heliotropium angiospermum* Murr. A loosely branching coarse weedy annual or short-lived perennial, becoming somewhat fruticose at maturity, erect or decumbent, 3-8 dm. tall; stems loosely and ascendingly branched above the base, moderately or even sparingly hispidulous; leaves mostly alternate, frequently dotted with very minute pale mineralized warts, ovate to broadly lanceolate, to 6 cm. long and 25 mm. wide, above sparingly hispidulous, below paler with hairs confined mostly to the midrib and veins, apex acute, base acute to rounded, abruptly contracted into a petiole 2-9 mm. long; inflorescence scorpioid, simple or geminate, evidently pedunculate, bearing crowded 2-ranked flowers and fruits, terminal on the leafy shoot or borne extra-axillary and lateral along the leafy shoot, in maturity slender and elongate, to 15 cm. long, stiff and erect, carried on a naked peduncle 1-5 cm. long; calyx sessile, the lobes equal or nearly so, lanceolate to lance-oblong, usually 1.5-2 mm. long, only moderately accrescent in fruit; corolla white, the limb 2-3 mm. broad; fruit strongly compressed laterally, usually 1.5-2 mm. high, 2-3 mm. long. In sandy and gravelly soils in chaparral, thickets and open fields in s. Tex., throughout year; from Bol. and n. Chile, n. through C.A. and the W.I. to Fla. and s. Tex.

3. *Heliotropium molle* (Torr.) I. M. Johnst. Low perennial, occurring in colonies; stems decumbent, loosely branched, 1-3 dm. long, developing anew each year from the root or from a small weakly developed caudex, gray or tan, appressed hispid-villose; leaves numerous, with a petiole 1-3.5 cm. long, densely hispid-villose with appressed hairs, the margin moderately to coarsely crenate and visually crisped, apex acute to obtusish, base usually broadly asymmetric; inflorescence terminal on the leafy stems or opposite leaves, consisting of 2 or 3 densely flowered scorpioid cymes borne at the apex of a naked peduncle 2-4 cm. long; calyx subsessile, at anthesis 2-3.5 mm. long, the lobes at maturity 3-5 mm. long, linear-lanceolate, hairy, embracing the fruit; corolla white or slightly stained with purplish, in throat yellow, total length 6-10 mm. long, funnelform, the lobes rounded and separated by well-developed plaited inflexed sinuses; fruit dry, ovoid-globose, 3.5-4 mm. high, dorsiventrally 4.5-5 mm. long. Growing in valley soils, on flats, usually in places where water collects and stands for a short time after rain storms, and most commonly in places in the vic. of Upper Cretaceous outcrops, in Tex. only from Brewster Co. and from along the Rio Grande in w. Presidio Co., Apr.-Sept.; also Coah. and Chih.

It is worthy of note that another Texan species of this genus, which also grows on clay flats in places where there is a shallow pooling of water after rains, likewise has what appears to be buoyant corky tissue developed in the mericarp. This corky tissue in the mericarps of *H. molle* and *H. glabriusculum* may be useful in the dissemination of the fruit by water and may be adaptations for the specialized habitat these plants affect.

4. *Heliotropium glabriusculum* (Torr.) Gray. COLA DE ALACRÁN. Perennial, forming colonies; stems usually several, springing from the root crown or from a small caudex, renewed annually, grayish strigose with the hairs all malpighiaceous, loosely decumbent

and branched, 1-3 dm. long; leaves numerous, green, minutely and abundantly dotted, firm, usually glabrous except on the petiole and along the prominent midrib on the lower surface, the margin weakly revolute and usually more or less evidently crisped, apex acute, base narrowed into a petiole 1-6 mm. long; inflorescence terminal on the leafy stems and branches, consisting of 2 or sometimes 3 densely flowered scorpioid cymes borne clustered on a naked peduncle 1-3 cm. long; flowers fragrant; calyx sessile, 2-3 mm. long, the lobes lanceolate, attenuate, moderately unequal, with a few malpighiaceus hairs down the middle line and sparingly ciliate with simple hairs on the margin; corolla white with a greenish-yellow throat when fresh, becoming cream-colored with a purplish throat when dry, 4-5.5 mm. long, the sinus between the short corolla lobes simple, closed with neither plaits nor lobules; fruit grayish from a dense pubescence of minute simple hairs. *Heliohytum glabriusculum* Torr. Growing on valley soils, usually on clay in limestone areas, and particularly in places subjected to temporary flooding after rain storms, in Tex. it has been collected most frequently in s. Brewster and s. Pecos cos., but it is also known from Val Verde, Maverick, Webb and McMullen cos., May-Aug.; from Tex. s. to e. Dgo. and n. Zac.

The malpighiaceus hairs distinguish *H. glabriusculum* from all other Texan Boraginaceae.

5. *Heliotropium curassavicum* L. var. *curassavicum*. SEASIDE HELIOTROPE, COLA DE MICO. Perennial, usually with a deep rhizome; stems prostrate or laxly decumbent, rubbery, to 4 dm. long and 5 mm. thick, ascendingly branched; leaves oblanceolate, often narrowly so, thick and juicy, strongly compressed, to 4 cm. long and 8 mm. wide, the apex obtuse or rounded; inflorescence terminal or extra-axillary and lateral along the leafy stems, single or paired or rarely ternate, densely flowered, entirely bractless, scorpioid cymes, in fruit elongating, becoming as much as 1 dm. long and the rachis usually more or less broadened and flattened; calyx sessile or nearly so, lobed almost to the base, the lobes lanceolate or oblong, equal or nearly so, fleshy, at anthesis 1-1.4 mm. long, moderately accrescent in fruit; corolla white, small, 1.2-3.5 mm. long, entirely glabrous, the lobes rounded, the tube shortly surpassed by the calyx lobes; fruit 4-lobed, 2-2.5 mm. high, 2-3 mm. thick, obscurely compressed laterally, embraced by the somewhat accrescent calyx lobes, smooth and glabrous; mericarps bearing a thick layer of firm vesicular exocarp which apparently functions as a float-organ in water dissemination. In sandy soil along beaches, about ponds, saline flats and similar areas throughout Tex., most of the year; from Fla., n. to Del., w. to Okla., Tex. and N.M., s. in the W.I., Mex. and C.A. to Surinam and Col. and thence s. along the Pac. Coast of S.A. to Chile and Arg.; introd. in s. Eur.

Var. *obovatum* DC. The corolla limb of var. *obovatum* is 5-10 mm. wide, at most only purplish-tinged at the throat, and the fruit is 2.5 mm. wide. The oblanceolate to spatulate leaves are also to 2 cm. wide. *H. spathulatum* Rydb. Rare, Dallam Co. in the Plains Country, on the edge of a large old buffalo wallow (playa lake) e. of Texpline, June-July; w. U.S.

6. *Heliotropium Torreyi* I. M. Johnst. Small shrub, 1-5 dm. tall, gray-green, usually stiff and bushy; stems slender, ascendingly branched, frutescent; branchlets strigose, frequently densely so and pallid; leaves abundant, linear, to 3 cm. long and 3 mm. wide, sparsely strigose, acute, scattered along the branchlets or sometimes in axillary fascicles, subsessile or with a petiole less than 1 mm. long, the margins revolute; racemose cymes terminal on the leafy branchlets, slender, 1-2 or rarely as much as 1 dm. long; calyx lobes linear, strigose, to 5 mm. long and 0.4 mm. wide, acute, moderately unequal; tubular portion of corolla about 4 mm. long, not surpassing the calyx, densely strigose outside, glabrous inside, with an annular linear constriction just above base, the throat with weak pleats above the middle, the limb 3-4 mm. in diameter; fruit 3 mm. thick, 2 mm. high. *H. angustifolium* Torr., non Raf. Mostly on open or brushy limestone slopes or mesas, in the Trans-Pecos, the Edwards Plateau, along the Balcones Escarpment, from Presidio and Pecos cos. e. in cos. along the Rio Grande to Edwards, Kinney and Uvalde cos., also on limestone and caliche beds from McMullen and Bee cos. through Duval, Jim Wells and Jim Hogg to Hidalgo Co., Apr.-Nov.; from Tex. s. in N.L., Coah. and e. Chih. to S.L.P.

Said to be a good browse for sheep.

7. *Heliotropium Greggii* Torr. Plant from a deep rhizome, strigose, pale-green; stems usually numerous, prostrate or loosely decumbent, ascendingly branched, leafy, to 15 cm. long; leaves numerous, thickish, lanceolate to linear, sessile or with petioles to 3 mm. long, midrib prominent but veins absent, the margin revolute; inflorescence at first glomerate and then elongating into a loose racemose cyme to 5 cm. long, commonly 5- to 10-flowered; calyx lobes about equal, 2-3 mm. long, lanceolate; corolla white with a yellow throat, fragrant, the limb 7-12 mm. broad, shallowly lobed with 5 broad rounded principal lobes and (alternating with these) 5 smaller somewhat triangular incurved lobes, the throat with hairy inflexed plaits, the tube inside bearing an inconspicuous nectariferous ring about 0.5 mm. above the base; fruit very hairy, about 3 mm. thick and 1.5 mm. high. Usually forming colonies in places where water collects temporarily, frequent along roadside shoulders and ditches, in sand, gravel or on clay flats, lacking in volcanic areas, frequent and widely distributed in the Trans-Pecos and also e. in Loving, Ward, Crane and Upton cos., with outlying stations in Knox and Medina cos., Apr.-Sept.; N.M., Tex., Coah., Chih., Dgo. and Zac.

8. *Heliotropium confertifolium* (Torr.) Gray. Plant usually less than 1 dm. tall, with a woody taproot, the herbage grayish or somewhat silvery, clad with fine abundant, pale, loosely and antrorsely appressed hairs that are intermixed with some coarser spreading hairs, forming rounded masses of crowded leafy stems and at times cespitose or even pulvinate; caudex dichotomously branched, sometimes as much as 4 cm. thick, annually expanding by the addition of generous portions of some of the leaf-bearing stems of the previous season, older branches of the caudex decorticated and becoming rough and brown and its oldest principal branches as much as 8 mm. thick; leaves small, alternate or the lowermost on the shoot opposite, usually bunched and more or less fasciculate at the apex of the shoot, several to many times longer than the adjoining stem internodes, strictly ascending and usually somewhat imbricate, strigose and commonly bearing also some long spreading hairs, narrowly lanceolate; inflorescence terminal on the stems and branches, simple, 2- to 10-flowered, usually glomerate, foliaceous, 2-4 mm. long; calyx subsessile, densely strigose, 3-4 mm. long, the lobes moderately unequal, linear to linear-oblong, foliaceous; corolla white with a yellow throat, funnellform, 5-8 mm. in length, densely strigose outside, the limb 5-8 mm. in diameter, the narrowed lobes separated by a broad but strongly plaited sinus, the throat puberulent inside, with inflexed puberulent plaits below each sinus; fruit about 1.5 mm. thick and 1 mm. high. In w. Tex. usually associated with Upper Cretaceous limestones perhaps because of the trace of gypsum they contain, in s. Tex. in areas where mildly gypseous soils occur, ranging from w. Pecos Co. and the Big Bend s.e. in cos. fronting on the Rio Grande to Webb, Zapata, Starr and Hidalgo cos., also from Jim Wells and Jim Hogg cos., Mar.-Oct.; also n. Mex.

9. *Heliotropium procumbens* Mill. Plant erect to loosely decumbent, 1-5 dm. tall, moderately to abundantly strigose or appressed hispid-villose, pale-green or somewhat cinereous or even canescent; stems one to several, when single usually loosely and ascendingly branched above the base; leaves numerous, with petioles to 1 cm. long, narrowly oblanceolate to elliptic, plane or more or less evidently revolute, to 4 cm. long and 2 cm. wide, apex usually acute, base cuneate, upper and lower surfaces consimilar in coloration and indument; inflorescence consisting of usually numerous scorpioid cymes; cymes solitary or geminate, densely flowered, borne terminal or extra-axillary along the leafy stems, 3-10 cm. long, on naked peduncles 1-3 cm. long; calyx at anthesis 1-1.2 mm. long, the lobes unequal, especially in width, linear to broadly lanceolate, as long as or slightly longer than the corolla tube, at maturity nearly doubling in size and becoming more unequal; corolla white, 1.5-3 mm. long, the tube sparsely strigose outside, the limb 2-3 mm. broad; fruit 1-2 mm. thick, 1-2 mm. high. A weedy species, usually growing in damp situations or on land subject to flooding, n. to Jefferson, Hays, Bexar and Brewster cos., Apr.-Nov.; in Fla., La. and Tex., mostly on the Coastal Plain, widely distributed in the W.I., C.A. and trop. S.A.

10. *Heliotropium indicum* L. TURNSOLE, ALACRANCILLO. Coarse annual herb, villose or hispid or hispidulous, to 1 m. tall; stems loosely branched, leafy, frequently fistulose; leaves with a petiole 4-10 cm. long, ovate to elliptic, drying thin, to 15 cm. long and 1 dm. wide, the margin repand or undulate, apex acute, base obliquely acute to obtuse or

subcordate; inflorescence a simple, very elongating scorpioid cyme to 3 dm. long, bearing two ranks of crowded flowers and fruits; calyx broadly sessile, 1.5-2 mm. long, the lobes linear or linear-lanceolate, unequal; corolla blue or violet (or rarely white), puberulent or strigose outside, the limb to 4.5 mm. in diameter, the tube elongate, evidently surpassing the calyx, usually about 3 mm. long, constricted at the throat; fruit miter-shaped, glabrous or puberulent. Along river banks and bottoms, ditches, lake shores and along creeks, e. half of Tex. w. to Dallas, Bexar and Hidalgo cos., June-Oct.; widely distributed in the warmer parts of Am. from n. Arg. to s. U.S.; also in the trop. of the Old World; probably a nat. of Am.

11. *Heliotropium europaeum* L. Erect or decumbent herb, 1-5 dm. tall, loosely and ascendingly branched; stems minutely and antrorsely hairy; leaves densely and minutely hairy, usually somewhat velvety, the hairs with thickened bulbous bases, elliptic to ovate or obovate, to 5 cm. long and 3 cm. wide, apex obtuse, base abruptly contracted into a slender petiole to 25 mm. long; inflorescence a simple or forked scorpioid cyme, becoming as much as 1 dm. long at maturity, borne on a naked peduncle 1-5 cm. long, terminal on the leafy branches or extra-axillary along their length; calyx sessile, at anthesis about 2 mm. long, hairy, the lobes subequal, lanceolate, persistent and spreading or reflexed after the fall of the mericarps; corolla white or somewhat bluish, yellow in the throat, minutely hairy outside, about 3.5 mm. long, the limb 2-3.5 mm. broad, with short rounded ascending lobes and strong reflexed pleats at and below the sinus. Rare (collected once in Hays Co.), introd. weedy species (seen from N.J., Pa., Va., Fla., Ga., Ala., Miss., La. and Tex.); nat. of s. and cen. Eur., N. Afr., and e. to the Caucasus and Iran.

12. *Heliotropium tenellum* (Nutt.) Torr. Plant erect, 2-5 dm. tall, usually simple below and abundantly and loosely branched above or about the middle; stems and branches slender, minutely strigose; leaves linear, to 5 cm. long and 5 mm. wide, narrowed toward both ends, minutely strigose, the margins revolute; flowers borne in slender, elongate, very loose terminal racemose cymes; calyx lobes extremely unequal, linear, with revolute margins, foliaceous, longest one about 4 mm. long at anthesis, becoming at least 5 mm. long and sometimes as much as 1 cm. long at maturity, twice as long as the shortest lobe; corolla funnelliform, white with a yellow throat, 6 mm. long, the limb 5-6 mm. in diameter, deeply lobed (the lobes obovate to elliptic), the tube glabrous inside, upper portion narrowed with inflexed pleats; fruit 3 mm. broad, 1.5 mm. high. *H. Nuttallii* House, *Lithospermum tenellum* Nutt., *L. gracile* Raf. On rocky or gravelly soils in the open or in cedar-oak woods or brushlands, mostly limestone, in the e. two thirds of Tex., May-Oct.; from Ky., Mo. and Kan. s. to Ga., Ala. and Coah.

13. *Heliotropium texanum* I. M. Johnst. Plant 1-4.5 dm. tall, simple and erect or with few to numerous ascending leafy stems; stems usually scantily branched, antrorsely short-strigose; leaves firm, thickish, rather bright-green, mostly alternate, strigose, oblanceolate to broadly lanceolate, to 3 cm. long and 9 mm. wide, apex acute, base narrowing into a slender petiole 2-5 mm. long, the margin usually revolute; inflorescence terminal on the leafy stems and branches, scorpioid, bearing numerous crowded 2-ranked flowers; calyx lobes very unequal with 2 lobes evidently longer and broader than the other three, the largest lobe oblong at anthesis and to 3.5 mm. long and 1.5 mm. wide, becoming slightly larger in fruit; corolla white with a yellow throat, sparsely strigose outside, funnelliform, 5-10 mm. long, the limb to 12 mm. broad; fruit hispidulous, 2 mm. thick, 1 mm. high. In sandy soils of the Rio Grande Plains to Atascosa Co., June-Oct.; Tex. s. to S.L.P.

14. *Heliotropium convolvulaceum* (Nutt.) Gray. Plant 1-4 dm. tall; stems at first usually simple and erect and later developing elongate ascending branches, less commonly becoming widely branched and sprawling or decumbent, strigose, the younger parts densely so and cinereous; leaves shortly petiolate, numerous, firm, appressed-strigose, the hairs arising from mineralized bulbous or discoid bases, lanceolate to ovate, to 4 cm. long and 15 mm. wide, the margin flat or very narrowly revolute, apex acute, base cuneate to rounded; flowers extra-axillary; calyx at anthesis 4-6 mm. long, becoming 6-8 mm. at maturity, the lobes linear-lanceolate or subulate-linear, unequal, with the two largest lobes evidently broader and 0.5-1 mm. longer than the shortest lobe; corolla pure-white with a yellow throat, fragrant, opening during morning and evening, the

limb widely funnellform and 15-22 mm. broad, the tube 8-11 mm. long, strigose outside, inflexures in the throat alternating with vertical bands of hairs borne along the principal veins; fruit 3-4 mm. long, 2-2.5 mm. thick, and 2-2.5 mm. high. In dunes and sandy places in w. Tex. and extending e. along the Rio Grande Valley to Grayson Co. and along the Brazos Valley to McLennan Co., June-Oct.; from Neb. and Wyo. s. to s. Nev., Ariz., Tex. and n. Chih.

15. *Heliotropium racemosum* (Rose & Standl.) I. M. Johnst. Plant 1-4 dm. tall; stems at first simple and erect but later developing elongate branches and usually becoming sprawling or decumbent, coarsely strigose, the young parts densely so; leaves shortly petiolate, numerous, firm, strigose (the hairs stiff, straight and closely appressed and parted left and right on either side of the midrib, their bases bulbous or discoid), lanceolate or rarely oblong to elliptic, to 4 cm. long and 11 mm. wide, apex acute; flowers and fruit extra-axillary; calyx strigose, 4-5 mm. long in anthesis and becoming 5-6 mm. long in fruit, the lobes unequal, linear to linear-lanceolate; corolla pure-white, fragrant, usually opening at night or on cloudy days, the limb when expanded funnellform and 6-17 mm. broad, tubular portion of corolla 4-8 mm. long, strigose outside, the inflexed fold from the sinus of the corolla limb extending down into the mouth of the corolla and continuing only as very weak inflexures in the upper half of the throat; fruit usually 2 mm. high, 3-3.5 mm. long, and about 2 mm. thick at maturity. *H. convolvulaceum* var. *racemosum* (Rose & Standl.) I. M. Johnst. Sandy places in the Coastal Plain of s. Tex., s. and s.e. of San Antonio; also known from Travis Co., May-Oct.; endemic.

Closely related to the more northern and western *H. convolvulaceum*, and differing only in its smaller flowers, its star-shaped corolla limb with acute lobes, and its denser and more readily delimited inflorescences.

6. OMPHALODES MILL.

About 28 species, mostly in the Mediterranean region and Asia.

1. *Omphalodes aliena* Gray. Weak decumbent annual; stems loosely few-branched, very slender, 1 mm. or less thick, to about 6 dm. long, sparingly hispidulous or strigose, ascending mostly from near the base of plant, soon spreading; leaves few, long-petioled, alternate, borne mostly below the middle of the plant, ovate, cordate at base, apiculate, 1-4 cm. long and about as wide, sparsely hispidulous, drying thin; petiole 1-4 cm. long; inflorescence slender, racemose, terminal, at maturity very elongate and remotely flowered, bractless or rarely with a single small foliaceous bract; flowers with slender pedicels at anthesis 1-5 mm. long, at maturity to 3 cm. long; calyx lobes 5, lanceolate, strigose, 1.5 mm. long at anthesis, acute, doubling in size at maturity; corolla rotate, sky-blue or sometimes white, yellow in the throat, the tube very short, the limb 8-10 mm. in diameter; faucal appendages well-developed, trapeziform, puberulent, protrudent; mericarps 4, depressed, forming a pyramid, attached to the small carpophore by their inner faces, their margins broad and thin, entire to serrate or ciliate, reflexed over the back of the mericarps so as to form on each a small nearly closed cell opening outwards by a small hole, the mericarps smooth on the back. Limestone areas in s. Val Verde, Terrell, Presidio and Brewster cos., Mar.-Apr.; also n. Mex.

7. CYNOGLOSSUM L.

HOUND'S TONGUE. BEGGAR'S-LICE

Biennial or perennial or rarely annual plants; leaves alternate, the basal ones long-stalked; racemes elongating, usually ebracteate, rarely bracted at the base; calyx cut to beyond the middle, somewhat accrescent at maturity and spreading or reflexed; corolla cylindrical or funnellform; lobes broad, spreading, imbricate; throat with trapeziform, oblong or sublunate appendages; stamens included, affixed in the tube; filaments short; anthers oblong or elliptic; ovules 4; mericarps 4, depressed-ovoid or orbicular, glochidiate, ascending or divaricate, back flat or convex, frequently with an elevated margin, attached by a small or large medial to apical scar to a convex or pyramidal gynobase and frequently with a free subulate prolongation decurrent on the short entire style.

A cosmopolitan genus of about 55 species.

1. Mericarps 5.5-7 mm. long; plant perennial 1. *C. virginianum*.
 1. Mericarps 2.5-4 mm. long; plant biennial 2. *C. zeylanicum*.

1. *Cynoglossum virginianum* L. WILD COMFREY. Plant erect, the simple stems conspicuously hirsute, 3-8 dm. tall; basal leaves elliptic-oblong, tapering at base and decurrent upon the long petiole, 1-2 dm. long; cauline leaves sessile, progressively smaller, some broadly clasping at base, some often narrowed below and more or less expanded at the very base; racemes 1 to 4, usually 3, at maturity 1-2 dm. long, terminating a long, erect, terminal peduncle; calyx at anthesis 3-4 mm. long, the lobes to 2.5 mm. long in fruit; corolla blue to white, the tube 1.5-3 mm. long, the broadly rounded lobes more or less overlapping; fruiting pedicels 5-15 mm. long, recurved; mericarps globose-obovoid, uniformly bristly over the exterior surface; style obscured by the mericarps, 1-2 mm. long. Upland deciduous woods in e. Tex., Mar.-Apr.; from s. N.E. s. to Fla. and w. to e. Tex.

2. *Cynoglossum zeylanicum* (Vahl) Thunb. Plant erect, depressed-strigose, the stems without spreading or lax hairs, 3-9 dm. tall; radical leaves large, long-petioled, persistent at the time of flowering; cauline leaves oblong, sessile, entire, softly hairy, to 1 dm. long and 25 mm. wide, acute, frequently subdecurent, glabrous or very minutely but scarcely scabrous on the upper surface, the nerves beneath often prominent, the upper leaves with a narrowly cuneate base; racemes furcate, the branches long-fulvous toward their tips; pedicels of lower flowers often 3-6 mm. long; calyx lobes ovate, in fruit often 3 mm. long and broadly oblong; corolla small, 4-5 mm. long; mericarps 2.5-4 mm. long, outer face of mericarps 3 mm. with no distinct medial line and with scattered glochidia often not much shorter than the marginal ones; carpophore linear, hardly conical at the base. Rare in e. Tex., May; nat. of India, Ceylon and Malaysia, introd. in various parts of the world.

The silky indumentum and tawny young racemes are distinctive.

8. LAPPULA FABR. STICKSEED

Small annual or rarely perennial herbs; leaves alternate, usually narrow, firm and veinless; flowers small, blue or white, on usually erect pedicels or rarely sessile, in bracted racemes; calyx 5-parted into spreading lanceolate lobes; corolla with a rather short tube; lobes rounded, ascending, imbricate; throat closed by intruded appendages; stamens affixed in the tube, included; filaments slender, short; anthers oblong, obtuse; style short, surmounting the subulate-columnar gynobase, commonly surpassing the mature mericarps; stigma subcapitate; ovules 4; mericarps 4, erect, smooth or verrucose, narrowly but firmly attached to a slender elongate gynobase along the length of the well-developed ventral keel, back angulate or margined by a single row of prickles which by confluence frequently form a winglike or cupulate border.

A difficult genus whose species are mainly critical ones, being largely separated by technical characters of the fruit, such as size and form of the mericarps, their surface and the characters of the dorsal margin. About 50 species in Eurasia, Australia and America.

1. Mericarps with marginal prickles in at least two rows . . 1. *L. echinata*.
 1. Mericarps with marginal prickles definitely in a single row (2)
 2(1). Marginal prickles distinct to base or nearly so, not confluent to form a cupulate structure 2. *L. Redowskii*.
 2. Marginal prickles confluent, forming a conspicuous smooth cupulate structure on back of some or all the mericarps 3. *L. texana*.

1. *Lappula echinata* Gilib. Erect annual, 1.5-8 dm. tall, the stems simple to freely branched, harshly appressed-pubescent and canescent; leaves linear to linear-oblong or the lowest oblanceolate, acute to obtuse, narrowed to a sessile base, closely ascending, 2-5 cm. long, roughly pubescent like the stem, passing above into the linear or lanceolate bracts of the usually numerous racemes; pedicels 1-3 mm. long; calyx lobes broadly linear, appressed-bristly, in fruit spreading, 2.5-3 mm. long; corolla bright-blue, the limb 2-4 mm. broad, the tube surpassing the calyx; mericarps 3-4 mm. long, sharply verrucose or muricate dorsally, with 2 marginal rows of long slender bristles not confluent at base, these sometimes irregularly distributed over most of the back. *L. Lappula* (L.) Karst.

Occasionally in waste places and cult. ground; nat. of Euras.; widespread as a weed in n. U.S. and Can. Reported from Texas 65 years ago but we have seen no specimens.

2. *Lappula Redowskii* (Hornem.) Greene. Annual, 1-5 dm. tall, usually somewhat cinereous, hispid-villose, the hairs spreading or loosely ascending; stems usually single but not infrequently with several minor stems springing from the base of the major stem; leaves narrowly oblanceolate to spatulate, the basal leaves to 5 cm. long and 8 mm. wide, clustered into a rosette which usually persists (at least in the dried state) until some time after anthesis, the stem leaves gradually reduced in size upwards along the stem; cymes racemose, terminating the stems and branches, abundantly and conspicuously bracted, becoming loosely flowered and to 3 dm. long at maturity; calyx at anthesis 2-3 mm. long, the mature calyx with unequal linear or lanceolate usually spreading lobes 3-5 mm. long; pedicels of fruiting calyx stiff, usually strictly ascending, 1-3 mm. long; corolla blue, surpassing the calyx 1 mm. or less, funnellform, the tube cylindric, about 1.2 mm. long; faucal appendages well-developed, borne at the base of the throat, intrusive, invaginate. Widely distributed in cen. and w. Tex., usually in sunny places in disturbed soils, Mar.-May; throughout w. U.S., in Arg. and Asia.

3. *Lappula texana* (Scheele) Britt. Annual, 1-4 dm. tall, hispid-villose, the pale hairs very slender and loosely ascending; stems single or several to many, simple and branched only above the middle; leaves narrowly oblanceolate or spatulate, rounded to obtuse at apex, the basal leaves crowded into a rosette which persists at least in a dried state for some time after anthesis, to 8 cm. long and 5 mm. wide, the cauline leaves gradually smaller up the stem; cymes racemose, solitary at the ends of the stems and its branches, becoming loosely flowered and 1-3 dm. long at maturity; calyx at anthesis 2-3 mm. long, at full maturity its lobes usually spreading, unequal, linear to lanceolate, 3-5 mm. long; pedicel becoming 1-4 mm. long, stiff, usually strictly ascending; corolla blue, funnellform, commonly 3 mm. long, surpassing the calyx lobes 1 mm. or less, the tube cylindric, usually about 1.2 mm. long; faucal appendages borne at the base of the deep throat, invaginate, intrusive. In fields, prairies, waste places and rocky soils, from Wichita Co. s. to Webb Co. and w. to n.e. Panhandle and s.w. to Davis Mts., Mar.-June; from Kan. to Ida., s. to Tex., N.M., and n. Ariz.

9. HACKELIA OPIZ STICKSEED

Coarse biennial or perennial or rarely annual herbs; leaves alternate, broad and veiny; flowers in naked or inconspicuously bracted racemes paniculately disposed; pedicels slender, recurving in fruit; calyx cut to the base into spreading ovate to oblong or lanceolate lobes; corolla white or blue, with a short or elongate tube; lobes rounded, imbricate; throat with trapeziform intruded appendages; stamens included, affixed at middle of tube; filaments slender, short; anthers oblong to elliptic; style slender, scarcely if at all surpassing the mericarps; stigma capitate; ovules 4; mericarps 4, erect, ovoid, affixed ventrally to the pyramidal gynobase by a broad medial or submedial areola, margin with subulate glochidiate appendages that are frequently confluent at the base, back smooth or with glochidiate appendages.

A genus centering in western North America with outlying species in South America and Eurasia.

- 1. Mericarps subequally prickly over the whole back or face 1. *H. virginiana*.
- 1. Mericarps only marginally prickly, smooth, verrucose or with several small glochidiate prickles on back or face (2)
- 2(1). Flowers about 2.5 mm. long; nutlets about 2.5 mm. long, the prickles free to the base 2. *H. grisea*.
- 2. Flowers 4-6 mm. long; nutlets 3-4 mm. long, the prickles usually somewhat united at base (3)
- 3(2). Cauline leaves linear-oblong, sessile or nearly so; dorsal surface of mericarps smooth 3. *H. floribunda*.
- 3. Cauline leaves narrowly elliptic to lanceolate, noticeably petiolate; dorsal surface of mericarps with several minute glochidiate prickles .. 4. *H. pinetorum*.

1. *Hackelia virginiana* (L.) I. M. Johnst. Plant to about 1 m. tall, hirsute throughout, the stem freely branched above; radical leaves broadly ovate to cordate, narrowed to a slender petiole, to 2 dm. long; cauline leaves ovate-oblong to oblong-lanceolate, acuminate at apex, tapering to the sessile base, to 15 cm. long, progressively reduced above and passing into the bracts; the numerous loosely paniculate racemes divaricate, with small bracts; pedicels and flower each about 2 mm. long, frequently supra-axillary; corolla whitish, about 2 mm. wide; mericarps of the globose fruit equally short-glochidiate over the whole back, 3-4 mm. long. In rich woods and open thickets in n.e. Tex. and the Panhandle, July-Sept.; from Que. and Me., w. to S.D., s. to Ga., Ala., La. and Tex.

2. *Hackelia grisea* (Woot. & Standl.) I. M. Johnst. Plant biennial from a short thick taproot; stems stout, 8 dm. tall or less, simple below, canescent; basal leaves numerous, narrowly oblanceolate, obtuse, 3-5 cm. long; cauline leaves narrowly oblanceolate to linear-oblong, obtuse to acute, 2.5-4 cm. long, the upper sessile, the lower attenuate to a broad winged petiole; all leaves densely canescent on both surfaces, the hairs with large white bulbous bases; inflorescence sparse, with slender loosely few-flowered erect branches; bracts very small, lanceolate; pedicels 3-4 mm. long; sepals ovate, obtuse; corolla blue, 2.5 mm. long; mericarps 2.5 mm. long, the spines as long as the body, free to the base, the back papillose. In open woods of mt. canyons in the Trans-Pecos and N.M., July-Sept.

Its relatively small corollas, with ascending lobes, readily distinguish this species from other west American annual and biennial species in this genus.

3. *Hackelia floribunda* (Lehm.) I. M. Johnst. Plants erect, stout, from a short-lived perennial root, 5-12 dm. tall, the rough pubescence deflexed, mixed with some spreading hairs; leaves oblanceolate to linear or oblong, hirsutulous-appressed, the basal leaves petiolate, with spreading hairs, the stem leaves sessile above; racemes many, rather strict, densely flowered; pedicels 5-7 mm. long in fruit; corolla blue, 4-7 mm. broad; appendages small, obscurely papillate, not closing the throat; mericarps 3-5 mm. long, face of mericarp with a median ridge, muriculate, hirsutulous, without short glochidiate prickles, the marginal spines much-flattened at base, distinct or somewhat confluent, 4 to 6 on each side, mostly exceeding in width the face of the mericarp. Brushy slopes and edge of woods in the Trans-Pecos, July-Aug.; mostly w. U.S. and Can., e. to Ont. and Minn.

4. *Hackelia pinetorum* (Greene) I. M. Johnst. Stems erect-spreading, several from a woody rootstock, to 7 dm. high; cauline leaves petiolate, narrowly elliptic to lanceolate, obtuse-apiculate to subacute, to about 6 cm. long and 15 mm. wide; racemes simple or sparsely branched, erect or ascending, laxly many-flowered, elongate; flowers about 4 mm. long; mericarps 3-4 mm. long, the smooth disk with several minute glochidiate prickles. On sheltered ledges on summit of Mt. Livermore, Davis Mts., rare, Aug.-Oct.; also N.M.

10. CRYPTANTHA LEHM.

Annual or perennial¹ herbaceous or fruticlose plants, usually with coarse stiff pubescence; leaves opposite at base, firm, veinless; flowers white or very rarely yellow, in bractless or bracted spikes or racemes; calyx usually cut to the base, the lobes erect or connivent, linear or oblong; mature calyx investing the mericarps falling away individually; corolla with usually a short cylindrical tube, with or without scales at the base inside, the throat with intruded appendages; corolla lobes imbricate, rounded, spreading; style slender, short or long, included; stigma capitate; ovules 2 to 4; mericarps 1 to 4, erect, ovate to triangular, roughened or smooth, margined or marginless, affixed laterally through a medial ventral and commonly basally forked groove to a usually columnar subulate or pyramidal gynobase.

One of the largest and most perplexing genera in the family, consisting of 100 or more species. It is exclusively American, mostly in western United States. Several of the species are reported to have value as forage for sheep.

1. Plants annual; stems slender (Doubtful cases should be keyed under both alternatives) (2)
1. Plants perennial; stems usually rather stout (12)

- 2(1). Cymes with numerous evident bracts (3)
- 2. Cymes bractless or having only a few very inconspicuous bracts (6)
- 3(2). Gynobase elongate, slender, surpassing the mericarps; mericarps smooth, grooved on the venter; plants small, with very slender wiry stems and small leaves (less than 1 cm. long and 1 mm. broad); roots and base of plants usually charged with a purple dye1. *C. micrantha*.
- 3. Gynobase evidently much shorter than the mericarps; some or all the mericarps with a warty surface and their venter largely occupied by a triangular excavated attachment scar; plants moderate-sized, the stems 1-7 mm. thick and not wiry; leaves 2-6 mm. broad (4)
- 4(3). Mericarps strongly heteromorphic, the adaxial one differing from the other three in being much larger and more firmly affixed, only the three smaller mericarps coarsely warted and their venter occupied by a large triangular excavated attachment scar; calyx lobes at maturity with conspicuously thickened and indurated midribs2. *C. minima*.
- 4. Mericarps all alike, all coarsely warted and all having the venter occupied by a large triangular excavated attachment scar; calyx lobes at maturity with only moderately thickened midribs (5)
- 5(4). Plant spring-flowering; stems dichotomously branched from the base outward; plant usually low (5-15 cm. high) and spreading, commonly greener and more coarsely hispid than in *C. albida* and the calyx larger and having a broader base3. *C. mexicana*.
- 5. Plant summer-flowering; main stems straight and erect, forming a central axis producing dichotomously branching laterals; plant usually taller (15-40 cm. high) and having more slender branches than *C. mexicana*4. *C. albida*.
- 6(2). Mericarps with a conspicuous marginal wing5. *C. pterocarya* var. *cycloptera*.
- 6. Mericarps not winged (7)
- 7(6). Back of mericarp distinctly rimmed by a narrow slightly thickened pallid margin; mericarps glossy, vitreous, bent6. *C. pusilla*.
- 7. Back of mericarp unrimmed; mericarps dull, not bent (8)
- 8(7). Fruit consisting of 4 or fewer mericarps; adaxial (not abaxial) mericarp always present, densely covered with abundant, very crowded and very minute warts; when 2 or more mericarps are matured the adaxial one differs from the others in being noticeably larger and more firmly affixed and in having a different shape and very different surface markings (9)
- 8. Fruit consisting of 4 mericarps; abaxial (not adaxial) mericarp usually the largest and most firmly attached but not differentiated from the other mericarps within the fruit in either shape or surface markings; mericarps all coarsely but not very abundantly warted (11)
- 9(8). Mericarp one, only rarely more; adaxial mericarp bearing only crowded, abundant, very minute warts; fruiting pedicels 0.2-0.5 mm. long8. *C. texana*.
- 9. Mericarps usually 4; adaxial mericarp with slightly taller papillae or spicules mixed among the more abundant, crowded, very minute warts covering its surface; fruiting pedicels 1-2 mm. long (10)
- 10(9). Corolla 4.5 mm. in maximum length, limb 3-6 mm. broad, lobes rounded, 1.5-2 mm. broad, tube 1.7-2 mm. long and 1 mm. thick; anthers 0.5 mm. long, borne about 1.2 mm. above base of corolla tube7. *C. crassisejala* var. *crassisejala*.
- 10. Corolla 2-3 mm. in maximum length, limb 2.5 mm. broad, lobes rounded, 0.6-0.8 mm. broad, tube 1.5-2 mm. long; anthers 0.4 mm. long, borne 1 mm. above base of corolla tube7. *C. crassisejala* var. *elachantha*.

- 11(8). Calyx in fruit 2-4 mm. long, the lobes not villose; mericarps heteromorphic, triangular-ovate, usually dark-colored, 0.7-1.2 mm. long 9. *C. angustifolia*.
11. Calyx in fruit 7-10 mm. long, the lobes conspicuously white-villose along the margin below the middle; mericarps all alike, lanceolate, 1.5-2 mm. long, prominently warted 10. *C. barbiger*a.
- 12(1). Mericarps smooth, not spaced equally about the gynobase, on the axial and abaxial side of gynobase the mericarps closely juxtaposed, laterally they are usually evidently separated, hence borne in opposing pairs; stamens always borne at the top of the corolla tube and directly beneath the faucal appendages (13)
12. Mericarps rough, equally spaced about the gynobase; corolla tube elongate, lacking an annulus, surpassing the calyx lobes for 1-3 mm. (15)
- 13(12). Corolla lacking an annulus; faucal appendages trapeziform, about as broad as long, about 0.5 mm. long; mature calyx 5-10 mm. long 12. *C. Coryi*.
13. Corolla bearing an evident very well-developed flangelike annulus inside the corolla tube just above its base; faucal appendages elongate, lingulate, about 1 mm. long; mature calyx about 5 mm. long (14)
- 14(13). Plant at maturity usually leafless at the base; stems frequently branching, commonly arising from a loose caudex; indument usually smooth, consisting of slender appressed hairs 11. *C. Jamesii* var. *Jamesii*.
14. Plant at maturity with usually simple stems and some persistent basal leaves; stems arising directly from a taproot or forming a small very compact caudex; indument hispid with evident stiff spreading hairs 1-3 mm. long 11. *C. Jamesii* var. *setosa*.
- 15(12). Flowers monomorphic; stamens always borne slightly above the middle of the corolla tube; style never projecting above the stamens; faucal appendages scantily puberulent or nearly glabrous; mericarps coarsely tuberculate; inflorescence soon lax and thyrsoid; frequent in western Trans-Pecos Texas 13. *C. oblata*.
15. Flowers strongly dimorphic, distinctly heterostyled; style elongate and nearly exerted from the corolla tube when the stamens are borne in mid-tube, and reaching up only to slightly above mid-tube when the stamens are borne slightly exerted at the summit of the tube; faucal appendages puberulent; inflorescence usually capitate except sometimes in extreme maturity; plants local (16)
- 16(15). Mericarps minutely but distinctly tuberculate or rugose; heads of flowers commonly 2-3 cm. in diameter; Guadalupe and Apache mts. 14. *C. Paysonii*.
16. Mericarps obscurely roughened, nearly smooth; heads of flowers 1-2.5 cm. broad; stems slender; Big Bend area 15. *C. crassipes*.

1. *Cryptantha micrantha* (Torr.) I. M. Johnst. Small annual, 3-10 cm. tall; stems minutely strigose, erect or ascending, loosely and dichotomously branched; leaves usually numerous, linear- to oblong-ob lanceolate, rounded or obtuse at the apex, to 8 mm. long and 1 mm. broad, strigose or the hairs loosely appressed, the uppermost leaves transformed into bracts of the inflorescence; inflorescence consisting of densely flowered, clustered, short, abundantly bracted scorpioid biseriata cymes terminating the stems and branches; calyx at anthesis 0.8-1 mm. long, at maturity to 1.5 mm. long, very tardily deciduous, the lobes linear or lance-linear, hispidulous, separated by an open sinus about as wide as the lobes; corolla minute, inconspicuous, white, 1.3-1.8 mm. in total length, shortly exerted from the calyx, the throat slightly constricted and bearing 5 minute yellow plaits as faucal appendages; mericarps 4, all alike or sometimes the abaxial one slightly the largest and the most firmly affixed, to 1 mm. long and 0.5 mm. broad, lanceolate, dark-colored, smooth, the back convex, the venter grooved from base to apex. *Eritrichium micranthum* Torr., *Krynitzkia micrantha* (Torr.) Gray, *Eremocarya micrantha* (Torr.) Gray. Rare and local in w. Tex., where it is apparently restricted to sandy places, Mar.-June; from w. Tex. and N.M. to Ariz. and Calif., n. through Nev. into e. Ore.

Plants of this species are readily recognizable because of their small size, wiry stems, diminutive leaves, elongate gynobase, short dense completely bracted cymes, and presence of a dye in root and base of stems.

2. *Cryptantha minima* Rydb. Plant annual, usually about 1 dm. tall and 2 dm. broad but occasionally much larger; stems few to numerous, usually ascending or decumbent, with ascending branches, with minute slender appressed hairs and spreading stiff usually pungent bristles; leaves narrowly oblanceolate to linear-oblanceolate, obtuse to acute at apex, to 4 cm. long and 6 mm. broad, gradually reduced up the stem and continuing into the inflorescence as foliaceous bracts, with appressed or ascending slender minute hairs and also stiff pungent bristles which frequently arise from mineralized disks; inflorescence consisting of single or paired, evidently bracted scorpioid cymes; calyx at anthesis 2-2.5 mm. long, subsessile; mature calyx deciduous, commonly about 5 mm. long, asymmetric, gibbous on adaxial side, spreading or somewhat decurved in age; corolla white, 2.5-3 mm. in maximum length, the rounded lobes ascending and scarcely surpassing the calyx; corolla throat partially closed by trapeziform puberulent invaginate faucal appendages, these with a short medial downward prolongation in the upper part of the tube; adaxial mericarp 1.6-2 mm. long, about 1.2 mm. broad; the 3 consimilar mericarps ovate, 1.2-1.5 mm. long, 0.7-0.9 mm. broad, and 0.5-0.6 mm. thick. *Eritrichium hispidum* Buckl. Frequenting sandy or gravelly places in the portions of the Tex. Panhandle below the High Plains (i.e., along canyons cut into the High Plains and along and e. of the breaks at their e. border), thence extending s. into e. portions of Trans-Pecos, with outlying stations in Archer and Val Verde cos., Mar.-June; from s. Can. through Mont. and the Dakotas, s. to Tex. and N.M.

A species very closely related to *C. crassisepala*, which differs in having naked rather than abundantly bracted cymes, and in having the surface of the large adaxial mericarp minutely warted with intermixed protruding elongate papillae or spicules rather than minutely warted only.

3. *Cryptantha mexicana* (Brandeg.) I. M. Johnst. A low loosely spreading or less commonly erect spring-flowering very fertile annual, 5-20 cm. tall, usually broader than tall; stems several to many, usually loosely decumbent or laxly ascending, hispid and sometimes also sparingly strigose, repeatedly dichotomous from the base outward; leaves mostly flat, oblong-oblanceolate to narrowly oblong, hispid with spreading hairs arising from discoid mineralized bases, to 45 mm. long and 6 mm. wide, gradually smaller up the stem and into the thyse, floriferous to below the middle and frequently even down to the base of the stems; the cymes numerous, to 15 cm. long, densely to loosely flowered; calyx at anthesis to 2.5 mm. long, the lobes lanceolate; calyx at maturity to 4 mm. long and 2.5 mm. broad above the base, broadly ovoid, eventually deciduous; corolla inconspicuous, white, 2-2.5 mm. long, the lobes rounded and ascending; faucal appendages well-developed, puberulent, invaginate, trapeziform, almost 2 mm. high; mericarps triangular-ovate, to 1.3 mm. long and 0.9 mm. broad, homomorphous (but the abaxial mericarp sometimes more firmly affixed than the other 3 mericarps). Usually in calcareous soils associated with limestone or caliche from the Trans-Pecos to Howard, Tom Green, Edwards, McMullen and Cameron cos., Apr.-June; from Tex. s. into n. N.L. and s. Coah.

In western Texas the plant is frequently abundant along the shoulders of modern highways and possibly may be aided in dissemination and be increasing its geographic range through assistance of the automobile. In the past this plant has been confused with the closely related *C. albida* and not distinguished from it.

4. *Cryptantha albida* (H.B.K.) I. M. Johnst. An erect, paniculately branching summer-flowering annual, 15-40 cm. tall; stems single or more commonly several, erect or short-decumbent only at the very base, rather stiff and strong, each stem developing a clearly defined straight erect central axis which produces (at least above the middle) numerous well-developed loosely ascending dichotomously branching laterals, cinereous, antrorsely strigose and sparingly hispid; leaves spatulate to spatulate-linear, abundant along the stems before anthesis, to 3 cm. long and towards the apex 5 mm. broad, usually conduplicate, the lower surface strigose or with only a few spreading hairs mostly with mineralized discoid bases, the upper surface scantily hairy or almost glabrous; inflorescences terminal on the main stem and on the many leafy branches and branchlets, dichotomous, composed of solitary or rarely geminate slender cymes; calyx at anthesis about 2 mm. long, the lobes lanceolate; calyx at maturity to 3 mm. long and 2 mm.

broad, ovoid, eventually deciduous, the lobes connivent, unequal, pungent-hispid; corolla white, inconspicuous, 2.5-3 mm. long, the lobes broadly obovate, rounded and ascending, about 1 mm. long; faucal appendages well-developed, invaginate, trapeziform, emarginate, puberulent, about 0.2 mm. high and slightly broader at the base; mericarps triangular-ovate, to 1.3 mm. long and 0.9 mm. broad, homomorphous (the axial one differentiated only in being more firmly affixed than the other three). Mostly in soils derived from volcanic rock but rarely in limestones in the w. Trans-Pecos, mostly July-Aug.; in w. Tex. and s.e. Ariz., s. to cen. Mex. Indistinguishable plants also occur in n.w. Arg.

5. *Cryptantha pterocarya* (Torr.) Greene var. *cycloptera* (Greene) Macbr. Annual, erect, simple or ascendingly branched, 1-4 dm. tall; stems strigose or short hispid with appressed or spreading hairs; leaves broadly linear or the reduced upper ones oblong to oblanceolate, obtuse, the lowermost leaves commonly to 4 cm. long and 4 mm. broad, strigose or short hispid with the hairs commonly arising from bulbous or discoid bases; inflorescence terminal on the leafy stems and branches, pedunculate, consisting of geminate or ternate scorpioid bractless cymes to 8 cm. long; flowers unilateral and biserial, usually becoming loose at maturity; calyx at anthesis about 2 mm. long; calyx at maturity becoming greatly enlarged, to 5 mm. long and 4 mm. broad, persisting until after the fall of the mericarps, symmetric, the lobes united above the base, loosely connivent, broad, elliptic to lance-ovate, hispidulous on the moderately prominent midrib; corolla inconspicuous, white, total length 2-3 mm. long, the lobes suborbicular and to 0.8 mm. in diameter, the throat bearing 5 weakly intruded convex faucal appendages; mericarps 4, all alike, consisting of a lanceolate body laterally surrounded by a spreading wing margin 0.3-0.5 mm. broad, viewed dorsally the winged mericarps 2-2.5 mm. long and 1.7-2 mm. broad, edge of the wing entire or crenate or more or less dentate-lobulate, body of mericarp with the back convex and conspicuously warted. Usually in limestone areas on hills and base of cliffs in the Trans-Pecos, along the valley of the Rio Grande and bordering mts., from s. Presidio Co. to Sierra Blanca and the vicinity of El Paso, Mar.-May; also in w. N.M., Ariz. and n. into Ut. and Nev.

6. *Cryptantha pusilla* (T. & G.) Greene. An early spring herb, with slender root, usually low and spreading; stems commonly numerous, laxly decumbent or prostrate, to 3 dm. long and 1.5 mm. thick, grayish, slender, strictly branched, strigose and hispidulous; leaves oblanceolate to linear, to 3 cm. long and 3 mm. broad, hispidulous, the hairs usually arising from thickened mineralized bases; inflorescence consisting of many solitary or less frequently geminate scorpioid cymes borne terminal on the stems and many branches; cymes slender, naked or with a few scattered small inconspicuous bracts, unilateral, 2-8 (-15) cm. long; calyx at anthesis about 1 mm. long, hispidulous, noticeably tawny; calyx at maturity to 2.5 mm. long and 2 mm. broad, early deciduous, the lobes lanceolate, noticeably unequal; corolla minute, usually 1.5 mm. long, only the ascending obovate lobes surpassing the calyx; faucal appendages weak and inconspicuous, hemispheric; fruit usually 1.1 mm. in diameter and 0.9 mm. tall; mericarps 4, dark-colored, porcelainlike, lustrous, triangular-ovate, somewhat bent and incurving, 0.7-1.0 mm. long, 0.6-0.8 mm. broad, back convex, bearing pale warts, margin pallid and somewhat thickened. *Eritrichium pusillum* T. & G., *Krynitzkia pusilla* (T. & G.) Gray. On open rocky hills, flats and in canyons in the Trans-Pecos, Feb.-May; Tex., N.M., Ariz., s. to Son., Dgo. and Chih.

7. *Cryptantha crassisepala* (T. & G.) Greene var. *crassisepala*. Annual, 10-15 (-25) cm. tall; stems few to numerous, usually decumbent or sprawling, loosely branched, usually bearing short slender appressed or spreading hairs and stiff spreading pungent bristles; leaves narrowly oblanceolate, rounded or obtuse at the apex, bearing appressed or ascending slender minute hairs and also stiff pungent bristles, the latter frequently with discoid bases, the lower leaves to 5 cm. long and 5 mm. broad, the upper leaves gradually reduced; inflorescence consisting of bractless scorpioid cymes borne solitary or geminate; cymes strongly unilateral, to 15 cm. long, bearing the flowers in 2 strongly diverging ranks; calyx at anthesis 2-2.5 mm. long; calyx at maturity deciduous, to 8 mm. long, asymmetric, gibbous on the adaxial side, the lobes developing extremely prominent excessively thickened indurate midribs armed with long spreading very pungent bristles; corolla white; faucal appendages invaginate, puberulent, trapeziform with a medial downward glandular prolongation in the upper part of the tube; mericarps strongly

heteromorphic with the adaxial one much the largest (to 2.5 mm. long and 1.2 mm. broad) and most firmly affixed. *Eritrichium crassisepalum* T. & G., *Krynitzkia crassisepala* (T. & G.) Gray. Dunes and other sandy places; most abundant n. of the Pecos River in Loving, Ward, Upton, Winkler and Ector cos., with outlying stations in Kent and Mitchell cos. and in s. Pecos and n. Brewster cos., Mar.-May; also e. of the Pecos River in Eddy Co., N.M.

Var. *elachantha* I. M. Johnst. Characters in the key. Usually in gravelly places in the Trans-Pecos, from Reeves and Brewster cos., w. through N.M. into Ariz., s. Ut. and adj. Mex.

8. *Cryptantha texana* (A.DC.) Greene. Annual, at first erect but usually spreading in age; stems usually several or more, decumbent, to 4 dm. long, loosely and ascendingly branched, clothed with slender rigid usually spreading hairs; leaves thickish, conduplicate, oblanceolate, retuse or obtuse to rounded at apex, covered with erect or ascending, stiff, slender hairs springing from mineralized discoid bases, the lower leaves to 6 cm. long and 9 mm. wide, the middle and upper leaves gradually reduced; inflorescence consisting of solitary or geminate bractless scorpioid cymes; cymes strongly unilateral, bearing the flowers in 2 strongly diverging ranks, in age loosely flowered and to 15 cm. long; calyx at anthesis to 2.5 mm. long; calyx at maturity deciduous, to 5.5 mm. long, asymmetric and spreading or even somewhat decurved; calyx lobes connivent, linear, the midrib moderately prominent, thickened and somewhat indurate, armed with stout spreading pungent hairs; corolla white, 2.8 mm. in maximum length, the lobes ascending, rounded; faucal appendages high-convex, with a short medial downward glandular prolongation inside the corolla tube. *Eritrichium texanum* A.DC., *Myosotis texana* (A.DC.) Hook., *Krynitzkia texana* (A.DC.) Gray. In sandy places, chiefly s. of the valley of the Colorado River, from Mason, Llano, Travis and Bastrop cos. s. to Jim Hogg, Brooks and Willacy cos., also with an outlying n. station along the Brazos near Glen Rose, Somervell Co., Mar.-June; endemic.

This is the most easterly ranging of the species of *Cryptantha*.

9. *Cryptantha angustifolia* (Torr.) Greene. Annual, usually spreading, to 15 cm. tall; stems usually several to numerous, to 3 dm. long, decumbent or ascending, dichotomously branched, grayish from an abundance of pale very slender spreading hairs, in drying frequently becoming reddish or reddish-brown; leaves numerous, narrowly oblanceolate or nearly linear, 1-3 (-4) cm. long, 1-2 (-3) mm. wide, hispidulous, the hairs straight and spreading, springing from thickened mineralized bases; inflorescence consisting of usually very abundant, slender, commonly geminate scorpioid cymes that remain closely flowered even in fruit; calyx at anthesis about 1.5 mm. long, the lobes armed with slender spreading pungent hairs; corolla white, inconspicuous, total length about 2 mm., scarcely exerted, the lobes suborbicular and ascending; faucal appendages weakly intruded, hemispheric. In very arid areas in the Trans-Pecos, in the warmer parts of the Big Bend and along the valley of the Rio Grande n.w. to El Paso, Feb.-May; from Tex. through N.M. to the deserts of Ariz. and Calif.; also adj. Mex.

10. *Cryptantha barbiger*a (Gray) Greene. Annual to 4 dm. tall; stems one or more, bristly with slender spreading hairs 1-2 mm. long, erect or sometimes sprawling, branches few to numerous, frequently well-developed, strictly ascending; leaves obtuse, linear or oblong to narrowly lanceolate or oblanceolate, to 8 cm. long and 9 mm. wide, hispid; inflorescence consisting of pedunculate geminate or less commonly ternate scorpioid cymes borne terminal on the stems and major branches; cymes usually not exceeding 1 dm. in length but at times greatly elongated in fruit and as much as 30 cm. long; calyx at anthesis about 4 mm. long, the lobes usually surpassing the corolla, bristly and below the middle villose; calyx at maturity as much as 1 cm. long, subsessile, promptly deciduous when fruit is ripe, midrib of the linear-lanceolate lobes armed with slender pale spreading bristles 1-3.5 mm. long; corolla inconspicuous, white, 2-3 mm. long, the lobes suborbicular and ascending; faucal appendages weakly intruded, hemispheric, puberulent. In Tex. only in the Franklin Mts. on talus in an igneous area on the w. slope and on limestone on the e. slope, Apr.-May; from w. Tex., Ariz. and s. Ut., w. into the deserts of Calif. and n. Mex.

11. *Cryptantha Jamesii* (Torr.) Pays. var. *Jamesii*. Perennial but probably persisting for no more than 2 or 3 seasons; stems usually several, loosely clustered, from the summit of a slender woody taproot or a decumbent caudex, leafy, erect or ascending, usually

with strict branches, stiffish, 2-3 dm. or rarely to 5 dm. tall, strigose, pale, developing from short leafy suckers that appear on the caudex or on the base of the fertile stems usually late in the previous season; leaves oblanceolate, somewhat coriaceous, usually flat, pale-green, rather smooth, thinly strigose with slender closely appressed minute hairs and (particularly on the lower surface) intermixed with slightly coarser, stiffer, also closely appressed bristles that arise from very inconspicuous discoid bases, to 8 cm. long and 1 cm. wide; inflorescence terminal, forming a thyrses occupying upper quarter of the stem or less, usually composed of about six major scorpioid cymes; cymes densely flowered and even crowded in fruit; bracts not conspicuous, spreading, 3-8 mm. long; calyx at anthesis 2-3 mm. long, the lobes lanceolate, equaling or evidently longer than the corolla tube, strigose, bristles inconspicuous and appressed; corolla white, the limb spreading and 5-8 mm. in diameter, the tube usually shorter than the calyx; faucal appendages yellow, well-developed; mericarps in age more or less brownish and mottled, lustrous. *Eritrichium Jamesii* Torr., *Krynitzkia Jamesii* (Torr.) Gray. Frequent on dunes and in sandy places on the high plains of the Tex. Panhandle and s. to the dunes of Ward and Crane cos., Apr.-July; a characteristic plant of the Great Plains, ranging from Tex. n. to s.e. Wyo. and w. S.D.

Var. *setosa* (M. E. Jones) Shinn. Plant hispid, its indument consisting of abundant minute appressed hairs and intermixed stiff spreading hairs 1-3 mm. long; leaves not smooth and tidy in appearance, rough hairy; the lower surface usually with evident discoid mineralized hair bases; blade usually more or less conduplicate; stems usually simple, densely tufted from the crown of the taproot or in age arising from a small (3-6 cm. broad), very dense flat caudex. *C. Jamesii* var. *laxa* (Macbr.) Pays. and var. *multicaulis* (Torr.) Pays. Confined to gravelly volcanic soils in the Davis Mts. in the Trans-Pecos, Mar.-June; Tex., N.M., Ariz. and Chih.

12. *Cryptantha Coryi* I. M. Johnst. Perennial, usually with several stems arising from the clusters of leaves crowning the woody taproot, usually about 3 (1.5-5) dm. tall, not forming a caudex; stems erect or ascending, branched only in the inflorescence, clothed with an abundance of very slender fine retrorsely appressed hairs and also bristly with spreading pungent hairs; leaves pale-tomentulose with a coating of fine appressed hairs, usually also bearing some loosely appressed bristles, those in the basal clusters oblanceolate, to 15 cm. long and 1 cm. broad, acute to obtuse at apex, the smaller cauline leaves spatulate-oblong to oblong; inflorescence at first capitate but soon developing a very loose and open thyrses composed of 3 or 4 major scorpioid cymes (becoming 6-15 cm. long) and several few-flowered small glomerules in the uppermost leaf axils; bracts lanceolate, only the lower ones longer than the calyx; calyx at anthesis 4-6 mm. long, the lobes lanceolate, tomentulose and bristly; corolla white, yellow in the throat, commonly becoming somewhat pinkish in drying, the limb 7-10 mm. broad, the tube slightly shorter than the calyx lobes; faucal appendages yellow, trapeziform, emarginate, densely puberulent, base decurrent and prolonged downward as puberulent lines on the inner surface of the corolla tube to between the tips of the anthers; mericarps angulate, usually 4, gray and frequently somewhat mottled with brown, lustrous or dull. *Hemisphaerocarya texana* Brand. On talus and rocky benches, in and about limestone hills, usually if not exclusively in Cretaceous areas, from Maverick, Tom Green, Howard and Lubbock cos. w. to Brewster and s. Culberson cos., Mar.-June; also N.M.

This species is referred to the Mexican *C. Palmeri* (Gray) Pays. by some authors.

13. *Cryptantha oblata* (M. E. Jones) Pays. Usually a short-lived perennial, 2-4 dm. tall; stems erect or ascending, several to many arising from leaf clusters crowning a taproot, branched only in the inflorescence, strigulose with slender retrorsely appressed hairs and also decidedly bristly with stiff spreading hairs 1-3 mm. long; leaves of the basal cluster usually persisting, elongate-oblanceolate, to 15 cm. long and 1 cm. broad, bearing abundant fine appressed hairs to form a smooth strigulose-tomentulose indument from which emerge coarse scattered bristles; cauline leaves gradually reduced up the stem and greener and more bristly than the basal leaves; inflorescence at first capitate but eventually developing into a very loose, open, very hispid thyrses composed of usually 5 to 7 (or rarely even 9) densely flowered cymes 4-10 cm. long and several few-flowered glomerules in the uppermost leaf axils; bracts of the cyme very slender and elongate; calyx at anthesis 6-7 mm. long, hispid; calyx at maturity ovate to lanceolate in outline, 7-12 mm. long, the lobes decidedly unequal, surpassing the mature fruits; corolla white, salverform, 12-18 mm. long. *Krynitzkia oblata* (M. E. Jones) Pays., *Oreocarya oblata*

(M. E. Jones) Macbr., *Hemisphaerocarya oblata* (M. E. Jones) Brand. Usually on alluvial soils or talus, on silty valley flats or on gravelly benches at the base of mts., from El Paso Co. and adj. N.M. e. to w. Loving Co., n.w. Brewster Co. and cen. Presidio Co., Mar.-June; endemic.

14. *Cryptantha Paysonii* (Macbr.) I. M. Johnst. Perennial, 10-20 (-25) cm. tall, with several stems that are finely hairy and bristly; leaves mostly basal, in numerous crowded clusters borne on the crown of the taproot or on the short ascending or more or less spreading branches of a crowded caudex, cinereous or somewhat canescent, moderately to densely clothed with abundant minute mostly appressed slender hairs and with less abundant bristles arising from mineralized bases, the basal leaves oblanceolate, to 9 cm. long and 15 mm. broad; inflorescence at first capitate and terminal then usually developing one to several minor heads in the uppermost leaf axils; calyx at anthesis 5-8 mm. long, villose-hispid; calyx at maturity lanceolate in outline, 8-12 mm. long, the lobes connivent, unequal, narrowly lanceolate, surpassing the mature mericarp; corolla white with a yellow throat, frequently becoming yellowish or pinkish in drying, salverform, the limb 8-10 mm. broad, the tube surpassing the calyx lobes; faucal appendages prominent, trapeziform, puberulent. In Culberson Co., about the Guadalupe and Apache mts., Apr.-June; also N.M. The known collections are all from localities with Paleozoic rock.

15. *Cryptantha crassipes* I. M. Johnst. Strong perennial, cinereous or somewhat silvery, developing a dense, high-domed caudex formed of very numerous strict crowded caudex branches and intermixed clay, this bearing many crowded fascicles of basal leaves and numerous simple slender erect leafy flower-bearing stems to 25 cm. tall, bearing minute appressed (mostly retrorse) hairs and less numerous spreading bristles; leaves smooth with a dense indument of minute hairs and intermixed bristles or bearing spreading hairs and bristles only on the margin, the basal leaves oblanceolate, to 6 cm. long and 7 mm. broad, the apex acutish, the cauline leaves several and gradually smaller up the stem; inflorescence at anthesis usually a terminal capitate cluster, occasionally accompanied by one or more inconspicuous few-flowered glomerules borne in the uppermost leaf axils; calyx at anthesis 6-7 mm. long; calyx in fruit 8-11 mm. long, densely and minutely appressed hairy and with intermixed slender spreading bristles, the lobes lanceolate; corolla white with a yellow throat, salverform, the limb spreading and 8-10 mm. in diameter, the tube surpassing the calyx; faucal appendages prominent, densely puberulent. Known only from barren clay flats w. of Terlingua Creek along the road to Agua Fria Mts., n. of Agua Fria Spring, Brewster Co., Apr.-May; endemic.

11. AMSINCKIA LEHM. FIDDLE-NECK. TARWEED

Annual bristly herbs; leaves alternate, linear to ovate, usually veinless; racemes usually bractless; calyx cut to base into erect lanceolate or oblong lobes; corolla tubular or salverform, heterostyled, yellow or orange; tube cylindrical, glabrous, unappendaged; lobes spreading, rounded, imbricate; throat unappendaged; stamens included, affixed in the tube; filaments very short; anthers oblong, obtuse; style filiform, included; stigma capitate, emarginate; ovules 4, cotyledons 2-parted; mericarps 4, erect, angulate-ovoid, smooth or rough, unmarginated, strongly keeled ventrally; areola inframedial, small, carunculate; gynobase pyramidal, frustrate, about half the height of the mericarps.

About 50 species of considerable technical difficulty which centers in western North America.

- 1. Corolla salverform, the throat constricted and closed or nearly so by intruding hairy saccate processes; stamens inserted evenly in one plane on the tube well below the constriction1. *A. lycopsoides*.
- 1. Corolla narrowly funnellform, with the throat open and glabrous; stamens inserted (usually more or less irregularly) in the corolla throat (2)
- 2(1). Corolla pale-yellow, 4-5 mm. long, little or not at all exserted beyond the calyx lobe2. *A. micrantha*.
- 2. Corolla orange-yellow, 8-10 mm. long, well exserted beyond the calyx; plants usually green; stems hirsute-bristly but with little or no fine-appressed hairs3. *A. intermedia*.

1. *Amsinckia lycopsoides* Lehm. Plant erect to procumbent, with long spreading branches, rather stout, bristly-hirsute with scant or no fine pubescence at least below, 3-10 dm. tall; leaves bristly-hirsute, the hairs spreading or appressed, the lower linear or linear-oblong, 6-15 cm. long, the upper lanceolate or the uppermost narrowly ovate; spikes usually not greatly elongating in fruit, bracteate below; fruiting calyx 6-10 mm. long, the lobes narrowly linear-lanceolate, sparsely bristly on the back, the margins densely ciliate with long slender hairs; corolla deep-yellow, 7-10 mm. long, the tube well-exserted, the throat nearly closed by hairy saccate intrusions; mericarps triangular-ovate, 2.5-3 mm. long, not strongly keeled dorsally, closely muricate, not rugose, the points usually not in definite rows. Usually in moist open ground; w. U.S., reported from Tex. but no specimen seen, spring.

2. *Amsinckia micrantha* Suksd. Plant slender, the stem simple or freely branched from the base and usually decumbent, 3-6 dm. tall, bristly-hirsute with little or no fine pubescence; leaves broadly linear or oblong, the upper sometimes lanceolate, 4-10 cm. long, thin, bristly, the hairs mostly spreading and strongly pustulate; spikes becoming lax and greatly elongated, with few bracts or none; fruiting calyx 6-8 mm. long, the lobes narrowly to broadly lanceolate, thin, bristly, the lower bristles somewhat reflexed; corolla light-yellow, 4-5 mm. long, the tube slightly or not at all surpassing the calyx, the lobes minute; stamens usually inserted just below opening of corolla; mericarps triangular, 2.5-3 mm. long, the dorsal keel with a narrow strongly toothed ridge, with similar ridges on either side, the area between the ridges finely and evenly verrucose. Dry ground or grasslands, isolated in cen. Tex., Mar.-May; n.w. U.S. and B.C.

3. *Amsinckia intermedia* Fisch. & Mey. RANCHERS FIREWEED. Stems varying from simple and strictly erect to widely branched, 2-10 dm. high, sparsely bristly, tomentose near base of spikes; basal and lower cauline leaves linear to linear-lanceolate, acute at apex, clasping at base, thinly hirsute with spreading pustulate hairs; spikes abbreviated, leafy-bracted at base, becoming somewhat elongate in fruit; calyx lobes linear, about half as long as corolla, dorsally rufous-hispid, densely white-hirsute on margins; corolla orange-yellow, 8-10 mm. long, 3-6 mm. broad; mericarps 2.5-3 mm. long, grayish, incurved, narrowly keeled and rugose on back, the surface papillate or tuberculate. Grasslands on plateaus in the Trans-Pecos, Feb.-Apr.; from w. Tex. and Ariz., n. to Ida. and westw.

12. MYOSOTIS L.

SCORPION-GRASS. FORGET-ME-NOT

Annual or perennial herbs; leaves alternate; racemes bractless or bracted; calyx cut to beyond the middle into lanceolate or triangular lobes; corolla blue, white or rarely rose, with short tube, the lobes contorted, rounded, spreading, the throat with intruded appendages; stamens affixed on tube, included or exserted, the filaments filiform; anthers oblong or ovate, obtuse; ovules 4; mericarps 4, erect, ovoid to ellipsoid, smooth and shiny, with a basal areola; gynobase flat or high convex; style filiform; stigma disciform.

About 50 species centered in the Old World. It is separated from practically all other genera of the subfamily Boraginoideae by the contorted rather than imbricate aestivation of the corolla.

1. Fruiting calyx more than 5 mm. in length; flowers rather distant on rachis, mostly more than 1 cm. apart 1. *M. macrosperma*.

1. Fruiting calyx less than 5 mm. in length; flowers close on rachis, less than 1 cm. apart 2. *M. verna*.

1. *Myosotis macrosperma* Engelm. Erect annual, 2-5 dm. tall, hispidulous with spreading hairs, above the middle tending to be strigose; stems usually simple only when young, commonly with elongate leafy fertile branches at least above the middle and sometimes also from the lower leaf axils and even from the base of the main stem; leaves veinless, the basal ones forming a short-lived vernal rosette, the cauline leaves rather numerous, the upper ones only moderately reduced in size, hispidulous, the stiffish hairs arising from inconspicuous bulbous or discoid mineralized bases, the larger leaves to 75 mm. long and 16 mm. wide; cymes racemose, usually with a few leafy bracts at the base, not forking, at maturity stiffish, erect, straight, to 35 cm. long, eventually becoming loosely flowered

and in age becoming naked as the older fruiting calyces detach from the summit of the pedicel and fall away; calyx at anthesis 2.5-3 mm. long, unequally lobed, bearing abundant appressed uncinata hairs, the mature calyx covered with hooked hairs and enclosing the ripe mericarps functioning as a small bur suitable for animal dispersal; pedicel at maturity 2-6 mm. long; corolla white or at times slightly bluish, 2.5-3 mm. long, exerted with at least the lobes surpassing even the longer calyx lobes. *M. verna* var. *macrosperma* (Engelm.) Chapm., *M. virginica* var. *macrosperma* (Engelm.) Fern. Usually in rich soil of woods and bottomlands in n.e. and e. Tex., s.e. to the coast, Mar.-May; from Md. to Fla., w. to Ill., Mo. and Tex.

2. *Myosotis verna* Nutt. Erect annual, 5-35 cm. tall; stems simple or commonly branched only above in the inflorescence, occasionally with leafy fertile branches from most of the leaf axils along the stem, hispidulous or hispid-villose; leaves veinless, numerous, the basal ones forming a short-lived vernal rosette, the upper cauline leaves only moderately reduced in size, hispidulous, the stiffish hairs arising from inconspicuous bulbous or discoid bases, especially on the under surface, the larger leaves to 4 cm. long and 1 cm. wide; cymes racemose, terminal, not forked, at maturity stiffish, erect, straight, to 15 cm. long, eventually becoming loosely flowered; calyx at anthesis about 2.5 mm. long, unequally 5-lobed, densely hispidulous and usually with only a few of the hairs uncinata; corolla white, 2.5-3 mm. long, exerted, with the lobes surpassing even the longest calyx lobe. In rocky woods, on slopes and banks, in prairies and open woodlands in n.e. Tex., Dallas to Travis and Harris cos., eastw. and northw., Mar.-May; from N.E. to Fla., w. to B.C., Calif., Ida., and Tex.

13. ANTIPHYTUM DC.

Perennial fruticose or fruticulose plants; leaves opposite at least at the very base of the plant, linear to lanceolate; racemes bracted; calyx cut to base or nearly so; corolla blue, yellowish or white; corolla tube cylindrical, the imbricate lobes rounded and spreading or laxly ascending; throat with intruded ciliate or papillate appendages; stamens included, attached at middle of tube; filaments slender, short; anthers oblong; style slender, included in tube; stigmas geminate; ovules 4; mericarps 4, erect, ovoid or angulate, rugose or verrucose; areola inframedial or suprabasal, at lower end of ventral keel or terminating a downward-projecting stipitate prolongation of the keel springing from just above the base of the mericarps; gynobase flat to depressed-pyramidal.

The genus *Antiphytum* as here accepted includes about 10 Mexican species as well as 2 species in Brazil.

1. Pedicels not elongating, at most 5 mm. long; leaves in basal rosettes, alternate or only lowermost opposite; corolla tube practically undeveloped; appendages lacking ..
..... 1. *A. floribundum*.
1. Pedicels elongating, becoming 5-10 mm. long; leaves alternate only in the inflorescence; corolla with definite tube and faucal appendages ..
..... 2. *A. heliotropioides*.

1. *Antiphytum floribundum* (Torr.) Gray. Plant 3-12 dm. tall, a biennial or short-lived perennial, with a thick taproot, cinereous, finely antrorse strigose admixed with elongate slender usually spreading hairs that frequently arise from discoid or thickened bases; stems one to several, fistulous, stiffly erect, forming a straight central axis producing numerous stiffly ascending floriferous laterals, especially above the middle; leaves more or less conduplicate, narrowly oblanceolate, acute, the margin thickish and not at all revolute, to 2 dm. long and 1 cm. wide, lower surface with a thickened midrib, veinless, gradually smaller upward along the stem; inflorescence an elongate thyrsoid panicle; flowers at first in numerous small glomerules but at maturity elongating into loosely flowered unilateral racemose cymes to 1 dm. long; calyx at anthesis sessile or subsessile, 2.5-4 mm. long, the lobes lanceolate, acute, unequal, without a midrib, in fruit about 5 mm. long; corolla white, saucer-shaped, broader than long, scarcely if at all surpassing the calyx, widely expanding from the very base, 3-4 mm. long, 1.3 mm. in diameter at base. *Eritrichium floribundum* Torr., *Krynitzkia floribunda* (Torr.) Gray, *Amblynotopsis floribunda* (Torr.) Macbr. In Tex., confined to rocky soil in igneous areas in the Davis

Mts. (in Jeff Davis and n. Brewster cos.) and in the Chinati Mts. (Presidio Co.), July-Oct.; s. in Chih. and Dgo. to Jal. and Michoac.

An erect herb with tall virgate stems. It is summer-flowering and has saucer-shaped corollas with a short widely expanded open tube and hence completely exposed stamens, style and ovary. The corolla develops no faucal appendages.

2. *Antiphytum heliotropioides* A. DC. A slender-stemmed shrubby perennial, branched from the base, 1-4 dm. tall, with a pallid indument of stiffish appressed hairs; middle and lower cauline leaves opposite, oblanceolate, 1-4 cm. long; cymes terminal, becoming 5-15 cm. long, abundantly and loosely flowered, unilateral, bracteate, racemose; corolla salverform, tube cylindrical. Apparently confined to rocky calcareous soils and particularly common on limestone hillsides, questionably from near Marfa, Presidio Co., May-June; from Tex. (?) s. to cen. Mex.

The species is definitely known to occur on limestone hills about 50 miles south of the Texas border in both extreme eastern, as well as western sections of Coahuila, and is to be looked for in limestone areas north of the Rio Grande between Maverick and Presidio counties. Distinctive features aiding in recognizing the plant are its bushy fruticose habit and pale indument, opposite lower and middle cauline leaves, and the frequently very elongate pedicels on the fruiting calyces.

14. LITHOSPERMUM L.

GROMWELL. PUCCOON

Annual or perennial, herbaceous or fruticose plants with alternate leaves; flowers white, yellow or violet, in bracted racemes; calyx usually undivided; corolla tubular or salverform, the tube cylindrical, lobes spreading and imbricate, the throat with intruded appendages or with pubescent or glandular areas; stamens affixed in tube, included; filaments short; anthers oblong, usually with apiculate connectives; style filiform; stigmas geminate; ovules 4; mericarps 4 or rarely fewer, erect, ovoid or angular, smooth or verrucose, affixed by a broad horizontal or slightly oblique basal areola; gynobase flat or very broadly pyramidal.

A large genus with about 40 species in North America and 20 in the Old World. A purple dye was obtained by the Indians from the roots of these plants. The conspicuous corollas may be more or less sterile, and most of the seed may be developed from inconspicuous cleistogamous flowers produced later in the season.

1. Plant annual; corolla white1. *L. matamorensis*.
1. Plant perennial; corolla yellow, yellowish-white or orange (2)
- 2(1). Stems arising out of a basal cluster of leaves, the largest leaves at the base of the stem (3)
2. Stems arising from a bud on a caudex, root crown or rhizome, the largest leaves usually on the mid-section of the stem, the lowest leaves on the stem scalelike and very reduced (8)
- 3(2). Cauline leaves and bracts of the raceme oblanceolate to elliptic or ovate-elliptic (often broadly so) and usually acute; roots fusiform-thickened
.....2. *L. tuberosum*.
3. Cauline leaves and bracts of the raceme linear to linear-lanceolate or narrowly oblong and mostly obtuse; roots not noticeably fusiform (4)
- 4(3). Flowers heterostylic, none cleistogamic; corolla usually about as broad as long, funnellform, the throat unappendaged but abundantly stipitate-glandular, the tube villous inside; plant spreading by rhizomes, hence forming colonies
.....3. *L. cobrense*.
4. Flowers monomorphic, sometimes cleistogamic; corolla usually longer than broad, salverform, the throat with faucal appendages, only sparsely stipitate-glandular, the tube glabrous inside; plant with taproot (5)
- 5(4). Corolla lobes with the margins lobulate, lacerate or toothed; mericarps with a linear constriction above the base, smooth or pitted; pedicels of fruiting calyces of cleistogamic flowers evidently recurved4. *L. incisum*.
5. Corolla lobes entire or practically so; pedicels of all flowers remaining erect (6)

- 6(5). Mericarps smooth and shiny, white 5. *L. Parksii* var. *rugulosum*.
- 6. Mericarps roughened, dull-colored (7)
- 7(6). Mericarps covered with very crowded warts or irregular ridges or both; scar of mericarp excavated; basal leaves usually veinless ... 5. *L. Parksii* var. *Parksii*.
- 7. Mericarps coarsely pitted and coarsely tuberculate or subcornute on the shoulders; scar of mericarp flat, not excavated; basal leaves usually with a few evident veins 6. *L. mirabile*.
- 8(2). Flowers heterostylic; corolla tube not narrowly constricted at top (9)
- 8. Flowers not heterostylic; corolla tube cylindric, elongate, that is several times as long as the diameter of the proportionately small limb; corolla tube narrowly and distinctly constricted at the top (10)
- 9(8). Corolla about as long as broad, the limb 15-25 mm. in diameter, the tube cylindric; annulus evidently villous; flowers all subtended by bracts, never cleistogamic; plant hispid; stems scattered, arising from a rhizome 7. *L. carolinense*.
- 9. Corolla much longer than broad, the limb 8-9 mm. in diameter, the tube gradually ampliate at least above middle; annulus only very minutely and inconspicuously hairy; flowers mostly extra-axillary, sometimes cleistogamic; stems crowded in clusters, arising from a taproot 8. *L. multiflorum*.
- 10(8). Leaves all conspicuously veined, 8-32 mm. broad; plant 2.5-10 dm. tall; flowers all subtended by bracts; corolla lobes with entire margins 9. *L. viride*.
- 10. Leaves veinless, less than 10 mm. broad; plant 1-2.5 dm. tall; flowers mostly extra-axillary; corolla lobes with margins lobulate or erose-dentate and commonly also somewhat crisped 10. *L. calycosum*.

1. *Lithospermum matamorensis* A. DC. Annual, villose-hispid with spreading hairs and frequently also with an under pubescence of minute appressed hairs; root juicy when fresh; stems few, to 4 dm. long, very loosely branched, leafy, erect, ascending or decumbent, fistulose; leaves thin, hispid, with an evident midrib, the basal leaves oblanceolate, to 9 cm. long and 2 cm. broad, the apex obtuse or slightly retuse, cuneate or shortly petiolate at base, gradually reduced in size (elliptic to elliptic-oblanceolate) upward along the stems and on into the inflorescence; inflorescence simple or forked, circinate, in age straightening and becoming loosely flowered and to 25 cm. long; flowers small, numerous, borne in the axils of foliaceous bracts; calyx at anthesis 2.5-3.5 mm. long; calyx at maturity about 5 mm. long, the lobes herbaceous, linear or linear-oblanceolate; corolla small, white with a yellow center, total length 4-5.5 mm. long, very sparsely strigulose outside, the limb 4-7 mm. broad, the tube much shorter than the calyx; annulus usually 5-lobed; faucal appendages invaginate, puberulent, glandular on the side; fruit commonly maturing only a single mericarp; mericarps (when more than 1) more or less diverging, brownish, coarsely pitted, at times obscurely tuberculate, 2.5-3 mm. high. *L. prostratum* Buckl. On edge of thickets, in open woods and weedy areas in s. Tex. (s. to Balcones Escarpment and Guadalupe River), with outlying stations along the Colorado River in Travis and Llano cos. and along the Rio Grande and lower Pecos River in s.w. Val Verde Co., Feb.-May; Tex., Tam., N.L. and Coah.

2. *Lithospermum tuberosum* A. DC. Perennial, clothed with a spreading pubescence, to 7 dm. tall; cauline leaves somewhat smaller than the basal ones, to 1 dm. long and 25 mm. wide; inflorescence laxly few-flowered; bracts of the racemes similar to the cauline leaves but smaller; corolla yellow or yellowish-white, 4.5-6 mm. long, with a tube 3-4 mm. long, the lobes 1.5-2 mm. long, longer than broad and ascending; corolla throat with 5 small intruding velvety trapeziform appendages formed by invagination, below the appendages the throat is sparingly glanduliferous; calyx shorter than the corolla tube or at most equal it in length; filaments attached at the middle of the corolla tube and without glands at their base; nectary a narrow glabrous flange; mericarps small, 1.5-2.5 mm. long, often abundantly punctate. In low often dry woods in e. Tex., Mar.-Apr.; scattered along the Coastal Plain and in adj. provinces from Fla. to Tenn. and Tex.

This species is readily recognized by its rosette of large basal leaves and its fleshy fusiform roots.

3. *Lithospermum cobrense* Greene. Perennial, early in the season producing radical leaf clusters from which later the flowering stems arise; stems erect, one to several, to 6 dm. tall, simple or sometimes with ascending branches above the middle, strigose or sparsely hispid with hairs 1-3 mm. long; basal leaves usually dried up and frequently disappearing before anthesis, oblanceolate, to 1 dm. long and 16 mm. wide; cauline leaves very numerous, crowded, much smaller than the basal ones, narrowly oblong to linear, obtuse, sessile, to 35 mm. long, and 5 mm. wide; inflorescence circinate, terminal, simple or sometimes forked, infructescence of stiff, erect, loosely flowered, unilateral racemes 1-2 dm. long; flowers mostly clearly extra-axillary; calyx at anthesis 5-7 mm. long, the lobes oblong-linear, very unequal; pedicels 1-3 mm. long; calyx in fruit 6-10 mm. long; corolla with a cylindric tube and abruptly expanding throat and limb, pale-yellow, darkening in drying, minutely pubescent outside, the limb 15-20 mm. in diameter, the lobes suborbicular, spreading, 5-6 mm. in diameter, the margins entire; tube cylindric, about 8 mm. long and 3-4 mm. thick; annulus well-developed, consisting of 10 quadrate lobes. In Tex. known only from grassy open places in the Davis Mts., June-Aug.; Tex., N.M. and Ariz., s. to Chih. and Dgo.

4. *Lithospermum incisum* Lehm. Perennial, smoothly strigose with the hairs usually closely appressed but at times somewhat loosely so; root crown first developing a cluster of basal leaves and later one to many erect stems to 3 dm. tall, these at first simple but becoming branches later in the season; basal leaves to 12 cm. long and 1 cm. wide, oblanceolate, usually broader but not always longer than the lower cauline leaves, commonly dried up and frequently disappearing before flowering time, the apex acute; cauline leaves numerous, gradually and very moderately reduced in size upwardly along the stem, linear to lance-linear, commonly 3-6 cm. long and 3-6 mm. broad, frequently hispid-ciliate towards the base; *inflorescence produced in the spring of the year*, consisting of leafy-bracted terminal clusters of usually sterile flowers with very conspicuous yellow trumpet-shaped corollas; calyx at anthesis 7-12 mm. long, the lobes slender and unequal; pedicels 1-4 mm. long, erect; corolla salverform, sparingly strigose outside, the tube 15-35 mm. long, slender, gradually ampliate above the middle, the limb 9-20 mm. in diameter; *in late spring and summer* only minute cleistogamic flowers are developed by the plant which becomes much-branched and very leafy, and changes its growth-form, the basal leaves entirely disappearing and the stem leaves becoming very numerous, narrowly linear or lance-linear and mostly smaller, usually only 2-3 cm. long and 1.5-3 mm. broad; cleistogamic flowers very numerous and extremely fertile, borne hidden among bracts terminal on the stems, branches and branchlets; corolla permanently closed, 1-2.5 mm. long, tubular, the tube glabrous with the rounded summit hairy; calyx of cleistogamic flowers at first 2-6 mm. long, subsessile, at maturity 5-7 (-8) mm. long, usually borne in some numbers along the leafy stems and branches; pedicels usually 2-4 mm. long. *L. breviflorum* Engelm. & Gray. Generally distributed throughout most of Tex. in various types of habitats but usually in sandy soils of prairies, fields and open-wooded areas, Nov.-June; widely distributed in the U.S., chiefly on the Great Plains and along the Rocky Mts., and extending into adj. Can. and Mex.

Plants of western Texas average lower (1-2 dm.) than those for the central and eastern parts of the state. The conspicuous open corollas also are smaller and less fertile, the late-season cleistogamic form is more bushily branched and more fertile, and the mericarps are more abundantly pitted and average slightly smaller in western plants than in those for farther east in Texas.

5. *Lithospermum Parksii* I. M. Johnst. var. *Parksii*. Perennial, early in the year producing a basal cluster of leaves out of which the flowering stems later arise, the herbage somewhat olivaceous, with loosely appressed hairs; stems one to several, to 5 dm. tall, at first simple but usually becoming more or less loosely and ascendingly branched in age; basal leaves to 9 cm. long and 13 mm. wide, commonly dried up at anthesis, oblanceolate, the apex obtuse or rounded; cauline leaves numerous, narrower and shorter than the basal leaves and very gradually reduced in size upwardly along the stem, the middle ones usually 3-6 cm. long and 2-5 mm. broad, linear or oblanceolate-linear, the margins somewhat revolute; inflorescence producing only flowers with conspicuous corollas or

sometimes also cleistogamic flowers at the end of the season or only cleistogamic flowers, terminal, circinate, simple or sometimes forking, in fruit lengthening to form stiff, erect, loosely flowered unilateral racemes 1-2 dm. long; the normal flower with conspicuous corolla varying greatly in size; calyx at anthesis 4-12 mm. long, in fruit 9-15 mm. long; corolla salverform, yellow, the limb spreading, 7-20 mm. in diameter, finely strigose outside; mericarps usually 3 mm. high when measured along the ventral keel, the convex back about 2 mm. broad, base of mericarp opaque; attachment surface triangular, about 1.7 mm. broad, in completely mature mericarps its surface collapsing and tissue inside the basal collar of the mericarp apparently excavated, the tissue surrounding the funicular canal forming a spurlike projection 0.5-0.7 mm. long arising from the depths of the excavated base. On limestone in Sutton, Edwards and Kinney cos. w. to Glass and Del Norte mts., Brewster Co., and also in the Guadalupe Mts. of Culberson Co. and adj. Eddy Co., N.M., Mar.-Aug.

Var. *rugulosum* I. M. Johnst. Agreeing with var. *Parksii* in all details except fruit; mericarps larger and more plump, smooth and shiny when mature except for some pits and slots on the venter, particularly along the base of the ventral keel, the body 2.5-3.5 mm. long measured along the ventral keel, 2-2.5 mm. broad across the convex back, body gradually narrowed to the base or gradually narrowed down to about 0.4-0.5 mm. above the base and thereafter more abruptly so and thus giving some of the mericarps a suggestion of a basal collar; attachment surface depressed, surrounded by projecting pericarpial walls 0.2-0.5 mm. high, the depression not formed by the break-down of tissue, the depressed surface with a pit in the ventral angle and a wart near the middle, no projecting spur developed. Four stations in Tex.: Real Co., Sierra Madera (Pecos Co.), Glass Mts. (Brewster Co.) and Guadalupe Mts. (Culberson Co.). At the last three localities mentioned it is associated with var. *Parksii*.

6. *Lithospermum mirabile* Small. Perennial, taproot slenderly clavate, its cortex dark in color from contained dye, usually grayish from a strigose indument, the hairs slender; stems erect, to 4 dm. tall, one to several, usually unequal and forked in the inflorescence and with several slender branches from below the middle; basal leaves clustered, usually persisting even on fruiting plants, oblanceolate, to 7 cm. long and 13 mm. wide, lower surface with a prominent densely strigose midrib and commonly with one or two well-developed assurgent veins; cauline leaves numerous, gradually reduced upwards along the stems, the middle ones usually linear-oblong, sessile, obtuse, to 4 cm. long and 3-5 mm. wide; inflorescence terminal on the stems and branches, stiffly circinate; flowers at first bunched at the summit of the stems, in fruit scattered along single or forked lengthening stiffly racemose cymes to 15 cm. long; producing first conspicuous perfect flowers and late in the season also cleistogamous flowers or sometimes only the latter; normal conspicuous flowers with corolla dark-yellow, salverform, outside sparsely strigose or appressed villulose, the limb 8-14 mm. in diameter, the tube 10-18 mm. long, slender; calyx 6-8 mm. long at anthesis, the lobes lanceolate, unequal, in fruit about 8 mm. long. *L. longiflorum* A. DC. var. *mirabile* (Small) Brand. In arroyos, open woods and brushlands of s. Tex., chiefly in Bexar Co. southw., Mar.-May; endemic.

This species is related to *L. incisum* but is readily distinguished by its coarsely tuberculate mericarps, the persisting commonly veined basal leaves, and entire-margined corolla lobes. The corolla is a deep-yellow and the plant has a distinctive grayish color because of its pubescence.

7. *Lithospermum caroliniense* (Walt.) MacM. Puccoon. Perennial, hispid, commonly becoming very dark in drying; arising from a deep strong usually dye-stained taproot; stem erect, 3-10 dm. tall, few to numerous, simple or commonly branched only in the inflorescence, bearing minute appressed hairs and also larger spreading hairs 1-2 mm. long; leaves numerous, lanceolate or sometimes lance-linear, sessile, usually acute, hispid, to 4 cm. long and 1 cm. wide; inflorescence terminal, circinate, simple to geminate or ternate, in age elongating, straightening and becoming 1-2 (-3) dm. long, loosely flowered; bracts commonly ovate or elliptic, acute; calyx at anthesis 6-8 mm. long, the lobes very unequal, lanceolate, herbaceous, the fruiting calyx 8-10 mm. long, the pedicel 3-5 mm. long, erect; corolla orange-yellow, salverform, sparsely villose-hispidulous outside; mericarps lustrous, white, usually smooth except for some pits and slots along the base of the ventral keel, plump ovoid, 3-3.5 mm. long. *L. bejariense* A. DC. In sandy

woods, from e. pine forests w. to the Western Cross Timbers and s. to Wilson Co. on the Coastal Plain, also local in the Panhandle (Hemphill, Briscoe and Wheeler cos.), Mar.-May; widely distributed in the e. half of the U.S.

8. *Lithospermum multiflorum* Gray. Perennial, arising from a small compact caudex crowning a strong deep taproot; stems erect, 2-5 dm. tall, few to numerous, simple or (especially late in the season) becoming ascendingly branched above the middle; indument thin, grayish, closely appressed or ascending, the hairs stiffish and frequently arising from mineralized bases; leaves numerous, green, pale beneath, the margins slightly thickened and usually not revolute, leaves on the middle third of stem the largest, sessile, lanceolate to lance-linear, to 7 cm. long and 9 mm. wide, usually at least twice the size of the lower and upper leaves on the stem; inflorescence simple or forked, terminal on the stems and branches, the flowers with conspicuous corollas opening only on the tight circinate summit, at maturity (usually maturing few nutlets) elongating and (especially when unusually fertile) forming stiff erect loosely flowered racemes to 15 cm. long, late in the season usually producing some inconspicuous but very fertile cleistogamic flowers; calyx of normal flowers 4-6 mm. long at anthesis, the lobes linear, very unequal, the fruiting calyx 6-10 mm. long; pedicels 3-8 mm. long, erect; corolla orange-yellow, longer than broad, usually narrowly funnelform above the middle, appressed-villulose outside; tube cylindric or more commonly ampliate from the middle (or even the base) upwards, 8-10 mm. long, 2-3 mm. thick, the limb 8-9 mm. broad; mericarps ovoid, rarely more than one maturing in each fruit, white or brownish, usually smooth except for some slots and pits along the ventral keel, 2.5-3.5 mm. high (measured along the ventral keel). Chiefly in the pine-belt in the Chisos, Davis, Guadalupe and Franklin mts. in the Trans-Pecos, June-Sept.; Chih. to Wyo.

9. *Lithospermum viride* Greene. Perennial, arising from a small suffrutescent caudex crowning a woody taproot; stems few to numerous, to 1 m. tall, erect, 3-5 mm. thick just above the base, simple or loosely and ascendingly branched in age, usually with a grayish indument made up of 2 types of hairs, the more abundant type spreading or retrorsely appressed and the less abundant more rigid type spreading or ascending; largest leaves near the middle of the stem to 8 cm. long and 32 mm. wide, ovate-elliptic to lanceolate, the apex acute, the upper surface scabrous with stiff erect bristles arising from discoid bases intermixed with shorter much less rigid hairs, the lower surface paler and somewhat velvety or strigose; inflorescence simple or forked, terminal on the stems and branches, circinate, in age elongating, straightening to form erect very loosely flowered racemes 1-3 dm. long; calyx at anthesis 8-13 mm. long, the lobes very unequal, linear, the fruiting calyx 10-18 mm. long; pedicel 2-10 mm. long, ascending or occasionally decurved, lobes lance-linear; corolla greenish-yellow, with a very small limb, villose-hispidulous outside; corolla tube cylindric, 1-3 cm. long, 3-5 mm. thick near the middle, inside glabrous except for the abundant stipitate glands in the constricted apical section, no faucal appendages developed; annulus a thickened 10-lobed ring bearing extremely minute tufts of hairs; corolla lobes ovate to elliptic, rounded, entire, spreading or usually recurved; mericarps ovoid, usually plump, white or somewhat brownish, smooth or obscurely pitted, almost always with some pits along the base of the ventral keel, 3.5-4.5 mm. high (measured along the ventral keel). Usually in limestone areas in the Glass, Del Norte, Chisos and Guadalupe mts. in the Trans-Pecos, May-Sept.; N.M., Tex., Coah. and N.L.

10. *Lithospermum calycosum* (Macbr.) I. M. Johnst. Perennial, with a coarse woody taproot; stems several, 10-25 cm. tall, erect, simple or sparingly branched above the middle, below the middle hispidulous, above the middle with almost all the hairs antrorsely appressed; largest leaves oblanceolate, to 3.5 mm. long and 8 mm. wide, obtuse or retuse, appressed-hispidulous; inflorescence simple, terminal, circinate; calyx at anthesis 6-7 mm. long, the pedicels strigose and 1-3 mm. long, the lobes extremely unequal, linear or linear-oblanceolate; corolla "pale dull yellow-cream," with an elongate tube and a relatively small limb, the tube 8-10 mm. long, surpassing the calyx 3-5 mm., strigose outside, inside glabrous except for stipitate glands at the summit. Known in the U.S. only from a single collection made high on Chinati Peak in w. Presidio Co.; Tex., Coah. and N.L. s.e. to Guat.

15. BUGLOSSOIDES MOENCH

About 15 species native to Eurasia.

1. *Buglossoides arvensis* (L.) I. M. Johnst. Annual; stems erect, 2-7 dm. tall, simple or sparsely branched above, hoary-strigose; leaves 2-5 cm. long, 2-8 mm. broad, closely appressed-hispid, firm, veinless, with prominent midrib, pale beneath; basal leaves rosulate, oblanceolate or spatulate, those of the mid-stem lanceolate or linear and acute; racemes bracted, becoming loosely flowered; pedicels short and stout, about 1 mm. long; calyx parted into subulate-linear lobes, hispid; mature calyx with the erect or ascending lobes becoming 8-13 mm. long, the very short tube oblique, pale and chartaceous; corolla white or yellowish or even purplish, 5-7 mm. long, tubular-funnelform, the tube glabrous within and scarcely if at all surpassing the calyx; corolla throat gradually expanded, without protuberances, merely puberulent; corolla lobes ascending, ovate, obtuse; mericarps brown, dull, roughened, tuberculate or rough-wrinkled or pitted, about 3 mm. long, triquetrous-ovate, the ventral keel prominent. *Lithospermum arvensis* L. In open woodlands, old fields and waste places generally in the e. half of Tex.; a Eur. plant, widely introd. in the U.S., adj. Asia, Afr. and S.A.

The bony, hard, rough mericarps are straight and have a broad basal attachment which tends to become oblique.

16. ONOSMODIUM MICHX. FALSE-GROMWELL. MARBLE-SEED

Plants erect, rough-hairy, branching, very leafy perennials from taproots, with alternate, entire, strongly veined leaves, and numerous flowers in terminal, leafy-bracted scorpioid cymes; flowers whitish, greenish-white or yellowish, sessile to shortly pedicellate; pedicels usually somewhat elongating in fruit; calyx shorter than the corolla, deeply 5-parted; corolla tubular, slightly enlarged at the throat, 5-lobed, glabrous within, more or less hairy outside, the lobes erect, acute or acuminate, the sinuses somewhat inflexed; stamens included; filaments minute; anthers glabrous, narrowly sagittate, acutish, the apex just about level with the sinuses of the corolla; ovary 4-parted; style filiform, exerted, long-persistent; mericarps 4 mm. long or less, usually but one or two maturing, globular to ovoid, smooth or sometimes sparingly pitted, white to dingy-whitish-brown, in some species noticeably constricted below, attached at base to the nearly flat receptacle, the scar attachment about 2 mm. wide.

About 15 species in the United States, Canada and Mexico.

- 1. Stems usually solitary; basal rosette usually persisting (at least dried) till anthesis; usually more southern (2)
- 1. Stems usually several, tufted, arising from a strong perennial root; basal leaves not persisting; usually more northern (3)
- 2(1). Plant fully developed at anthesis; leaves finely strigose below (bristles few) and on upper surface with strigose hairs (0.2-0.4 mm. long) under pubescence at least on either side of veins and with coarse bristles (1-2 mm. long) either appressed or spreading; pedicels short, less than 7 mm. long; bracts lanceolate, not greatly accrescent 1. *O. bejariense*.
- 2. Plant flowering while stem and herbage still fresh and incompletely developed; leaves completely lacking strigulose indument, only bristles about 1 mm. long and erect or ascending on leaves (top or bottom); pedicels elongate, the lower ones commonly 10-15 mm. long; at maturity bracts much-enlarged, ovate or elliptic 2. *O. Helleri*.
- 3(1). Mericarps strongly constricted at the base; plant always coarsely spreading-hirsute 3. *O. hispidissimum*.
- 3. Mericarps with base rounded or if weakly constricted the plant somewhat silky-hirsute 4. *O. occidentale*.

1. *Onosmodium bejariense* A. DC. Plants 6-9 dm. tall; stem branching above, the branches ascending, strongly hispid-pubescent with white or whitish hairs, the branches

also softly appressed-pubescent; leaves lanceolate or the lower oblanceolate-spatulate, the well-developed stem leaves to 13 cm. long and 14 mm. wide, acute, sessile, strongly 5- to 7-nerved, the nerves prominent on both surfaces; calyx lobes linear-lanceolate, 8-10 mm. long, acute, appressed-pubescent and long-ciliate at base; well-developed corollas 14 mm. long, very finely canescent outside, often appearing nearly glabrous, with a few spreading hairs on the lobes; corolla lobes 3-4 mm. long, triangular in outline, tapering to a long-acuminate often abruptly bent apex; mericarps 3 mm. long, obtusish or acutish, from little to quite noticeably constricted at base. In dry open woodlands and on open hillsides, w. to Tom Green and Uvalde cos., e. to Gonzales and Cherokee cos., Mar.-June; endemic.

2. *Onosmodium Helleri* Small. Plants 3-4 dm. tall, drying black and brown, short-pubescent all over with scattered hairs or densely soft-pubescent on the leaves beneath; leaves broad, large, obtusish, short-petioled, 8-10 cm. long, 3-5 cm. wide, the upper leaves and bracts more ample than basal leaves, the lower leaves broadly spatulate and tapering to the base, the middle leaves broadly oblong-elliptic and rounded at the base; bracts broadly ovate (at least the lower ones), obtuse; calyx lobes 7-10 mm. long, linear, obtusish, ciliate; corolla lobes more or less acuminate, about as long as tube, 8-10 mm. long; mericarps obtusish; 3 mm. long, apparently not constricted at base. Edwards Plateau, cen. Tex., in thickets and woodlands, Mar.-May; endemic.

Recognizable by the short-petioled leaves.

3. *Onosmodium hispidissimum* Mack. Plant 9-12 dm. tall, strongly branched above, the branches spreading or ascending; stems and branches thickly covered with spreading hispid whitish (or in the inflorescence yellowish-white) hairs 2-4 mm. long, the branches and often the stem also appressed-pubescent; leaves typically lanceolate, 8-10 cm. long, 14-25 mm. wide, acute or acutish, tapering to the sessile base, prominently 5- to 7-nerved on both surfaces, strongly covered with whitish or sometimes yellowish-white spreading papillose hispid hairs above and on the veins beneath and appressed-strigose between the veins beneath; bracts 8-16 mm. long, resembling the leaves in outline; fruiting pedicels to 4 mm. long; calyx lobes linear-oblong, obtuse, 4-6 mm. long, strongly hispid with yellowish-white hairs; corolla (in earlier flowers, at least) 14-18 mm. long, twice the length of the flowering calyx, sparingly canescent outside below the lobes but usually strongly canescent and with strongly developed tufts of hairs at the tip of the broadly triangular-acute lobes that are about 3 mm. long; mericarps 2-3 mm. long, very obtuse to acutish, strongly constricted at base, dull, little if at all pitted. Usually in gravelly or rocky calcareous soils in prairies, on banks and in openings of glades, rare in n.-cen. Tex. (Dallas Co., where last collected in 1880), Mar.-May; from N.Y. s. to Md., w. to La., Tex. (?) and Neb. Perhaps not a persistent member of our flora.

4. *Onosmodium occidentale* Mack. Plant 3-6 dm. tall, rarely more, branching above or often from near the base, the branches spreading or almost erect, clothed all over with silvery-white or sometimes a slightly yellowish appressed or more or less spreading canescent pubescence usually not exceeding 2 mm. in length, the pubescence of the branches and leaves usually appressed; leaves typically about 5 cm. long and 15 mm. wide, acutish, prominently 5- to 7-nerved on both surfaces, the pubescence sometimes strongly spreading and papillose, but most typically soft, appressed and hardly papillose; bracts 6-24 mm. long, often 2-ranged, resembling the leaves in outline; fruiting pedicels from very short to 6 mm. long; calyx lobes lanceolate, acute to obtusish, rarely linear-oblong, 6-12 mm. long, canescent or with somewhat spreading hairs; corolla 1.2-2 cm. long, canescent all over outside, the broadly triangular acute lobes (3-4 mm. long) usually with apical tuft of hairs not strongly noticeable; mericarps 3.5-4 mm. long, acutish or acute, not constricted at base, dull in color, little if at all pitted. *O. molle* Michx. var. *occidentale* (Mack.) I. M. Johnst. Usually in open rocky woods, prairies, bottomlands and on hillsides from Denton, Grayson and Lamar cos., s. to Bexar, Victoria and Jackson cos., Apr.-June; from Minn. and Ill., w. to N.M., Ut. and Sask.

Those plants occurring from Tarrant County south typically have smaller leaves that are less hirsute and frequently strigose, whereas those occurring northward are usually coarse and hispid.

17. ECHIUM L. VIPER'S BUGLOSS

A complex genus of about 40 species in the Old World with several species introduced in the New World.

1. *Echium vulgare* L. BLUE-WEED. Biennial herb; stems erect, solitary or occasionally several, 3-9 dm. tall, finely hispid-villous as well as shaggy coarse-hirsute; leaves alternate, appressed-hispid and along the margins and midrib somewhat hirsute, with a strong midrib but very obscure or absent veins; lower leaves 8-16 cm. long, oblanceolate, broadly stalked, forming a rosette that withers away at anthesis; cauline leaves reduced up the stem, the middle ones linear-lanceolate, 3-9 cm. long, contracted to a rounded sessile base; racemes unilateral, short, bracteate, disposed in a long narrow thyse or open panicle; calyx 5-parted with linear or lanceolate segments; corolla tubular-funnelform, oblique and irregular, bright-blue, rarely rose or white, pubescent and sparsely setose, rather firm in texture, 10-15 mm. long, the tube about equaling the calyx; stamens very unequal, inserted low in the tube, the 2 pairs slightly unequal but both surpassing the lower corolla lobe, the odd stamen included; mericarps 4, about 2 mm. long, erect, rugose or verrucose, ovoid or oblong, with a basal areola; gynobase flat or low-pyramidal. Nat. of Eur., long ago introd. into e. U.S. and now a serious pest in the N.E. and Middle Atl. States, w. to S.D., Kan. and reported (but not seen by us) from Tex.; also Chile.

FAM. 156. AVICENNIACEAE ENDL.¹⁵⁸

BLACK-MANGROVE FAMILY

Shrubs or trees of maritime regions; branches and twigs usually terete, nodose, articulate; leaves opposite, thick, persistent, petiolate, exstipulate, entire; inflorescence axillary or terminal, spicate or subcapitate, the axillary ones mostly paired; flowers sessile, perfect, hypogynous, small; sepals 5, nearly separate, ovate, imbricate, subtended by a false involucre of a scalelike bract and 2 alternate scalelike prophylla slightly shorter than the calyx and imbricate with each other and the sepals; corolla regular, gamopetalous at the base, campanulate-rotate, 4-parted; stamens 4, inserted in the corolla tube, equal or subdidynamous; carpels 2; ovary superior, compound but with a free central often more or less 4-winged placenta; ovules 4, pendent, orthotropous, hanging from the tip of a central columella; fruit a compressed oblique capsule, the exocarp juicy, somewhat fleshy, usually tomentulose, dehiscent by 2 valves, usually only 1-seeded; seeds without a testa; embryo viviparous.

A single genus with 11 living species, 5 varieties, and 4 fossil species; one of the chief constituents of coastal mangrove belts throughout the tropics and subtropics of the world.

1. AVICENNIA L.

1. *Avicennia germinans* (L.) L. BLACK-MANGROVE, MANGLE BLANCO. Shrub rarely over 1 m. tall in our area (to 16 m. in tropics); petioles 2-27 mm. long, often farinaceous; leaf blades oblong or lanceolate to elliptic or obovate, to 15 cm. long and 44 mm. wide, obtuse or acute at the apex, entire, acute to cuneate at the base, usually grayish-mealy beneath, sometimes glabrous and punctate; spikes to 65 mm. long and 15 mm. wide during anthesis, the axillary ones usually only a single pair at the base of the terminal one and shorter than it or a second pair in the next lower leaf axils; calyx lobes 3-5 mm. long, 2-3 mm. wide, densely appressed-pubescent outside, glabrous within; corolla white, 1.2-2 cm. long, parted to about the middle, the tube equaling or shorter than the calyx, practically glabrous, the lobes spreading, densely gray-pubescent outside and velvety within; fruit obpyriform or ovate, asymmetric, to 2 cm. long and 12 mm. wide, densely

¹⁵⁸ Contributed by H. N. Moldenke; cf. his earlier treatment in C. L. Lundell, *Flora of Texas* III: 10-12. 1942.

gray-hairy. *A. nitida* Jacq. In mangrove lagoons and along tidal shores, s.e. and s. Tex.; very variable, ranging from Fla. and Tex., Berm., Bah. I. and both coasts of Mex., through W.I. and C.A. to the coasts of Braz. and Peru.

The fruits of the red mangrove, *Rhizophora Mangle* L. (Rhizophoraceae), of southern Florida and tropical America, are commonly washed ashore (especially near the mouth of the Rio Grande), where they have been known to sprout, but no living plant has apparently thus far become established in Texas. This species grows in habitats similar to those of the black mangrove but it is readily distinguished from that species by its aerial roots that arise from its trunk and branches, its regular corolla, and the development of a conspicuous radicle to several decimeters in length.

FAM. 157. VERBENACEAE ST.-HIL.¹⁵⁹

VERVAIN FAMILY

Herbs, shrubs, woody vines or trees; branchlets and twigs mostly tetragonal, not prominently nodose nor articulate; leaves mostly opposite, deciduous, exstipulate, mostly simple, sometimes compound or 1-foliolate, the blades entire or variously dentate, incised or cleft; inflorescence axillary or terminal, determinate or indeterminate, as cymes, racemes, spikes, panicles, thyrsi, heads or false umbels, sometimes involucrate, the axillary ones mostly solitary; flowers sessile or pedicellate, perfect or imperfect, hypogynous, sometimes heterostylous or polygamous, large or small, mostly irregular, the individual ones not involucrate; calyx gamosepalous, campanulate to tubular or salverform, persistent, usually accrescent, mostly 4- (more rarely 2-, 5- or 7-) lobed or toothed or sometimes the rim subentire; corolla regular or irregular, gamopetalous, mostly funnelliform or salverform, usually with a well-developed tube with its limb 4- or 5- (rarely 7- or many-) parted, often somewhat 2-lipped; stamens mostly 4 and didynamous or reduced to 2, sometimes 4 or 5 and equal, inserted in the corolla tube; staminodes often present; carpels mostly 2 (rarely 4 or 5), united, one sometimes aborted; ovary superior, mostly compound, sessile, mostly somewhat 4-lobed, at first 2- to 5-celled but almost invariably soon becoming 4- to 10-celled through formation of false partitions, never with a free central placenta or columella; the axile placentae-lobes each bearing 1 ovule, the unpartitioned cells 2-ovulate, partitioned cells 1-ovulate; ovules anatropous and basal or hemianatropous and lateral; fruit usually a dry schizocarp separating into "cocci" at maturity or less commonly a drupe or fleshy schizocarp, with a thin and dry or fleshy exocarp and more or less hard endocarp, 2- to 4-celled and indehiscent when ripe or dehiscent into 2 (or rarely 4 to 10) 1- or 2-celled pyrenes; seeds plainly testate; embryo not viviparous.

About 3,375 species and subspecific taxa in 76 genera, very widely distributed almost throughout the world except in the Arctic and Antarctic.

1. Leaves palmately compound 12. *Vitex*, p. 1339.
1. Leaves simple (2)
- 2(1). Inflorescence indeterminate and centripetal, racemose (3)
2. Inflorescence determinate and centrifugal, cymose (12)
- 3(2). Fruit composed of four 1-seeded pyrenes, schizocarpous (4)
3. Fruit not composed of four 1-seeded pyrenes (5)
- 4(3). Pyrenes (cocci or nutlets) readily separating from each other at maturity 1. *Verbena*, p. 1313.
4. Pyrenes adhering or very tardily separating from each other at maturity 2. *Stylodon*, p. 1326.
- 5(3). Fruit composed of one or two 1-celled and 1-seeded pyrenes (6)
5. Fruit composed of two or four 2-celled and 2-seeded pyrenes (10)
- 6(5). Fruit usually with a fleshy exocarp (rarely dry); calyx truncate or obscurely toothed or lobed 3. *Lantana*, p. 1326.
6. Fruit with a thin dry exocarp; calyx deeply 2- to 5-toothed or -lobed (7)

¹⁵⁹ Contributed by H. N. Moldenke; cf. his earlier treatment in C. L. Lundell, *Flora of Texas* III:13-87. 1942.

- 7(6). Calyx elongated, conspicuous, herbaceous, often half as long as the corolla tube or longer; fruit (cocci) beaked 7. *Bouchea*, p. 1335.
7. Calyx very small and inconspicuous, membranous; fruit not beaked (8)
- 8(7). Flowers and fruit scattered at conspicuous intervals along a greatly elongated flowering rachis 6. *Aloysia*, p. 1334.
8. Flowers and fruit very densely imbricate, often capitate (9)
- 9(8). Mostly herbaceous with trailing or ascending stems, sometimes somewhat woody; spikes elongated in fruit; bractlets cuneate-obovate, not 4-ranked 5. *Phyla*, p. 1331.
9. Erect bushes, shrubs or subshrubs; spikes not usually elongating in fruit; bractlets ovate or lanceolate, often more or less 4-ranked 4. *Lippia*, p. 1330.
- 10(5). Fruiting calyx patelliform or cupuliform, not inflated nor enclosing the fruit nor rostrate at the apex 9. *Citharexylum*, p. 1337.
10. Fruiting calyx flask-shaped, completely enclosing the mature fruit, usually rostrate at the apex (11)
- 11(10). Herbaceous; fruit dry, composed of 2 pyrenes 8. *Priva*, p. 1337.
11. Woody; fruit fleshy, composed of 4 pyrenes 10. *Duranta*, p. 1338.
- 12(2). Flowers regular; stamens equal 11. *Callicarpa*, p. 1339.
12. Flowers irregular; stamens didynamous (13)
- 13(12). Fruit very strongly and coarsely reticulate, pubescent, with a definite rugose commissural scar 14. *Tetraclea*, p. 1341.
13. Fruit glabrous, not reticulate 13. *Clerodendrum*, p. 1340.

I. VERBENA L.

VERVAIN

Herbs; stems and branches procumbent, ascending or erect, glabrous or variously pubescent; leaves mostly opposite, dentate (very rarely entire) or variously lobed, incised or pinnatifid; inflorescence spicate, terminal, usually densely many-flowered, often flat-topped and pseudo-umbellate, sometimes greatly elongate with scattered flowers, very rarely also axillary; flowers small or medium-sized, each solitary in the axil of a usually narrow bractlet; calyx usually tubular, 5-angled, 5-ribbed, unequally 5-toothed, not at all or but slightly changed in fruit; corolla salver- or funnelform, its tube straight or curved, often slightly ampliate at the apex, the limb flat, weakly 2-lipped, lobes 5, usually rather elongate, obtuse or rounded to emarginate at apex; stamens 4, didynamous, inserted in the upper half of the corolla tube, mostly included; anthers ovate, with parallel or slightly divergent thecae, the connective unappendaged or glandular-appendaged; style single, usually short, shortly 2-lobed, the posterior lobe smooth, the anterior lobe broader, papillose and stigmatic; ovary 2-carpellary, 4-lobed, completely 4-celled, 4-ovulate; fruit mostly enclosed by the mature calyx, schizocarpous, readily separating at maturity into four 1-seeded linear cocci.

A complex genus of about 206 species, 122 named varieties and forms, and 49 named hybrids, mostly of temperate and tropical America; 2 or 3 species native to the Mediterranean region and introduced elsewhere in the Old World; many are widely cultivated and tend to escape. The Section Glandularia, with a different basic chromosome number, is possibly worthy of segregation as a distinct genus.

1. Sterile style lobe usually not protruding beyond the stigmatic surface; ovary entire or very shallowly depressed; schizocarp commonly not constricted along the lines of cleavage; anthers unappendaged; corolla mostly small, often not showy; calyx rarely more than twice as long as the schizocarp, not contorted beyond it. (Sect. 1. *Verbenaca* Schauer) (2)
1. Sterile style lobe protruding well beyond the stigmatic surface; ovary in its later stages definitely (although shallowly) lobed at the distal end; schizocarp constricted along the lines of cleavage; connective of the upper anthers mostly appendaged; corolla mostly large and showy; calyx usually more than twice as long as the schizocarp and constricted or contorted beyond it. (Sect. 2. *Glandularia* Schauer) (36)

- 2(1). Heads or spikes crowded and short (at least during anthesis), not at any time greatly elongate or open, generally disposed in compound cymes. (Ser. 1. *Pachystachyae* Schauer) (3)
2. Spikes slender and open or compact at anthesis, greatly elongating in fruit, solitary or in simple cymes or panicles. (Ser. 2. *Leptostachyae* Schauer) (5)
- 3(2). Leaves semiamplexicaul and subcordate at the base (4)
3. Leaves tapering into a cuneate-attenuate sessile or petiolar base 4. *V. brasiliensis*.
- 4(3). Inflorescence glandular; bractlets conspicuously longer than the calyx; corolla tube 2 or 3 times as long as the calyx 1. *V. rigida*.
4. Inflorescence not glandular; bractlets barely equaling or only slightly surpassing the calyx; corolla tube scarcely twice as long as the calyx 2. *V. bonariensis*.
- 5(2). Spikes paniced at the apices of the stems and branches, subtended chiefly by inconspicuous bracts; floral bractlets not prominent (6)
5. Spikes solitary or in 3's at the apices of stem and branches or paniced and subtended by leafy bracts at the base; floral bractlets often conspicuous (16)
- 6(5). Leaves sessile to sessile or long-tapering at the base 3. *V. litoralis*.
6. Leaves distinctly petiolate (7)
- 7(6). Spikes very slender, elongate and graceful, usually with remote fruits (8)
7. Spikes thicker and dense-flowered, usually with contiguous fruits (15)
- 8(7). Lower leaves 1- or 2-pinnatifid, 3- or 5-cleft or deeply incised (9)
8. Leaves merely serrate or crenate (12)
- 9(8). Schizocarp a little longer than broad; leaves all deeply cleft or incised 5. *V. menthaefolia*.
9. Schizocarp about twice as long as broad; leaves diverse, the basal incised-dentate, the middle stem leaves 1- or 2-pinnatifid, the upper sparingly toothed or entire (10)
- 10(9). Corolla white 6. *V. Halei* f. *albiflora*.
10. Corolla not white (11)
- 11(10). Corolla mostly blue 6. *V. Halei*.
11. Corolla deep-rose or pink 6. *V. Halei* f. *roseiflora*.
- 12(8). Leaves very scabrous above; fruiting calyx spreading; calyx lobes connivent; stigmatic surface subtended by 2 sterile style lobes (13)
12. Leaves not pronouncedly scabrous above; fruiting calyx ascending; calyx lobes not connivent; stigmatic surface subtended by one sterile style lobe (14)
- 13(12). Leaf blades ovate, to 5 cm. wide 7. *V. scabra*.
13. Leaf blades narrowly elliptic or elliptic-lanceolate, to 2 cm. wide 7. *V. scabra* f. *angustifolia*.
- 14(12). Lower leaf surface glabrous or scattered long-pilose 8. *V. urticifolia*.
14. Lower leaf surface uniformly and densely short-pubescent 8. *V. urticifolia* var. *leiocarpa*.
- 15(7). Leaf blades membranous, not conspicuously scabrous above, mostly glabrous or inconspicuously strigillose beneath 9. *V. hastata*.
15. Leaf blades rigid, harshly scabrous above, often conspicuously pubescent beneath .. 9. *V. hastata* var. *scabra*.
- 16(5). Leaves predominantly entire, mostly linear, the lower ones sometimes with a few salient teeth 17. *V. perennis*.
16. Leaves not predominantly entire (17)
- 17(16). Leaves serrate-dentate or shallowly incised (18)
17. Leaves deeply incised-dentate to pinnatifid or 3-cleft (20)

- 18(17). Plants coarse, more or less densely hirsute-pubescent or hirsute-villous; leaves elongate-elliptic to ovate-orbicular; spikes stout, 7-10 mm. wide during anthesis (19)
18. Plants slender, densely canescent-hirtellous with short hairs; leaves linear to narrowly-elliptic; spikes more slender, 5-6 mm. wide during anthesis 16. *V. neomexicana* var. *hirtella*.
- 19(18). Leaves elongate-elliptic to ovate-acuminate, short-petiolate; corolla limb 5-6 mm. wide 11. *V. Macdougalii*.
19. Leaves ovate-orbicular, sessile; corolla limb 8-9 mm. wide 10. *V. stricta*.
- 20(17). Spikes not conspicuously bracteose; bractlets not foliaceous (21)
20. Spikes conspicuously bracteose with somewhat foliaceous bractlets (at least at the base of the spike) (31)
- 21(20). Leaf blades (at least the lower ones) oblong-ovate or obtusely elliptic-ovate, not narrowly elongate, usually 3-cleft with the segments incised-dentate (22)
21. Leaf blades (at least the lower ones) oblong-lanceolate to spatulate, narrowly elongate, usually incised-pinnatifid or incised-dentate (27)
- 22(21). Leaves petiolate; pubescence various but not coarsely hirsute; spikes often stout, not greatly elongate if slender (23)
22. Leaves subsessile or at most very shortly petiolate; pubescence coarsely hirsute or glandular; spikes slender and greatly elongate (25)
- 23(22). Corolla tube scarcely longer than the calyx, 4-4.5 mm. long; corolla limb 4-6 mm. wide 14. *V. plicata*.
23. Corolla tube far-exceeding the calyx, 8 mm. or more long; corolla limb 7-8 mm. wide (24)
- 24(23). Corolla blue to lavender or purple 15. *V. Cloverae*.
24. Corolla white 15. *V. Cloverae* f. *alba*.
- 25(22). Pubescence on calyx long, whitish, appressed, not glandular 12. *V. xutha*.
25. Pubescence on calyx shorter, sordid, spreading, glandular (26)
- 26(25). Corolla mostly blue 13. *V. Runyonii*.
26. Corolla mostly rose 13. *V. Runyonii* f. *rosiflora*.
- 27(21). Plants coarse, with a low somewhat compact habit, canescent-hirsute; leaves subpinnatifid, contracted into a broadly margined semiamplexicaul or petiolar base (28)
27. Plants more slender, with a taller and open habit, hirsute or canescent-hirtellous; leaves pinnately cleft to incised-dentate, with a narrowly margined petiolar base (29)
- 28(27). Inflorescence somewhat glandular-hirsute; bractlets lanceolate 18. *V. canescens*.
28. Inflorescence sparsely or not glandular, densely hirsute; bractlets ovate, sharply acuminate 18. *V. canescens* var. *Roemeriana*.
- 29(27). Corolla limb 4 mm. wide; commissural faces extending to the tip of the cocci; pubescence hirsute, sparse on the stems 16. *V. neomexicana*.
29. Corolla limb 6-10 mm. wide; commissural faces scarcely extending to the tip of the cocci (30)
- 30(29). Plants more or less hirsute; leaves pinnately cleft; bractlets lanceolate 16. *V. neomexicana* var. *xylopoda*.
30. Plants canescent-hirtellous; leaves dentate or somewhat more deeply incised; bractlets ovate 16. *V. neomexicana* var. *hirtella*.

- 31(20). Leaves more or less strongly plicate; venation noticeably whitish near the margins (32)
31. Leaves not plicate nor conspicuously whitish-veined near the margins (35)
- 32(31). Corolla tube scarcely longer than the calyx, 4-4.5 mm. long; corolla limb 4-6 mm. wide (33)
32. Corolla tube far-surpassing the calyx, 8 mm. or more long; corolla limb 7-8 mm. wide (34)
- 33(32). Bractlets ovate-lanceolate, green, herbaceous, gradually attenuate from base to apex 14. *V. plicata*.
33. Bractlets broadly ovate, dry, rigid, very abruptly acuminate at apex 14. *V. plicata* var. *Degereri*.
- 34(32). Corolla blue to lavender or purple 15. *V. Cloverae*.
34. Corolla white 15. *V. Cloverae* f. *alba*.
- 35(31). Leaves with a subpetiolar or semiamplexicaul base; bractlets ovate, a little longer than the flowers, abruptly acuminate, ascending 18. *V. canescens* var. *Roemeriana*.
35. Leaves narrowed into a margined petiole; bractlets linear-lanceolate, much longer than the flowers, usually reflexed in age 19. *V. bracteata*.
- 36(1). Cocci with a very definite beak parallel to the axis of the schizocarp 21. *V. quadrangulata*.
36. Cocci with an indefinite beak or beakless (37)
- 37(36). Cocci suggesting a tendency toward a beak (a slight protrusion horizontal to the axis of the schizocarp); commissural face practically reaching to the tip of the coccus (38)
37. Cocci without a beak or tendency toward one; commissural face not reaching the tip of the coccus (39)
- 38(37). Corolla in shades of pink 22. *V. delticola*.
38. Corolla lavender 22. *V. delticola* f. *lilacina*.
- 39(37). Cocci subovoid, the lateral surfaces ventricose and smooth, not at all similar to the dorsal surface 26. *V. tumidula*.
39. Cocci subcylindric, the lateral surfaces not ventricose, usually scrobiculate, similar to the dorsal surface (40)
- 40(39). Leaves shallowly lobed to incised or toothed (41)
40. Leaves 3-cleft to incised-pinnatifid or bipinnatifid (45)
- 41(40). Flowers very large and showy; corolla 20-30 mm. long, its limb 10-24 mm. wide (42)
41. Flowers small and inconspicuous; corolla 7-10 mm. long, its limb 2-7 mm. wide 20. *V. cameronensis*.
- 42(41). Leaves appressed-strigose or glabrate (43)
42. Leaves rather densely pubescent (44)
- 43(42). Corolla blue to pink or purple 23. *V. canadensis*.
43. Corolla white 23. *V. canadensis* f. *candidissima*.
- 44(42). Corolla to 2 cm. long and 12 mm. wide 24. *V. elegans* var. *asperata*.
44. Corolla to 3 cm. long and 24 mm. wide 25. *V. hybrida*.
- 45(40). Corolla tube protruding well beyond the calyx (46)
45. Corolla tube only slightly longer than the calyx (61)
- 46(45). Corolla tube approximately twice as long as the calyx (47)
46. Corolla tube one and one third to one and one half times as long as the calyx (48)

- 47(46). Bractlets usually one half to two thirds as long as the calyx; inflorescence usually not greatly elongating 24. *V. elegans* var. *asperata*.
47. Bractlets usually subequaling or only slightly shorter than the calyx; inflorescence conspicuously elongating 23. *V. canadensis*.
- 48(46). Floral bractlets equaling or exceeding the calyx; calyx hispid-hirsute, not glandular (49)
48. Floral bractlets shorter than the calyx; calyx hispid-hirsute to villous-pubescent and mostly somewhat glandular or appressed-strigose and not glandular (52)
- 49(48). Leaves bipinnatifid, the ultimate segments linear-oblong (50)
49. Leaves not bipinnatifid, usually more or less 3-cleft, with the segments remotely incised or lobed, the ultimate segments much broader than in the above (51)
- 50(49). Calyx and bractlets hispid-hirsute 27. *V. bipinnatifida*.
50. Calyx and bractlets finely appressed-pubescent or puberulent
..... 28. *V. oklahomensis*.
- 51(49). Sinuses of leaves extending practically to the midrib, the segments sharply acute at the apex; western 27. *V. bipinnatifida* var.
latilobata.
51. Sinuses of leaves usually rather shallow, the segments obtuse at the apex; Rio Grande Plains and Valley 22. *V. delticola*.
- 52(48). Calyx appressed-strigose with sericeous hairs, not glandular; introduced (53)
52. Calyx hispid-hirsute or villous, mostly more or less glandular; native (54)
- 53(52). Corolla blue to purple or rose 29. *V. tenuisecta*.
53. Corolla white 29. *V. tenuisecta* var. *alba*.
- 54(52). Plants coarse; leaves usually 2.5-4 cm. long, hispidulous-hirsute; corolla limb 6-12 mm. wide; cocci 2.5-3 mm. long; corollas mostly blue, pink or purple (55)
54. Plants slender; leaves smaller, 1-2.5 cm. long, hirtellous; corolla limb 5-6 mm. wide; cocci 2 mm. long; corollas always white 33. *V. racemosa*.
- 55(54). Calyx teeth 2-3 mm. long (56)
55. Calyx teeth usually less than 2 mm. long (58)
- 56(55). Plants usually tall (2-4 dm.); leaves bipinnatifid, with the ultimate segments lanceolate; calyx teeth not especially conspicuous in mature fruit (57)
56. Plants usually low (1-2 dm.); leaves trifid, with the segments more or less incised; calyx teeth conspicuously long in mature fruit 32. *V. ciliata* var.
longidentata.
- 57(56). Calyx glandular 30. *V. ambrosifolia*.
57. Calyx not glandular 30. *V. ambrosifolia* f.
eglandulosa.
- 58(55). Plants decumbent-ascending or prostrate, densely hirsute; calyx somewhat glandular, hispidulous-hirsute, scarcely viscid (59)
58. Plants ascending-erect, more or less hirsute; calyx densely glandular-hirsute and somewhat viscid-pubescent (60)
- 59(58). Plants with decumbent-ascending loose habit; leaf margins slightly revolute ..
..... 32. *V. ciliata*.
59. Plants with prostrate compact habit; leaf margins strongly revolute
..... 32. *V. ciliata* var. *pubera*.
- 60(58). Corolla pink to purple 31. *V. Wrightii*.
60. Corolla white 31. *V. Wrightii* f. *albiflora*.
- 61(45). Corolla inconspicuous, its limb 3-5 mm. wide; plants decumbent, more or less hirsute (62)
61. Corolla conspicuous, its limb 8-9 mm. wide; plants erect or ascending, densely white-villous 34. *V. Gooddingii*.

- 62(61). Corolla blue to pink or lavender35. *V. pumila*.
 62. Corolla white35. *V. pumila* f. *albida*.

1. *Verbena rigida* Spreng. TUBER VERVAIN. Stems 2-6 dm. tall, scabrous; leaves sessile, oblong to oblong-lanceolate or narrowly obovate, subcordate and semiamplexicaul at base, coarsely sharp-serrate, scabrous on both surfaces, revolute-margined when old; spikes usually short, dense, cylindrical, in subternate cymes, the laterals pedunculate; bractlets lanceolate, acuminate-subulate, usually closely imbricate and longer than the calyx, glandular-pubescent, ciliate; calyx 4 mm. long, glandular-pubescent, the acute lobes with short mucronulate-subulate tips; corolla mostly purple to magenta, the tube 2 or 3 times as long as the calyx, pubescent outside, limb 5-7 mm. wide. *V. venosa* Gill. & Hook. Pastures, prairies and roadsides, adv. from cult., very showy in large patches, e. Tex. w. to Fayette and Travis cos., Apr.-Oct.; nat. to Braz. and Parag., introd. in W.I. and s. U.S.

2. *Verbena bonariensis* L. SOUTH AMERICAN VERVAIN. Stiffly erect, 1 m. or more tall, somewhat scabrous-pubescent; leaves sessile, subcordate and semiamplexicaul at base, lanceolate or oblong, sharply serrate, rugose and hirtellous above, spreading-pubescent beneath; spikes compact, mostly short, usually sessile and crowded in dense fasciculate cymes, not elongating; bractlets lanceolate-acuminate, barely equaling or slightly surpassing the calyx, pubescent; calyx 3 mm. long, pubescent, the acute lobes with short subulate tips; corolla blue to violet or purple, the tube scarcely twice as long as the calyx, pubescent outside, limb inconspicuous. Sandy loam, moist flatlands and along rice field fences, introd. in e. Tex. from Red River to Jefferson cos., Apr.-June; nat. of Braz., Parag., Urug. and Arg.; introd. in W.I., s. U.S. and elsewhere.

3. *Verbena litoralis* H.B.K. SEASHORE VERVAIN. Fastigiate branched, to 1 m. tall, glabrous or sparsely strigillose; leaves lanceolate or oblong, 3-10 cm. long, tapering into a very short petiole or subsessile, more or less sharply and coarsely serrate, sparsely strigillose on both surfaces, often slightly scabrous and rugose above; spikes terminal, pedunculate, cymosely arranged or paniculate, at first fairly dense, usually soon elongating; bractlets ovate-lanceolate, subequaling or somewhat shorter than the calyx, not conspicuous, acuminate, glabrate; calyx 2-2.5 mm. long, finely strigillose, subtruncate, the subulate teeth minute; corolla blue to lavender or purple, the tube longer than the calyx limb, 2.5-3 mm. wide, inconspicuous. Waste ground, introd. in Newton Co.; nat. from Mex. almost throughout C.A. and S.A.; introd. in H.I., Calif., La. and elsewhere.

4. *Verbena brasiliensis* Vell. BRAZILIAN VERVAIN. Stems stout, to 25 dm. tall, acutely tetragonal, practically glabrous below, somewhat scabrous-pubescent above, slightly contracted at nodes; leaves elliptic or lanceolate, tapering into a cuneate subsessile or petiolar base, sharply serrate or incised (at least above the middle), strigillose and somewhat pustulate above with impressed venation, sparsely pubescent beneath; spike compact, mostly short, not much elongating, usually sessile in open cymes, numerous but not crowded; bractlets scarcely as long as the calyx, lanceolate-subulate, ciliate; calyx 2.5-3.5 mm. long or more, somewhat appressed-pubescent, the acute lobes with short subulate tips; corolla purple or lilac, the tube a little longer than the calyx, pubescent outside, the limb 2.5 mm. wide, inconspicuous. Waste places, dry sandy soil, coastal prairies, mainly in s.e. Tex., May-Oct., introd.; nat. to most of S.A.; naturalized from Va. to Fla. and Gulf Coast, Ore., Calif., Jam., S. Afr. and elsewhere.

5. *Verbena menthaefolia* Benth. MINT VERVAIN. Stems decumbent or ascending, branched, sparsely and minutely hispidulous; leaves ovate, 3-6 cm. long, tapering at base into a margined petiole, deeply cleft or subincised, the divisions remotely serrate-dentate, strigillose on both surfaces, somewhat pustulate above; spikes paniced, slender, elongate, compact only at the apex; bractlets ovate-lanceolate, acuminate, usually shorter than the calyx, sparsely strigillose, ciliate; calyx 2.5-3 cm. long, strigillose, sparsely or not glandular, the teeth minute; corolla blue or light purple, the tube only slightly longer than the calyx, limb about 6 mm. wide, lobes more or less truncate. Bottomlands, ravines, stream-sides and roadsides, Uvalde and Bexar cos.; also in Ariz., s. Calif. and most of Mex. Misidentified as *V. officinalis* L. in some works.

6. *Verbena Halei* Small. TEXAS VERVAIN. Stems usually several from a woody base, erect, ascendingly branched, glabrous or strigillose above; leaves 3-10 cm. long, strigillose on both surfaces, diverse in shape, the basal and lower stem leaves oblong to ovate, tapering into a petiole about as long as the blade, irregularly dentate or incised, middle

stem leaves 1- or 2-pinnatifid with shorter petioles, uppermost leaves sparingly dentate or entire; spikes paniculate, slender, elongate; bractlets about half as long as the calyx, appressed, ciliate; calyx 3-3.5 mm. long, strigillose, subtruncate, unequal teeth subulate; corolla mostly blue, the tube scarcely longer than the calyx, the limb 6-7 mm. wide, lobes retuse. Sandy or calcareous meadows, prairies, fields, woodlands, rocky hillsides and roadsides, often very abundant, widespread practically throughout Tex., especially in e., cen. and s. sections, Feb.-Nov.; Ala. to Okla. and Tam. Widely misidentified as *Eur. V. officinalis* L. in older works.—*f. albiflora* L. I. Davis has white corollas; known from Brooks and Hidalgo cos.; *f. roseiflora* (Benke) Moldenke has deep-rose or pink corollas, known from Goliad, Hood and Kleberg cos.

7. *Verbena scabra* Vahl. SANDPAPER VERVAIN. Stems to 1 m. tall, erect, solitary, simple or branched, hispidulous; leaves ovate, 3-13 cm. long, to 5 cm. wide, petiolate, acute or obtusish, serrate-dentate, very rough and usually strigillose above, less scabrous and paler beneath, hispidulous on the venation; spikes paniculate, slender, pedunculate, closely many-flowered; bractlets ovate-acuminate, half as long as the calyx, hispidulous; calyx 2.5-3 mm. long, ovoid, hispidulous, diverging from the rachis by 45° or more, the unequal lobes acutely connivent; corolla blue, the tube about equaling the calyx, limb 2 mm. wide, lobes obtuse; stigmatic surface midway between 2 almost equal obtusish sterile style lobes. Mostly rich soil of low ground, marshes, swamps and edges of lakes and streams, throughout most of Tex. except Plains Country; Mar.-Dec.; N.C. to Fla. and W. I., w. to Ariz., Calif. and n. Mex.—*f. angustifolia* Moldenke differs in having elliptic to elliptic-lanceolate leaves only to 2 cm. wide; known only from Burnet Co.

8. *Verbena urticifolia* L. WHITE VERVAIN. Stems solitary, to 25 dm. tall, coarse, simple or branching from near the base, hispid or hirtellous to almost glabrous; leaves petiolate, broadly lanceolate to oblong-ovate, 8-20 cm. long, acute or shortly acuminate, coarsely crenate-serrate, rounded at base and decurrent into the petiole, glabrous on both surfaces or scattered-pilose with rather long irregular hairs beneath; spikes paniculate, slender, pedunculate, rather sparsely flowered, often very elongate; bractlets ovate-acuminate, very short, ciliate; calyx 2 mm. long, pubescent (especially on the veins), the obtuse lobes not connivent, the short and subequal teeth subulate; corolla white, very small, the tube scarcely surpassing the calyx, limb 2 mm. wide, lobes obtuse. Low rich or open woods, bottomlands, waste places, fencerows, pastures and streamsides, from Bowie and Wilbarger to Newton, Brazoria and Gonzales cos., also in Wheeler Co. in the Panhandle, June-Oct.; Que. and Ont. to Neb., s. to Fla. and w. to Tex. and Okla.—*var. leiocarpa* Perry & Fern. differs in having the lower leaf surface uniformly and densely short-pubescent; known from Cass Co.; it occurs sporadically almost throughout the extralimital range of the species.

9. *Verbena hastata* L. BLUE VERVAIN. Stems to 23 dm. tall, mostly simple, stiffly erect, often branched above, mostly rough-pubescent with short antrorse hairs; leaves lanceolate or oblong-lanceolate, occasionally ovate-lanceolate, petiolate, 5-18 cm. long, gradually acuminate, coarsely serrate or incised, sometimes hastately 3-lobed at base, glabrous or slightly pubescent, not scabrous; spikes usually numerous, paniculate, stiffly erect, pedunculate, compact, densely many-flowered; bractlets lanceolate-subulate, usually a little shorter than the calyx; calyx 2.5-3 mm. long, pubescent, the acute lobes with short subulate tips and more or less connivent; corolla purplish-blue, the tube somewhat longer than the calyx, pubescent outside, the limb 3-4.5 mm. wide. Moist fields, meadows, prairies, swamps, woods and streamsides, Plains Country, July-Oct.; N.S. to B.C., s. to Fla., Neb. and Ariz. In dry fields and pastures a field-form is developed with the leaves more canescent-puberulous beneath and slightly rough above, the stem many-branched, and the terminal inflorescences in many groups, all more or less equally dense.—*var. scabra* Moldenke differs in its more rigid leaves that are conspicuously scabrous above and often more or less conspicuously pubescent beneath; known from Hemphill Co.; a w. form of the species, B.C., Ida., Mont. and N.D. to Calif., N.M. and Tex., e. to Wisc. and Kan.

10. *Verbena stricta* Vent. HOARY VERVAIN. Stems to 2 m. tall, subterete, simple or branched above, often very robust, rather densely hirsute, often canescent; leaves ovate or oblong to elliptic or suborbicular, sessile or nearly so, sharply serrate or biserrate to irregularly incised-serrate, thick-textured, hirsute and rugose above, densely hirsute-villous and prominently veined beneath, often canescent; spikes solitary or several, short-

pedunculate, thick, usually quite dense both in anthesis and in fruit, often more than 3 dm. long; bractlets lanceolate-subulate, about as long as the calyx, hirsute, ciliate; calyx 4-5 mm. long, densely hirsute, the lobes acuminate; corolla blue or purple, the tube slightly surpassing the calyx, pubescent outside, limb 8-9 mm. wide. Pastures, prairies, waste places and railroad embankments, usually in dry soil, from Lipscomb to Red River, Liberty and Gonzales cos., June-Sept.; Ont. and O., w. to S.D. and Wyo., s. to Tex. and N.M.; introd. in e. U.S. and in Wash.

11. *Verbena Macdougali* Heller. NEW MEXICAN VERVAIN. Stems to 1 m. tall, stout, obtusely tetragonal, simple or occasionally branched, ashy-green, hirsute-pubescent; leaves oblong-elliptic or elongate-ovate, 6-10 cm. long, short-petiolate or narrowed into a subpetiolar base, coarsely and irregularly serrate-dentate, hirtellous, rugose and minutely pustulate above, densely pilose-pubescent and prominently veined beneath; spikes solitary or sometimes several, thick, comparatively dense both in anthesis and in fruit; bractlets lanceolate-subulate, usually longer than the calyx, pubescent, ciliate; calyx 4-5 mm. long, rather densely pubescent, the very obtuse lobes ending in short subulate teeth; corolla deep-purple, the tube scarcely surpassing the calyx, the limb 6 mm. wide. On flats at high elev., Culberson Co., June-Oct.; also s. Wyo. and cen. Ut. to N.M. and Ariz.

12. *Verbena xutha* Lehm. GULF VERVAIN. Stems usually upright, to 2 m. tall, coarse and spindly, tetragonal, often tufted in clumps from a common base, branched, hirsute-hispid, rarely procumbent; leaves oblong or broadly ovate in outline, sessile, 5-12 cm. long, incised-pinnatifid or more often trifid, with the segments coarsely dentate, the laterals much smaller than the middle segment and close to the leaf base, strigose above, canescent and spreading-hirsute beneath, the hairs especially conspicuous along the somewhat paler venation, the upper leaves lanceolate; spikes elongate, rather stiff, compact only during anthesis, short-pedunculate; bractlets lanceolate-subulate, subequaling or a little shorter than the calyx, strigillose, ciliate; calyx 3-4 mm. long, strigose-hirsute, the lobes acuminate-subulate; corolla blue to purple, the tube about as long as the calyx, pubescent outside, throat white, villous, limb 5-8 mm. wide. *V. Matthesii* Turcz. Dry mostly sandy soil of beaches, fields, roadsides and blackland prairies, Bowie and Navarro to Jefferson and Cameron cos., w. to the Trans-Pecos, Mar.-Oct.; Ala. to Ariz.

13. *Verbena Runyonii* Moldenke. RIO GRANDE VERVAIN. Stems erect, coarse, to 14 dm. tall, green, rather stout, sharply tetragonal, sparsely hirsutulous with short whitish divergent hairs especially on the angles and at the nodes, glabrescent in age but more or less scabrellous on the angles; leaves sessile, clasping, 2-6 cm. long, 8-30 mm. wide, more or less 3-parted with each division pinnatifid-incised with broad acute teeth, abundantly hirsutulous on both surfaces with rather short whitish hairs that are bulbous-based, the upper surface scabrous on older leaves; spikes compound, the branches slender, erect, 14-25 cm. long, rather closely many-flowered, often with 1 to 3 pairs of much reduced leaves near the base; flowers with a faint odor, very densely imbricate before and during anthesis, rather uniformly separated in fruit; peduncles and rachis slender, sharply tetragonal, spreading-pilose and glandular, the hairs very short; bractlets linear-lanceolate, 3 mm. long, equaling the calyx, sharply attenuate, rather sparsely puberulent and glandular, sparsely and irregularly ciliolate toward the base; calyx 3 mm. long, glandular-pilose with short spreading hairs; corolla blue, 6 mm. long, tube puberulent at apex outside, limb 4 mm. wide. Mostly in moist ground, open fields, banks, resaca bottoms, ditches and roadsides, from Hidalgo and Cameron cos. along the coast to Nueces Co., Feb.-June; also N.L.; introduced in Ore.-f. *rosiflora* L. I. Davis differs in having rose-colored corollas; known only from Cameron Co.

14. *Verbena plicata* Greene. FANLEAF VERVAIN. Stems decumbent or ascending, branched, hirtellous; lower leaf blades elliptic-ovate, 1-4 cm. long, narrowed at base into a margined petiole of about the same length, broadly obtuse at apex, plicate, coarsely incised-dentate, often 3-lobed, more or less canescent, rugose and somewhat appressed-hirsute above, hirsute beneath and prominently marked (especially near the margins) with whitish veins; upper leaves similar but smaller, often subspatulate; spikes terminal on stems and branches, usually not compact; bractlets green, herbaceous, ovate-lanceolate, equaling or usually surpassing the calyx, 5-7 mm. long, 1.5-4 mm. wide, gradually attenuate from base to acute apex, hirsute, the midrib often conspicuous; calyx 3.5-4 mm. long, glandular-hirsute, the very obtuse or subtruncate lobes terminating abruptly in

subulate teeth; corolla blue to lavender or purple, the tube subequalling the calyx, limb 4-6 mm. wide, anterior lobe obtuse. Open sandy ground, flats, prairies, ravines, cliffs, gravel hills and roadsides, from Childress and Young to Gonzales and Cameron cos. w. to the Trans-Pecos, Feb.-Sept.; also N.M., Ariz. and n. Mex.—var. *Degeneri* Moldenke differs in the bractlets being very firm and rigid, dry, stramineous, broadly ovate, to 9 mm. long and 6 mm. wide, and very abruptly long-acuminate; known only from Brewster and Pecos cos.

15. *Verbena Cloverae* Moldenke. CLOVER'S VERVAIN. Branching from near the woody base; branches rather sharply 4- or 5-angled, densely short-villous, the hairs at right angles to the branches, not glandular; petioles 5-15 mm. long, broadly winged to the base; leaf blades rather firm, resembling those of *V. plicata*, mostly ovate, 1.5-3 cm. long, 1-2.5 cm. wide, coarsely and irregularly incised-dentate or shallowly 3-lobed toward the base, obscurely short-puberulent above, more densely short-pubescent (especially on the larger venation) beneath; the entire venation impressed above and very prominent and whitish beneath as in *V. plicata*; leaves in the inflorescence small, sessile to shortly winged-petiolate, sharply and coarsely incised-dentate or lobed, firm and rather stiff, rapidly decreasing in size upwards; spikes 8-25 cm. long; bractlets lanceolate, stiff, the lowermost to 7 mm. long, the uppermost 2.5-3 mm. long, shorter than the calyx in anthesis; calyx 4-4.5 mm. long, prominently 4-ribbed, the ribs hirsute, purplish as in *Stylodon carneus* before and during anthesis; corolla bluish to pink, lavender or purple, its tube far-surpassing the calyx, 8 mm. long or more, limb 7-8 mm. wide. Open slopes, in clay and sandy soil, and open desert scrub, from Coke and Houston cos. s. to Kenedy and Hidalgo cos., Feb.-May; endemic.—f. *alba* Lundell differs in having white corollas; known only from Dimmit and Zapata cos.—var. *lilacina* Moldenke, described as having lavender corollas, appears to be only a transitory state in flower maturity.

16. *Verbena neomexicana* (Gray) Small. HILLSIDE VERVAIN. Stems slender, erect, to 1 m. tall, branched from the base, hirsute; leaves 1-5 cm. long, pinnately cleft or almost parted, the segments incised or coarsely toothed, rugose, somewhat scabrous and finely pustulate above, the venation rather prominent beneath, hirsute on both surfaces; spikes solitary or paniced, mostly short-pedunculate, hirsute; bractlets lanceolate-acuminate, mostly not surpassing the calyx; calyx 3 mm. long, hirsute-pubescent, very slightly glandular, the teeth short and subulate; corolla blue to lavender or purple, the tube scarcely surpassing the calyx, limb 4 mm. wide. Pine-oak forests, streambeds, gravel and sand bars, streamsides and rocky hillsides, from Travis and Cameron cos. w. to the Trans-Pecos, Apr.-Nov.; also N.M. and n. Mex.—var. *xylopoda* Perry differs in having shorter, denser, and more glandular pubescence, the glandular-hirsute calyx 4 mm. long and with acuminate teeth, and the corolla limb 6-10 mm. wide; sandy soil on hillsides, Rio Grande Plains; also s. Calif., Ariz. and n. Mex.; introd. in Fla.—var. *hirtella* Perry differs in being densely canescent-hirtellous, the leaves only rather shallowly incised, the bractlets usually broadly ovate-acuminate, and the corolla limb 8 mm. wide; dry arroyos and desert scrub, plains and foothills, from Trans-Pecos Tex. e. to Travis and Cameron cos.; also N.M., Ariz. and n. Mex.; introd. in Md.

17. *Verbena perennis* Woot. PINLEAF VERVAIN. Stems 3-4 dm. tall, several from a woody base, divaricately ascending or erect, usually somewhat branched, glabrate or often finely glandular and slightly short-hispidulous; leaves mostly linear, 1-4 cm. long, mostly entire or the lowest pinnately few-lobed, erect-ascending, sparsely hispidulous, revolute-margined; spikes terminal, pedunculate, filiform, elongate; bractlets ovate, 1.5-3 mm. long, acute, hispidulous, ciliate; calyx 4-5 mm. long, more abundantly pubescent on the veins, the subequal lobes short and acute; corolla deep-blue to lavender or purple, the tube slightly longer than the calyx, pubescent, limb 5-7 mm. wide, lobes repand. Rough grassy slopes, hillsides and flats, in the Trans-Pecos, Mar.-Nov.; also N.M., Ariz. and Coah.

18. *Verbena canescens* H.B.K. GRAY VERVAIN. Stems several, branched, tetragonal, decumbent to ascending or erect, canescent, hirsute, 15-46 cm. tall; leaves oblong-lanceolate, rigid, mostly sessile, 1-5 cm. long, acute, remotely incised-dentate or sub-pinnatifid, semiamplexicaul at base, rugose and hirtellous above, canescent-hirsute and often rather conspicuously veined beneath; spikes sessile or short-pedunculate, mostly solitary, loose-flowered or compact, glandular-hirsute; bractlets lanceolate, acuminate, variable in length, often surpassing the calyx, hirsute, ciliate; calyx 2-3 mm. long,

canescent-hirtous, somewhat glandular, subtruncate, the teeth short and very inconspicuous; corolla blue to lavender or purple, the tube slightly surpassing the calyx, limb 4-6 mm. wide, lobes retuse. In sand and rocky places on dry limestone hills, valleys and canyons, Edwards Plateau and s.-cen. Tex., Apr.-Oct.; widespread in Mex.; introd. in Nev.—var. *Roemcristana* (Scheele) Perry differs in being more densely hirsute, sparsely or not at all glandular, and the bractlets broadly ovate, abruptly acuminate, concave during anthesis, later slightly recurved, and mostly surpassing the calyx. Dry rocky or sandy soil, clay slopes and hillsides, ravines, open woodlands, cedar brakes, fields, pastures and blackland prairies, preferring dry rocky hillsides, from the Trans-Pecos s. to Cameron Co., e. to Wharton and Waller cos., n. to Wichita and Scurry cos., Mar.-Oct.; also s. Calif. and n. Mex.

19. *Verbena bracteata* Lag. & Rodr. PROSTRATE VERVAIN. Stems usually several from a common base, diffusely branched, prostrate or decumbent, rarely erect, coarsely hirsute; leaves 1-6 cm. long, pinnately incised or 3-lobed (lateral lobes narrow and divaricate, middle lobe large, cuneate-obovate, incised-dentate or cleft), narrowed into a short margined petiole, hirsute on both surfaces, larger venation slightly prominent beneath; spikes terminal, sessile, ascending, rather thick, conspicuously bracteose; bractlets much longer than the calyx, spreading-ascending, recurved in age, coarsely hirsute, foliaceous, the lowermost often incised, the upper linear-lanceolate, acute to acuminate and entire; calyx 3-4 mm. long, hirsute especially on the veins, the very short lobes connivent; corolla bluish to lavender or purple, the tube slightly surpassing the calyx, very finely pubescent outside, the limb 2.5-3 mm. wide. *V. bracteosa* Michx. Low and newly cleared ground, grassy places, waste ground and roadsides, from the Trans-Pecos and Plains Country through the Edwards Plateau e. to Newton Co., Apr.-Oct.; almost throughout the U.S. and s. Can., introd. and local eastw.

20. *Verbena cameronensis* L. I. Davis. SOUTHWEST VERVAIN. Stems slender, decumbent or ascending, obtusely tetragonal, abundantly hirsute with stiff white hairs; branches numerous, very slender, ascending or erect, more densely hirsutulous; petioles 5-25 mm. long, slightly margined, densely hirsutulous; leaf blades thin, ovate, to 7 cm. long and 53 mm. wide, acute, subtruncate at base and slightly prolonged into the petiole, coarsely and irregularly incised-dentate with blunt or subacute teeth, scattered appressed-pilose on both surfaces with whitish hairs; spikes abbreviated, 2-6 cm. long during anthesis, densely many-flowered, the flowers closely imbricate before and during anthesis, somewhat more separated in fruit, elongated to 15 cm. in fruit, densely hirsutulous, often glandular; bractlets linear-lanceolate, 6 mm. long, slightly shorter or longer than the calyx, densely puberulent, long-ciliate; calyx tubular, swollen, 5-6 mm. long, somewhat puberulent and sparsely white-hirsutulous, not glandular; corolla small, inconspicuous, lavender to purple, the tube barely surpassing the calyx, 7-11 mm. long, limb 2-8 mm. wide. *V. Lundelliorum* Moldenke. Woodlands, fields, clearings and roadsides, Cameron Co., Apr.-May; also n. Mex. s. to Ver. and S.L.P.

21. *Verbena quadrangulata* Heller. BEAKED VERVAIN. Stems prostrate-ascending, diffusely branched from the base, rooting at the lower nodes, hirsute; leaves 1-3 cm. long, broadly ovate, cuneate at base and contracted into a very short margined petiole, incised-pinnatifid or 3-cleft, the lobes again incised, strigose-hirsute on both surfaces; spikes compact, sessile or nearly so, terminal; bractlets narrowly lanceolate, somewhat shorter than the calyx, hirsute, ciliate; calyx 5-6 mm. long, hirsute especially on the ribs, the short lobes subulate-tipped; corolla mostly white, varying to bluish, pink or lavender, the tube slightly surpassing the calyx, subglabrous outside, the limb 2.5-3 mm. wide, lobes emarginate; anthers unappendaged; ovary surmounted by a subhemispheric-angulate stylopodium; each coccus surmounted by a smooth obtusish beak. *Helleranthus quadrangulatus* (Heller) Small. Waste and open grounds, fields, desert scrub, clay slopes, caliche and sandy beaches, from Pecos and Upton to Cameron and Wharton cos. n. to Tarrant Co., Feb.-Aug.; also Tam.

22. *Verbena delticola* Perry. ALFOMBRILLA, MORADIA. Stems decumbent to ascending, to 3 dm. tall, branched, more or less hirsute; leaves ovate-deltoid, 3-7 cm. long, obtuse or subacute, the truncate-cuneate base narrowed into a margined petiole, coarsely serrate-dentate, often 3-lobed, usually thin-textured, sparsely appressed-hirsute on both surfaces; spikes pedunculate, fasciclelike during anthesis, elongating in fruit; bractlets linear-attenuate, shorter than or equaling the calyx; calyx 7-8 mm. long, hirsute, sparsely glandu-

lar, the slender lobes unequal and subulate; corolla showy, mostly red, pink or magenta, the tube 1-1.5 cm. long, protruding well beyond the calyx, pubescent or glabrate outside, the limb 7-10 mm. wide, lobes emarginate; cocci with a definitely broadened base and a slight protrusion suggesting a tendency toward a beak. Open grounds, fields, orchards and the edges of thickets, often covering acres of ground, Rio Grande Plains and Valley, Feb.-Aug.; also n. and e. Mex.—f. *lilacina* L. I. Davis differs in having lavender corollas: known only from Cameron Co.

23. *Verbena canadensis* (L.) Britt. ROSE VERVAIN. Stems decumbent or ascending, rooting at the lower nodes, branched, glabrate or rather irregularly spreading-hirsute; leaves thin-textured, very variable, ovate to ovate-oblong, 2.5-9 cm. long, 1.5-4 cm. wide, acute or acuminate, truncate or cuneate at base and narrowed into a margined petiole, incised or incised-pinnatifid to 3-cleft, appressed-hirsute or glabrate on both surfaces; spikes pedunculate, fasciclelike during anthesis, conspicuously elongating in fruit, densely many-flowered; bractlets linear-attenuate, shorter than or sometimes equaling the calyx, irregularly hirsute with weak hairs, ciliate; calyx 10-13 mm. long, weakly glandular-hirsute, the very slender lobes subulate-setaceous and unequal, the posterior lobe much shorter; corolla showy, mostly pink, rose or magenta, varying to blue, lavender or purple, sometimes variegated, the tube about twice as long as the calyx, glabrous to finely pubescent or glandular outside, the limb 11-15 mm. wide, lobes emarginate; anther glands usually present and large; cocci with a slightly broadened base. *Glandularia canadensis* (L.) Small. Extremely polymorphic; plants with white corollas are f. *candidissima* (Haage & Schmidt) Palm. & Steyerl., with dark-violet corollas are var. *atroviolacea* Dermen, with compact habit are var. *compacta* Dermen, with extra large corollas are var. *grandiflora* (Haage & Schmidt) Moldenke, with the leaf blades incised-pinnatifid or almost bipinnatifid and the calyx only 1 cm. or less in length are var. *Drummondii* (Lindl.) Baxt., and those with narrow pinnatifid lanceolate or ovate leaves, cuneate at base, and the calyx 12 mm. or more in length are var. *Lambertii* (Sims) Thell. Open ground, fields, woods, pinelands, roadsides and railroad embankments, often covering large areas of ground, mostly n.e., e. and s.e. Tex. but extending into n., cen., s. and w. cos. perhaps as introd.; Ill. to Tenn., s. Pa., Va., and Fla. w. to Colo.; introd. in Conn., N.Y., Mich. and Minn.

24. *Verbena elegans* H.B.K. var. *asperata* Perry. MOUNTAIN VERVAIN. Stems decumbent-ascending, branched, densely hirsute-hispid; leaves lanceolate-ovate, 2-5 cm. long, 1-3.5 cm. wide, cuneate at the base and narrowed into a margined petiole, variously incised-pinnatifid, trifid, cleft or lobed, somewhat appressed-hirsute on both surfaces, often with much-abbreviated branches or fascicles of smaller leaves in the axils; spikes terminal, pedunculate, dense, many-flowered, fasciclelike during anthesis, usually not elongating; bractlets usually one half to two thirds as long as the calyx, lanceolate, attenuate, glandular-hirsute, ciliate; calyx 8-10 mm. long, hispidulous-hirsute and glandular, the unequal teeth subulate with the larger about 2 mm. long, often the whole calyx or only the teeth purple; corolla pink or rose to purple, the tube 15-18 mm. long, sparsely pubescent outside, throat gibbous, limb 10-12 mm. wide. Limestone or sandstone outcrops in mts., canyons and arroyo margins, mt. meadows and forests; known only from Duval and Hidalgo cos.; widespread in Mex. at high alt.; often cult.

25. *Verbena hybrida* Voss. GARDEN VERBENA. Stems mostly procumbent or ascending, spreading or compact, rooting at the nodes, densely hirsute or villous; branches many, densely soft-villous with whitish hairs; petioles 2-7 mm. long, densely white-hirsute, margined; leaf blades thick, lanceolate or ovate, 1.3-7 cm. long, 1-4 cm. wide, acute, usually truncate or subtruncate at base or cuneately narrowed into the petiole, irregularly incised-dentate from apex to base with numerous acute and spreading often lobelike and doubly dentate teeth, densely soft-pubescent on both surfaces with whitish hairs, antrorsely strigose above and with hairs spreading from the larger venation beneath; spikes terminal, large and showy, pedunculate, densely white-hirsute, at first fasciclelike, later elongating, very densely many-flowered, the flowers closely imbricate; bractlets lanceolate, much shorter than the calyx, 5-6 mm. long, attenuate, densely white-pubescent; calyx 8-15 mm. long, 5-costate and -plicate, densely white-hirsutulous, the rim truncate and undulate to very shortly 5-apiculate; corolla very large and showy, white or variously colored, often with a white or yellow "eye", often very fragrant, the tube 1.5-3 cm. long, glabrous or obscurely pilosulous outside, limb 1-2.4 cm. wide. *V. hortensis* Vilm. Planted for ornament throughout the state and tending to escape in n.e., cen. and w. Tex., Mar.-Oct.; an artificial

hybrid of several S.A. speceis; there are hundreds of horticultural named varieties and forms.

26. *Verbena tumidula* Perry. PLAINS VERVAIN. Stems decumbent-ascending, 1.5-2 dm. long, branching, pilose-hirsute; leaves broadly ovate, 2-4 cm. long, cuneate at base and narrowed into the margined petiole, trifid with the segments again incised or coarsely crenate-dentate, appressed-pubescent or strigillose above, hirtellous beneath; spikes short-pedunculate, protruding slightly above the uppermost leaves, compact; bractlets ovate-lanceolate, not surpassing the calyx, acuminate, ciliate; calyx 8-9 mm. long, inflated at base, hirsute, finely glandular, the subulate teeth 1.5 mm. long; corolla blue-purple, the tube 11 mm. long, puberulent outside, limb 8-10 mm. wide; anthers not glandular. High Plains, Trans-Pecos and Edwards Plateau, May-Nov.; also N.M. and n. Mex.

27. *Verbena bipinnatifida* Nutt. DAKOTA VERVAIN, SMALL-FLOWERED VERBENA. Stems diffusely branched from the base, ascending, rooting at the lower nodes, densely hispid-hirsute; leaves petiolate, 2-6 cm. long, bipinnately parted or tripartite with the divisions again bipinnatifid, the lobes linear or oblong, appressed-hirsute on both surfaces, often revolute; spikes pedunculate, fasciclelike during anthesis, conspicuously elongating in fruit; bractlets mostly longer than the calyx, linear-subulate, hispid-hirsute, ciliate; calyx 8.5-10 mm. long, pubescent, hispid-hirsute on the veins, the very slender unequal lobes subulate-setaceous from a broader base; corolla very nectariferous, pink to lavender or purple, the tube one and one half times the length of the calyx, pubescent outside, limb 8-10 mm. wide, lobes emarginate. *Glandularia bipinnatifida* (Nutt.) Nutt. Dry plains and prairies, meadows, pastures, roadsides and streamsides, often covering large areas, widespread almost throughout the state except in most of the Trans-Pecos, throughout the year; S.D. to Mo. and Ala., w. to Colo. and Ariz.; also n. Mex. and in cult.—var. *latilobata* Perry differs in having its leaves trifid, with the segments remotely incised or lobed, strigillose above, hirtellous-hirsute (especially on the venation) beneath, the spikes compact or somewhat elongate in age, and the bractlets variable in length, usually equaling or surpassing the calyx; known from Brewster, Dallas and Hidalgo cos.; also in Okla., N.M., Ariz. and n. Mex.

28. *Verbena oklahomensis* Moldenke. Supposed natural hybrid between *V. canadensis* and *V. bipinnatifida*, with leaves deeply bipinnatifid and corollas small and densely pubescent outside as in *V. bipinnatifida*, but calyx and bractlets are finely appressed-pubescent or puberulent as in *V. canadensis*, only the lower bractlets conspicuously and densely ciliate at the base. Known from Lampasas Co.; also Ark. and Okla.

29. *Verbena tenuisecta* Briq. MOSS VERBENA. Stems decumbent, with divergent ascending branches, to 6 dm. tall, sparsely pilose with antrorse hairs, glabrescent in age; leaves triangular in outline, 2-3.5 cm. long, 2-3 cm. wide, tripartite-pinnatifid, the linear divisions 1-3 mm. long, entire or dentate, obtuse or sharply acute, revolute-margined, substrigose above with appressed antrorse hairs, more densely so along the venation beneath, glabrescent in age; spikes terminal, pedunculate, solitary, short and dense during anthesis, later elongating to 4 cm. or more; flowers sessile, at first dense and ascending, later loosely spreading; bractlets subovate-lanceolate, 2-3 mm. long, usually about one fourth the length of the calyx, canescent-puberulent; calyx 8-9 mm. long, densely white-strigose throughout with closely appressed antrorse hairs and a few scattered black glands, the tube about 7 mm. long, the teeth filiform-setulose; corolla blue to violet, lilac or purple, showy, the glabrous tube surpassing the calyx mouth by 3-5 mm., limb 10 mm. wide, lobes broadly obcordate, spreading, emarginate, ciliate-pilose at base; anthers with a scarcely exserted glandular appendage. "*V. pulchella* var. *gracilior* (Troncoso) Shinners," *Glandularia tenuisecta* (Briq.) Small. Roadsides, fields and waste places, from Sabine and Jefferson cos., s.w. to Zapata and Webb cos., Mar.-July; N.C. to Fla. and the Gulf Coast, with isolated colonies in Ill., Ky., Mo., Ariz. and Calif.; introd. from S.A.—var. *alba* Moldenke, differing in its white corollas; known from Angelina Co., to be expected throughout the range of the species.

30. *Verbena ambrosifolia* Rydb. WESTERN PINK VERVAIN, WESTERN PINK VERBENA, MORADILLA. Stems loosely decumbent-ascending, diffusely branched from the base, somewhat hirsute; leaves short-petiolate, 2-6 cm. long, bipinnatifid, the ultimate segments lanceolate, appressed-hirsute on both surfaces, slightly revolute-margined; spikes pedunculate or subsessile, fasciclelike in anthesis, somewhat elongate in fruit; bractlets a little shorter than the calyx, lanceolate-subulate, hirsute, ciliate; calyx 8-9 mm. long, glandular-

pubescent, hirsute especially on the veins, the elongate teeth subulate and often coarctate; corolla pink or rose to lavender or purple, the tube one and one third to one and one half times the length of the calyx, pubescent outside, limb 6-10 mm. wide. Fields, prairies, grassy and alkali flats, deserts, mesas and roadsides in the Trans-Pecos and Panhandle, Apr.-Dec.; also Colo., N.M., Ariz. and isolated colonies in S.D., Kan., Okla. and Ark.—*f. eglandulosa* Perry differs in its more hirsute-hispid pubescence on the flowers and the absence of glands; roadsides, open fields and waste ground, in sandy loam or black clay soil, often covering acres of ground, scattered from Childress, Young and Rockwell cos. s. to Cameron and Webb and w. to Culberson and El Paso cos., Feb.-Oct.; also Okla., N.M., Ariz. and n. Mex.

31. *Verbena Wrightii* Gray. DESERT VERBENA. Stems usually several from a common base, decumbent-ascending to erect, branched, sparsely hispid-hirsute, to 6 dm. tall; leaves subsessile or contracted into a short margined petiole, 2-4 cm. long, bipinnatifid or trifid, the divisions rather deeply incised, ultimate segments narrowly lanceolate, hirtellous or hirsute on both surfaces; spikes short-pedunculate, rather compact even in fruit; bractlets shorter than the calyx, lanceolate, acute or acuminate, hirsute-ciliate; calyx 7-9 mm. long, densely glandular-pubescent, hirsute on the veins, the unequal short lobes subulate and not coarctate; corolla pink or rose to magenta or purple, the tube 11-12 mm. long, pubescent around the throat, limb 6-8 mm. wide, lobes retuse. Fields, flats, dry gravelly creek beds and bars, dry or semidesert hillsides and slopes, in the Trans-Pecos e. to Ector, Bexar and Guadalupe cos., with an isolated colony in Montgomery Co., Feb.-Nov.; also Kan., Colo., Okla., N.M., Ariz. and n. Mex.—*f. albiflora* Moldenke, differing in its white corollas; known only from the Trans-Pecos.

32. *Verbena ciliata* Benth. MEXICAN VERVAIN, ALFOMBRILLA DEL CAMPO, MORADILLA. Stems several from a common base, annual, decumbent, branched, hispidulous-hirsute, rarely erect, to 6 dm. tall, canescent throughout; leaves short-petiolate or subsessile, sub-bipinnatifid or trifid, the divisions rather deeply incised, ultimate segments linear-oblong, slightly revolute-margined, hirsute-strigillose on both surfaces; spikes subsessile or short-pedunculate, rather compact even in fruit; bractlets a little shorter than the calyx, lanceolate, subulate-acuminate, hirsute, ciliate; calyx 7-8 mm. long, somewhat glandular, hirsute-hispidulous, the short lobes subulate and unequal; corolla showy, pink or red to violet or purple, the tube 10-12 mm. long, pubescent outside, limb 6-8 mm. wide, lobes retuse. Flats, plains and roadsides, growing in patches but not extensive areas like *V. bipinnatifida*, from the Trans-Pecos and Plains Country e. to Polk Co. and s. Cameron Co., Feb.-Nov.; also Okla., N.M., Ariz., s. Calif., Mex., Guat. and offshore islands; introd. in Tenn. and S.D.—var *longidentata* Perry differs in its more open growth, bipinnatifid leaves of characteristic appearance and calyx teeth 2-2.5 mm. long; open ground, fields, arroyo banks and mesquite pastures, often covering large areas, from the s. Plains Country e. to Wharton and Denton Cos., s. to Cameron Co., Feb.-Nov.; also N.M. and n. Mex.—var. *pubera* (Greene) Perry differs in its more or less prostrate compact habit and the ultimate segments of the leaves linear-oblong and strongly revolute-margined; plains and low mts., the Trans-Pecos, Plains Country and Rio Grande Plains, Feb.-Aug.; also N.M. and Ariz.

33. *Verbena racemosa* Eggert. PALE VERVAIN. Stems several from a common base, ascending-erect, branched, pubescent, sometimes blooming when only 25 mm. tall; leaves small, bipinnatifid or trifid, the segments deeply cleft, the ultimate segments linear, somewhat pubescent or hirtellous on both surfaces; spikes subsessile, elongate but still dense at maturity; bractlets scarcely as long as the calyx, lanceolate, acuminate, ciliate; calyx 5-6 mm. long, sparsely glandular-hirtellous, the teeth short-acute-subulate; corolla white or essentially so, the tube 7-9 mm. long, puberulent or glabrous outside, the limb 5-6 mm. wide. Deserts, low valleys, foothills and roadsides, from Trans-Pecos e. to LaSalle, Bexar and Houston cos., Jan.-June; also N.M. and n. Mex.

34. *Verbena Gooddingii* Briq. SOUTHWESTERN VERVAIN, SOUTHWESTERN VERBENA. Stems usually several from a common base, erect or decumbent-ascending, often forming mats, gray-green, branched, densely white-villous, often glandular; leaves 3-5 cm. long, tapering at base into a short margined petiole, 3-cleft, the divisions coarsely toothed or incised, gray-green, usually villous-hirsute on both surfaces, slightly or not revolute-margined, the venation rather prominent beneath; spikes pedunculate, fasciclelike in anthesis, later somewhat elongating, white-villous; bractlets usually a little shorter than the calyx, lanceolate, acuminate, villous-hirsute, long-ciliate; calyx 8.5-11 mm. long,

villous-hirsute, more or less glandular, the subulate lobes unequal; corolla showy, blue to pink or lavender, the tube slightly surpassing the calyx, pubescent outside, the limb 8-12 mm. wide, segments retuse. *Glandularia Gooddingii* (Briq.) Solbrig. Washes, mts., grasslands, pinyon forests, open or brushy flats and riverbeds, Rio Grande Plains (Uvalde Co.), Feb.-Oct.; also Nev., Ut., N.M., Ariz., s. Calif. and n. Mex.

35. *Verbena pumila* Rydb. PINK VERVAIN. Stems usually several from a common base, branched, decumbent-ascending, hirsute, often finely glandular; leaves 1.5-3 cm. long, obtusely triangular, truncate at base and cuneately contracted into a short narrowly margined petiole, trifid, sometimes lobed, the divisions variously incised, appressed-hirsute on both surfaces; spikes short-pedunculate or sessile, rather compact, hardly elongating; bractlets almost as long as the calyx, linear-lanceolate, hispid-hirsute; calyx 6 mm. long, pubescent, hispidulous on the veins, sometimes finely glandular, the short lobes subulate; corolla inconspicuous, small, pink or lavender to blue, the tube slightly surpassing the calyx, 8-10 mm. long, slightly or not pubescent outside, the limb 3-5 mm. wide; anther glands minute or absent. Fields, prairies, chaparral, meadows, pastures, river terraces, woods, sandy slopes and hillsides, practically throughout Tex., from the Trans-Pecos, s. to Cameron Co., e. to Wharton and Walker cos., n. to Grayson, Childress, Armstrong and Bailey cos., Jan.-Aug.; also Ark., Okla., N.M. and n. Mex.—f. *albida* Moldenke differs in its white corollas; s. and w. Tex.

2. STYLODON RAF.

CAROLINA VERVAIN

A monotypic genus of the southern United States.

1. *Styloдон carneus* (Medic.) Moldenke. Gray-pubescent perennial herbs to about 8 dm. high, with simple or sparingly branched tetragonal puberulent stems; leaves opposite, spatulate to oblong or the upper oblong-hastate, sessile, to about 12 cm. long and 4 cm. wide, shallowly serrate-dentate, scabrous above, less harsh and spreading-pubescent along the prominently reticulate venation beneath; spikes terminal, pedunculate, mostly solitary, sometimes ternate, slender with crowded tips, more open in fruit; bractlets lanceolate, about half as long as the calyx, glandular-pubescent; flowers hypogynous, perfect, complete, zygomorphic; calyx gamosepalous, tubular-campanulate, 5-costate, its rim sharply 5-lobed, about 5 mm. long, glandular-pubescent, the lobes unequal, acute; corolla gamopetalous, salverform, usually blue or pink, slightly longer than the calyx, pubescent outside, the limb 5 mm. wide, the 5 lobes subtruncate; stamens 4, inserted at or above the middle of the corolla tube, included, didynamous; filaments extremely short; anthers unappendaged, 2-celled, the thecae parallel; pistil one, included; style short; stigma very shortly 2-lobed, the larger lobe stigmatiferous, the smaller one toothlike; ovary 4-celled, each cell 1-ovulate; ovules erect; fruit nutlike, ridged, with 4 broad plane surfaces at the top which form a caplike beak; cocci 4, not readily separating. Sandy barrens, woods and upland pinelands, from Newton and Jefferson cos. s.w. to Kleberg Co., Apr.-Sept.; also N.C. to Fla. and La.

3. LANTANA L.

LANTANA

Mostly erect herbs or shrubs, sometimes decumbent or scandent, usually more or less scabrous and hirtous-pubescent or tomentose with simple hairs; leaves opposite or ternate, dentate, often rugose; inflorescence in the form of dense cylindrical spikes or contracted to form heads, usually axillary, pedunculate; flowers red, yellow, blue or white, often fading to various other shades, sessile, borne in the axils of solitary bractlets that are oblong to lanceolate or ovate, acuminate, spreading or subimbricate; calyx small, membranous, truncate and entire or sinuate-dentate; corolla hypocrateriform, the tube cylindrical, slender, equal in diameter throughout or slightly amplified above, the limb spreading, regular or obscurely 2-lipped, 4- or 5-fid, the lobes broadly obtuse or retuse; stamens 4, didynamous, inserted at about the middle of the corolla tube, included; anthers ovate, with parallel thecae; ovary 1-carpellary, 2-celled, each cell 1-ovulate; style usually short; stigma rather thick, oblique or sublateral; ovules basal and erect or attached laterally near the base of each cell; fruit drupaceous, the exocarp usually more or less

fleshy (rarely dry), the endocarp hard, 2-celled or splitting into two 1-celled pyrenes; seeds without endosperm.

A genus of about 160 species and 75 named varieties and forms, mostly natives of tropical and subtropical America; a few also in tropical Asia and Africa.

1. Bractlets narrow-lanceolate to oblong or linear; heads large, mostly 2-3 cm. wide; corolla mostly orange, yellow or red, its tube to 1 cm. long, the limb to 9 mm. wide; leaves broad, mostly 20-70 mm. wide (2)
1. Bractlets broadly ovate; heads smaller, mostly 1-1.5 cm. wide; corolla mostly magenta, lilac, pink or white, large or small; leaves mostly narrow, 6-28 mm. wide (5)
- 2(1). Pubescence (if any) of branches and leaves usually very sparse, not glandular (3)
2. Pubescence of branches and leaves usually very dense, white, often glandular 3. *L. scorta*.
- 3(2). Leaves usually relatively small, mostly 3-5 cm. long and 2-4 cm. wide, very coarsely toothed; native 1. *L. horrida*.
3. Leaves usually relatively large, mostly 5-11 cm. long and 2.5-7 cm. wide, regularly and more abundantly toothed, the teeth appressed; introduced (4)
- 4(3). Young twigs mostly glabrate or short-puberulent . . 2. *L. Camara*.
4. Young twigs rather densely white-hispid 2. *L. Camara* var. *mista*.
- 5(1). Stems and branches usually procumbent or decumbent; corolla large, showy, magenta or lilac when newly opened, the tube 10 mm. long, the limb 8-18 mm. wide; introduced 4. *L. montevidensis*.
5. Stems and branches usually erect or ascending; corolla smaller, not especially showy, mostly white, pink or yellow when newly opened, the tube 4-6 mm. long, the limb about 3 mm. wide; native (6)
- 6(5). Leaf blades usually very densely canescent-tomentose or velutinous beneath, upper surface more or less bullate, the marginal teeth small and rounded 5. *L. velutina*.
6. Leaf blades appressed-strigose or short-pubescent beneath, upper surface not bullate, the marginal teeth coarse or appressed, acute (7)
- 7(6). Mature inflorescence always much shorter than the subtending leaves; lower leaf surface densely black-punctate; fruit fleshy . . . 6. *L. Frutilla*.
7. Mature inflorescences often longer than the subtending leaves; lower leaf surface not black-punctate; fruit dry (8)
- 8(7). Leaf blades finely crenate or subentire; peduncles mostly shorter than the subtending leaves 7. *L. microcephala*.
8. Leaf blades sharply serrate; peduncles mostly greatly surpassing the mature subtending leaves (9)
- 9(8). Leaf blades sparsely strigose beneath with distinct straight stiff hairs; marginal teeth of leaf narrow, regularly attenuate and very sharp, often greatly appressed 8. *L. achyranthifolia*.
9. Leaf blades densely strigose-pubescent beneath with massed soft hairs that are not notably straight or stiff; marginal teeth of leaf usually broadly triangular, very abruptly acute (10)
- 10(9). Corolla pink 9. *L. macropoda*.
10. Corolla white with a yellow "eye" 9. *L. macropoda* f. *albiflora*.

1. *Lantana horrida* H.B.K. TEXAS LANTANA, HIERBA DE CRISTO, CALICO BUSH. Shrub to 2 m. tall, much-branched; stems and branches unarmed or with many stout recurved prickles, glabrous to sparsely hirsute, the younger ones often more hirtellous; petioles 2-12 mm. long, pilose-hirsute; leaf blades ovate or subrotund-ovate, usually 3-5 cm. long and 2-4 cm. wide, acute or obtuse, usually truncate or subtruncate at base, often very shortly cuneate-attenuate into the petiole, very coarsely serrate from apex almost to base with large rather irregular widely spreading acute or obtuse teeth, short-strigose and very scabrous above, subglabrate to puberulent or hirtellous on the venation beneath, often sub-bullate above;

peduncles 3-9 cm. long, usually slightly surpassing the leaves, subglabrate to hispidulous; bractlets narrow-lanceolate or oblong, 4-9 mm. long, 1-2 mm. wide, acute, strigillose, the innermost usually one half the length of the corolla, the outermost often larger and forming an involucre subequalling the corolla tube; heads hemispheric, 2-3 cm. wide, densely many-flowered, not elongating; corolla very showy, yellow to orange or red, the tube 7-10 mm. long, densely pubescent outside, limb 5-9 mm. wide; fruit black or dark-blue, edible. Fields, thickets, swamps, rich sandy woods, scrub, gravelly hills, flats, chaparral and roadsides, often in large patches, almost throughout Tex. except the n.w.; also cult. and in N.M., Ariz., Calif., n. Mex., and introd. in N.C. and Miss.

2. *Lantana Camara* L. WEST INDIAN LANTANA, ALFOMBRILLA HEDIONA. Branching shrub to 2 m. tall; stems and branches usually unarmed or with only comparatively few weak prickles, the young parts puberulent or short-pubescent to subglabrate; petioles 5-20 mm. long, glandular-puberulent; leaf blades ovate to oblong-ovate, 5-11 cm. long, 2.5-7 cm. wide, acute or short-acuminate (rarely obtuse), crenate-serrate with abundant and regular appressed teeth, acutely narrowed or abruptly rounded to a subcuneate base, reticulate-rugose and decidedly scabrous above, short-pubescent mostly on the venation beneath; inflorescence shorter than to equaling or surpassing the leaves; heads hemispheric, 2-3 cm. wide, densely many-flowered, not elongating; peduncles 2-8 cm. long, appressed-puberulent; bractlets oblong or narrow-lanceolate, 4-7 mm. long, 1-1.5 mm. wide, equal, acute, usually about one half the length of the corolla tube, appressed-strigose; corolla very showy, yellow to orange or red, the tube 10 mm. long, barely enlarged above the middle, slightly curved, puberulent outside, limb 6-9 mm. wide; drupes black. Widely cult. and tending to escape, cen. and s. Tex.; Berm. and Fla. through the W.I.; less common in C.A. and S.A.; introd. in trop. Asia and Afr.; widely cult.—var. *mista* (L.) Bailey differs in having the youngest parts rather densely spreading-hirsute; known from Travis Co.; found practically throughout the range of the species.

3. *Lantana scorta* Moldenke. Extremely variable shrub, to 2 m. tall; branches often armed with few or many strong recurved prickles or unarmed, the younger parts usually densely hirsute-hispid with white wide-spreading hairs, often glandular; petioles 4-17 mm. long, usually densely white-hirsute, often glandular; leaf blades ovate or broadly ovate, 15-75 mm. long, 12-55 mm. wide, acute or subacuminate, more rarely obtuse or rounded, regularly crenate-serrate from almost the base to apex with either small and appressed antrorse or large and coarse spreading teeth, acute to truncate or subcordate at base and cuneately prolonged into the petiole, scabrous and densely hirsute or antrorsely substrigose-pilose above, mostly velutinous or densely canescent-tomentose beneath, sometimes merely pilose-pubescent on the larger venation; peduncles usually far surpassing the leaves, 35-85 mm. long, usually densely hirsute-hispid, often glandular; heads hemispheric, 1-2.5 cm. wide, not elongating; bractlets numerous, linear or oblong to lanceolate, to 12 mm. long, 1-3.5 mm. wide, densely white-hirsute to appressed-strigose; corolla surpassing the bractlets, red or orange, the tube 10-16 mm. long, densely short-pubescent outside. Thickets, prairies, banks and roadsides, Rio Grande Plains (Hidalgo Co.), Feb.-June; widespread in Mex.; may represent a hybrid population.

4. *Lantana montevidensis* (Spreng.) Briq. WEEPING LANTANA, TRAILING LANTANA, POLECAT-GERANIUM. Stems many from a woody base, much-branched, weak, often mat-forming; branches prostrate or decumbent to arching and vinelike, to 1 m. long, rooting at the nodes, strigose or hirtellous; petioles about 4 mm. long; leaf blades ovate or elliptic-ovate to rhomboid-lanceolate, 1-3 cm. long, 8-16 mm. wide, acute or subacute, crenate or coarsely serrate, abruptly narrowed or truncate at base and cuneate into the petiole, rugose and scabrous-pubescent or pilose-hirsute above, strigose on the venation or densely tomentulose beneath, densely resinous-glandular; heads long-pedunculate, plainly involucrate, at first hemispheric, later somewhat elongating and finally oblong; peduncles filiform; bractlets large, broadly ovate, concave, acuminate, spreading, strigose-hirtellous, ciliate, densely resinous-glandular, one half as long as the corolla, the outer ones somewhat larger; corolla magenta or lilac to rose or purple, with a white "eye," showy, the tube 8-10 mm. long, almost straight, slightly ampliate above, puberulent and resinous-dotted outside, limb 8-18 mm. wide, lower lobe elongate; mature drupes violet-black. *L. Sellowiana* Link & Otto, *L. delicatissima* Poit. Roadsides, waste places, fencerows, pine-lands and woods, s.e. Tex. (Orange Co.), Feb.-June; introd. from s. S.A.; also established in Ga., Fla., Ala., Calif., C.R., Cuba, W.I. and n. S.A.; widely cult.

5. *Lantana velutina* Mart. & Gal. VELVET LANTANA, CONFITURILLA BLANCA, CONFITE BLANCA, OREGANO XIU. Small diffusely branched shrub to 2 m. tall, with rhubarb odor; branches unarmed, slender, rather densely short-pubescent or tomentose, less so in age; petioles 1-9 mm. long, densely gray-tomentose; leaf blades ovate or elliptic-ovate, 1-4 cm. long, 7-28 mm. wide, acute to short-acuminate or rounded, regularly crenate with small obtuse antrorse teeth, cuneately narrowed into the petiole, mostly reticulate-rugose or bullate and densely velutinous-pubescent above, mostly very densely canescent-tomentose or velutinous beneath; peduncles equaling or surpassing the leaves, 1-7.5 cm. long, rather densely short-pubescent; heads at first hemispheric, later slightly ovate-elongate; bractlets large, conspicuous, closely imbricate, broadly ovate, the outermost to 12 mm. long and 8 mm. wide, subacute or obtuse, venose, densely appressed-pubescent or velutinous, shorter than or surpassing the corolla; corolla white, turning lavender or pinkish in age, yellow in the throat, fragrant, the tube 6 mm. long, densely strigose-pubescent outside (as are also the lobes); fruit at first pink, then bluish-black, edible. Open woods, thickets, mesas, sandy loams, cliffs and dry soil on hills, Webb Co., Feb.-June; widespread in Mex. and C.A.

6. *Lantana Frutilla* Moldenke. FRUTILLA LANTANA, FRUTILLA. Shrub to 2 m. tall; branches slender, very sparsely strigillose-pubescent, elongate; petioles 3-5 mm. long, sparsely whitish-strigillose; leaf blades ovate, 1.8-6 cm. long, 1-3 cm. wide, acute or subacuminate, uniformly serrate from widest part to apex with rather appressed acute or bluntish teeth, rounded at base or abruptly acuminate and prolonged into the petiole, sparsely strigillose above, densely short-pubescent and black-punctate beneath; heads 1-2 cm. long, to 1 cm. wide, densely many-flowered, slightly elongating in age, on peduncles that are always much shorter than the subtending leaves; bractlets conspicuous, involucrate, ovate, 6 mm. long and 3 mm. wide, acute, strigillose, spreading, about equaling the corolla tube; corolla white with a yellow center, fading to pinkish, the tube 6-7 mm. long, densely strigillose outside, limb 3-4 mm. wide; fruit lavender or bright-purple. Woods, high matorral, chaparral, llanos, shady gullies and steep hillsides, Cameron Co.; widespread in Mex.

7. *Lantana microcephala* A. Rich HAMMOCK LANTANA, HIERVADA JAVILLAS, OREGANO XIU, TORONJIL, SAC-CHILI. Slender unarmed shrub to 25 dm. tall; stems and branches whitish, rather densely white-strigose with appressed antrorse hairs (less so in age); petioles 2-8 mm. long, densely appressed-strigose with white antrorse hairs, mostly winged; leaf blades lanceolate or ovate, to 6 cm. long and 25 mm. wide, acute or acuminate, regularly and finely crenate with blunt antrorse teeth or subentire, long-acuminate at base and attenuate into the petiole, densely white-strigose on both surfaces (especially beneath), not bullate but venation often impressed above and prominent beneath; peduncles shorter than or surpassing the leaves, 9-50 mm. long, densely appressed-strigose; heads globose at first, later oblong, 4-12 mm. long, 6-13 mm. wide; bractlets plainly imbricate, 4-ranked, ovate or broadly ovate, involucrate, acuminate, the lowermost to 6 mm. long and 3 mm. wide, densely white strigose, keeled; corolla white with a yellow-throat, slightly surpassing the inner bractlets, tube 4-5 mm. long, strigose-puberulent outside, limb 2-lipped, 3 mm. wide; drupes dry, 1.5 mm. in diameter. *L. citrosa* (Small) Moldenke, *Gonostachyum citrosum* Small. Hammocks, forests, brushlands and roadsides, Rio Grande Valley and coastal Tex.; also s. Fla., Mex. and Guat.

8. *Lantana achyranthifolia* Desf. BRUSHLAND LANTANA, CARAQUITO BLANCO, CARIACO DE SAN JUAN, FRUTILLA BLANCA, OREGANILLO CIMARRÓN. Shrubby, to 2 m. tall; stems unarmed; branches slender, elongate, ascending, light-yellowish-green, densely appressed-strigose with stiff straight white antrorse hairs; leaves often ternate; petioles 1-10 mm. long, densely strigose; leaf blades narrow-lanceolate to broadly ovate, 2.5-8 cm. long, 15-53 mm. wide, acute or acuminate, coarsely and sharply serrate with usually narrow and regularly attenuate teeth, acuminate or acute at base, scabrous-strigose on both surfaces with closely appressed antrorse whitish or yellowish hairs, stiffer and more scattered beneath, denser on the large venation, resinous-punctulate beneath; peduncles erect or ascending, 4-14 cm. long, far-surpassing the leaves, 2 or 3 per node, densely appressed-strigose; heads at first hemispheric, showy, later ovoid-cylindric, 1-2 cm. long and wide, not greatly elongating after anthesis; bractlets broadly ovate, plainly imbricate and involucrate, attenuate-acuminate, often red, the lowest to 12 mm. long and 8 mm. wide, appressed-strigose and resinous-punctate; corolla equaling or slightly surpassing the inner

bractlets, somewhat shorter than lowest bractlets, opening yellow, turning white with yellow or orange center, fading to violet, blue or purple, the tube 5 mm. long, strongly curved, very densely puberulent outside, limb bilabiate, 3 mm. wide; fruit dry, entirely enclosed by the fruiting calyx. Canyons, valleys, fields, arroyo margins and meadows, San Patricio Co.; widespread in Mex.; also Guat. and S.A.; introd. in Java.

9. *Lantana macropoda* Torr. DESERT LANTANA, HIERBA NEGRA, MEJORANA, YERBA DEL CRUSTO. Aromatic shrub to 15 dm. tall; stems and branches slender, gray, densely white-strigose on younger parts; petioles 2-10 mm. long, densely white-strigose with antrorse hairs; leaf blades ovate or lanceolate, 5-35 mm. long, mostly 6-15 mm. wide, sharply acute, sharply serrate from apex almost to base with coarse broadly triangular often rather spreading teeth, densely white-strigose above, more densely pubescent beneath with soft irregular whitish or yellowish hairs and densely resinous-punctate; peduncles much-surpassing the leaves, to 10 cm. long, white-strigose; heads at first hemispheric, later elongating to 2 cm., 1-1.5 cm. wide; bractlets broadly ovate, the lowermost to 7 mm. long and 4 mm. wide, long-acuminate, densely white-strigose, closely imbricate, resinous-punctate; corolla pink or lavender to purple, often with a yellow "eye," the tube 4-5 mm. long, limb 3 mm. wide; fruit thin-fleshed, translucent, almost dry. Gravelly hills, dry rocky slopes, flats, mesas, deserts, limestone bluffs, dry open ground, valleys, pastures and fencerows, Trans-Pecos and Rio Grande Plains and Valley e. to Fort Bend and Houston cos., Feb.-Nov.; also N.M., Ariz. and n. Mex.—f. *albiflora* Moldenke differs in its white corollas, often with a yellow eye; Starr and Cameron cos., Feb.-May; also n. Mex.

4. LIPPIA HOUST.

LIPPIA

Erect bushes, shrubs or subshrubs; leaves opposite or ternate, rarely alternate; inflorescence spicate, solitary or fascicled and axillary or aggregate into terminal corymbs or panicles, the spikes mostly contracted into heads or cylindric, usually not conspicuously elongated in fruit, very dense-flowered; flowers small, sessile, borne singly in the axils of rather large ovate or lanceolate bractlets, often more or less 4-ranked; calyx small, membranous, ovoid-campanulate or compressed and 2-carinate or 2-alate, its rim 2- or 4-fid or 4-dentate; corolla salverform, its tube cylindric, straight or incurved, very slender, slightly exerted from the calyx or rarely elongate, equal in diameter throughout or ampliate above, the limb oblique, spreading, somewhat 2-lipped, 4-parted, the broad lobes often retuse; stamens 4, didynamous, inserted at about the middle of the corolla tube, included or slightly exerted; anthers ovate, unappendaged, the cells parallel; ovary 2-celled, each cell 1-ovulate; style often short; stigma rather incrassate, oblique or recurved; ovules basal and erect or affixed laterally near the base; fruit small, dry, included by the calyx and sometimes adnate to it, dividing into 2 pyrenes at maturity, the pericarp papery and hard, the exocarp membranous and rarely distinct from the pyrenes; seeds without endosperm.

A genus of about 206 species and 44 named forms and varieties, widely distributed in subtropical and tropical America; a few also in tropical portions of the Old World.

1. Peduncles mostly solitary in the leaf axils, usually 2 per node; leaves mostly cuneate at base 1. *L. alba*.
1. Peduncles 2 or 3 in each leaf axil, 4 to 6 per node; leaves mostly rounded or subcordate at base 2. *L. graveolens*.

1. *Lippia alba* (Mill.) N. E. BR. BUSHY LIPPIA, ALFOMBRILLA, CIDRILLA, HIERBA BUENA, ORÉGANO DE BURRO, SALVA DO BRASIL, SALVA COLORADO, TÉ DE CASTILLA, TORONJIL DE ESPAÑA, HIERBA NEGRA, HIERBA DEL NEGRO. Aromatic shrub to 2 m. tall, usually much-branched, with long rooting suckers at base; branches elongate, slender, ascending, pubescent; leaves often ternate; petioles 3-8 mm. long, gray-pubescent; leaf blades ovate or oblong, 2-7 cm. long, 12-23 mm. wide, acute or obtuse, serrate or serrulate except at base, cuneately narrowed into petiole at base, puberulent or strigose-hirtellous and rugose (when mature) above, densely short-pubescent or tomentose beneath; inflorescence axillary, capitate, mostly much shorter than the leaves or only subequaling the petiole, solitary or rarely paired in all the upper leaf axils; heads subglobose or short-oblong, 8-12 mm. long; bractlets ovate, 3-5 mm. long, the lowermost 3-3.5 mm. wide, nearly as long as the corollas; corolla purple to violet, pink or white, the tube 4-5 mm. long. *L. geminata*

H.B.K. Woods, river banks and resacas, Hidalgo and Cameron cos. n.e. to Wharton Co., Mar.-Oct.; widespread in W.I., Mex., C.A. and S.A., introd. elsewhere, widely cult.

2. *Lippia graveolens* H.B.K. REDBRUSH LIPPIA, HIERBA DULCE, OREGANO CIMARRÓN, ROMERILLO DE MONTE, TÉ DEL PAÍS, TARBAY. Slender aromatic shrub to 3 m. or tree to 9 m. tall; branchlets slender, villosulous-pubescent, densely resinous-punctate; petioles 2-20 mm. long, rather densely appressed-pubescent; leaf blades oblong or ovate-oblong to elliptic, 1-6.5 cm. long, 5-30 mm. wide, mostly obtuse or rounded (sometimes acute), regularly crenate from base to apex with closely set blunt teeth, rounded or subcordate at base, sometimes abruptly acute and slightly prolonged into the petiole, reticulate-rugose or sub-bullate above and rather densely strigose-hirsutulous, puberulent and resinous-glandular to gray-tomentose beneath; peduncles 4 to 6 per node, usually equaling or slightly surpassing the petioles, spreading, appressed-pubescent or strigose; spikes oblong, 4-12 mm. long; bractlets plainly 4-ranked, conduplicate-carinate, narrow-lanceolate, imbricate, connate at base, usually wide-spreading or reflexed at apex in fruit, acute, hirsute-tomentose, resinous-glandular, the margins and keel more densely white-villous, subequaling the corolla tube; corolla yellowish or white with a yellow "eye," the tube 3-6 mm. long, gray-strigose outside. *L. Berlandieri* Schauer, *Goniostachyum graveolens* (H.B.K.) Small. Dry and rocky hills, valleys, arroyos, chaparral and open desert scrub, Trans-Pecos, Rio Grande Plains and Valley, n.e. to Austin and Houston cos., Mar.-Dec.; also N.M., Mex. and C.A.

5. PHYLA LOUR. FROG-FRUIT

Perennial procumbent or creeping herbs, with trailing or ascending stems, sometimes somewhat woody at base or even shrubby, subglabrate or appressed-strigose with more or less cinereous malpighiaceus hairs; leaves opposite, variously dentate except at the base, flat or pinnately plicatulate above; inflorescence spicate, axillary; spikes cylindric, very densely many-flowered, usually greatly elongate in fruit, solitary or paired or ternate in the leaf axils, never aggregated into corymbs or panicles; flowers small, sessile, borne singly in the axils of small cuneate-obovate or flabelliform bractlets, not at all 4-ranked; otherwise with characters of *Lippia*.

A genus of about 10 species and 10 named forms and varieties, widely distributed in subtropical and tropical America; a few introduced in the warmer parts of the Old World.

- 1. Leaf blades mostly widest at or below the middle, toothed from below the middle to the apex (2)
- 1. Leaf blades mostly widest toward the apex and toothed only near the apex (4)
- 2(1). Leaf blades mostly oblong-lanceolate or oblong-ovate, mostly widest at or near the middle, not plicatulate, the teeth antrorsely appressed, extending below the widest part of the leaf 1. *P. lanceolata*.
- 2. Leaf blades mostly ovate or triangular-ovate to rhomboid, often plicatulate, widest below the middle, the teeth coarse and divergent, not extending below the widest part of the leaf (3)
- 3(2). Mature leaves mostly to 75 mm. long and 20 mm. wide 2. *P. strigulosa*.
- 3. Mature leaves mostly less than 15 mm. long and 10 mm. wide 2. *P. strigulosa* var. *sericea*.
- 4(1). Leaf blades with 1 to 4 pairs of remote salient teeth (5)
- 4. Leaf blades with numerous pairs of small mostly antrorse teeth (6)
- 5(4). Bractlets 2-3 mm. long, closely imbricate, acute, not conspicuously reflexed; peduncles 1.5 to 4 times as long as the subtending leaf during anthesis; heads 5-10 mm. thick, becoming elongate-cylindric or oblong in fruit; fruit obovoid 3. *P. incisa*.
- 5. Bractlets 5 mm. long, wide-spreading, the apex long-acuminate and finally reflexed; peduncles 0.7 to 1.5 times as long as the subtending leaf during anthesis; heads 7-12 mm. wide, usually not elongating in fruit; fruit oval 4. *P. cuneifolia*.

- 6(4). Leaves uniformly elongate, to 5.5 cm. long, 4-10 mm. wide 5. *P. nodiflora* var. *longifolia*.
6. Leaves mostly shorter, cuneate-spatulate to rhomboid, 1-3 cm. long (7)
- 7(6). Midrib and secondaries usually prominent beneath, often very conspicuous, often impressed above; blades often large and elliptic or rhomboid, coarsely toothed ... 5. *P. nodiflora* var. *reptans*.
7. Midrib and secondaries usually obscure or indiscernible on both surfaces; blades usually small and spatulate or cuneiform (8)
- 8(7). Plants usually densely matted, more or less densely strigose-canescens throughout; leaves mostly very small and cuneiform, usually thin-textured and few-toothed, sometimes entire or subentire 5. *P. nodiflora* var. *rosea*.
8. Plants usually creeping and wide-spreading, open in growth, often with ascending branches, usually green and only finely strigillose; leaves mostly larger, cuneate-spatulate or spatulate to obovate, thick-textured, usually more abundantly toothed (9)
- 9(8). Teeth on leaf blades mostly rather large, coarse and salient-spreading 3. *P. incisa*.
9. Teeth on leaf blades mostly small and appressed, usually forward-pointing 5. *P. nodiflora*.

1. *Phyla lanceolata* (Michx.) Greene. NORTHERN FROG-FRUIT. Stems procumbent or ascending, to 6 dm. long, simple or somewhat branched, often rooting at the nodes, glabrous or obscurely white-strigillose with closely appressed hairs; petioles 5-10 mm. long or obsolete, obscurely appressed-strigillose; leaf blades bright-green on both surfaces, oblong to oblong-lanceolate or ovate, 18-75 mm. long, 5-30 mm. wide, acute or subacute, sharply serrate to below the middle, widest at or below the middle, narrowed to the cuneate base, rather obscurely appressed-strigillose on both surfaces, venation flat but conspicuous above, rather prominent and very conspicuous beneath; inflorescence equaling or surpassing the leaves, peduncles 4-9 cm. long, rather sparsely and obscurely white-strigillose; heads at first globose, later cylindrical and elongating to 35 mm. and 5-7 mm. wide; bractlets obovate, closely imbricate, 3 mm. long, acute, appressed-strigillose; corolla pale-blue, purplish or white. *Lippia lanceolata* Michx. Moist soil of river bottoms, lake shores and coastal marshes, from Bowie to Jefferson cos. w. to Wise, Callahan and Bexar cos., n. to Hemphill and Hutchinson cos. in the Panhandle, and s.w. to Victoria and Matagorda cos., May-Oct.; also Ont. to Minn., N.J., Ill., Kan., Fla., Calif. and n. Mex.

2. *Phyla strigulosa* (Mart. & Gal.) Moldenke. DIAMOND-LEAF FROG-FRUIT, TURREHEMBRA, HIERBA BUENA MONTES. Procumbent, freely branched from the base; branches rooting at the nodes, to 2 m. long, often sulcate, often reddish to purplish toward the base, gray-strigillose with closely appressed antrorse hairs, the tips ascending or erect; petioles 1-5 mm. long, mostly winged, rather obscurely canescent-strigillose or glabrescent; leaf blades mostly broadly ovate or triangular-ovate to rhomboid or ovate-elliptic, mostly conspicuously widest below the middle, to 75 mm. long and 2 cm. wide, rounded or acute (in outline) at apex, abruptly acuminate at base and prolonged into the petiole, conspicuously and regularly coarse-dentate from apex to the widest part with sharply acute or apiculate broadly triangular rather divergent teeth (their margins often thick and involute), both surfaces rather densely but microscopically canescent-strigillose, often plicatulate, the larger venation white and very prominent beneath; peduncles 25-55 mm. long, deeply sulcate, densely canescent-strigillose or glabrescent; heads 4-8 cm. long, later elongating; bractlets ovate to obovate, 3 mm. long, 1.5 mm. wide, sharply acute or acuminate, densely canescent-strigose, strongly costate; corolla about 3 mm. long, white, sometimes lavender- or purple-tinged in age, limb 1.5 mm. wide. *Lippia strigulosa* Mart. & Gal., *P. yucatanana* Moldenke. Fields, woods, open ground, swamps, sandy streambanks and muddy hollows, Rio Grande Plains and Valley, Feb.-May; widespread from Mex. and Gr. Ant. through Virg. I., C.A. and S.A.—var. *sericea* (O. Ktze.) Moldenke differs in having the mature leaves to 15 mm. long and 1 cm. wide. Incl. var. *parviflora* (Moldenke) Moldenke. Rio Grande Plains and Valley, Feb.-May; also Mex., Bah. I., W.I., Trin. and Venez.

3. *Phyla incisa* Small. TEXAS FROG-FRUIT. Stems mostly prostrate, often swollen and rooting at the nodes, simple or branched, often purplish, appressed-strigillose; branches

decumbent to ascending or erect, abundantly appressed white-strigose; petioles usually obsolete or 1-3 mm. and winged; leaf blades often thick-textured, narrow-oblong or cuneiform to broadly obovate, very variable, 1-5 cm. long, 2-15 mm. wide, acute to obtuse or rounded (in outline) at apex, usually with only 1 to 4 pairs of coarse and saliently spreading teeth near the apex, cuneate from the middle or above the middle to the base, appressed-strigillose on both surfaces with small inconspicuous white hairs, secondary venation mostly obscure on both surfaces; inflorescence usually much-surpassing the subtending leaves; peduncles 2-9 cm. long, appressed-strigillose; heads at first globose, later cylindric and elongating to 3 cm., 5-10 mm. wide; bractlets obovate, 2-3 mm. long, closely imbricate, acute, abundantly white-strigillose; corolla white with yellow center, the tube 2-2.5 mm. long, limb 2 mm. wide. *Lippia incisa* (Small) Tidestr. Open ground, fields, pastures, clay or sandy flats, dry riverbanks and bottoms, damp shady woods and seashores, practically throughout Tex., Mar.-Nov.; also Colo., Okla. and Mo. to N.M., Ariz., s. Calif. and n. Mex.

4. *Phyla cuneifolia* (Torr.) Greene. WEDGE-LEAF FROG-FRUIT. Stems branching from a woody base, procumbent, often rooting at the nodes, to 1 m. long, sparsely appressed-strigillose with very short white hairs, somewhat zigzag, often with short erect branchlets at the nodes; leaves sessile, rigid, thick-textured, often with a fascicle of smaller ones in the axils, linear-oblongate or cuneiform, often canescent when young, 1-5.2 cm. long, 2-8 mm. wide, acute or subacute, with 2 to 8 very sharp and often salient teeth above the middle or rarely entire, gradually attenuate to the cuneate base, appressed-strigillose on both surfaces, secondary venation indiscernible on both surfaces; inflorescence shorter than or slightly surpassing the leaves; peduncles 8-50 mm. long, obscurely appressed-strigillose; heads at first globose, later cylindric and elongating to 2 cm., 8-12 mm. wide; bractlets conspicuous, obovate, 5 mm. long and 3 mm. wide, abruptly long-acuminate, at least the tip soon wide-spreading and finally reflexed, scarious on the upper margins, densely appressed-strigillose; corolla whitish or purplish, the tube 4-5 mm. long, limb 2-4.5 mm. wide. *Lippia cuneifolia* (Torr.) Steud. Plains and low prairies, frequent in Plains Country s. to Trans-Pecos, e. to Travis, Gonzales and Dallas cos., May-Sept.; also S.D., Neb. and Colo. to Ariz., s. Calif. and n. Mex.

5. *Phyla nodiflora* (L.) Greene. COMMON FROG-FRUIT, CAPE-WEED, TURKEY-TANGLE, MAT-GRASS, HERBA DE LA VIRGEN MARÍA. Stems prostrate, to 9 dm. long, mostly rooting at the nodes; branches procumbent or ascending, glabrate or puberulent to appressed-strigillose; petioles obsolete or 2-8 mm. long and cuneate-winged; leaf blades thick-textured, spatulate to oblanceolate or obovate, sometimes elliptic or cuneiform, 1-7.2 cm. long, 6-25 mm. wide, rounded or obtuse to subacute at apex, cuneate into the petiole, rather regularly sharply serrate above the middle with numerous appressed antrorse acute or acuminate teeth, glabrous or strigillose-puberulent on both surfaces, secondary venation practically indiscernible on both surfaces; peduncles usually much longer than the leaves, to 11.5 cm. long, appressed-puberulent or strigose with antrorse canescent hairs or glabrous; heads at first globose, cylindric in age and elongate to 25 mm., 6-9 mm. thick; bractlets closely imbricate, obovate or subrhomboid-cuneate, subequaling the corolla tube, often rather broadly membranous-margined toward the apex, mucronate-acuminate or muticous, glabrous or finely ciliate; corolla rose-purple or white, 2-2.5 mm. long, slightly surpassing the bractlets, slightly strigillose outside, limb exiguous. *Lippia nodiflora* (L.) Michx. Wet or moist soil, fields, clearings, hillsides, ditches, thickets and beaches, along the coast from Chambers to Cameron cos., inland to Kendall, Tom Green and Childress cos., May-Oct.; almost cosmopolitan in subtrop. and trop. regions of the Old World and New World; Pa. to Fla., Ky., Ark., La., Okla. and Calif.—var. *longifolia* Moldenke differs in having much more uniformly elongate leaves, the blades being oblanceolate-cuneate, to 55 mm. long and 4-10 mm. wide, and sharply spreading-dentate toward the apex; open sandy flats near the seacoast, Cameron Co.; also along the coasts of Mex., C.A. and w. S.A.—var. *reptans* (H.B.K.) Moldenke differs in usually being more densely strigose throughout and having the leaves thinner in texture, often rhomboid-elliptic, with the teeth usually more spreading and the larger venation firmer and more or less prominent beneath; low moist ground, shaded places, clearings, ditches, lawns and roadsides, from Presidio to Cameron and Chambers cos., n. to Dallas and Wichita cos., Feb.-Sept.; occurring sporadically almost throughout the range of the species.—var. *rosea* (D. Don) Moldenke (CARPET GRASS) differs in usually forming dense mats, more or less

densely and conspicuously canescent-strigose throughout, the leaves mostly very small, 5-28 mm. long and 2-9 mm. wide, cuneiform, usually thin-textured and few-toothed, sometimes entire or subentire; in dry sandy soil, lawns and roadsides, Harris Co., Jan.-Sept.; introd. from s. S.A., widely cult. in Calif. and elsewhere for lawns; escaped and naturalized in N.C., Fla., Tex., N.M., Ariz., Calif. and Mex.

6. ALOYSIA ORT. BEE-BRUSH

Usually sweet-aromatic shrubs; leaves opposite, simple, exstipulate, deciduous, the blades entire or toothed, not pinnatifid nor lobed; inflorescence centripetal, as axillary usually numerous slender mostly elongate loosely flowered spikes or racemes; flowers perfect, hypogynous, each subtended by a narrow inconspicuous or broader and conspicuous bractlet; calyx gamosepalous, tubular-campanulate, usually spreading-hirsute or -villous, not inflated at maturity, its tube angled, not flattened, the limb 4-lobed, lobes slender, subequal; corolla gamopetalous, zygomorphic, salverform, 2-lipped, the upper lip and the lobes of the lower lip subequal; stamens 4, didynamous, inserted at about the middle of the corolla tube, included; anthers 2-celled, unappendaged, the thecae parallel; pistil one, included; ovary 2-celled, each cell 1-ovulate; ovules erect; schizocarp small, dry, composed of 2 thin-walled cocci; seeds without endosperm.

A genus of about 41 species and 12 varieties in the southwestern part of the United States, Mexico and southern South America; one species introduced in the West Indies and widely cultivated elsewhere.

1. Leaf blades ovate or subrotund, many-toothed, densely tomentose beneath (2)
1. Leaf blades oblong to elliptic or obovate to obovate-oblong, entire or few-toothed, densely puberulent or strigillose beneath (3)
- 2(1). Leaf blades comparatively large, to 30 mm. long and 4-21 mm. wide, always ovate; spikes 5-16 cm. long, loosely flowered; twigs and petioles densely spreading-hirsutulous 1. *A. macrostachya*.
2. Leaf blades very small, 2-15 mm. long, 2-13 mm. wide, ovate or subrotund; spikes 1-4 cm. long, densely flowered; twigs and petioles densely appressed-puberulent 2. *A. Wrightii*.
- 3(1). Leaf blades narrowly oblong or elliptic, appressed-puberulent beneath 3. *A. gratissima*.
3. Leaf blades more broadly elliptic to obovate or oblong-elliptic, the larger ones usually 2- to 8-toothed, densely strigillose beneath and short-hispidulous along the venation 3. *A. gratissima* var. *Schulzae*.

1. *Aloysia macrostachya* (Torr.) Moldenke. WOOLLY BEE-BRUSH, VARA DULCE, CABRADOR CIMARRONA, ANGELITOS. Erect shrub to 2 m. tall; branches numerous, slender, erect, brittle, young parts densely hirsutulous with white hairs borne at right angles to the twigs, glandular; petioles 2-5 cm. long, densely white-hirsute; leaf blades ovate, 7-30 mm. long, 4-21 mm. wide, rounded, regularly crenate from widest part to apex with rather large rounded teeth, truncate or subtruncate at base, sub-bullate and densely strigose-hirsutulous with bulbous-based hairs above, scabrellous, densely white-tomentose beneath, resinous-glandular on both surfaces, larger venation usually impressed above and prominent through the tomentum beneath; inflorescence far-surpassing the leaves; spikes 5-12 cm. long, erect or ascending, loosely many-flowered; peduncles 1-3.5 cm. long, very densely white-hirsutulous, often with gland-tipped hairs; rachis densely white-hirsutulous; bractlets lanceolate, 2-3 mm. long, long-acuminate, densely hirsutulous; corolla pink to red or lavender, the tube 4-5 mm. long, limb 4 mm. wide. *Lippia macrostachya* (Torr.) Wats. In sand and scrub on gravel and limestone hills, Rio Grande Plains, Jan.-Oct.; also n. Mex.

2. *Aloysia Wrightii* (Gray) Heller. OREGANILLO. Aromatic branching shrub to 15 dm. tall; stems slender, brittle, the wood bright-yellow, bark thin and membranous, readily peeling off in long filamentous strips, young parts densely grayish-puberulent, the angles plainly deciduous-margined; petioles 1-4 mm. long or obsolete, densely appressed-puberulent with grayish or yellowish hairs; leaf blades usually very small, ovate or subrotund, 2-15 (rarely to 30) mm. long, 2-17 mm. wide, rounded, regularly crenulate

or crenate-serrate from apex almost to base with small rounded teeth, acute or obtuse to rounded or truncate at base, sub-bullate and strigillose-scabrous above, very densely tomentellous beneath with short appressed grayish or yellowish hairs and resinous-glandular, venation usually deeply impressed above and hidden by the tomentum beneath; inflorescence surpassing the leaves; spikes 1-4 cm. long, very densely many-flowered, the flowers closely crowded; peduncles subfiliform, 1-10 mm. long, usually much-abbreviated, densely puberulent; rachis subfiliform, densely puberulent; bractlets lanceolate, 1.5-2 mm. long, long-acuminate, densely puberulent; corolla white, 2.5 mm. long, puberulent outside, limb 2 mm. wide. *Lippia Wrightii* Gray. Rocky slopes, banks, ledges, arroyos, gullies, canyons, limestone hills, mesa slopes and desert scrub, frequent in Trans-Pecos, s. to Starr Co., n. to Tom Green Co., June-Oct.; also Nev., N.M., Ariz., s.e. Calif. and n. Mex.

3. *Aloysia gratissima* (Gill. & Hook.) Troncoso. COMMON BEE-BRUSH, WHITE BUSH, WHITE BRUSH, PALO AMARILLO, CEDRÓN, POLEO, CEDRÓN DEL MONTE, NIÑARUPÁ, RESEDA DEL CAMPO, ANGEL, FAVORITA, JAZMINILLO, OREGANILLO, ROMERILLO, VARA-DULCE, HIERBA DE LA PRINCESA. Slender shrub to 3 m. tall, much-branched; branches gray, stiff, grayish pulverulent-puberulent, often spinescent at the tips, the wood yellow; leaves often with fascicles of smaller ones in the axils; petioles 1-3 mm. long or obsolete; leaf blades narrow-oblong or elliptic to lanceolate-oblong, 3-27 mm. long, 2-8 mm. wide, obtuse or acute, sometimes mucronulate or emarginate, entire, attenuate into the petiole, minutely strigillose and scabrellose-pustulate above, very densely puberulent-pulverulent and resinous-punctate beneath, incanous, only the midrib usually prominent beneath; inflorescence greatly surpassing the leaves, erect or ascending, 2-7 cm. long, rather densely many-flowered; peduncles 5-15 mm. long, densely short-pubescent or puberulent; rachis densely short-pubescent; bractlets very small, lanceolate, 1-1.5 mm. long, acuminate, caducous, densely puberulent; flowers with strong vanilla odor; corolla white or tinged with violet, the tube 3.5 mm. long, glabrous outside, limb 3 mm. wide, loosely villous in the throat. *A. lycioides* Cham., *A. ligustrina* of auth., *Lippia lycioides* (Cham.) Steud., *L. ligustrina* of auth. Rock outcrops, desert grasslands, low places, rocky creek-beds, dry washes, woods, hillsides and rocky bluffs, practically throughout Tex. except the Plains Country, Mar.-Nov.; also N.M., Mex. and s. S.A.—var. *Schulzæ* (Standl.) Moldenke (BEE-BLOSSOM) differs in having broader leaf blades that are elliptic or obovate to oblong-elliptic, 5-18 mm. long, 3-7 mm. wide, obtuse or acute at apex and base, entire or the larger ones with 1 to 4 rather large and salient teeth on each side, tuberculate and strigillose or scabrous above, densely strigillose-pubescent beneath with longer more distinct hairs, often hispidulous on the larger venation with short ascending rather rigid hairs, usually revolute-margined, the midrib and secondaries usually impressed above on mature leaves; sandy soil, gravelly hillsides, chaparral thickets, arroyos and limestone bluffs, from Trans-Pecos to Cameron and Houston cos., Mar.-Nov. *A. ligustrina* var. *Schulzii* (Standl.) Moldenke, *Lippia ligustrina* var. *Schulzii* Standl.

7. BOUCHEA CHAM.

Annual or perennial herbs or low shrubs, densely pubescent or glabrous; leaves opposite or ternate, usually petiolate, sometimes sessile; blades usually serrate to serrate-crenate, rarely incised, dissected or entire; inflorescence centripetal, usually racemiform, rarely spicate, terminal (seldom axillary), elongate, loosely to densely many-flowered, bracteolate; flowers solitary in the axils of the bractlets, usually large and showy, usually pedicellate; bractlets subulate or lanceolate, sometimes enlarged and leaflike; calyx persistent, tubular, gamosepalous, 5-ribbed, the ribs terminating in 5 more or less unequal teeth; corolla gamopetalous, funnel- or salverform, zygomorphic, the tube cylindric, straight and erect or curvate, the limb oblique, spreading, unequally 5-lobed, the 2 posterior lobes shorter than the 3 anterior ones; stamens 4, didynamous, included, the posterior pair inserted at about the middle of the corolla tube and the anterior pair inserted somewhat above the middle; filaments short; anthers ovate to subcordate, 2-celled; pistil single, compound; style filiform; stigma 2-lobed, the anterior lobe club-shaped, the posterior lobe toothlike, on a level with the anterior pair of stamens; ovary 2-celled, oblong, each cell 1-ovulate; fruit dry, schizocarpous, linear, beaked, included by the mature calyx or exserted, separating into 2 cocci at maturity; cocci completely separate or coherent at

the base, the dorsal surface more or less reticulately ridged, the commissural surface plane, furrowed or ridged, sometimes a little roughened.

A genus of about 16 species and 6 named varieties, ranging from the southern United States and the Bahamas, through the West Indies, Mexico, and Central America to southern South America.

- 1. Leaves distinctly petiolate, coarsely serrate 1. *B. prismatica* var. *brevirostra*.
- 1. Leaves sessile, entire (2)
- 2(1). Leaves linear to narrow-lanceolate, thin, smooth ... 3. *B. linifolia*.
- 2. Leaves spatulate, thick, densely short-pubescent or rugose 2. *B. spathulata*.

1. *Bouchea prismatica* O. Ktze. var. *brevirostra* Grenz. Erect or sprawling herb, to 4 dm. tall; branches often numerous, ascending, medullose, minutely puberulent throughout, often more densely so and canescent on younger parts; leaves opposite, often with several smaller ones in the axils; petioles 11-25 mm. long, short-pubescent or puberulent; leaf blades mostly elliptic, 1-4 cm. long, 8-30 mm. wide, often falcate, obtuse or rounded, coarsely but regularly serrate with rather broad teeth to below the middle, acute or obtuse at base, rather densely short-pubescent on both surfaces when young, becoming more sparsely so or glabrate in age, larger venation plainly visible; spikes terminating stems and short axillary branches that often far surpass the terminal one, erect, 5-15 cm. long, to 1 cm. wide in anthesis, many-flowered; peduncles short, puberulent; rachis often slightly flexuous, minutely puberulent; flowers somewhat divaricate in anthesis, closely appressed to the rachis in bud and fruit, overlapping; bractlets lanceolate-subulate, 4-6 mm. long, puberulent; pedicels 1 mm. long or less; calyx narrow-tubular, slightly curved, thin-textured, 5-7.5 mm. long, 1.25 mm. wide, very minutely appressed-puberulent, slightly plicate, translucent between the 5 ribs, the rim unequally 5-mucronulate; corolla salverform, pink or rose to lavender, purple or blue, the tube 8.5-10 mm. long, 1.2 mm. wide, glabrous, lobes 1-2.5 mm. long. Fields, clearings, waste places and roadsides, Val Verde Co., Mar.-Nov.; also Ariz., Less. Ant. and Mex. to Col.

2. *Bouchea spathulata* Torr. SPOON-LEAF. Densely branching low shrub, to 6 dm. tall; branches rather stout, subterete, densely pubescent, internodes extremely abbreviated; leaves opposite or ternate, usually densely clustered with 2 or 3 in a cluster and the clusters whorled, sessile or subsessile, fleshy, usually uniformly colored on both surfaces, spatulate, 5-25 mm. long, 2-6 mm. wide, rounded to an acute or obtuse apex, entire, long-attenuate at the base, short-pubescent on both surfaces, often decidedly rugose and nigrescent in drying; spikes 4.5-10 cm. long, 1.5-2 cm. wide, very densely many-flowered, conspicuously bracteate; flowers and fruit ternate, closely overlapping, somewhat divaricate; peduncles none; bracts spatulate, foliaceous, very abundant and conspicuous, 6-10 mm. long, 2-4 mm. wide, lightly pubescent or puberulent; calyx 8-14 mm. long, 2-2.5 mm. wide, very thin-textured between the 5 ribs, scabrous-pubescent, the upper part and lobes usually bright-purple during and after anthesis, rim unequally 5-toothed; corolla large, salverform, lavender, the tube 17-19 mm. long, glabrous, lobes 5 mm. long. Canyons, dry rocky ridges and mt. sides, Brewster Co., June-Oct.; also n. Mex.

3. *Bouchea linifolia* Gray. Low and shrubby, less than 1 m. tall; branches slender, very numerous, erect, conspicuously ridged, glabrate; leaves opposite, numerous, sessile, linear to narrow-lanceolate, 7-44 mm. long, 1.5-4 mm. wide, acute and submucronate, entire, often revolute in drying, narrowed to base, glabrate on both surfaces; spikes 5-12 cm. long, 7-15 mm. wide (or wider during full anthesis), erect, loosely flowered; peduncles very short or obsolete; rachis slender, ridged, glabrate, occasionally purplish at apex; flowers spreading during anthesis, closely appressed to the rachis in bud and fruit; bractlets setaceous-subulate, 1-2 mm. long, usually with 2 smaller ones in the axils; pedicels often subobsolete in anthesis, to 2 mm. long in fruit; calyx slightly curved, 10-13 mm. long, often purplish, glabrous, the rim unequally 5- or 6-toothed; corolla large, lavender, salverform, the tube almost sigmoid, 15 mm. long, glabrous, lobes 6-7 mm. long. Dry calcareous hillside and shrub-covered valleys, from Presidio to Sutton and Uvalde cos., July-Oct.; also N.M.(?) and Coah.

8. PRIVA ADANS.

A genus of about 21 species and 4 named varieties of tropical and subtropical Asia, Asia Minor, Africa and America.

1. *Priva lappulacea* (L.) Pers. COMMON VELVET-BUR, CADILLO DE BOLSA, BUR-VERVAIN, CAT'S-TONGUE, PEGAJOSA, GLOBITO, MOZOTE DE GALLINA, MOZOTE DE POLLO, COLA DE ALACRÁN. Perennial to 1 m. tall, usually lower; stems and branches often prostrate or ascending, pilose with curved or uncinete hairs, in age glabrescent below; petioles 8-30 mm. long, scattered whitish-pilose; leaf blades very thin, ovate, 1.4-14.5 cm. long, 9-85 mm. wide, acute or acuminate, rather uniformly and coarsely serrate (except at base and on terminal acumination) with acute or blunt appressed teeth, mostly subtruncate or subcordate at base (or acute when young) and short-cuneate into the petiole, pilose or strigose above with scattered whitish bulbous-based hairs, scattered-pilose and puberulent beneath, venation inconspicuous; inflorescence 4.5-21 cm. long, 5-15 mm. wide, many-flowered, flowers loosely alternate on a puberulent-pilose rachis; peduncles 8-58 mm. long, puberulent-pilose; bractlets usually surpassing the pedicels; calyx oblong-campanulate, 2-3.1 mm. long, 2.3 mm. wide, densely short-tomentose with short uncinete hairs and with scattered longer straight hairs, minutely 5-apiculate; corolla blue to pink, lavender, purple or white, the tube 3.6 mm. long, lobes broadly elliptic, rounded; pistil compound; fruiting calyx inflated, short-beaked, densely uncinete-hispidulous; cocci glabrous, dorsal surface with 2 parallel rows of straight short spines. Fields, thickets, resacas and roadsides, Cameron Co., throughout year; a cosmopolitan weed in the trop. and subtrop. of the New World; naturalized in Java.

9. CITHAREXYLUM B. JUSS.

FIDDLEWOOD

Shrubs (ours), trees in tropics; branches and branchlets tetragonal, sometimes spiny; leaf scars mostly large, corky and elevated; leaves opposite or whorled, deciduous, exstipulate, entire or dentate, usually bearing a pair of prominent glands at base of blade; inflorescence centripetal, spicate or racemiform, axillary and terminal, mostly elongate and many-flowered, rarely reduced to only a few flowers, erect or nutant, mostly simple, occasionally sparsely branched; flowers small, each subtended by a tiny inconspicuous bractlet; calyx tubular or cyathiform, thin, accrescent, its rim truncate or 5-toothed or -lobed; corolla funnel- or salverform, mostly yellow or white, its tube narrow-cylindric, regular, the limb spreading, 5-parted, with broad slightly irregular lobes, the 2 hindermost outermost in prefloration, mostly more or less pubescent in the throat; stamens 4, didynamous, inserted at or above the middle of the corolla tube, included, a fifth one represented by a very rudimentary staminode; filaments very short; anthers ovate or sagittate, introrse, erect, with 2 parallel thecae opening by longitudinal slits and a thickened connective that often surpasses the thecae in length; style terminal, included, often thickened toward the apex; stigma very shortly bifid; ovary perfectly or imperfectly 4-celled, composed of 2 carpels, each cell with 1 lateral anatropous ovule; fruiting calyx conspicuously enlarged, indurated, cupuliform or patelliform, shorter than the fruit; fruit drupaceous, with juicy exocarp and hard endocarp, with two 2-celled and 2-seeded pyrenes that are often separated by a median fissure.

A genus of about 109 living species, 18 named varieties, 3 hybrids and 4 fossil representatives, from Bermuda and southern United States through the West Indies, Mexico, and Central America to Uruguay and Argentina; several are extensively cultivated.

1. Leaves large, lanceolate to broadly elliptic or ovate to oblong or rhomboid, to 72 mm. long and 45 mm. wide, petiolate 1. *C. Berlandieri*.
1. Leaves small, oblanceolate or spatulate, 2-15 mm. long, 1-4 mm. wide, sessile (2)
- 2(1). Leaves densely short-pubescent 2. *C. brachyanthum*.
2. Leaves glabrous 3. *C. spathulatum*.

1. *Citharexylum Berlandieri* Robins. NEGRITO, ORCAJUELA, ENCORBA GALLINA. Shrub or tree to 6 m. tall; branches heavy, gray, subterete, glabrous, often gnarled; branchlets

more slender, tetragonal, gray-puberulent or glabrate, youngest parts densely short-pubescent or brownish-velutinous; petioles 1-10 mm. long, short-pubescent; leaf blades often firm, lanceolate or oblong to elliptic or ovate, sometimes rhomboid, 14-72 mm. long, 7-45 mm. wide, blunt or acute, entire or with 2 or 3 coarse blunt lobelike teeth near apex, rounded or acute to short-attenuate at base, not glanduliferous, softly short-pubescent above (sometimes only on the larger venation), densely velutinous beneath; racemes 1-8 cm. long, 1-2 cm. wide, densely many-flowered, the terminal one often accompanied by a pair of axillary ones from the uppermost axils; peduncles and rachis densely villous; pedicels to 1 mm. long; calyx 3-4 mm. long, 2-2.5 mm. wide, densely short-pubescent, shortly 5-toothed, ciliolate; corolla white or cream, the tube equaling the calyx, limb 4 mm. wide; fruit red, blackening in drying, 4-5 mm. long and wide, very shiny. Thickets, flats, hillsides and semi-desert roadsides, Hidalgo to Willacy and Cameron cos., Feb.-Aug.; also n. Mex.

2. *Citharexylum brachyanthum* (Gray) Gray. BOXTHORN FIDDLEWOOD, CHILE DE PÁJARO. Shrub to 25 dm. tall, intricately branched, irregular; branches obtusely tetragonal, the angles margined with white or gray corky ridges, glabrous, youngest parts densely short-pubescent, the wood yellow; internodes much-abbreviated; leaves opposite on young shoots, clustered on very short opposite spurlike branchlets on older wood, sessile, oblanceolate or spatulate, often curled in drying, 2-15 mm. long, 1-4 mm. wide, rounded or subacute, entire, cuneate at base, not glanduliferous, densely gray-pubescent on both surfaces; racemes terminating extremely short spurlike branchlets, reduced to 1 or 2 flowers, often borne in pairs at every node of the wood of 1, 2 or even 3 years back; pedicels about 1 mm. long, gray-pubescent; corolla white; fruit pinkish-white when young, red or orange-red when ripe, 5 mm. long and wide, shiny. Mts., plains and dry valley floors, Webb and Zapata cos., June-Sept.; also n. Mex.

3. *Citharexylum spatulatum* Moldenke & Lundell. MISSION FIDDLEWOOD. Slender shrub to 18 dm. tall, diffusely branched; branches long, slender, flexible, glabrous, youngest parts short-hirtellous at the nodes; leaves opposite on young shoots, clustered on short spurlike branchlets on older wood, sessile, spatulate, 8-25 mm. long, 2.5-5 mm. wide, usually rounded, sometimes shallowly emarginate to subacute or apiculate, entire, attenuate at base, glabrous or with a few short stiff hairs at apex; flowers 1 or 2 terminating the spurlike branchlets; pedicels very short, densely white-hirtellous; corolla white, 6 mm. long, lobes rounded, ciliate; fruit orange-red, 6-7 mm. long and wide. *C. brachyanthum* var. *glabrum* Hitchc. & Moldenke. Chaparral, Hidalgo and Starr cos., Apr.-June; endemic.

10. DURANTA L. GOLDEN-DEWDROP

A genus of 34 living species, 14 named varieties, and 1 known fossil representative, of tropical and subtropical America.

1. Corolla purple or lavender to lilac or blue 1. *D. repens*.
 1. Corolla white 1. *D. repens* var. *alba*.

1. *Duranta repens* L. ADONIS MORADO, CELOSA CIMARRONA, CORALILLO, ROSADO, CUENTA DE ORO, ESPINA DE PALOMA, FRUTA DE IGUANA, GARBANCILLO, HELIOTROPIO MORADO, PIGEONBERRY, VARITA DE SAN JOSÉ, YELLOW-HAT-TREE. Extremely variable and polymorphic shrub or small tree, to 6 m. tall; branches slender, often drooping or trailing, unarmed or spiny; leaves numerous, ovate-elliptic or oval to obovate, 1.5-5 cm. long, obtuse to acuminate or apiculate, entire or serrate above the middle, cuneate into a short petiole, glabrate on both surfaces; racemes terminal and axillary, 5-15 cm. long, loosely many-flowered, erect or usually recurved, often paniculate; bractlets minute, occasionally subfoliaceous; pedicels 1-5 mm. long; calyx tubular, 3-4 mm. long, angled, its teeth triangular, subulate, shorter than the tube; corolla blue or lilac to lavender or purple, the tube surpassing the calyx, limb 7-9 mm. wide; fruit yellow, globular, 7-11 mm. long and wide, completely enclosed by the accrescent yellowish mature calyx that is extended into a curved beak. *D. erecta* L., *D. Plumieri* Jacq. Widely cult., tending to escape in Rio Grande Plains and Valley; introd. from W.I.; widespread throughout subtrop. and trop. Am., also introd. in Old World tropics.—var. *alba* (Mast.) Bailey differs in its white corollas; cult., Rio Grande Plains and Valley; nat. to W.I.

11. CALLICARPA L. BEAUTYBERRY

A complex genus of 147 species, 54 named forms and varieties, and 1 known hybrid, widely distributed in subtropical and tropical America, Asia and Oceanica, a few species extending into temperate portions of Asia and the southeastern United States; 1 in Madagascar; several are widely cultivated and tend to escape.

1. Fruit blue or pink to lilac, violet or purple 1. *C. americana*.
 1. Fruit white 1. *C. americana* var. *lactea*.

1. *Callicarpa americana* L. AMERICAN BEAUTYBERRY, FRENCH-MULBERRY, BERMUDA-MULBERRY, SOUR-BUSH, BUNCHBERRY, FILIGRANA, FILIGRANA DE MAZORCA, FILIGRANA DE PIÑAR, FOXBERRY, PURPLE BEAUTYBERRY, SPANISH-MULBERRY, TURKEYBERRY. Bush or shrub to 3 m. tall, usually much-branched; branches densely stellate-scurfy; leaves opposite or ternate; petioles to 38 mm. long, stellate-scurfy; leaf blades very thin, ovate to elliptic, 8-23 cm. long, 3.5-13 cm. wide, acute or acuminate, coarsely serrate or crenate-dentate except at base and apex, cuneately narrowed into the petiole, stellate-scurfy with whitish tomentum (especially beneath and when immature); cymes 1-3.5 cm. long and wide, many-flowered, usually shorter than the petiole, many times dichotomous; peduncles 3-10 mm. long, stellate-scurfy or glabrate; pedicels 0.4-1.2 mm. long, scurfy or glabrate; bractlets subulate or setaceous; calyx obconic or campanulate, 1.6-1.8 mm. long, 1-1.5 mm. wide, slightly puberulent-granulose, rim subtruncate, very shortly apiculate; corolla small, bluish, pinkish, reddish or white, funnelliform, the tube 2.6-2.9 mm. long, lobes about 1.5 mm. long and 1 mm. wide; fruit showy, rose-pink or lilac to violet or red-purple, globose, 3-6 mm. long and wide. Woods, moist thickets, wet slopes, low rich bottomlands, fencerows and the edges of swamps, from Bowie and Grayson to Orange, Jefferson and Goliad cos. w. to Bexar, Kendall and Tarrant cos., June-Dec.; also Md. to Fla. and La., Berm., Cuba and Coah.; also widely cult.—var *lactea* F. J. Mull. differs in having the mature fruit white; sandy open woods, e. Tex.; also N.C. to Fla. and Ark.; sometimes cult.

12. VITEX L. CHASTE-TREE

Trees or shrubs, rarely scandent; leaves opposite, palmately compound, 3- to 7-foliolate (rarely 1-foliolate); leaflets sessile or petiolulate, entire or dentate to incised or lobed; inflorescence determinate, cymose, the cymes short and dense or loosely divaricate, sessile or pedunculate in the leaf axils or aggregate in terminal racemiform or thyrsoid or laxly diffuse panicles, more rarely contracted into heads; flowers perfect, more or less zygomorphic; bractlets usually very small, mostly linear, sometimes surpassing the calyx; calyx campanulate or rarely tubular-infundibular, 5-dentate or -fid, rarely 3-fid, the teeth mostly slightly unequal; corolla white, blue, violet or yellowish, salverform or funnelliform, its tube short or rarely elongate, cylindrical, straight or slightly incurved, equal in diameter throughout or slightly ampliate above, the limb oblique, spreading, sub-bilabiate, the upper lip bifid, the lower lip trifid, the 2 posterior lobes exterior and usually shorter; stamens 4, didynamous, inserted in the corolla tube, often exerted; anthers 2-celled, thecae distinct, subparallel or divergent to arcuate, attached near the apex, dehiscing by longitudinal slits; pistil single, compound, bicarpellary; style terminal, filiform, shortly bifid at apex, branches acute; ovary at first imperfectly 2-celled, later usually 4-celled, cells 1-ovulate; ovules attached laterally at or above the middle of the cell; fruiting calyx often accrescent, usually patelliform or very shallowly cupuliform, rarely subincluding the fruit; fruit drupaceous, more or less fleshy, the endocarp hard, 4-celled; seeds without endosperm.

A genus of about 263 living species, 108 named forms and varieties, and 3 known fossil representatives, mostly of the tropics and subtropics of both the Old and New Worlds; a few also in the temperate portions of Europe and Asia; widely cultivated and naturalized elsewhere.

1. Leaflets mostly 5 to 9, usually entire or undulate-subrepand; cymules usually practically sessile, mostly not conspicuously branched (2)
 1. Leaflets 3 or 5, more or less irregularly dentate, serrate, incised or pinnatisect; cymules distinctly stipitate and conspicuously branched (4)

- 2(1). Corolla white 1. *V. Agnus-castus* f. *alba*.
- 2. Corolla not white (3)
- 3(2). Corolla lavender or lilac 1. *V. Agnus-castus*.
- 3. Corolla blue 1. *V. Agnus-castus* var. *caerulea*.
- 4(1). Leaflets more or less irregularly dentate or serrate with sparse teeth, not incised nor pinnatisect 2. *V. Negundo* var. *intermedia*.
- 4. Leaflets deeply and irregularly incised or pinnatisect . . 2. *V. Negundo* var. *heterophylla*.

1. *Vitex Agnus-castus* L. COMMON CHASTE-TREE, INDIAN-SPICE, HEMP-TREE, MONK'S-PEPPER-TREE, WILD-PEPPER, ABRAHAM'S BALM, CHASTE LAMB-TREE, SAGE-TREE. Shrub or low tree to 5 m. tall; branches densely short-puberulent, resinous-punctate; leaves 5- to 9- (rarely 3-) foliolate; petioles to 75 mm. long, densely puberulent and resinous; leaflets unequal, only the 3 largest ones petiolulate, elliptic, to 11.5 cm. long and 2 cm. wide, attenuate or acuminate at both ends, pulverulent or glabrate above, densely white-puberulent or tomentellous beneath, entire or undulate-subrepand; inflorescence pyramidal-paniculate, terminal and axillary or supra-axillary, to 31 cm. long and 33 mm. wide; cymules numerous, paired, many-flowered, sessile or subsessile; peduncles and rachis densely white-puberulent and resinous-granular, the former 1.5-8 cm. long; pedicels to 1 mm. long; bractlets 1-4 mm. long, linear-setaceous; calyx broadly campanulate, 2-2.5 mm. long, densely white-puberulent, rim shortly 5-toothed; corolla lavender or lilac, the tube 6-7 mm. long, densely white-puberulent above the calyx outside, limb to 13 mm. wide. Widely cult., escaped in every part of Tex. except Trans-Pecos and Plains Country, Apr.-Oct.; introd. from s. Eu. and Orient; very widely cult.; naturalized in various parts of s. U.S.—f. *alba* (West.) Rehd. differs in having white corollas; escaped in n.e. and cen. Tex.—var. *caerulea* Rehd. differs in its blue corollas; escaped in Dallas Co.

2. *Vitex Negundo* L. var. *intermedia* (P'ei) Moldenke. Shrub or tree to 4 m. tall; branches rather densely short-pubescent or puberulent; leaves 3- or 5-foliolate; petioles to 6 cm. long, densely puberulent; leaflets subequal or the 2 lowermost somewhat smaller, all petiolulate, oblong or elliptic to lanceolate, to 11 cm. long and 4 cm. wide, acutely attenuate or subacuminate, irregularly dentate or serrate with sparse scattered teeth, acute or short-acuminate at base, minutely puberulent or glabrous above, appressed-puberulent beneath, often obscurely so in age; inflorescence paniculate, simple or widely branched and thyrsoid, to 42 cm. long and 15 cm. wide, composed of numerous pairs of opposite distinctly stipitate cymes, canescent throughout; bractlets linear, numerous, 2-8 mm. long; peduncles and rachis brown, densely white-puberulent, the former 4.5-7 cm. long; calyx broadly campanulate, 2-3 mm. long, densely white-puberulent, rim 5-toothed with long-apiculate teeth; corolla violet or purple to bluish, the tube 3 mm. long, limb to 7 mm. wide. Sometimes cult., escaped in s. and s.e. Tex.; introd. from China; cult. in many parts of the Old and New Worlds.—var. *heterophylla* (Franch.) Rehd. differs in its usually much smaller leaflets (mostly 2-7 cm. long) that are deeply and very irregularly incised or pinnatisect, the sinuses extending half way to the midrib. Incl. var. *incisa* (Lam.) Clarke. Introd. from China, often cult.; escaped in Brazos Co.

13. CLERODENDRUM BURM.

GLORY-BOWER

Trees, shrubs or woody vines, usually unarmed or rarely with petiole base spinescent; leaves simple, opposite or whorled, deciduous, exstipulate; inflorescence determinate, cymose; cymes mostly rather loose-flowered, more rarely dense, pedunculate in upper leaf axils or paniculate at apex of branchlets, sometimes densely aggregate in terminal corymbs or heads; flowers rather zygomorphic, often large and showy, mostly white, blue, violet or red; calyx often the same color as the corolla or contrastingly red, white or green, campanulate or tubular, truncate to 5-toothed or -fid, often accrescent, subtending the fruit in patelliform fashion or enclosing it; corolla salverform, gamopetalous, its tube

narrow-cylindric, straight or incurved, sometimes ampliate above, often very elongate, more rarely only slightly surpassing the calyx, the limb spreading or subreflexed, 5-parted, lobes subequal or the 2 posterior and exterior ones slightly shorter; stamens 4, didynamous, inserted in the corolla tube, long-exserted, involute in bud, alternate with the corolla lobes; anthers ovate or oblong, 2-celled, with parallel thecae, opening by longitudinal slits; pistil compound, 2-carpellary; style terminal, elongate, shortly and acutely 2-fid at apex; ovary imperfectly 4-celled, each cell 1-ovulate; ovules high-lateral, hemianatropous; fruit drupaceous, globose or obovoid, often 4-sulcate or almost 4-lobed, the exocarp rather fleshy, the endocarp bony, separating into 4 pyrenes or these sometimes cohering in pairs; seeds oblong, without endosperm.

A large and complex genus of about 409 living species, 148 named forms and varieties, and 3 fossil representatives, of tropical and subtropical regions, most abundant in Asia and Africa, poorly represented in America except in cultivation and by naturalization; a few species extending into the temperate zones.

1. Leaves always opposite, deltoid-ovate, very broad, cordate at base, coarsely serrate; corolla short, its tube 2-2.5 cm. long, red or purple . . . 1. *C. Bungei*.
1. Leaves mostly approximate or whorled, narrowly oblanceolate to oblong or elliptic, acute at base; corolla long, its tube 10-14 cm. long, white or yellow 2. *C. indicum*.

1. *Clerodendrum Bungei* Steud. ROSE GLORY-BOWER, BROCAMELIA, CAMELIA AMERICANA, FLOR DE LA ROSA MUERTE, HORTENSIA, VOLCANA. Shrub or tree to 2 m. tall; branches rather stout, shiny, the young parts sparsely pilose-puberulent, soon glabrescent, with numerous whitish elevated lenticels; leaves opposite, strong-scented; petioles stout, to 16.5 cm. long, minutely puberulent or glabrate, usually collapsing at base in drying; leaf blades deltoid-ovate, 6.5-23 cm. long, 4.5-23 cm. wide, acute or short-acuminate, uniformly serrate with broadly triangular apiculate teeth, subtruncate or cordate at base, often slightly short-cuneate into the petiole, pulverulent and scattered-strigillose on both surfaces, becoming almost glabrous, usually with some discoid glands at base beneath; inflorescence terminal, rarely also supra-axillary, paniculate, 6-11 cm. long and slightly wider, densely many-flowered, puberulent throughout; peduncles obsolete or to 1 dm. long; pedicels 1-4 mm. long, densely puberulent; bracts often large and leaflike; bractlets linear-setaceous, 1-3 mm. long, puberulent; calyx campanulate, 3-6 mm. long, minutely puberulent and granular-lepidote, rim with 5 long-acuminate teeth; corolla rose or red to purplish, its tube 2-2.5 cm. long, limb 1-1.4 cm. wide. *C. foetidum* Bunge. Cult. and escaped in Harris Co.: nat. to China and n. India; widely cult. in many parts of the world, naturalized in the Gulf States, P.R., Mex. and S.A.

2. *Clerodendrum indicum* (L.) O. Ktze. TURK'S-TURBAN, TURK'S HEAD, BEADFLOWER, TUBEFLOWER. Virgate shrub or low tree to 2 m. tall; branches very stout, hollow, subglabrous, the larger ones 8- to 10-sulcate; leaves approximate, opposite or whorled in threes to sixes; petioles 4-8 mm. long, glabrous, often striate; leaf blades oblong or elliptic to oblanceolate, 8.5-23 cm. long, 23-55 mm. wide, acute or acuminate, entire, acute at base, glabrous on both surfaces, sparsely punctate beneath; inflorescence axillary and terminal, abundant; cymes usually supra-axillary, 4-6 cm. long, few-flowered, lax, widely divaricate; terminal panicle thyrsoid, to 45 cm. long or longer and 25 cm. wide, very showy, composed of 3 to 12 whorls of cymes, glabrous; bractlets broadly linear, very numerous, 5-15 mm. long, 2-3 mm. wide, glabrous; calyx very broadly campanulate, thick, its tube 5-7 mm. long, the rim deeply 5-lobed, lobes wide-spreading, ovate, 6-10 mm. long and almost as wide, acute or subacute, glabrous; corolla white to yellow, very large, the slender tube 10-14 cm. long, glabrous, limb 1.5-2 cm. wide. *Siphonanthus indica* L. In cult. and tending to escape in Harris Co.; introd. from India and Burma; widely cult. in many parts of the world; naturalized in the Gulf States, W.I. and n. S.A.

14. TETRACLEA GRAY

Low erect annual or perennial herbs or subshrubs, woody at base; leaves simple, opposite, deciduous, oblong or ovate, dentate or entire, those in the inflorescence similar but smaller; inflorescence axillary, determinate, cymose, pedunculate, mostly 1- to 3-

flowered; flowers short-pedicellate; calyx broadly campanulate, 8- or 10-veined, deeply 4- or 5-parted, persistent, accrescent, the lobes subequal; corolla gamopetalous, salverform, white or tinged with red, its tube exerted, narrow-cylindric, limb spreading, 5-parted, lobes obovate-oblong, subequal; stamens 4, didynamous, long-exserted, incurved-ascending, the anterior pair longer; anthers 2-celled, the thecae distinctly parallel; disk present, equal, short; ovary shortly 4-lobed at apex; style bifid at apex, the branches subulate and subequal; pyrenes obovoid, hard, reticulate-rugose, attached to beyond the middle by a broad keeled areole, the fallen ones not leaving a gynobase; seeds attached laterally.

A genus of only 2 known species and 1 variety of southwestern United States and Mexico. Included in the Labiatae by some authors.

1. Annual, the pubescence sticky-glandular; leaves elliptic, sessile or nearly so 1. *T. viscida*.
1. Perennial, the pubescence not glandular; leaves oblong or ovate, plainly petiolate (2)
- 2(1). Leaf blades broadly ovate, at least the lower ones entire 2. *T. Coulteri*.
2. Leaf blades narrowly oblong, conspicuously toothed . . . 2. *T. Coulteri* var. *angustifolia*.

1. *Tetraclea viscida* Lundell. Erect viscid annual to 45 cm. tall, densely puberulent with gland-tipped hairs; stem and main branches drying reddish-purple; branchlets green, subterete; leaves sessile or subsessile (with petioles not over 3 mm. long), thick and fleshy, narrowly elliptic, 5-18 mm. long, to 9 mm. wide, acute at both ends, broadest at the middle, glandular-puberulent on both surfaces with some coarser eglandular incurved hairs intermixed; cymes 1- or 2-flowered; peduncles to 1 cm. long; pedicels to 1 mm. long; calyx campanulate, 8- or 10-veined, 4- or 5-lobed, to 8 mm. long in fruit and lobed to below the middle; corolla less than 5 mm. long, the 4 outer lobes pubescent above the middle outside, the other lobe with a line of hairs on the midvein. Known only from Uvalde Co., Sept.; also in cen. Ariz.

2. *Tetraclea Coulteri* Gray. Herbaceous perennial; stems ascending or spreading, branching, from a woody base, to 4 dm. tall; branches very slender, gray, densely whitish appressed-puberulent, not glandular; petioles 4-10 mm. long, appressed-puberulent; leaf blades ovate, 16-35 mm. long, 6-18 mm. wide, sharply acute and mucronulate, irregularly dentate with 2 or 3 teeth on each margin or at least the lower ones entire, acute or acuminate at base and prolonged into the petiole, finely substrigose-puberulent on both surfaces with whitish hairs, not glandular; cymes mostly 3-flowered, sometimes reduced to 1 or 2; peduncles 3-8 mm. long; corolla cream-colored, tinged with red outside, lobes elliptic-obovate, entire. Foothills, riverbeds, chaparral and sandy flats, South Plains, Trans-Pecos and Rio Grande Plains, Mar.-Sept.; also in Ariz., N.M. and Mex.—var. *angustifolia* (Woot. & Standl.) A. Nels. & Macbr. differs in having its leaf blades narrowly oblong and always very conspicuously toothed, the stems taller and more slender, less pubescent with shorter hairs, the calyx lobes narrower, and the pyrenes more reticulated; in depressions, on banks and on dry rocky plains in the South Plains and Trans-Pecos; also N.M., Ariz. and Mex.

FAM. 158. LABIATAE JUSS.

MINT FAMILY

Plants herbaceous annuals or perennials with spreading rhizomes, occasionally woody shrubs; stems typically square; leaves opposite; flowers variously arranged; calyx usually more or less 2-lipped, the upper 3 teeth more or less joined, the lower pair of teeth usually free, occasionally all teeth subequal, the tube mostly enlarged in fruit; corolla obscurely to distinctly 2-lipped, the upper 2 petals usually joined to form an erect sometimes galeate lip that includes the stamens or sometimes very short and deeply notched, occasionally with the 5 lobes subequal, the lower lip usually spreading with its midlobe sometimes dipperlike; stamens 2 or 4, mostly in 2 unequal pairs, the connective sometimes strongly developed at the expense of the filament; anthers parallel or divergent, with one cell sometimes completely or partly aborted; style bifid at apex, arising between

the quite distinct lobes of the 4-lobed ovary or from near the apex of the ovary when the lobes (and the cocci) are partly united below.

A large family of about 3,500 species in 180 genera of world-wide distribution. The typically aromatic plants provide many herbs used as condiments. The family contains numerous important honey plants.

Rosmarinus officinalis L. (ROSEMARY), an aromatic evergreen Mediterranean shrub often cultivated in south Texas, is occasionally found as a possible escape. The shrub grows to 2 meters high and may be distinguished by its thick, narrowly linear, entire, revolute leaves (15-25 mm. long) that are lustrous dark-green above and white-tomentose beneath. The violet-blue flowers, in axillary racemes, are about 1 cm. long and have only 2 perfect stamens.

1. Ovary 4-lobed; style not basal; cocci almost completely united, laterally or obliquely attached (2)
1. Ovary of 4 distinct or nearly distinct cocci; style basal; cocci essentially free, basally attached (4)
- 2(1). Corolla nearly regular, distinctly 2-lipped 1. *Trichostema*, p. 1345.
2. Corolla strongly irregular so as to appear 1-lipped (3)
- 3(2). Leaves of flowering stems entire or indistinctly and bluntly toothed 2. *Ajuga*, p. 1346.
3. Leaves of flowering stems sharply to coarsely toothed or deeply lobed 3. *Teucrium*, p. 1347.
- 4(1). Calyx 2-lipped, the lips entire (5)
4. Calyx regularly 5- (rarely 10-) toothed or 2-lipped with 3 teeth on the upper lip and 2 teeth on the lower lip (6)
- 5(4). Calyx bladderly-inflated in fruit; flowers in loose spikes; rare desert shrub 4. *Salazaria*, p. 1348.
5. Calyx with helmetlike protuberance on the upper side; flowers solitary in the axils; widespread herbs and subshrubs 5. *Scutellaria*, p. 1349.
- 6(4). Stamens declined toward or resting on the lower lip of the corolla, 2 long and 2 short; corolla declined, the upper lip with 4 entire lobes, the lower lip saccate and abruptly deflexed at the contracted and callous base 6. *Hyptis*, p. 1354.
6. Stamens not declined and resting on the lower lip of the corolla (7)
- 7(6). Stamens and style included in the tube of the small corolla; plant villous or woolly-villous (8)
7. Stamens and style mostly exerted beyond the corolla tube; plant rarely woolly (9)
- 8(7). Calyx teeth 10, clawlike; corolla white; leaves prominently rugose-veined 7. *Marrubium*, p. 1354.
8. Calyx teeth 5, not clawlike; lower lip of corolla dark-purple; leaves not noticeably rugose 8. *Sideritis*, p. 1354.
- 9(7). Fertile stamens 4, all with 2-celled anthers; upper lip of corolla galeate or concave (10)
9. Fertile stamens 2 or (if 4) the upper pair shorter than the lower pair and the upper corolla lip neither galeate nor concave (19)
- 10(9). Calyx enlarging into a flaring veiny funnel about 25 mm. across; floral bracts stoutly spinose 9. *Molucella*, p. 1355.
10. Calyx not as above; floral bracts not stoutly spinose (11)
- 11(10). Upper pair of filaments longer than the lower pair (12)
11. Upper pair of filaments shorter than the lower pair (except in *Leonurus*) (13)
- 12(11). Anther sacs parallel or nearly so 10. *Agastache*, p. 1355.
12. Anther sacs divergent 11. *Nepeta*, p. 1356.
- 13(11). Calyx strongly 2-lipped (14)
13. Calyx not 2-lipped, the lobes essentially similar (15)

- 14(13). Anther sacs divaricate; flowers 3 together or 6 in a whorl; calyx dorsally flattened 12. *Prunella*, p. 1357.
14. Anther sacs parallel; flowers solitary or 2 together; calyx somewhat inflated 13. *Brazoria*, p. 1357.
- 15(13). Tube of the calyx faintly nerved, inflated at maturity 14. *Physostegia*, p. 1359.
15. Tube of calyx prominently 5- or 10-nerved, not inflated at maturity (16)
- 16(15). Cocci nearly terete, rounded at apex 15. *Stachys*, p. 1361.
16. Cocci 3-sided, truncate at apex (17)
- 17(16). Calyx lobes not spine-tipped 16. *Lamium*, p. 1363.
17. Calyx lobes spine-tipped (18)
- 18(17). Calyx lobes 5 17. *Leonurus*, p. 1363.
18. Calyx lobes 8 to 10 18. *Leonotis*, p. 1363.
- 19(9). Functional stamens 2, ascending and parallel, the upper pair wanting or rudimentary; anthers mostly appearing to be 1-celled; corolla strongly 2-lipped (20)
19. Functional stamens 2 or (if 4) with the upper pair shorter than the lower pair; anthers always 2-celled; corolla scarcely 2-lipped, the upper lip neither galeate nor curved (22)
- 20(19). Connective of the anther elongated, usually but not always bearing a perfect sac at one end and a rudimentary sac at the other end, very rarely 2-celled 19. *Salvia*, p. 1364.
20. Connective of the anther short; anther sacs confluent (21)
- 21(20). Calyx elongate-tubular, nearly regular, with 5 subequal teeth; midlobe of lower lip of corolla larger or longer than the lateral lobes .. 20. *Monarda*, p. 1370.
21. Calyx ovoid-tubular, 2-lipped, with subulate or bristlelike teeth; midlobe of lower lip of corolla narrower than the rounded lateral lobes 21. *Blephilia*, p. 1375.
- 22(19). Flowers in loose terminal racemes or panicles, slender-pedicelled 22. *Perilla*, p. 1376.
22. Flowers in axillary whorls or clusters that sometimes form terminal spikelike racemes or panicles (23)
- 23(22). Corolla regular or essentially so, with 4 or 5 equal lobes (24)
23. Corolla more or less 2-lipped; upper corolla lip erect, entire or emarginate (25)
- 24(23). Fertile stamens 2; flowers white, clustered in the axils of reduced upper leaves; foliage scarcely aromatic 23. *Lycopus*, p. 1376.
24. Fertile stamens 4; flowers purplish to bluish or white, spicate or clustered in upper axils; foliage strongly aromatic 24. *Mentha*, p. 1377.
- 25(23). Stamens ascending or arched, commonly converging or ascending parallel under upper lip of corolla (26)
25. Stamens distant and straight, often spreading-divergent, never connivent or curved (30)
- 26(25). Fertile stamens 2 (27)
26. Fertile stamens 4 (29)
- 27(26). Small shrubs; calyx softly and densely hairy with hairs as long as the calyx teeth; calyx teeth deltoid, undifferentiated, enclosing the calyx tube at maturity .. 25. *Poliomintha*, p. 1378.
27. Perennial herbs; calyx mostly bristly pubescent; calyx teeth differentiated into upper and lower sets, not enclosing the calyx tube at maturity (28)
- 28(27). Calyx gibbous, the throat closed by hairs; corolla without folds in the throat; stamens exerted from corolla tube 26. *Hedeoma*, p. 1379.
28. Calyx not gibbous, the throat not closed by hairs; corolla with 2 folds in the throat; stamens included in the corolla tube 27. *Rhododon*, p. 1383.

- 29(26). Calyx with 5 subequal lobes, scarcely 2-lipped; leaves more or less orbicular ..
28. *Micromeria*, p. 1384.
 29. Calyx distinctly 2-lipped, the lobes unequal; leaves of a linear type
29. *Satureja*, p. 1384.
 30(25). Fertile stamens 430. *Pycnanthemum*, p. 1384.
 30. Fertile stamens 231. *Cunila*, p. 1386.

1. TRICHOSTEMA L.¹⁶⁰

Annuals or suffrutescent perennials; stems variously pubescent; leaves subsessile to petioled, linear to elliptic or ovate, usually entire; inflorescence glandular, the flowers 1 to many in axillary cymes, the lateral branches of which develop racemosely or the entire inflorescence racemose; calyx regular or irregular, the upper 3 teeth fused two-thirds their length in which case the calyx bends backward and becomes resupinate at maturity, the upper lip then appearing as the lower; corollas blue or lavender, often pink or even white, the lowermost normally longest, as much as one and one half times the length of the other 4 equal lobes, pubescent on the outside, glabrous within; stamens 4, usually seated near the throat and ascending, arched or nearly straight, sometimes thrust out between the upper two lobes of the corolla, the anther sacs divergent at maturity; styles about as long as the stamens, the upper branch usually somewhat shorter than the lower; cocci joined one-third their length, alveolate or rugose-reticulate, the ridges varying in prominence.

About 15 species in North America.

1. Calyx regular, the teeth equal or nearly so (2)
1. Calyx 2-lipped, the upper 3 teeth partially fused, the lower pair of teeth free and shorter, the whole calyx becoming inverted (resupinate) at maturity (3)
- 2(1). Plants annual1. *T. brachiatum*.
2. Plants perennial, forming small or large bushes, woody at the base
2. *T. arizonicum*.
- 3(1). Leaves linear, at least 6 times as long as broad ...3. *T. setaceum*.
3. Leaves oval to oblong, not more than 5 times as long as broad
4. *T. dichotomum*.

1. *Trichostema brachiatum* L. FLUX-WEED. Weedy annual herb to 4 dm. tall; stems usually freely branched, hirtellous below the inflorescence with short spreading or downwardly curled but seldom appressed hairs, often pilose with longer straight hairs about 1 mm. long and occasionally and irregularly sprinkled with capitate glands; leaves elliptic to linear, acute at the apex, narrowed at the base to indefinite petioles as much as 1 cm. long, 2-5 cm. long, 4-16 mm. wide, both surfaces hirtellous with short hairs curled toward the apex, usually sprinkled with capitate glands, usually 3-nerved, the margins entire or sometimes irregularly serrate; cymes axillary, predominantly 1-flowered, often 2- to 3-flowered, the peduncles seldom exceeding 2 cm. in length, clothed like the stems but usually more glandular, the small bracts seldom exceeding 3 mm.; flowering calyx regular, the triangular-lanceolate teeth 1.5-3.7 mm. long but increasing to 2.5-4.9 mm. in fruit, the tube shorter than the teeth; corolla rose-pink; corolla tube straight, flaring somewhat at the throat, not exerted from the calyx, 1.6-3.5 mm. long, the lower lip 1.3-2.1 mm. long, usually somewhat longer than the 4 upper lobes; stamens straight or but slightly arched, 2.3-4.2 mm. long, not greatly exerted from the corolla; cocci 2-2.9 mm. long, hirtellous at least at apex with short usually curled hairs and irregularly sprinkled with capitate glands, alveolate, the ridges prominent. *Isanthus brachiatus* (L.) B.S.P. In sandy or limestone soils, mainly on the Edwards Plateau, July-Oct.; from Ont. and N.E., s. to N.C., Ga., Ala., Ark. and Tex.

2. *Trichostema arizonicum* Gray. Suffrutescent perennial, woody at the base, with numerous straight erect herbaceous branches 2-6 dm. long, these hirtellous with short

¹⁶⁰ Adapted from Harlan Lewis in *Brittonia* 5:276-303. 1945.

downwardly curled hairs (particularly on the faces directly above the leaves), occasionally irregularly interspersed with sessile glands; leaves oblong to ovate, 1-3 cm. long, 5-15 mm. wide, frequently with numerous smaller leaves on dwarf branches in the axils, acute to obtuse at the apex, acute or somewhat rounded at the base, sessile or with indefinite petioles as much as 5 mm. long, the margins entire, sometimes irregularly crenate, both surfaces sparsely hirtellous with short hairs curled toward the apex, often with numerous sessile glands; cymes as much as 4 cm. long, 1- to 7-flowered, borne in graceful narrow panicles; flowering calyces hirtellous with short rather stout upwardly curled hairs or these nearly lacking, usually with many sessile or rarely capitate glands, 2.5-4 mm. long, increasing to 3.5-6.5 mm. in fruit, the teeth subequal, lanceolate to nearly deltoid, about the length of the tube; corolla tubes not exerted from the calyx, straight, 2-4 mm. long, the lower lip 5-10 mm. long; stamens strongly arched, 1-2.5 cm. long; cocci 2-3 mm. long, irregularly alveolate, the ridges not prominent, glabrous, sometimes minutely hirtellous at the apex. Rare in Guadalupe Mts. in the Trans-Pecos, summer-fall; Tex., N.M., Ariz. and n. Mex.

3. *Trichostema setaceum* Houtt. Weedy annual herb to 5 dm. tall; stems usually branched, hirtellous below the inflorescence with short downwardly curled hairs, rarely nearly glabrous; leaves linear to narrowly lanceolate, 2-5 cm. long, 1-5 mm. wide, rarely as much as 7 mm. wide, hirtellous with short hairs curled toward the apex, acute at apex, the base narrowed to an indefinite petiole as much as 5 mm. long, the margins entire; cymes axillary, 3- to 7-flowered; the peduncles as much as 5 cm. long, the pedicels about 5 mm. long, both clothed with short stout spreading hairs and glandular-capitate hairs, the bracts often leaflike; calyces strongly zygomorphic, the lower 2 teeth about one third the length of the upper three which are fused for one-half to two-thirds their length; flowering calyces 3.5-5.5 mm. long, becoming inverted at maturity so that the 3 long teeth are lowermost, increasing to 4.5-7.5 mm. long; corolla tube not extending beyond the longer calyx teeth, 2.3-3.8 mm. long, the lower lip 2.8-6 mm. long; stamens exerted, arched, 8-20 mm. long; cocci 1.5-2 mm. long, glabrous, alveolate, the ridges prominent. In dry sandy soil in open woods in e. Tex., July-Oct.; from Conn. and N.Y., s. to Fla. and e. Tex.

Closely allied to *T. dichotomum* but has much narrower leaves.

4. *Trichostema dichotomum* L. FORKED BLUE CURLS, BASTARD PENNY ROYAL. Weedy annual herb as much as 1 m. tall; stems usually branched, hirtellous below the inflorescence with short downwardly curled or straight spreading hairs, usually pilose with longer straight hairs and occasionally sprinkled with capitate glands, rarely only pilose; leaves oblong to ovate, to 6 dm. long and 25 mm. wide, hirtellous with short hairs curled toward the apex, acute to obtuse at apex, the base narrowed to a petiole 2-15 mm. long, the margins entire; cymes axillary, 3- to 7-flowered, the peduncles as much as 5 cm. long, the pedicels about 5 mm. long, both glandular with stalked capitate glands, usually hirtellous with short spreading hairs and having longer coarse hairs 2 to 3 times the length of the glandular hairs or these absent, the bracts often leaflike; calyces strongly zygomorphic, the lower teeth about one third the length of the upper three which are fused for one-half to two-thirds their length; flowering calyces 2.7-6 mm. long, becoming inverted at maturity so that the three long teeth are lowermost, increasing to 4.6-8.9 mm. long; corolla bluish; corolla tube not extending beyond the longer calyx teeth, 1.5-4 mm. long, the lower lip to 7 mm. long; stamens exerted, arched, 6-16 mm. long; cocci 1.5-2.9 mm. long, glabrous, alveolate, the ridges prominent. In sandy soil in open woods and on stream banks in e. Tex., July-Oct.; from N.E., s. to Fla. and Tex.

2. AJUGA L.

About 40 species of wide distribution.

1. *Ajuga reptans* L. BUGLE. Low perennial, spreading by leafy stolons to form mats; flowering stems to 3 dm. high, essentially glabrous; leaves obovate to oblong-spatulate, 2-5 cm. long, the larger ones commonly sinuate-dentate, the lower leaves tapered to a margined petiole, the upper leaves sessile; flowers sessile, in whorls of 2 to 6 in the axils of bracteal leaves to produce a terminal leafy spike; calyx 4-6 mm. long, sparsely villous, the 5 lobes ovate-triangular, somewhat shorter than the tube; corolla blue to purplish, upper lip of corolla very short, bilobed; lower lip of corolla elongate and

dilated, the lateral lobes shorter and narrower than the broad bilobed midlobe; stamens 4, unequal in length, included; ovary shallowly 4-lobed; style terminal. A nat. of Eur. that is cult. as a ground cover and occasionally escapes or persists, Apr.-July.

3. TEUCRIUM L.¹⁶¹

GERMANDER

Perennial herbs to 15 dm. high, with simple serrate leaves and the flowers in terminal slender spikes or smaller annual or perennial plants with at least some of the leaves pinnatifid and with the flowers in the axils of the reduced upper leaves; calyx saccate, toothed or deeply 5-lobed; corolla pinkish to bluish or pallid, the upper lip very short and deeply notched, the lower lip conspicuous and spreading, with small lateral lobes; stamens 4, paired, exerted from the deep cleft between the 2 upper lobes of the corolla; cocci roughened.

About 300 species in temperate and tropical regions of both hemispheres.

1. Leaf blades toothed, pubescent on lower surface; flowers in a terminal bracteate spike; corolla lavender with dark dots 1. *T. canadense*.
1. Leaf blades noticeably lobed (especially the lower ones), glabrous; flowers in the axils of the reduced upper leaves; corolla white with pink to purple markings toward the base (2)
- 2(1). Largest lobes of corolla 5-8 mm. long; leaf blades mostly with a few wide lobes; plant usually more than 2 dm. high 2. *T. cubense*.
2. Largest lobes of corolla 9-13 mm. long; leaf blades laciniately lobed into narrow segments; plant mostly less than 1.5 dm. high 3. *T. laciniatum*.

1. *Teucrium canadense* L. AMERICAN GERMANDER, WOOD SAGE. Perennial herb as much as 1 m. tall, with creeping rootstocks and erect stems that branch chiefly in the inflorescence, the latter usually silvery with closely appressed minute hairs, sometimes pubescent with curled hairs or hirsute with elongate spreading or deflexed glandular or eglandular hairs, rarely glabrate; leaves prevailing 6-10 cm. long and 2-4 cm. broad, narrowly elliptic to oval or ovate, acute to acuminate or rarely obtuse at apex, generally narrowed below the middle but sometimes rounded at the base or even subtruncate, obscurely or strongly toothed, the upper surfaces glabrous or variably pubescent with curled or straight hairs or variably hirsute with elongate stiffish glandular or eglandular hairs, the lower surfaces silvery with minute closely appressed hairs or pubescent with small curled hairs or even tomentose with longer curled hairs or hirsute with glandular spreading hairs, rarely glabrous; median petioles to 15 mm. long; flowers subsessile, disposed in usually dense conspicuously bracteate spikes 2-3 dm. long, the bracts usually exceeding the calyces; flowering calyces 5-7 mm. long, silvery with minute appressed hairs or pubescent with curled and spreading glandular hairs or hirsute with elongate mostly glandular hairs, these variably combined in some forms, the tube enlarged and cuplike at maturity but scarcely saclike or inflated, the orifice oblique; calyx teeth deltoid, the three upper more or less joined and tending to be obtuse or blunt, the two lower more or less acute or acuminate and generally about 2 mm. long; corolla 11-18 mm. long, the tube 4-7 mm. long; cocci glabrous, wrinkled. Incl. var. *virginicum* (L.) Eat., *T. virginicum* L. In water and mud along streams and canals, about lakes, in marshes and wet grassy swales throughout Tex., May-Sept.; a variable species that occurs from Que. to B.C., s. to Cuba and Mex.

The following varieties are found in Texas.

1. Hairs of the stem and lower leaf surface elongate, spreading, dense, more or less glandular; calyx tomentose with short as well as long glandular hairs; confined to the Rio Grande Valley region (*T. occidentale* Gray)
..... var. *occidentale* (Gray) McCl. & Epl.
1. Hairs of stem and lower leaf surface minute, curling and eglandular; calyx mostly thinly pubescent with nonglandular hairs .. var. *canadense*.
2. *Teucrium cubense* Jacq. Annual or perennial weedy herb; stems usually several from a taproot, branching at the base and often above, more or less bushy, as much as

¹⁶¹ Adapted from Elizabeth McClintock and Carl Epling in *Brittonia* 5:491-510. 1946.

7 dm. high, usually much smaller, glabrous or cinereous with minute spreading or downwardly curled hairs, sometimes pubescent in the inflorescence with longer somewhat curled hairs; basal leaves oblong to obovate, shallowly lobed to crenate or entire, attenuate to petioles that are usually shorter than the blades, soon withering, these passing into the cauline leaves that are variably lobed, these (in turn) passing gradually into the leaves of the inflorescence that are sometimes subentire, sometimes lobed to the middle or sometimes lobed nearly to the base with the lobes linear; flowers with slender pedicels 4-12 mm. long, usually in the upper half of the stem, sometimes nearly to the base; flowering calyces campanulate, glabrous or hirtellous with minute spreading hairs and glandular or sometimes pubescent with longer somewhat curled hairs, 5-10 mm. long, the tubes 2-3 mm. long; calyx teeth 3-6 mm. long, deltoid-lanceolate, closed over the cocci at maturity or spreading; corolla white, often with purple lines in throat, pubescent, tending to be bearded in the throat, 7-15 mm. long, the tube 1-2 mm. long, the lower lip 4-8 mm. long; stamens glabrous, the longer pair 6-8 mm. long; cocci pitted or grooved lengthwise (the grooving may be a function of the degree of maturity), glabrous or pubescent at the tip. *Melosma cubense* (Jacq.) Small. In clay or hard sandy loams, along streams and draws, in palm groves and low grassy soils along the coast and Rio Grande Plains, w. to the Trans-Pecos, throughout the year; from s.w. U.S., through W.I. to s. S.A.

The following varieties are found in Texas.

1. Plant annual, pubescent along the stem and in the inflorescence with scattered long coarse somewhat curled hairs; flowers disposed often nearly to the base of the stems; cocci conspicuously pubescent at the apex with a tuft of hairs; confined to the Trans-Pecos [*T. depressum* (Small) McCl. & Epl.] var. *densum* Jeps.
1. Plant annual or perennial, glabrous or sparingly puberulent along the stem and in the inflorescence; flowers chiefly in upper part of stem; cocci with globular glands or rarely minutely pubescent (2)
- 2(1). Median leaves irregularly lobed about halfway to the midrib or only deeply crenate; floral leaves 3-lobed to the middle or entire; along the coast and in the Rio Grande Plains and Valley [subsp. *chamaedriformium* (Mill.) Epl.] var. *cubense*.
2. Median leaves mostly 3- or 5-lobed nearly to the midrib, the lobes linear; floral leaves 3-parted nearly to the base; in the Rio Grande Plains and Trans-Pecos [*T. laevigatum* Vahl, *Melosma laevigatum* (Vahl) Small] subsp. *laevigatum* (Vahl) McCl. & Epl.

3. *Teucrium laciniatum* Torr. Perennial herb usually 7-15 cm. tall, rarely to 25 cm., branching from base, the stems many, erect, tufted, usually unbranched, forming beds from oblique creeping roots, entirely glabrous or occasionally with a few scattered minute spreading hairs; leaves pinnately cut nearly to the midrib into 2 to 8 usually entire but sometimes branched lobes, 15-55 mm. long, the lobes 2-4 mm. wide, blunt or gradually acuminate at the tips, their margins usually inrolled on the lower side, a few of the basal leaves occasionally entire; flowers crowded toward the tips of the branches, sweet-scented with a spicy odor, the pedicels 3-8 mm. long; flowering calyces campanulate, 8-13 mm. long, the tube 2-4 mm. long, the acuminate teeth 5-10 mm. long; corolla white to cream-color or rarely pale-green, usually with purplish veins in throat, glabrous or with a few scattered hairs on the outside, bearing a dense beard of hairs in the throat and a few scattered hairs on the lower lip, 14-22 mm. long, the tube 1-2 mm. long, the lower lip 8-14 mm. long; stamens glabrous or pubescent on the lower half, the longest pair 9-11 mm. long; cocci about 3 mm. long, oval, rugose or grooved lengthwise, glabrous. On limestone and gypseous soils from the Edwards Plateau to the Trans-Pecos and Plains Country, May-Sept.; also Okla., Colo. and N.M.

4. SALAZARIA TORR.

A monotypic genus.

1. *Salazaria mexicana* Torr. BLADDER-SAGE. Shrub to 2 m. high, intricately branched, the branchlets becoming spiny-tipped, pale-green and minutely canescent; leaves short-petioled, ovate to ovate-oblong or the upper ones reduced and narrowly oblong, entire or rarely toothed, to about 25 mm. long, rounded to subcordate at base; flowers subsessile

in the axils of the upper bractlike leaves, forming an open narrow raceme; calyx equally 2-lobed, 6-8 mm. long in flower, the lips entire, becoming inflated into a papery bladder in fruit; corolla bilabiate, pink with a purple lip, 12-18 mm. long, pubescent on the outer surface, the upper lip arched, the lower lip broad with recurved margins and its 2 small lateral lobes attached to the base of the upper lip; stamens 4, in 2 pairs, included in the upper lip; style entire, included; fruiting calyx papery and subglobose, 16-18 mm. long; cocci 4, tuberculate, raised on a gynobase. In chaparral of desert washes and on clay flats in s. Trans-Pecos, July-Nov.; also Mex.

5. SCUTELLARIA L.¹⁶² SKULLCAP

Bitter perennial or annual herbs or subshrubs, commonly rhizomatous, not aromatic; flowers 1 to 3 together on short peduncles or pedicels in the axils or often in 1-sided bracted axillary racemes or terminal spikes or racemes; calyx campanulate in flower, splitting to the base at maturity, strongly bilabiate, the lips entire, the upper longer lip usually falling away, in fruit with an appendage or scale; corolla with an elongated curved ascending tube exerted from the calyx, dilated at the throat, the upper lip entire or barely notched, the lateral lobes mostly connected with the upper rather than the lower lip, the lower spreading lobe or lip convex and notched at the apex; stamens 4, ascending under the upper lip; anthers approximate in pairs, ciliate or bearded, those of the lower stamens 1-celled, those of the upper stamens 2-celled and cordate; cocci variously marked.

About 300 species of wide geographic distribution.

1. Low herbs or subshrubs, mostly less than 3 dm. high; leaves 1-2 cm. long, entire (or crenulate in *S. muriculata*) (2)
1. Rather tall herbs, mostly much more than 3 dm. high; leaves 3 cm. long or more, more or less dentate to crenate or rarely entire (in *S. integrifolia*) (9)
- 2(1). Plant with fibrous roots and moniliform rhizomes; cocci provided with an encircling wing or skirt and covered with peglike processes 1. *S. parvula*.
2. Plant with fibrous roots and often a woody caudex, usually with slender or stout rhizomes; cocci variously covered, not as above (3)
- 3(2). Plants essentially glabrous throughout, at most with scattered sessile glands; endemic to Trans-Pecos Texas 2. *S. laevis*.
3. Plants variously pubescent or glandular-pubescent; mostly east of Trans-Pecos Texas (4)
- 4(3). Calyx with sessile or short-stalked glands or appressed-puberulent, never noticeably long-pubescent (5)
4. Calyx with long conspicuous glandular or nonglandular hairs (7)
- 5(4). Stem puberulent with minute decurved-appressed hairs to give a smooth appearance, without glandular hairs 3. *S. Wrightii*.
5. Stem with spreading glandular or nonglandular hairs (6)
- 6(5). Stem densely puberulent with minute conical glandless hairs; distribution in Plains Country 4. *S. resinosa*.
6. Stem thinly pubescent with soft glandular hairs; distribution southwest Texas 5. *S. microphylla*.
- 7(4). Stem with long spreading usually somewhat glandular hairs; cocci covered with blunt subimbricated scalelike processes 6. *S. Drummondii*.
7. Stem with most or all the hairs retrorse-decurved and glandless; cocci not as above (8)
- 8(7). Cocci covered with sharp conical processes; leaves with noticeably crenulate margins; plant annual; distribution in the Rio Grande Plains and coastal Texas .. 7. *S. muriculata*.
8. Cocci granulose with rounded low tubercles; leaves with entire margins; plant perennial; distribution in Trans-Pecos Texas 8. *S. potosina*.

¹⁶² Adapted from Carl Epling in Univ. Calif. Publ. Bot. 20:1-146. 1942.

- 9(1). Median leaves oblong to linear-lanceolate, entire, tapered at base to a short petiole 9. *S. integrifolia*.
9. Median leaves deltoid-ovate to ovate-oblong, more or less dentate or serrate, broadly cuneate to rounded or cordate at base (10)
- 10(9). Median leaves ovate-oblong; petiole mostly 3 mm. or less long; distribution in Texas Panhandle 10. *S. galericulata*.
10. Median leaves broadly ovate to ovate-lanceolate; petiole usually much more than 5 mm. long; distribution mainly in east Texas (11)
- 11(10). Upper surface of leaves essentially glabrous; lower part of stem essentially glabrous or with minute decurved hairs (12)
11. Upper surface of leaves noticeably pubescent with spreading often glandular hairs (13)
- 12(11). Stems strict and stiffish; calyx and triangular-ovate leaflike bracts subtending the flowers coarsely ciliate on margins; galea and corolla tube 13-22 mm. long 11. *S. cardiophylla*.
12. Stems mostly weak and spreading; calyx and elliptic-lanceolate bracts subtending the flowers essentially glabrous or minutely puberulent; galea and corolla tube 5-7 mm. long 12. *S. lateriflora*.
- 13(11). Floral rachis densely pubescent with glandular spreading hairs, the bracts ovate; median leaves with strongly cordate base 13. *S. ovata*.
13. Floral rachis with curved appressed glandless hairs, the bracts elliptic; median leaves with subtruncate to broadly cuneate base 14. *S. elliptica*.

1. *Scutellaria parvula* Michx. Small herb, 1-3 dm. high, spreading by moniliform rhizomes, the tubers fusiform to ellipsoid and white; stems usually erect, branching at the base, pubescent to glabrate; leaves pilose to glabrate; median leaves sessile, deltoid-ovate to ovate-oblong, usually irregularly subdentate, 8-19 mm. long, 4-12 mm. broad; lowermost leaves with petioles 5-15 mm. long, subrotund 7-12 mm. wide; flowers axillary, mostly above the middle of the plant, borne on retrorse-hirtellous pedicels; lower calyx lip 2.5-3 mm. long at anthesis, in fruit 4-5 mm. long, the concave scale 3-3.5 mm. tall and clothed like the stems; corolla slender, bluish, the galea and tube 7-10 mm. long, the lower lip hirtellous in 2 lines, the lower filaments seated near the middle of the tube; cocci brown or black, covered with peglike processes, banded. Usually in sandy soils or clays on the edge of and in open woods, roadside banks and flats in e. and n.-cen. Tex., Mar.-June; represented by several variants in much of the e. half of the U.S. and Can.

Represented in Texas by three variants as follows:

1. Stems glabrate to minutely puberulent; pubescence of upper parts ascending, the hairs curled or appressed, not at all glandular (*S. Leonardii* Epl., *S. ambigua* of auth.) var. *Leonardii* (Epl.) Fern.
1. Stems clearly hairy with glandular and nonglandular hairs (2)
- 2(1). Stem with both short retrorse nonglandular hairs and glandular hairs; lateral veins of the leaf not noticeably anastomosing var. *parvula*.
2. Stem with both short curved-ascending nonglandular hairs and glandular hairs on the angles; lateral veins of the leaf arched and anastomosing to form a continuous submarginal vein [*S. australis* (Fassett) Epl.] var. *australis* Fassett.

2. *Scutellaria laevis* Shinn. Low-growing multistemmed perennial to 35 cm. high, the herbage yellowish-green; stems subwoody, glabrous, from a thick woody rootstock; leaves very shortly petiolate, entire, sparingly and minutely scabrous-puberulent to almost glabrous; lower leaves ovate-elliptic, pinnately nerved, somewhat obtuse, 1-2 cm. long, 6-11 mm. wide; upper leaves gradually smaller, elliptic-lanceolate; flowers spicate-racemose, short-pedicellate, with the pedicels scabrous-puberulent; calyx 3-3.5 mm. long, minutely scabrous-puberulent to almost glabrous; corolla pale-white-lavender, 14-17 mm. long, minutely pilose on the exterior; cocci several pressed together, granular-tuberculate to somewhat muriculate. On mt. slopes and in arroyos along dry stream beds, Culberson and Hudspeth cos., Apr.-Sept.; endemic.

3. *Scutellaria Wrightii* Gray. Low perennial 1.5-2 dm. high; stems usually several arising from a woody usually branched crown; pubescence minute, decurved and ap-

pressed, usually curved downward on the leaves, eglandular except for larger sessile resin dots, the calyces sometimes with a few capitate glands; leaves oval, tending to oblong rather than rotund, narrowed at the base to petioles to 3 mm. long, the median 8.5-20 mm. long and 4.5-12.5 mm. broad, rounded at the apex; calyx resinous with sessile glands and usually with decurved hairs, infrequently with spreading capitate glands, the lower lip 3.5-4.5 mm. long at anthesis and somewhat longer in fruit, the scale about 4 mm. tall but broader and flaring; corolla deep-violet-blue, the tube and galea 12-23 mm. long, the lower stamens attached 5-8.5 mm. above the base of the tube, the galea pilose within (especially above the base), the lip glabrous or sparingly pilose in two lines or patches; cocci black and minutely evenly and closely tuberculate. *S. brevifolia* Gray, *S. resinosa* var. *brevifolia* (Gray) Penl. In limestone or chalky soils or sandy loam in prairies, on breaks, bluffs and slopes and in open woods, mostly on the Edwards Plateau, s. to Nueces Co. on the coast and n. to the Plains Country and n.e. to Denton and Cooke cos. in n.-cen. Tex., Mar.-July; also s.w. Okla.

A species closely allied to this one, *S. tessellata* Epl., should occur in Texas. It has been collected in the Guadalupe Mts. in adjacent New Mexico. It differs in that its tessellated cocci have the appearance of a mosaic, and its corolla tubes are generally broadly annulate near the mouth of the calyx. Its leaves are also ovate.

4. *Scutellaria resinosa* Torr. Low perennial 1.5-2 dm. high, often with numerous stems arising in a tuft from a usually massive woody often-branched crown; pubescence of the stems consisting of minute conical spreading hairs, rarely somewhat retrorse, or if ascendent usually so only on the leaves, usually somewhat glandular with larger sessile resin-dots, rarely with capitate glands except on the calyces; leaves shortly petioled, oval, tending to rotund, the median leaves 8-16 mm. long and 4.5-12 mm. wide, rounded at the apex, narrowed toward the base; calyces resinous with sessile glands and with spreading minute hairs, with some of the hairs often capitate-glandular, the lower lip 3.5-5 mm. long at anthesis but somewhat longer at maturity, the scutellum about 4 mm. tall but broader and flaring; corolla deep-violet-blue, the tube and galea 17-22 mm. long, the lower stamens attached 7-10 mm. above the base of the tube, the galea pilose within on both sides, the tube pilose within (especially above the base), the lip glabrous or sparingly pilose in 2 lines or patches; cocci black, minutely evenly and closely tuberculate. On breaks, caprock, banks, slopes and sandhills in the Panhandle, Apr.-Oct.; also in adj. Okla., n. to cen. Kan.

5. *Scutellaria microphylla* Benth. An Erect perennial or sometimes annual, to 4 dm. high, more or less branched throughout, softly pilose throughout with slender spreading glandular hairs; basal leaf blades ovate, commonly 1-1.5 cm. long, with slender petioles about half as long, subcrenate, the median leaves similar but on shorter petioles and entire or subcrenate, the upper entire leaves often scarcely 5 mm. long and subsessile; flowering calyces glandular-pilose, the lower lip 2-3 mm. long but somewhat longer at maturity, the scale then about 2.5-3 mm. tall; corolla violet or bright-blue, its tube and galea 5-11 mm. long, the lower lip glabrous or with 2 small patches of hairs, the throat pilose, the tube nearly glabrous below the lower stamens; lower stamens seated 2.5-4 mm. above the base of the tube; cocci black, finely granulose. On limestone soils on hills, mesas and in canyons on the Edwards Plateau and s. Trans-Pecos, Mar.-July; also n.e. Mex.

6. *Scutellaria Drummondii* Benth. Annual herb commonly 2-3 dm. high, branching at the base when well-developed with the branches commonly procumbent at the base, clothed throughout with slender soft spreading more or less glandular hairs (some retrorse) or sometimes (especially in the lower parts) clothed by retrorse finer hairs; basal leaf blades ovate, commonly 1-2 cm. long, with slender subequal petioles, subcrenate, the median leaves similar but on shorter petioles and commonly entire, the diminished uppermost leaves subsessile and usually entire; flowering calyces pilose and more or less glandular, the lower lip 3-5.5 mm. long but somewhat longer at maturity, the scale then about 3 mm. tall; corolla violet, its tube and galea 5-15 mm. long, the lower lip glabrous or with 2 patches of hairs, the throat pilose, the tube glabrous or nearly so below the point of attachment of the stamens; lower stamen seated 2.5-6.5 mm. above the base of the tube (averaging about 4 mm.); cocci fuscous or black, covered with more or less imbricated lamellae. In sandy, gravelly, clayey or rocky soils, or on rocks, ledges and flats in thickets, chaparral, or on open plateaus and slopes throughout most of Tex., Feb.-July; also w. Okla., s.e. N.M. and n. Mex.

7. *Scutellaria muriculata* Epl. Annual herb 2-3 dm. high, branching at the base and more or less procumbent, the stems with ashy-gray hairs; leaves provided with small curved hairs on both surfaces; lowermost leaves with petioles 7-8 mm. long, ovate to deltoid-ovate, crenate, mostly 1-1.5 cm. long; upper leaves subsessile, subrotund, subentire; flowering calyces with hairs like the leaves, the lower lip about 3.5 mm. long at maturity, the scale about 2 mm. high; corolla-tube blue, with the galea about 12 mm. long, the lower lip glabrous and spotted, the tube subannulate within to the connected stamen; lowest stamens placed on the tube about 3 mm. above base; cocci dark-brown, muriculate. In sandy soil on slopes, knolls, flats and in open woods on the Rio Grande Plains and Valley and along the s. coast of Tex., Jan.-May; undoubtedly also in adj. Mex.

8. *Scutellaria potosina* Brandeg. Perennial herb 2-4 dm. high, usually with several stems arising from a woody usually branched crown; pubescence usually of 2 sorts, composed of small hair that is usually somewhat retrorse and often a longer capitate-glandular hair that is usually spreading or somewhat retrorse, the pubescence of the leaves similar and mostly spreading; leaves shortly petiolate, ovate, variable in size, the median leaves usually 7-8 mm. long, rarely as much as 25 mm. long, rounded at the apex, narrowed at the base to petioles 2-3 mm. long; calyces resinous with sessile glands and thinly clothed with spreading often capitate-glandular hairs, the lower lip 3-4 mm. long at anthesis but enlarging somewhat at maturity, the scale about 4 m. tall but broader and flaring; corolla deep-violet-blue, the tube and galea 8-19 mm. long, the stamens attached 4-7.5 mm. above the base of the tube, the galea pilose within on both sides, the tube pilose within toward the base, subannulate, the lip glabrous or sparingly pilose in two lines or patches; cocci black, evenly and closely coarsely tuberculate. In rocky areas in mts. of the Trans-Pecos, Apr.-Nov.; also N.M., Ariz. and n. Mex.

Those plants with galea and tube about 15 mm. long and stamens inserted about 5.5 mm. above the base of the tube are referred to subsp. *platyphylla* Epl., while those plants with galea and tube about 1 cm. long and stamens inserted about 4 mm. above the base of the tube are referred to subsp. *parviflora* Epl.

9. *Scutellaria integrifolia* L. ROUGH SKULLCAP. Perennial herb 3-7 dm. high; stems rather slender, 1 or several from a subligneous base, simple or with arched-ascending branches above, often with abbreviated axillary branches densely incurved-pilose above, sometimes with divergent hairs, with or without some glands; leaves 3 to 8 pairs below inflorescence; lowest leaves ovate, slender-petioled, crenate; the successively narrower middle and upper leaves mostly oblong to linear-lanceolate and entire, narrowed to petioles to 1 cm. long, punctate, minutely hoary, 2-6 cm. long, up to 1.6 cm. broad; lowest internodes 1-2.5 cm. long; inflorescence a terminal raceme or leafy elongate panicle of 6- to 40-flowered racemes, all but lowest flowers in axils of much reduced foliaceous linear-lanceolate bracts; pedicels short; calyx 2.5-3.5 mm. long in anthesis, becoming 5-7 mm. long in fruit, puberulent; corolla 2-2.5 cm. long, purple-blue and whitish or rarely rose-pink, the large lips subequal; the lower stamens inserted about 8.5 mm. above base of tube; cocci subglobose, blackish, 1.2-1.6 mm. in diameter, covered with rosulate flattish subimbricated papillae. Borders of woods, thickets and clearings, along streams, on seepage slopes and about ponds in e. Tex., Apr.-June; from Fla. to Tex., n. to N.E., O., Ky. and Mo.

The var. *hispida* Benth. has stems with numerous straighter and more divergent hairs, and the transition from lower to median leaves more gradual than in var. *integrifolia*. Plants with rose-pink flowers are designated as f. *rhodantha* Fern.

10. *Scutellaria galericulata* L. MARSH SKULLCAP. Perennial with slender creeping rhizome and mostly subterranean slightly thickened stolons; stems ascending, simple or forking, to 1 m. high, minutely pilose on angles above with recurved hairs; leaves sessile or shortly petioled, oblong-lanceolate to ovate-oblong, crenate, rounded to cordate at base, to 8 cm. long and 3 cm. broad, often somewhat rugose, veiny, minutely pubescent (often canescent) beneath with recurving hairs; flowers solitary in the axils of reduced upper leaflike bracts to form 1-sided interrupted racemes, very short-pedicelled; calyx 3.5-4.5 (in fruit 5-6.5) mm. long, minutely pilose; corolla blue-violet with whitish throat and tube, pilose, 15-25 mm. long; stamens inserted 8-10 mm. above base of tube; cocci pale-olive, 1.5-2 mm. long, with broad low pebbling. *S. epilobiifolia* A. Hamilt. Gravelly, sandy or rocky shores, meadows, marshes, swampy thickets in n. Panhandle, June-July;

from Nfld. and Lab. n.w. to Alas., s. to Del., Pa., W.Va., O., Ind., Ill., Mo., Kan., Tex., N.M., Ariz. and Calif.

11. *Scutellaria cardiophylla* Engelm. & Gray. Annual, 4-6 dm. high, rather strict and stiffish, branching freely above the middle, the branches ascendent and strict, clothed with recurved appressed hairs (particularly along the angles), sometimes with spreading glandular hairs in the lowermost parts as well; basal leaves soon deciduous; median leaves deltoid, lightly cordate, 2-5 cm. long, crenate-dentate, the lower ones borne on petioles as long as the blades, the uppermost sessile and subentire, gradually diminished upward, the upper surfaces of all glabrous, the lower surface hispidulous with spreading hairs, their margins usually ciliate with longer hairs; flowers produced in the upper parts of the plant in the axils of gradually diminished leaves, the pedicels clothed as are the stems; flowering calyces retrorse-pubescent and ciliate on the margins, the lower lip 4-4.5 mm. long at anthesis but 5-6 mm. long at maturity, the scale about 3.5 mm. tall and concave; galea and tube 13-22 mm. long, the tube pilose within, the lip glabrous; lower filaments seated 7-13 mm. above the base of the tube; cocci black, shallowly papillate. Usually in sandy or rocky soils on the edge of woods and in grassy areas in open woods, on banks, in seepage areas and old fields in e. fourth of Tex., w. to Kaufman, Freestone and Madison cos., Apr.-Oct.; also Ark. and possibly w. La.

12. *Scutellaria lateriflora* L. MAD-DOG SKULLCAP. Perennial with filiform rhizomes and stolons; stem to 1 m. high, simple or freely branched, smooth or minutely pilose on the angles with incurved-ascending hairs; leaves with slender pilose petioles to 3 cm. long, ovate to deltoid-ovate, acuminate, coarsely serrate or serrate-dentate, rounded to subcordate at base, thin, glabrous or at most minutely pilose on veins beneath and on margin, to 12 cm. long and 6 cm. broad; racemes 1-sided, axillary and terminal (occasionally reduced to 1 flower), usually with 2 to 44 flowers in the axils of progressively smaller leafy bracts, internodes of lateral racemes mostly 2-7 (rarely -10) mm. long; calyx 2-2.7 (becoming in fruit 3-4) mm. long, puberulent; corolla slender, blue-violet, 5-9 mm. long, pilose; upper stamens inserted about middle of tube; cocci pale, 1.4-1.7 mm. high, obtusely pebbled. In alluvial thickets, meadows, marshes, swampy woods and on seepage slopes in n.e. Tex. and n. Panhandle, July-Sept.; from Ga. to s. Calif., n. to Nfld., Que., Ont., Man., Sask., Alta. and B.C.

13. *Scutellaria ovata* Hill. Stem simple or forking, to about 85 cm. high, erect to somewhat depressed, the middle and upper internodes villous to pilose-hirtellous, with or without gland-tipped hairs; leaves with long slender petioles, cordate-ovate, with deep basal sinus, more or less pubescent to glabrescent, to 13 cm. long, crenate-serrate; racemes terminal, simple, forking or in panicles, the glandular rachis pilose to villous or hirsute; bracts of raceme ovate, the lower bracts merging into the foliage leaves; calyx glandular, in anthesis 3-4 (in fruit 6-8) mm. long; corolla blue with a whitish lower lip, 1-2.3 cm. long, the slender tube flaring to 5 mm. thick at the throat, the lateral lobes almost equaling the short upper lip; the lower stamens seated 8-14 mm. above the base of the tube; cocci buff to orange or brownish, covered with conical papillae. In open woodlands, along roads and on brushy slopes in e. and s. Tex., Apr.-June; represented by several variants mostly in e. and cen. U.S. with the following found in Tex.

1. Middle and usually the lower parts of the stem below the inflorescence pubescent with decurved or retrorse nonglandular hairs . . . subsp. *mexicana* Epl.
1. Stems glandular throughout with spreading capitate glands and usually with shorter somewhat retrorse nonglandular hairs [*S. versicolor* Nutt. var. *bracteata* Benth., *S. ovata* var. *bracteata* (Benth.) Blake] subsp. *bracteata* (Benth.) Epl.

14. *Scutellaria elliptica* Muhl. Hairy SKULLCAP. Stems 1 or few erect from a strong base, to 7 dm. high, pilose with short soft curving hairs or with spreading-divergent hairs, the longest internodes to 15 cm. long; leaves usually few, sparsely strigose-hirsute above, very minutely pilose along the veins beneath, the lower ones with slender-petioled ovate to deltoid blades that are smaller than those above; median and upper leaves cuneate to short petioles, more rhombic-oval, dentate, blunt, 3-6 cm. long and 2-3.5 cm. broad; racemes terminal, 6- to 20-flowered or 3 to 5 (to 7) in a panicle, the rachis curling-pilose; bracts of all but the lowest flowers spatulate to oblong-obovate, entire, exceeding calyx; lowest flowers 1-2 cm. apart; calyx 2.5-3 (in fruit 6-8) mm. long, glandular-hirsute;

corolla 1.4-2 cm. long, pubescent, the tube pale, the unequal lips blue-violet; the lower stamens inserted 6-8 mm. above the base of the tube; cocci subglobose, dark-brown, about 2 mm. in diameter, with many concentric rings of rosulate slightly flattened subimbricated papillae. *S. ovalifolia* Pers., *S. pilosa* Michx. In dry woods and thickets in s.e. Tex., Apr.-June; from Fla. to Tex., n. to N.Y., N.J., Pa., W.Va., Mich., O. and Mo.

Those plants whose stems have numerous divergent hairs 1-2 mm. long and whose median and upper leaves are more deltoid-ovate are segregated as var. *hirsuta* (Short) Fern.

6. HYPTIS JACQ.

About 400 species, mostly in tropical America.

1. *Hyptis alata* (Raf.) Shinn. CLUSTER BUSHMINT, DESERT-LAVENDER. Herbaceous perennial from a woody rootstock; stem stout and elongate, to about 2 m. high, finely pubescent, simple or rarely branched; leaves ovate to rhombic-lanceolate or linear-lanceolate, to about 15 cm. long and 5 cm. wide, coarsely and irregularly serrate, cuneately narrowed into a petiolar base; flowers in dense axillary glomerules about 2 cm. thick that are supported by peduncles to 5 cm. long; calyx 6-8 mm. long, the tube strongly cross-ribbed at maturity, the lobes subulate-lanceolate and short-hairy; corolla declined, 2-lipped, white with lavender dots, 8-10 mm. long, the upper lip with 4 entire lobes, the lower lip saccate, abruptly deflexed at the contracted and callous base; stamens 4, declined or resting on the lower lip, didynamous; disk entire or with a gland on the anterior side; cocci oval, nearly 1.5 mm. long. *Hyptis radiata* Willd. In low pinelands, seepage areas, swamps and marshes in s.e. Tex., June-Nov.; from Fla. to Tex., n. to N.C.

7. MARRUBIUM L.

About 45 species, all in the Old World.

1. *Marrubium vulgare* L. COMMON HOREHOUND, MARRUBIO. Perennial aromatic herb with bitter sap; stem with stout erect or ascending branches, to about 1 m. high, white-woolly (especially below); leaves with petioles 1-2 cm. long, oval to broadly ovate or suborbicular, to about 5 cm. long, crenate-dentate, rugose-veined, obtuse to rounded at apex, narrowed to subcordate at base, woolly beneath, canescent above; flowers whitish, in dense axillary clusters; calyx cylindric, 4-5 mm. long; calyx teeth usually 10, subulate, more or less recurved; corolla white, 5-6 mm. long, 2-lipped, the upper lip erect and entire or emarginate, the spreading lower lip 3-cleft with its middle lobe broadest and often emarginate; stamens 4, included, didynamous, the posterior pair shorter; anthers 2-celled; styles cleft into 2 short lobes at summit; ovary deeply 4-lobed; cocci ovoid, smooth, about 2 mm. long. In waste places, along roadsides, about corrals, animal pens and along roadsides throughout most of Tex., flowering throughout year; nat. of Euras. but naturalized throughout much of N.A.

The flowering tops and dried leaves are used medicinally and as a flavoring.

8. SIDERITIS L. IRONWORT

About 100 species in North Temperate Eurasia.

1. *Sideritis lanata* L. Annual, branched from base to form a globose habit, 3 dm. high or more, villous or woolly-villous throughout; leaves with winged petioles to 15 mm. long, ovate to oval, broadly cuneate to rounded at base, obtuse at apex, crenate, to 3 cm. long and 2 cm. wide; verticils several-flowered, about 1 cm. apart in an elongate raceme, subtended by persistent leafy bracts; pedicels about 1 mm. long; calyx campanulate-funnelform; bilabiate, the tube to 5 mm. long, with 5 sharp unequal spiny-tipped teeth; corolla 6-8 mm. long, exerted, the slender cylindrical tube white, the bilabiate limb marked or suffused with dark-purple or nearly black, the upper lip with 2 linear lobes about 2 mm. long, the lower 3-lobed lip with 2 short triangular lateral lobes and an orbicular midlobe 1.5 mm. in diameter; cocci 2 mm. long, brown, pitted. A

nat. of Greece and Asia Minor that is adv. on sandy banks in oak-mesquite area in Llano Co. on the Edwards Plateau, Apr.-June.

9. MOLUCELLA L.

Two species that are native to the Mediterranean region.

1. *Molucella laevis* L. SHELL-FLOWER. Annual herb; stems erect, glabrous, simple or branched, to about 8 dm. high; leaves suborbicular, coarsely toothed with broad rounded teeth, to about 5 cm. long, with slender petioles about as long as the blade; flowers fragrant, several in the axils of the leaves, subtended by several slender spreading or reflexed spines; calyx campanulate, the lobes united into a broadly dilated funnelform membranous reticulate-veined structure 2-2.5 cm. long, subtended by several spines; corolla included, white tipped with pink, bilabiate, the upper lip arched and including the stamens, cocci 4, convex on one side, angular on the other, broader upward, truncate. An occasional escape from gardens, nat. of w. Asia.

10. AGASTACHE CLAYT.¹⁶³

Erect herbs with perennial rootstocks; leaves serrate, mostly petioled; flowers small, in dense verticillate clusters that form compact or interrupted terminal bracted spikes; calyx campanulate or tubular, somewhat oblique, usually 15-nerved, slightly 2-lipped, tho upper lip with 2 (the lower lip with 3) approximately equal teeth; corolla tube not exceeding the calyx, the limb conspicuously 2-lipped, the erect upper lip 2-lobed, the spreading lower lip 3-lobed with the middle lobe crenate; stamens 4, all fertile, exerted, divergent or distant, the upper pair usually declined, the lower shorter and ascending; anther cells parallel or nearly so, both fertile; style 2-cleft at summit; ovary deeply 4-parted; cocci ovoid, commonly smooth.

A North American genus of about 30 species.

1. Flowers in elongate spikes 1 cm. or less thick; calyx tube 2 mm. long or less; corolla tube 2.5-5 mm. long 1. *A. micrantha*.
1. Flowers in short congested spikes or heads mostly more than 1 cm. thick; calyx tube usually more than 3 mm. long; corolla tube 6-30 mm. long (2)
- 2(1). Leaf margins entire above the middle, sparsely toothed below middle 2. *A. cana*.
2. Leaf margins crenate or crenate-dentate from base to apex (3)
- 3(2). Corolla usually rose-purple, the tube 6-10 mm. long 3. *A. breviflora*.
3. Corolla whitish to rose-purple, the tube 9-18 mm. long 4. *A. pallidiflora*.

1. *Agastache micrantha* (Gray) Woot. & Standl. Stems to about 6 dm. high or more, with slender erect subfastigiate branches, finely pubescent; leaves deltoid-lanceolate, thin; median leaves with petioles 1-1.5 cm. long, 3-6 cm. long and 1-2.5 cm. wide, acute, mostly rounded or cuneate at the base, coarsely serrate (mostly below the middle), both surfaces hirtellous or pubescent with fine hairs; basal leaves reniform, hirsute, with slender petioles about twice as long as the blades; inflorescence continuous or somewhat moniliform, at least the upper whorls usually crowded, 8-20 cm. long and to 1 cm. thick; calyx green, minutely hirtellous with spreading hairs, the tube 2-3 mm. long; calyx teeth to 1 mm. long, commonly whitish, acute, unequal, their margins thin; corollas white, scarcely or not at all exerted from the calyx, the tubes 2.5-3 mm. long; stamens less than 1 mm. long, scarcely exerted; cocci to 1 mm. long, glabrous. In rocky or sandy soils or on ledges in mts. of the Trans-Pecos, July-Oct.; from Tex. to Ariz. and n. Mex.

2. *Agastache cana* (Hook.) Woot. & Standl. MOSQUITO PLANT. Stems to about 6 dm. high, with numerous slender ascending branches, arising from a woody crown, minutely

¹⁶³ Adapted from Harold Lint and Carl Epling in Am. Midl. Nat. 33:207-230. 1945.

puberulent; lower leaves with slender petioles about as long as the blade, deltoid to deltoid-ovate, coarsely crenate-serrate, 1-3 cm. long, the mostly entire median leaves ovate-lanceolate and 1-2 cm. long, the uppermost leaves nearly sessile, both surfaces minutely puberulent but green, about equally pitted with sessile glands; verticils 6- to 12-flowered, mostly 1-2 cm. distant, shortly pedunculate, forming a loose narrow panicle or interrupted spike as much as 3 dm. long, the internodes of the rachis about as long as the pedicels, evident; calyx turbinate, whitish or tinged with rose, the tube 5.5-7.5 mm. long, thinly hirtellous with spreading hairs; calyx teeth narrowly deltoid, 1.5-3.5 mm. long, acute to acuminate; corolla rose-color, thinly hirtellous to glabrous, the tube 16-25 mm. long; cocci 1.5-2 mm. long, usually puberulent. On rocky slopes and in crevices of ledges in w. Trans-Pecos, July-Oct.; also N.M.

3. *Agastache breviflora* (Gray) Epl. Stems to about 6 dm. high, with ascending often subcorymbose branches, arising from a woody caudex, hirtellous, the internodes elongate; leaves with petioles mostly less than 1 cm. long, deltoid-ovate, the upper leaves sometimes narrowly deltoid, the lower leaves deltoid-cordate, 2-4 cm. long, obtuse to rounded at the apex or the upper ones acute, truncate to subcordate at the base, coarsely crenate-serrate, the upper surfaces hirtellous and green, the lower surface more or less pubescent, or both surfaces nearly glabrous; verticils sessile, approximate in continuous spikes mostly 5-10 cm. long and 1.5-2 cm. in diameter, the lower whorls sometimes distant; calyx usually rose-color, hirtellous with spreading hairs, the tube 3.5-5.5 mm. long, the firm teeth tending to be subulate; corolla rose-color or purplish, the tube 6-10 mm. long; stamens 1.5-2.5 mm. long, scarcely exerted beyond the lip; cocci about 1.5 mm. long. *A. verticillata* Woot. & Standl. In crevices of rocks and near summit of mts. in the Trans-Pecos, July-Oct.; from Tex. to Ariz. and n. Mex.

4. *Agastache pallidiflora* (Heller) Rydb. Stems usually simple, to about 6 dm. high, rarely to 1 m. high, ascending from a woody caudex; leaves with petioles rarely to 2 cm. long, prevailingly deltoid-ovate, to 6 cm. long and 55 mm. wide, usually much smaller, mostly obtuse at apex, truncate to shallowly cordate at the base, crenate-serrate, hirtellous on the upper surface but green, finely and usually sparingly pubescent on the lower surface, sometimes nearly glabrous; verticils sessile, usually crowded into continuous cylindrical spikes, the lowermost verticils sometimes approximate or remote; calyx green, rose or deep-rose-purple, hirtellous with spreading hairs, the tube usually 5-8 mm. long, the deltoid to almost subulate teeth quite variable in shape and relative size (1-4 mm. long); corolla whitish to rose-color, their tube 9-18 mm. long. In humus in mt. forests in the Trans-Pecos, June-Oct.; from Tex. to Ariz. and n. Mex. The following variants occur in Texas.

Subsp. *Havardii* (Gray) Lint & Epl.: calyx tube tinged with violet or rose, 4-5 mm. long, the teeth 1.5-3 mm. long, tending to flare somewhat; corolla (?) rose, the tube 9-11 mm. long. *A. brevifolia* var. *Havardii* (Gray) Shinnars.

Subsp. *neomexicana* (Briq.) Lint & Epl.: calyx rose (at least on the teeth), the tube mostly 5-8 mm. long; corolla rose, the tube 9-15 mm. long. *Agastache neomexicana* (Briq.) Standl., *Brittoniastrum neomexicanum* Briq.

11. NEPETA L.

CATMINT

A genus of about 250 species, all of which are natives of Eurasia and Africa.

1. *Nepeta Cataria* L. CATNIP. Perennial erect herb with pale-green and densely canescent herbage; stems to about 1 m. high, with ascending branches; leaves petioled, ovate to triangular-ovate or oblong, to about 8 cm. long and 5 cm. wide, acute at apex, usually cordate at base, coarsely dentate or crenate-serrate; flower verticils in the axis of small foliaceous bracts to form dense or interrupted terminal spikes; bractlets subulate; calyx urceolate, slightly oblique at apex, about 6 mm. long, very pubescent, the 5 subulate teeth about half as long as the tube, short-pubescent on the prominent 15 nerves; corolla white to pale-purple, dotted with dark-purple, strongly 2-lipped, 1-1.2 cm. long, puberulent on the outer surface, the upper lip erect and somewhat 2-lobed, the broad middle lobe of the 3-lobed lower lip crenulate; stamens 4, all fertile, didynamous, ascending under the upper lip; anther sacs 2, divergent; ovary deeply 4-parted; style 2-cleft at

summit; cocci ovoid, compressed, smooth. In waste places in e. and cen. Tex., May-Sept.; a nat. of Eur. that is naturalized in various parts of N.A.

12. PRUNELLA L.

About 7 species of world-wide distribution.

1. *Prunella vulgaris* L. COMMON SELF-HEAL, HEAL-ALL, CARPENTER-WEED. Perennial herb with simple or several stems and slender rootstocks, tufted or loosely ascending from leafy-tufted bases, to about 6 dm. high, usually much smaller, glabrous or commonly pilose (especially above); leaves ovate to ovate-lanceolate or oblong-lanceolate, 3-7 cm. long and about a third as wide, acute to acutish or sometimes rounded at apex, narrowed to a short or elongate petiole, entire or irregularly and remotely toothed; flowers in clusters of 3, sessile in the axils of round and bractlike membranaceous floral leaves, imbricated in a close spike 2-5 cm. long; bracts orbicular to broadly ovate, cuspidate, more or less bristly-ciliate, green or often tinged with purple; calyx tubular-campanulate, about half as long as the corolla, usually 10-nerved, naked in the throat, closed in fruit, deeply 2-lipped, the upper lip truncate or with 3 short often ciliate teeth, the lower lip cleft into 2 lanceolate often ciliate teeth; corolla 1-2 cm. long, violet or rarely white, ascending, strongly 2-lipped, the upper lip arched, the lower lip spreading and 3-lobed; stamens 4, didynamous, ascending under the upper lip, the lower pair longer; filaments 2-toothed at apex with one of the teeth bearing the anther, the other sterile; anther cells 2, divergent; ovary deeply 4-parted; cocci ovoid, smooth. In low meadows, open woodlands, along roadsides and pasturelands in the e. fourth of Tex., Apr.-June; widespread throughout the N. Hemis.

This species is represented in Texas by var. *hispida* Benth. with densely pubescent stems and lower surface of leaves, and var. *lanceolata* (Bart.) Fern. with narrow leaves.

13. BRAZORIA ENGELM. & GRAY¹⁶⁴

Annual herbs; leaves typically oblong, sessile or petiolate, denticulate, reduced above to bracts; flowers in virgate racemes or spikes; calyx more or less inflated and essentially closed at maturity, bilabiate, the upper lip with 3 lobes, the lower lip with 2 lobes; corolla pink to rose-purple or bluish, more or less variegated, bilabiate; stamens 4; anthers 2-celled, the sacs parallel or nearly so; cocci 3-angled.

A genus endemic to Texas and Oklahoma.

1. Stem glabrous toward base; corolla 9-14 mm. long; plant of calcareous rocky or clayey soils 1. *B. scutellarioides*.
1. Stem pubescent or hispidulous at base; corolla 13-28 mm. long; plant of light sandy or sandy-clay soils (2)
- 2(1). Pubescence of inflorescence of long simple hairs to 2 mm. long; calyx conspicuously bearded with long hairs; flowers in short dense subspicate racemes 2. *B. truncata*.
2. Pubescence of inflorescence of short hairs; calyx not bearded; flowers in elongated open interrupted subspicate racemes (3)
- 3(2). Stem leaves mainly at base, with 3 to 5 pairs of stem leaves below inflorescence, the upper reduced to clasping bracts, the basal leaves persistent; middle calyx lobe of upper lip rounded and entire, not subulate-apiculate, the 2 lobes of lower lip not overlapping, the sinus open 3. *B. arenaria*.
3. Stem leaves at base withering early, not persistent, with 5 to 8 pairs of stem leaves below inflorescence, large and spatulate, not reduced above to clasping bracts; middle calyx lobe of upper lip truncate-rounded and subulate-apiculate, the 2 lobes of lower lip overlapping, the sinus closed 4. *B. pulcherrima*.

¹⁶⁴ Ref.: Lloyd H. Shinnars in *Field & Lab.* 21:153-154. 1953; C. L. Lundell in *Wrightia* 4:29-30. 1968, and *Flora of Texas* II: 319-330. 1969.

1. *Brazoria scutellarioides* Engelm. & Gray. PRAIRIE BRAZORIA. Stem glabrous below the inflorescence, erect, to about 45 cm. high, paniculately branched above; leaves sessile and partly clasping at base, oblong to oblong-lanceolate or oblong-spatulate, acute, serrate above the middle; spikes or racemes loosely flowered, paniced, to 2 dm. long, the rachis (and calyx) densely and minutely pubescent; bracts ovate to lanceolate, 3-6 mm. long, ciliolate; calyx deeply and unequally bilabiate, 3-4 mm. long, becoming 5 mm. in fruit, the lobes (except the middle and upper lip) pointed with a rather conspicuous cusp, in fruit the upper ovate-rounded lobes are somewhat curved backwards while the narrow lower lip is incurved so as to nearly close the orifice; corolla pinkish or flesh-color; anthers purplish, slightly ciliolate; cocci rather granular, glabrous, about 1 mm. thick. In calcareous soils in cen. Tex., Mar.-May; also Murray Co., Okla.

2. *Brazoria truncata* (Benth.) Engelm. & Gray. Stem stout, somewhat pubescent, to 5 dm. high, simple or branched at base; leaves oblong to oblanceolate or spatulate, to about 1 dm. long, the lower leaves tapering to a long winged-petiole, the upper leaves sessile and partly clasping; spike densely flowered, stout, viscid-hairy, to 15 cm. long; floral bracts orbicular, apiculate, with long white marginal hairs; calyx about 5 mm. long, becoming 8-9 mm. in fruit, acutely toothed, with a tuft of hairs at base; corolla slightly puberulent along the back, 1.5-2 cm. long, the tube spotted with purple, lobes of the lower lip emarginate; cocci 1.5 mm. thick, pubescent, contained in a gibbous cavity on the upper side of the calyx which is flat on the lower side and very gibbous at the base on the upper side. In sandy soils in s.-cen. Tex., Apr.-May; endemic.

3. *Brazoria arenaria* Lundell. SAND BRAZORIA. Stem to about 4 dm. high, branching at the base, erect or ascending, pubescent with short hairs; leaves membranaceous; basal leaves long-petiolate, oblong-elliptic to elliptic-oblanceolate, to 12 cm. long and 35 mm. wide, attenuate at base, rounded at apex, denticulate, glabrous beneath, with a few short hairs along midrib at base of blade above; cauline leaves few, sessile, remote, linear-oblong to oblong-oblanceolate or oblong-obovate, denticulate, reduced above to clasping bracts; racemes to 3 dm. long, interrupted, remotely flowered, pubescent with short glandular and nonglandular hairs; bracts broadly elliptic to ovate-elliptic, at most ciliate, obtuse to acute, 3.5-5 mm. long; calyx campanulate, broadly toothed, about 5.5 mm. long, becoming 9 mm. long in fruit, puberulent at base, the lips subequal; calyx tube pubescent with short nonglandular and glandular hairs, not bearded, the upper lip of 3 broad rounded lobes, the lateral lobes apiculate, the middle lobe rounded, the lower lip slightly longer, shallowly 2-lobed, the lobes sharply dentate with 3 to 5 short subulate teeth; corolla lavender with maculate throat, sparsely puberulent along the back, 13-18 mm. long, the tube dilated upward, the upper lip with 2 oblong subentire lobes, the lower lip with 3 smaller lobes that are emarginate at the apex; cocci pubescent, 2 mm. in diameter. In sandy soils in the Rio Grande Plains, Mar.-Apr.; endemic.

4. *Brazoria pulcherrima* Lundell. Annual to 6 dm. high; stems with rounded angles, simple or branched near base, pubescent with short hairs; leaves membranous, the basal withering early, with 5 to 8 pairs of stem leaves below the inflorescence, spatulate, to 13 cm. long and 2.5 cm. wide, rather remotely crenate-denticulate above middle, acutish to obtusish at apex, the upper leaves winged at base, the lower petiolate, short-pubescent above at base (otherwise glabrous); racemes subspicate, paniced, interrupted, remotely flowered, to 35 cm. long, the rachis pubescent with short glandular and nonglandular hairs; bracts ovate, 6 mm. long, subulate-acuminate, conspicuously ciliate with long hairs; pedicels to 2 mm. long, slender; calyx campanulate, not bearded, short-pubescent with glandular and nonglandular hairs, about 6 mm. long, becoming 8 mm. long in fruit, the 3 lobes of upper lip truncate-rounded, each lobe subulate-apiculate, the 2 lobes of lower lip each with 2 to 5 subulate teeth, the lateral teeth often reduced, the lobes overlapping medially to close the sinus; corolla lavender with maculate yellow throat, sparsely pubescent along the back, to 22 mm. long, the tube dilated upward, the upper lip with 2 rounded conspicuously toothed lobes, the teeth rounded, the lower lip with 3 smaller emarginate lobes, the upper lip villous at base within throat; cocci 3-angled, about 1.8 mm. long, hirtellous. Sandy soils along roadsides and open fields near Centerville, Leon Co., Tex., Apr.-June; endemic.

14. *PHYSOSTEGIA* BENTH.¹⁶⁵

FALSE DRAGON-HEAD. OBEDIENT-PLANT

Smooth perennial herbs with upright simple or sparingly branched stems; leaves sessile or the lower ones sometimes petiolate, linear to lanceolate or oblong, mostly crenate or dentate; flowers usually large and showy, opposite, scattered or crowded in simple or paniced terminal leafless spikes; calyx regular, obscurely 10-nerved, short-tubular to campanulate, more or less enlarged and slightly inflated in fruit; corolla funnel-form, the tube exceeding the calyx, with a much-inflated throat, varying from white to rose-color and commonly spotted or variegated with purple, 2-lipped; upper corolla lip erect, nearly entire; lower corolla lip 3-parted, spreading, small, its larger middle lobe broad and rounded, notched; stamens 4, ascending beneath the upper corolla lip; cocci ovoid, smooth.

About a dozen species that extend from Canada to northern Mexico. The vernacular name, "obedient-plant," is derived from the fact that when the flowers are moved laterally in the inflorescence they remain where placed. All of these species have value as ornamentals.

1. Corolla rarely to 2 cm. long (2)
1. Corolla more than 2 cm. long (3)
 - 2(1). Corolla less than 1 cm. long; calyx 3-4 mm. long . . . 1. *P. micrantha*.
 2. Corolla more than 1 cm. long; calyx 5 mm. long or more 2. *P. intermedia*.
- 3(1). Plant mostly slender and to about 1 m. high; leaves on lower half of stem linear to linear-lanceolate, rarely more than 15 mm. wide (4)
3. Plant large, coarse, commonly above 1 m. high; leaves on lower half of stem elliptic to oblong-elliptic or oblong-lanceolate, 20 mm. wide or more (5)
- 4(3). Flowering from April to July 3. *P. angustifolia*.
4. Flowering from August to November 4. *P. praemorsa*.
- 5(3). Distribution in Val Verde County, commonly in flowering water; rhizome large and elongate 5. *P. Correllii*.
5. Distribution in eastern half of Texas, in dry or wet soil; rhizome short and thick (6)
- 6(5). Corolla very pale lavender-pink or whitish; mostly in sandy or gravelly soils 6. *P. Digitalis*.
6. Corolla reddish purple or deep lavender-pink, the lobes purplish; mostly in wet clayey soils 7. *P. pulchella*.

1. *Physostegia micrantha* Lundell. Erect rhizomatous herb to 9 m. high, slender, the internodes progressively longer from base to apex, the upper nodes puberulent, otherwise glabrous below the inflorescence; leaves small, glabrous, chartaceous, linear-lanceolate or oblong-lanceolate, acute to acuminate, to 12 cm. long and 11 mm. wide, the basal leaves petiolate, the medial leaves largest, sessile, clasping at base, the apical leaves bractlike below the inflorescence; leaf margin repand to sinuate, rather remotely and inconspicuously denticulate; inflorescence to 2 dm. long, slender, usually simple, sometimes with 2 lateral branches at the basal node, densely puberulent; bracts shorter than the calyx, puberulent; flowers subsessile, the puberulent pedicels about 1 mm. long; calyx pellucid-punctate, puberulent, 3-4 mm. long, the acute teeth slightly shorter than tube; corolla white, tinged lavender or pink, puberulent, 5-7 mm. long, the campanulate tube shorter than the calyx; filaments glabrous. Wet bottomland along creek in Titus Co., May-June; endemic.

2. *Physostegia intermedia* (Nutt.) Engelm. & Gray. Slender, rhizomatous, 3-15 dm. high; leaves dark-green, linear-lanceolate to linear, thickish, the larger 3-12 mm. broad, the margin repand-sinuate and entire or rarely obscurely dentate, all but the lowest attenuate, the uppermost greatly reduced; spike very slender, much-interrupted, the lateral ones (if developed) strictly erect, the rachis 5-35 cm. long; corolla lavender,

¹⁶⁵ Ref.: C. L. Lundell in *Wrightia* 2:4-12, 66-74. 1959-1960, and *Flora of Texas* II: 319-330. 1969. See Appendix.

purple-spotted in throat, 1-1.5 cm. long, rarely more. Usually found in wet periodically flooded areas or even growing as an aquatic along ditches, in swamps, marshes and bottomlands in e. and most of s. half of Tex., Apr.-June; from Ky. to Kan., s. to Ala., La. and Tex.

3. *Physostegia angustifolia* Fern. Stem stiffly erect, with rhizomes to 3 dm. long, to about 2 m. high; leaves rigid, sessile or the lower ones with slender petioles to 2 cm. long, grayish or pale, linear to narrowly lanceolate or oblong-lanceolate, the lower leaves obtuse to subacute; median leaves attenuate and appressed-acerose-serrate, to 13 cm. long and 12 mm. wide, rarely larger, the uppermost leaves passing rather abruptly into the small leafy bracts of the inflorescence; spikes slender, virgate, solitary or with few erect laterals, to 35 cm. long, remotely flowered; branches of inflorescence, bracts and calyces finely and densely pubescent with nonglandular hairs; calyx 6-10 mm. long; corolla pale- to deep-purple or whitish, purple-spotted, 2.5-3 cm. long; cocci dark-brown, 3 mm. long or more. *P. edwardsiana* Shinnars. In marshy areas, along streams, roadsides and fields and meadow in e. and cen. Tex., Apr.-July; from Ill. to Tenn., s. to Miss., La. and Tex.

4. *Physostegia praemorsa* Shinnars. Perennial with rhizomes; stem glabrous, to about 12.5 dm. high; lower leaves shortly petiolate, narrowly oblong to lanceolate or oblong-lanceolate, acute, 3-7 cm. long, 5-13 mm. wide, the margins sharply serrate except near base, gradually reduced above to sessile linear-lanceolate bracteal leaves; inflorescence simple or virgately branched, with the bracts and calyx densely and minutely pubescent with glandular and nonglandular hairs; calyx 6-10 mm. long, the teeth narrowly deltoid-lanceolate; corolla showy, light-lavender-violet to whitish, with rose-purple spots, 22-32 mm. long, the tube 7-14 mm. long, often exerted from calyx; cocci dark-brown, about 4 mm. long, sharply 3-angled. *P. serotina* Shinnars. Along streams and ditches, in moist grasslands in e. n.-cen. Tex., with a disjunct area in the Guadalupe Mts., Aug.-Oct.; also La. and N.M., probably also Okla.

5. *Physostegia Correllii* (Lundell) Shinnars. Plants erect, robust, somewhat succulent, to 22 dm. high, with thick creeping rhizomes; stems simple or sparingly branched, to 25 mm. thick, glabrous, as many as 20 nodes per stem; leaves decussately opposite, sessile, leathery and firm, elliptic or oblong-elliptic, 5-13 cm. long, 2-6.5 cm. wide, short-acuminate at apex, slightly narrowed at base and inconspicuously clasping, the margin conspicuously and sharply serrate-dentate to base, primary veins usually 2 or 3 on each side, the upper leaves only slightly reduced; racemes spikelike, simple or compound, short, leafy at base, finely pubescent, comparatively few-flowered; bracts leafy, ovate, those at base of raceme equal to or longer than calyx, reduced above, acuminate; pedicels very short, about 1 mm. long in fruit; calyx finely pubescent, gland-tipped hairs abundant, subcylindric, 8-9.5 mm. long, the acuminate lobes slender and subequaling tube, inflated at maturity; corolla lavender-pink, spotted or streaked with purple, about 3 cm. long, sparsely pubescent; cocci about 2.3 mm. long, sharply angled. *Dracocephalum Correllii* Lundell. In water along streams and in irrigation ditches in Val Verde Co., June-July; also N.L.

6. *Physostegia Digitalis* Small. Stems erect, to 2 m. high, stout, sharply angled; leaves several, sessile and partly clasping at base, somewhat leathery-thickened, oblong to elliptic-oblong, to 22 cm. long and 75 mm. wide, acute to subacute, the margins undulate or repand-serrate above the middle; raceme simple or compound, finely pubescent; bracts ovate-lanceolate to lanceolate, 4-6 mm. long; pedicels very short; calyx 8-10 mm. long, the tube turbinate or cylindrical-turbinate, the lanceolate lobes acuminate and about one half as long as the tube; corolla pale-lavender to whitish, commonly with reddish-purple dots, 2-2.5 cm. long, barely puberulent dorsally, the upper lip slightly undulate, the lower lip spreading with the lobes oblong (the middle lobe emarginate and about twice as long as the others). *P. obovata* of auth. In sandy open pinelands, edge of forests, prairies, grasslands and swampy areas in e. Tex., June-Aug.; from e. Tex. to La., Ark. and probably Okla.

7. *Physostegia pulchella* Lundell. Erect rhizomatous herb to 14 dm. high, slender or robust; stem to 15 mm. in diameter near base; basal leaves chartaceous, usually with slender petioles to 8 cm. long, expanded and clasping at base, narrowed above, entire to subentire or remotely dentate; leaves above base oblong-lanceolate or oblong-elliptic, to 12 cm. long and 25 mm. wide, tapering into a winged petiole, obtuse at apex, the margin

subentire to denticulate; leaves of middle stem rather firm, chartaceous, pallid, oblong to oblanceolate-oblong or oblong-elliptic, 7.5-15 cm. long, 1-2 cm. wide, sessile and clasping at base or with a broadly winged petiole below, the apex acute or obtuse, the margin usually serrate to base or sometimes subentire below; apical leaves bractlike below the inflorescence; inflorescence densely pubescent throughout, simple or with two or more lateral branches from the basal bracts, usually less than 3 dm. long, sometimes to 6 dm. long; flowers rather remote, not crowded, subsessile, subtended by small ovate acuminate bracts 2-3 mm. long; pedicels in fruit not over 1.5 mm. long; calyx tubular-campanulate, 6-7 mm. long at anthesis, the pellucid-punctate acute teeth ovate-deltoid or ovate and 1.5-2 mm. long; corolla pink-lavender to deep reddish-purple, the lobes purplish, the throat red-purple striped or maculate, finely pubescent, 2-3 cm. long, the tube subequaling the calyx, the upper lobe entire, the lower lobes inconspicuously emarginate and subentire; filaments villous below; anthers glabrous or sparsely short-villous; fruiting calyx turbinate, 6-7 mm. long, about 5 mm. in diameter at base, the rigid teeth slightly incurved; cocci brown, 3-angled, about 3 mm. long, the ridges hyaline. In wet soil of bottomlands along streams mostly in e. Tex., May-June; endemic.

15. STACHYS L.¹⁶⁶ HEDGE-NETTLE

Annual, biennial or perennial herbs, mostly pubescent or hispid; flowers in verticils to form dense or interrupted terminal racemes or spikes, sometimes in the upper leaf axils; calyx usually campanulate, 5- to 10-nerved, 5-toothed with the teeth nearly equal and erect or spreading; corolla mostly reddish or purplish, the narrow tube not dilated at the throat and strongly 2-lipped; upper corolla lip erect, often arched, concave, entire or emarginate; lower corolla lip spreading, 3-lobed, the middle lobe broader than the often deflexed lateral ones and sometimes 2-lobed; stamens 4, didynamous, ascending under the upper corolla lip, the anterior pair the longer; anthers contiguous in pairs, the sacs divergent; ovary deeply 4-lobed; style 2-cleft, the lobes subulate; cocci ovoid or oblong, obtuse.

Nearly 300 species mostly in the North Temperate Zone, with several in South America and South Africa.

- 1. Distribution in mountains of Trans-Pecos Texas; plant perennial (2)
- 1. Distribution east of the Trans-Pecos region; plants annual, biennial or perennial (3)
- 2(1). Corolla scarlet, the tube 15-21 mm. long; rare in the El Paso region 1. *S. coccinea*.
- 2. Corolla pink or pink-lavender, the tube 8-13 mm. long; occasional in the central and southern Trans-Pecos region 2. *S. Bigelovii*.
- 3(1). Plant annual or biennial, mostly in central and south Texas (4)
- 3. Plant perennial; in extreme east Texas (5)
- 4(3). Calyx teeth mostly longer than the tube; lower lip of corolla noticeably surpassing the calyx 3. *S. Drummondii*.
- 4. Calyx teeth about as long as or shorter than the tube; lower lip of corolla only slightly surpassing the calyx 4. *S. crenata*.
- 5(3). Plant glabrous or nearly so; inflorescence essentially glabrous; petioles less than one fourth as long as the blades 5. *S. tenuifolia*.
- 5. Plant more or less hirsute; inflorescence puberulent or glandular-puberulent; petioles one third to one half as long as the blades 6. *S. floridana*.

1. *Stachys coccinea* Jacq. TEXAS BETONY. Perennial with assurgent to erect stems, to 1 m. high or more, rather stout, pubescent with long soft spreading hairs below, less so upward, very obscurely resiniferous-viscid beneath the indument throughout; leaves broadly to narrowly triangular-ovate to ovate-lanceolate, dentate-serrate, dark-green and short-pubescent above, paler and densely pubescent beneath, subacute at apex, rounded to truncate or subcordate at base, the lower leaves to 8 cm. long, gradually smaller upward

¹⁶⁶ Adapted from Carl Epling in Repert. Sp. Nov. 80:1-75. 1934.

and passing into the sessile foliar bracts of the verticils, the petioles of lower leaves equaling or exceeding the blades; inflorescence an open interrupted spike; verticils mostly 4-flowered; flowers usually distinctly pedicelled; calyx deeply and narrowly campanulate, its tube 5-6 mm. long, with 5 triangular acute cuspidate teeth half as long as tube; corolla scarlet, 18-24 mm. long, its tube twice as long as the calyx and transversely annulate near base, strongly bilabiate, the entire upper lip broadly ovate to subreniform and 7-8 mm. in diameter, the lower lip deeply divided with the middle lobe ovate and the lateral lobes oblong-spatulate. In moist crevices of steep stony slopes in mts. of the Trans-Pecos; w. to Ariz. and n. Mex.

2. *Stachys Bigelovii* Gray. ROCK BETONY. Perennial, branched, to about 6 dm. high; the herbage sparsely or densely minutely cinereous-pubescent; leaves with petioles to 5 cm. long, triangular-ovate to triangular-lanceolate, obtuse to acute at apex, broadly rounded to truncate or cordate at base, to 6 cm. long and 4 cm. wide; flowers few in the clusters, almost sessile or with pedicels to 2 mm. long; calyx tube 5-6 mm. long, oblong-campanulate, with subulate teeth 2.5-5 mm. long; corolla pink to pink-lavender or purplish, its tube 8-13 mm. long. Under oaks, on rocky slopes and ledges and in crevices in mts. of the Trans-Pecos, June-Oct.; probably also n. Mex.

Two forms are found in Texas. Those plants in the Chisos Mts. usually are less pubescent, have narrower, more dentate leaves, and a more slender corolla tube.

3. *Stachys Drummondii* Benth. PINK MINT. Annual or biennial, softly hirsute; stems solitary or tufted, to 9 dm. high, usually branched from below middle; leaves with petioles about as long as the leaf blades or shorter, broadly ovate to ovate-oblong, to 1 dm. long, obtuse at apex, crenate, truncate to cordate at base; clusters few-flowered; pedicels 1-2 mm. long; bracts spine-tipped; calyx tube 5-6 mm. long, turbinate; calyx lobes lanceolate, acuminate, subulate-tipped, as long as the tube or longer; corolla lavender or pink, appressed-pubescent, about 1 cm. long, the tube shorter than the calyx, the upper lip notched, the lower lip twice as long as the upper one and its lobes truncate or retuse at the apex; cocci nearly 2 mm. long, dull. In clayey soils, sandy or gravelly loam in chaparral, open woods, palm groves and brushlands in s. and coastal Tex., Feb.-July; also adj. Mex.

4. *Stachys crenata* Raf. SHADE BETONY. Annual or biennial, hirsute; stems usually branched at the base, the branches erect or decumbent, to 3 dm. long; leaves ovate to oblong, to 4 cm. long, obtuse at apex, crenate, truncate to cordate at base, the lower ones with petioles as long as or longer than blade, the uppermost sessile; clusters few-flowered; pedicels 1-2 mm. long; bracts oval to suborbicular, subulate-tipped; calyx 3-5 mm. long; calyx lobes ovate-lanceolate to lanceolate, with subulate tips, mostly shorter than the tube, glabrous beyond the middle; corolla 5-6 mm. long, pink-lavender, pink to blue or rarely white, glabrous except the bearded upper lip, the lobes of the lower lip rounded or the middle one barely emarginate; cocci about 1 mm. long, granular. *S. agraria* Cham. & Schlecht. In shaded rocky or gravelly soils in woods, ravines in prairies, on banks and in open grounds in e., cen. and s. Tex., Feb.-May; also n.e. Mex.

The plant with white corolla and green calyx teeth is segregated as f. *albiflora* Benke.

5. *Stachys tenuifolia* Willd. Perennial, extensively creeping, glabrous or nearly so; the erect simple or branching stems glabrous or at most sparsely hirtellous on the sides, smooth to roughened or hirsute on the angles, to 13 dm. high; leaves with petiole 1-2 cm. long, linear or linear-lanceolate to narrowly ovate, the principal ones 6 cm. broad, glabrous or hirsute on one or both faces, with rounded to subtruncate or tapering base, taper-pointed, sharply dentate to serrate, the middle and lower blades 4 to 11 times as long as their petioles; spike few-flowered, interrupted; calyx 5-6 mm. long, glabrous or bristly along the angles, the lance-attenuate teeth soon outwardly curving; corolla about 1 cm. long, the tube surpassing the calyx, the lower lip drooping and slightly shorter than the tube, the upper lip concave and glandular-pubescent on the back; filaments villous at the base; cocci 2 mm. long, somewhat lustrous. Rich bottomlands, lake shores, muddy bayous, low woods and meadows in e. fourth of Tex., Aug.-Nov.; from N.Y. to Minn., s. to S.C., Tenn., La. and Tex.

6. *Stachys floridana* Shuttlew. Plant spreading by means of elongate sometimes branching tubers; stem to about 4 dm. high, hirsute; leaves elliptic to ovate, serrate or dentate, 1-4 cm. long, the middle and lower blades shorter to slightly longer than their petioles; calyx 5-7 mm. long, puberulent, the lobes lanceolate; corolla 1-1.3 cm. long, the lower

lip as long as the tube; cocci 1.5 mm. long or rarely smaller. In wet sandy soils in s.e. Tex., Mar.-June; from Fla. to Tex., n. to N.C.

16. LAMIUM L.

Annual or perennial herbs; leaves toothed or incised, more or less cordate; flowers small, verticillate in axillary and terminal clusters; calyx tubular-campanulate, usually 5-nerved, 5-toothed, with the sharp-pointed teeth equal or the upper longer; corolla tube dilated above, usually longer than the calyx, the limb 2-lipped; upper corolla lip concave, erect, ovate to oblong, usually entire; lower corolla lip spreading, 3-lobed with the middle lobe emarginate and contracted at the base, the lateral lobes often with a lateral appendage; stamens 4, didynamous, the anterior pair longer; anthers 2-celled, the divaricate sacs often hirsute on the back; style 2-cleft at apex; ovary 4-parted; cocci smooth or tuberculate.

About 40 or more species that are native to the Old World.

1. Upper leaves sessile or clasping 1. *L. amplexicaule*.
 1. Leaves all petioled 2. *L. purpureum*.

1. *Lamium amplexicaule* L. HENBIT, DEAD-NETTLE. Annual or biennial, sparsely pubescent; stems freely branched from the base and often from the lower axils, ascending or decumbent, to 45 cm. high; leaves broadly ovate to reniform or nearly orbicular, truncate to cordate at base, coarsely crenate, the basal leaves slender-petioled and to about 10 mm. wide, the upper leaves sessile or clasping and to about 25 mm. wide; flowers 6 to 10 in axillary and terminal clusters; calyx pubescent, 5-6.5 mm. long, the erect teeth nearly as long as the tube; corolla purple or red, 12-16 mm. long, the tube very slender; lower corolla lip with very small lateral lobes, its middle lobe spotted; upper corolla lip pubescent with reddish hairs; cocci smooth and shining, brown or olivaceous, pebbled or mottled with white, clavate-obovate, trigonous, 2-2.4 mm. long. In cult. areas, among grasses, waste places and along roadsides in most of Tex., flowering throughout the year; a nat. of Eur. naturalized throughout N.A.

2. *Lamium purpureum* L. RED HENBIT, PURPLE DEAD-NETTLE. Annual, sparsely pubescent; stems branched from the base and sometimes from the axils, hollow, decumbent, to about 45 cm. high; leaves deep-green or purplish, setulose, crenate or crenulate; lower leaves slender-petioled, orbicular to broadly ovate, 8-12 mm. long, cordate at base, rounded at apex; upper leaves short-petioled, ovate, usually acutish at apex, cordate at base, 15-25 mm. long; flowers 3 to 6 in a whorl, subtended by a short linear bractlet; calyx purple-angled, hairy, 6-8 mm. long, with lance-attenuate bristly lobes; corolla purple-red, 1-1.6 cm. long, the straight tube rather stout, lateral lobes of the linear lip reduced to short teeth with the middle one spotted, the upper lip densely reddish-pubescent; cocci about 2 mm. long. In waste places and cult. ground in e. Tex., Mar.-Sept.; a nat. of Eur. naturalized in much of N.A.

17. LEONURUS L. MOTHERWORT

About a dozen species native to Eurasia.

1. *Leonurus sibiricus* L. Tall biennial, the softly retrorse-hispid stem to 15 dm. high and leafy; leaves palmately 3-parted, the divisions 2- to 5-cleft or deeply 3- to 7-cleft and incised; flowers in close whorls in leaf axis; calyx 5- to 10-nerved, with 5 nearly equal spiny teeth; corolla strongly bilabiate, purplish, twice as long as the calyx, the upper finely pubescent lip fornicate and entire, the lower 3-lobed lip spreading. In fields, open woods and waste grounds in n.e. to s.-cen. Tex., Apr.-Aug.; a nat. of Eur. that is naturalized from Fla. to Tex., n. to Que., Ky. and Ia.; also trop. Am.

18. LEONOTIS L.

About 40 species, all in Africa.

1. *Leonotis nepetaefolia* A. Br. LION'S-EARS. Annual to about 2 m. high, soft-pubescent, the stout stems simple or branched; leaves petiolate, ovate to ovate-deltoid, to about 12

cm. long, cuneate to subcordate at base, coarsely crenate; the globular flower cluster dense, 4-6 cm. thick; pedicels 1-2 mm. long; calyx curved puberulent, becoming 2 cm. long, 2-lipped, the upper lip longer than the reticulated 10-nerved tube, the 8 to 10 lobes unequal and bristle-tipped; corolla orange-yellow or scarlet, 2-2.5 cm. long, villous-hirsute, 2-lipped, the tube dilated above, curved, the long upper lip erect, the lower lip much shorter than the upper lip and with 3 small lobes; stamens 4, didynamous, ascending, filaments minutely pubescent; cocci 3-angled, smooth, about 3 mm. long. Cult. grounds, roadsides and waste places, mostly in e. and cen. Tex., June-Sept.; from Fla. to Tex., n. to Tenn. and N.C.; nat. of S. Afr.

19. SALVIA L.¹⁶⁷ SAGE

Shrubs or herbs of varied habits, often aromatic; flowers commonly large and showy, in interrupted spikes or terminal heads; calyx bilabiate, usually somewhat laterally compressed, the upper lip commonly entire but sometimes 3-toothed or 3-mucronate, the lower lip usually 2-toothed; corolla mostly blue, red or white, tubular, strongly bilabiate, the upper lip either plane and emarginate or galeate and entire; stamens 2, exerted from the corolla tube beyond the limb or contained within the galea, the connective strongly developed, often more prominent than the filament, bearing a single terminal anther sac, either straight or projected back into the corolla tube, sometimes geniculate; style usually exerted from the galea or beyond the upper lip; cocci smooth.

About 700 species distributed throughout the world but mostly in temperate and tropical regions, centered in South America. The more western *S. Parryi* Gray and *S. chamaedryoides* Cav. have been reported in literature as being in Texas. Also, the Old World *S. aethiopsis* L. has been reported from Texas. It is a coarse woolly herb with flowers subtended by conspicuous persistent sheathing bracts. No Texas specimen has been seen for any of the above species.

1. Calyx with dense ring of hairs in throat; floral bracts equal to or exceeding calyx (2)
1. Calyx without a conspicuous ring of hairs in throat, if somewhat villous the leaves lobed; floral bracts rarely as long as calyx (4)
- 2(1). Stems and leaves stellate-canescens; corolla tube several times the length of the calyx 1. *S. dolichantha*.
2. Stems and leaves setose-hispidulous, not stellate-canescens; corolla tube not or scarcely exceeding the calyx (3)
- 3(2). Nodes below inflorescence mostly 4 to 6; stem with retrorse pubescence continuous on all sides 2. *S. texana*.
3. Nodes below inflorescence 8 to 11; stem lacking retrorse pubescence on the internodes just beneath the leaves 3. *S. Engelmännii*.
- 4(1). Leaves (at least some) deeply divided or lobed (5)
4. Leaves entire, at most crenate or dentate (8)
- 5(4). Leaves mainly in basal rosette, lyrate; corolla blue; distribution in forest region of east Texas 4. *S. lyrata*.
5. Leaves basal and cauline, commonly lobed; corolla usually red or pink; distribution in central and west Texas (6)
- 6(5). Leaves or terminal leaflet 25 mm. wide or more; distribution mainly on Edwards Plateau in west-central Texas 5. *S. Roemeriana*.
6. Leaves or terminal leaflet less than 20 mm. wide; distribution in mountains of Trans-Pecos Texas (7)
- 7(6). Corolla red, the lower lip shorter than the upper lip, the tube somewhat ventricose and rather abruptly dilated just above the calyx 6. *S. Henryi*.
7. Corolla bluish or pinkish with red dots, the lower lip much-exceeding the upper lip, the tube nonventricose and gradually dilated to its mouth 7. *S. summa*.

¹⁶⁷ Adapted partly from Carl Epling in Repert. Sp. Nov. Beih. 110:1-380. 1938-1939; Eula Whitehouse in Field & Lab. 17:151-165. 1949.

- 8(4). Shrubs with distinctly woody stems (9)
 8. Annuals or perennials with herbaceous stems (13)
- 9(8). Corolla red, 25 mm. long or more; calyx 1-2 cm. long (10)
 9. Corolla blue or purplish, less than 15 mm. long; calyx 1 cm. long or less (11)
- 10(9). Leaves typically deltoid-ovate and coarsely crenate; calyx tinged bright red, nearly glabrous, reticulate-veined 8. *S. regla*.
 10. Leaves typically elliptic-oblong and entire; calyx strongly striate, glandular 9. *S. Greggii*.
- 11(9). Flowers in slender open naked racemes; calyx lobes acute-apiculate; corolla tube exceeding the calyx; plant mostly less than 5 dm. high 10. *S. lycioides*.
 11. Flowers in short dense racemes; calyx lobes rounded and obtuse to apiculate; corolla tube included in calyx; plant mostly 10 dm. high or more (12)
- 12(11). Distribution in mountains of extreme west Texas .. 11. *S. pinguiifolia*.
 12. Distribution in Rio Grande Plains and coastal Texas ... 12. *S. ballotaeiflora*.
- 13(8). Leaves linear to narrowly oblong-elliptic or lanceolate, tapered at base (14)
 13. Leaves deltoid-ovate to ovate-lanceolate, rounded to truncate or subcordate at base (19)
- 14(13). Corolla crimson, about 4 cm. long; floral leaves and bracts conspicuous, lanceolate and cuspidate 13. *S. penstemonoides*.
 14. Corolla blue or lavender, occasionally white, less than 3 cm. long; floral leaves and bracts not as above (15)
- 15(14). Calyx oblong-cylindrical, truncated at apex, densely and softly white-tomentose, usually tinged with violet 14. *S. farinacea*.
 15. Calyx narrowly campanulate, distinctly bilabiate, at most shortly pubescent, not tomentose (16)
- 16(15). Leaves linear, at most 5 mm. wide, mostly with entire margins; calyx nearly glabrous, adorned with resinous dots 15. *S. leptophylla*.
 16. Leaves oblong-elliptic to lanceolate, at least some more than 5 mm. wide; calyx more or less minutely pubescent (17)
- 17(16). Corolla 15 mm. long or more, the tube noticeably exerted; calyx puberulent to tomentulose-sericeous 16. *S. azurea*.
 17. Corolla less than 15 mm. long, the tube scarcely exerted; calyx not as above (18)
- 18(17). Calyx minutely hairy on the nerves; widespread .. 17. *S. reflexa*.
 18. Calyx glandular-pilose; rare in western Texas 18. *S. subincisa*.
- 19(13). Flowers in a cylindrical continuous spicate raceme; floral bracts ovate and acuminate, persistent 19. *S. hispanica*.
 19. Flowers in verticils in an interrupted raceme; floral bracts inconspicuous (20)
- 20(19). Calyx truncated at apex, densely and softly white-tomentose, usually tinged with violet 14. *S. farinacea*.
 20. Calyx distinctly bilabiate, minutely pubescent (21)
- 21(20). Corolla deep-red, about 25 mm. long, the tube more than twice as long as the puberulent calyx 20. *S. coccinea*.
 21. Corolla blue, less than 10 mm. long, barely exceeding the calyx; calyx minutely pubescent on the veins (22)
- 22(21). Native perennial; calyx red- or black-dotted, the lobes acuminate; leaves black-dotted on lower surface 21. *S. arizonica*.
 22. Escaped or adventive annual; calyx light-green, the lobes acute; leaves inconspicuously brown-dotted on lower surface 22. *S. tiliaefolia*.

1. *Salvia dolichantha* (Cory) Whiteh. Perennial from a woody taproot, to 45 cm. high; stems herbaceous, commonly unbranched, canescent or cinereous with short stellate hairs

and long setose hairs, with 3 to 5 nodes below the inflorescence; leaves simple, linear, acute, densely stellate-pubescent, the margins revolute, to 85 mm. long and 5 mm. wide; flowers usually 1 or 2 in each axil to form a raceme; floral bracts linear, to about 3 cm. long and 1.5 mm. wide, conspicuous; calyx about 5 mm. long, bilabiate, glandular and setose, the throat closed by a dense band of villous hairs; corolla lavender, 3-4.5 cm. long. *Salviastrum dolichanthum* Cory, *S. texana* var. *canescens* Gray. On chalky outcrops in w. Edwards Plateau and Trans-Pecos, Feb.-May; probably also n.e. Mex.

2. *Salvia texana* (Scheele) Torr. Perennial from a taproot, to 4 dm. high; stems several, herbaceous, more or less branched, densely clothed with long spreading setose-hispidulous and short retrorse setose hairs on all sides; leaves obovate-lanceolate to oblanceolate, obtuse to acute at apex, rugose, with long and short setose hairs, conspicuously glandular-punctate on the lower surface, entire or somewhat dentate, to 6 cm. long and 2 cm. wide; flowers in setose racemes; calyx about 1 cm. long at anthesis, hirsute with spreading bristly hairs, the throat closed by a dense tuft of white hairs; corolla purplish-blue, widely ringent, about 25 mm. long. *Salviastrum texanum* Scheele. Widely distributed in limestone soils and on hills in cen. and w. Tex., Mar.-Oct.; also n. Mex.

3. *Salvia Engelmannii* Gray. Perennial from a woody taproot, to about 4 dm. high; stems often forming dense clumps, slightly hirsute or setose to glabrate, also retrorsely pubescent except on internode face directly below the leaves, commonly unbranched; leaves petiolate, linear-oblongate, entire or the lower ones sometimes denticulate, sparsely setose, conspicuously glandular-punctate, to 8 cm. long and 1 cm. wide; flowers in a compact conspicuous raceme with 2 to 6 flowers at a node; calyx deeply bilabiate, the tube about 5 mm. long, glandular, pubescent, the throat closed by a dense ring of hairs; corolla pale-lavender, widely ringent, to about 4 cm. long. *Salviastrum Engelmannii* (Gray) Briq. Widely distributed on limestone hills of cen. Tex., Apr.-June; endemic.

4. *Salvia lyrata* L. CANCER-WEED, LYRE-LEAF SAGE. Rosulate perennial from a somewhat tuberous root, more or less pilose or hirsute throughout, the scapiform stem to 8 dm. high or more; basal obovate to oblanceolate leaves petioled, membranaceous, the vernal ones sinuate to repand or lyrate-pinnatifid and to 3 dm. long, those of summer and autumn (holding over winter) mostly subentire, usually sparsely strigose-hirsute, often purple-tinged; scape naked or with 1 or 2 pairs of small leaves, simple or with virgate branches; whorls of flowers 3 to 10, becoming distant; floral bracts oblong-linear, mostly shorter than the calyx; calyx campanulate, membranaceous, to 12 mm. long at maturity, the broad upper lip truncate and with 3 widely separated sharp teeth, the lower lip with 2 longer lanceolate cuspidate-pointed teeth; corolla violet or light-blue with darker blue markings, 2-3 cm. long, ampliate-funnelform, exserted, its straight upper lip much shorter than the broad lower one; both forks of connective bearing fertile anthers; cocci fuscous, obovoid, about 2 mm. long. Sandy open woods, meadows and clearings in e. fourth of Tex., Dec.-May; from Fla. to Tex., n. to Conn., N.Y., N.J., Pa., W.Va., O., Ind., Ill., Mo. and Okla.

5. *Salvia Roemeriana* Scheele. CEDAR SAGE. Perennial to about 7 dm. high; stems herbaceous, sometimes straggly, often sparsely hirsute with long spreading hairs; leaves or terminal leaflet roundish or reniform-cordate, coarsely repand-toothed or crenately incised, membranaceous, 2.5-5 cm. wide; lower leaves often with 2 or 3 similar but smaller (sessile or slender-petiolulate) lateral leaflets that are occasionally reduced to dentiform appendages on the petiole; raceme loose and elongated; floral leaves mostly shorter than the pedicels; calyx to 15 mm. long, strongly bilabiate, somewhat pubescent, naked within, its upper lip 3-ristulate or with the middle tooth obsolete, the 2-parted lower lip of triangular-lanceolate cuspidate-acuminate teeth; corolla 25-35 mm. long, deep-scarlet, puberulent, narrowly tubular-funnelform, somewhat arcuate, its spreading lower lip with rounded and obcordate 2-cleft midlobe and scarcely longer than the erect strongly emarginate upper lip; lobes of the style more or less unequal. In cedar brakes, oak woods and in rocky areas, mainly on the Edwards Plateau, rare in the Trans-Pecos, Mar.-Aug.; also adj. Mex.

6. *Salvia Henryi* Gray. Slender perennial to 5 dm. high, soft-pubescent; leaves 3- to 5-foliolate, rarely simple by suppression of the lateral leaflets, the terminal leaflet deeply and irregularly toothed or angulately lobed; flowers 2 at each node; calyx hirsute, ciliate-bearded or somewhat bearded in the sinuses and throat; corolla red, 3-4 cm. long, bilabiate, the tube somewhat ventricose and rather abruptly dilated just above the calyx,

the lower 3-lobed lip shorter than the projecting upper lip; stamen connective bearing fertile anthers at both ends. Rocky areas in canyons and about bluffs in mts. of the Trans-Pecos, Apr.-May; from Tex. to Ariz. and n. Mex.

7. *Salvia summa* A. Nels. Several or many stems from a perennial root, simple or sparingly branched, assurgent, to 3 dm. long, the resinous-dotted herbage finely and densely silky-ciliate and pilose; basal and lower stem leaves often pinnately lobed (occasionally to the midrib), the relatively large terminal lobe coarsely toothed, the other stem leaves ovate to cordate-triangular and variously toothed; flowers showy, singly in the axils of the leaves (two at each node), short-pedicel; calyx 2-lipped to near the middle, the upper lip three-lobed with the middle lobe triangular and shorter and broader than the lance-linear outer ones, the lower lip with two lance-linear lobes similar to and equaling the outer lobes of the upper lip; corolla pilose, bluish to pink with red dots in throat, 35-45 mm. long, more than 3 times as long as the calyx, widely 2-lipped, the nonventricose tube slender but gradually dilated to the spreading lobes, the upper lip concave and nearly or quite entire or abruptly acute, the lower 3-lobed lip noticeably longer than the upper lip; connective shorter than the filament, its branches unequal, both anther cells polleniferous; the unequal subulate stigma lobes well-exserted and surpassing the stamens; cocci smooth. Confined to Guadalupe Mts., in partial shade in canyons and on rocky slopes, Apr.-May; also N.M.

8. *Salvia regla* Cav. MOUNTAIN SAGE. An ornamental much-branched shrub to 2 m. high, the stems and branches puberulent to glabrate; leaves with petioles 5-15 mm. long, broadly deltoid-ovate to subreniform, obtuse to short-acuminate at apex, typically truncate at base, to about 5 cm. long and wide, the margins coarsely crenate, thick-membranaceous, dark-green and glabrous above, hirsute and glandular-punctate beneath; flowers opposite, axillary or in short racemes; pedicels slender, 2-4 mm. long; calyx 1-2 cm. long, bright-red, subinflated, sparsely hirtellous and punctate, the broad lobes obtuse; corolla scarlet, 4-5 cm. long, the tube 2.5-4 cm. long. On rocky wooded slopes and in canyons of Chisos Mts., June-Sept.; also Mex.

An ornamental plant that should receive more attention in landscaping.

9. *Salvia Greggii* Gray. AUTUMN SAGE. Shrubby much-branched perennial to 9 dm. high, glabrous or somewhat farinaceous-puberulent throughout, the slender branches leafy; leaves with petioles 2-5 mm. long, coriaceous, obovate to elliptic, narrowed at base, very obtuse at apex, 1-2.5 cm. long, 1-ribbed, almost veinless, punctate, glabrous, entire to obscurely crenulate; flowers rather few in a naked raceme, the pedicels about 5 mm. long; calyx 1-1.5 cm. long, slightly puberulent or glandular, membranaceous, with at length spreading lips about half the length of the tube; corolla 2.5-3 cm. long, red or scarlet, its tube enlarging and strongly ventricose-gibbous, the throat abruptly contracted under the lower lip which nearly equals the pubescent or glandular-puberulent upper lip (8-10 mm. wide); lower fork of stamen connective oblong-linear; style hairy along the upper side. In rocky soils in cen., w. and s. Tex., Mar.-May; also Mex.

An ornamental plant worthy of cultivation.

10. *Salvia lycioides* Gray. CANYON SAGE. Slender perennial shrub 3-6 dm. high, often straggly, the usually numerous branches sparsely puberulent to glabrate and often slightly glandular above; leaves with petioles 2-5 mm. long, oblong-elliptic to broadly oval, mostly obtuse, 1-3 cm. long, with a strong midnerve, obscurely veined, the margins entire to coarsely crenulate-serrulate, glabrous to minutely hispid-puberulent, glandular-punctate; racemes slender, elongate, interrupted, to 15 cm. long, the flowers opposite; calyx 6-8 mm. long, scabridulous on the ribs, glandular-punctate at maturity, often bluish-tinged, the lobes merely apiculate; corolla blue to indigo-blue, the tube about 1 cm. long, the upper lip 4-4.5 mm. high, the lower lip about 7 mm. long. In canyons, on rocky slopes and on ledges in mts. of the Trans-Pecos, Apr.-Oct.; also N.M. and Mex.

11. *Salvia pinguifolia* (Fern.) Woot. & Standl. ROCK SAGE. Shrub to 15 dm. high, the stems and branches puberulent with whitish hairs; leaves with petioles to 15 mm. long, broadly deltoid-ovate, 2-5 cm. long and about as broad, obtuse at apex, truncate to broadly cordate at base, the margins coarsely crenate-serrate, essentially glabrous, conspicuously glandular-punctate beneath; verticils crowded, in spikes 3-8 cm. long; calyx broadly cornucopiate at maturity, canescent with minute simple appressed hairs and punctate, 6.5-10 mm. long, the lips broadly rounded, the lower lip 3.5-5 mm. wide; corolla lavender-purple, punctate, the tube 5-8 mm. long, the upper lip 4.5-5 mm. high,

the lower lip 4.5-6.5 mm. long; stamen connective 6.5-8 mm. long. Rare in rocky soils in Franklin Mts. at El Paso, Aug.-Sept.; from Tex. to Ariz. and n. Mex.

A plant essentially identical to this species with larger flowers (corolla tube 8.5-10 mm. long) has been segregated as *S. vinacea* Woot. & Standl. It should also occur in the Franklin Mts., as does the present species.

12. *Salvia ballotaeflora* Benth. MEJORANA, BLUE SAGE, CRESPA. Much-branched shrub to 25 dm. high, tomentose-canescens; leaves with petioles to 1 cm. long, broadly ovate-deltoid to oblong-elliptic, obtuse to acute at apex, truncate-cuneate to subcordate at base, 1-4 cm. long, crenate to coarsely dentate, reticulate-veiny, often rugose, glabrate and green above, white stellate-tomentose beneath so as to usually conceal the glands; flowers 1 to 3 in verticils to form short and rather dense simple racemes and in axils of upper leaves; pedicels about 2 mm. long; calyx 5-10 mm. long, tomentulose and glandular-punctate, in fruit broadly funnellform and pendulous, the narrow tube striate-nerved with its 3 subequal lobes broadly ovate and obtuse; corolla bluish or purplish, about 12 mm. long, the throat ventricose, the tube 4-6 mm. long, the upper lip 4-5 mm. high, the lower lip 4.5-6.5 mm. long; stamen connective 5-6 mm. long, hairy opposite its insertion. *S. laxa* Benth. Rocky, sandy or gravelly soils on brushy slopes, thickets and chaparral from Edwards Plateau s. to coast in Tex., Jan.-Oct.; also Mex.

13. *Salvia penstemonoides* Kunth & Bouché. BIG RED SAGE. Perennial, nearly glabrous or below sparsely hirsute; stems to 15 dm. high, leafy to the summit; leaves thickish, linear-lanceolate to oblong-lanceolate, acute to acuminate and mucronate, entire or obscurely denticulate and with ciliolate-scabrous margins, the midnerve prominent beneath; lower leaves 7.5-13 cm. long, with long margined petioles; upper leaves gradually much smaller and becoming essentially sessile; floral leaves and the similar persistent bracts and bractlets of the elongated racemiform or narrowly thyrsoidal inflorescence ovate-lanceolate to linear-lanceolate, cuspidate; cymules subsessile, 3- to 5-flowered; calyx equaled by the hirsute pedicels, campanulate, strongly bilabiate, about 13 mm. long, glandular-puberulent, the upper broad lip truncate and with 3 short and broad cuspidate-mucronate teeth, lower lip 2-parted with its teeth lanceolate and cuspidate; corolla crimson, about 4 cm. long, slightly pubescent, its tube villous-annulate towards the base inside, its large and nearly straight upper lip half the length of the gradually enlarged exerted tube, the middle lobe of the small lower lip concave and entire; style glabrous. In seepage on limestone ledges and banks along streams in cen. Edwards Plateau, June-Oct.; endemic.

14. *Salvia farinacea* Benth. MEALY SAGE, MEALY-CUP SAGE. Perennial herb to 1 m. high, minutely and canescently puberulent or glabrous below, the stems numerous in a cluster; lower leaves with slender petioles to 4 cm. long, linear to ovate-lanceolate or even ovate, obtuse to cuneate or rarely subcordate at base, to about 10 cm. long and 3 cm. wide, usually much smaller, coarsely and irregularly serrate; upper leaves lanceolate or linear-lanceolate, sometimes entire; floral bracts subulate to ovate-lanceolate, mostly caducous; spiciform inflorescence on a long naked peduncle, interrupted, composed of densely many-flowered clusters, finely and (with the calyx) densely and softly white-tomentose (often tinged with violet); calyx oblong-cylindrical and (in age) striate-sulcate, truncated and hairy at apex, the 3 short teeth very broad and obtuse; corolla to 25 mm. long, purple or violet-blue, the tube 6-9 mm. long, the upper lip 3-6 mm. high, with middle division obcordate and 2-lobed. In limestone soils in prairies, thickets, meadows, hillsides and floodplains in most of Tex., mainly in cen. and w. Tex., Apr.-Nov.; also N.M.

Some plants in Brewster County have all their leaves linear. The broad-leaved plants, found especially on the Rio Grande Plains, that are abruptly contracted to a truncate or subcordate base, are segregated as var *latifolia* Shimmers.

15. *Salvia leptophylla* Benth. Perennial herb to about 1 m. high, the erect stems usually forming clumps, typically glabrous but sometimes setose (especially at nodes); leaves linear, attenuate to each end, to 8 cm. long, at most 5 mm. wide, more or less glandular-punctate throughout, entire or rarely remotely denticulate or serrulate; flowers 1 to 3 in bracted verticils in slender interrupted virgate spikes 1.5-3 dm. long, the verticils 1-4 cm. apart; pedicels 2-3 mm. long; calyx to 1 cm. long, glabrous to hispid, resinous-dotted, the lips subequal, the upper lip 7-veined; corolla blue to indigo-blue, the tube 7-11 mm. long, slightly narrowed at base, with or without papillae, the upper lip 3.5-5.5 mm. high, the rounded lower lip 7-10 mm. long and with the midlobe emarginate or

undulate. *S. angustifolia* Cav. and var. *glabra* Gray. In cobbly-gravelly soils in dry washes and stream beds in mts. of the Trans-Pecos, Sept.-Nov.; also Mex.

16. *Salvia azurea* Lam. BLUE SAGE. Erect perennial from a heavy rootstock, to 15 dm. high, cinereous with short curving pubescence, rarely essentially glabrous, the leafy stem simple or branched; leaves to 1 dm. long and 4 cm. wide; lower leaves often lanceolate or oblong, obtuse at apex, tapering to a petiole, denticulate or serrate; upper leaves often linear and entire; inflorescence spiciform, the flower whorls crowded above, tomentulose-sericeous; floral bracts subulate, somewhat persistent; calyx oblong-campanulate, 4.5-10 mm. long, appressed-hispidulous, cleft about one fourth its length, obscurely bilabiate, the broad upper lip entire; corolla deep-blue or rarely white, 15-25 mm. long, with prominently exerted tube, the lower lip sinuately 3-lobed and emarginate. Dry prairies, oak-cedar hills, flats and openings throughout most of Tex., May-Nov.; from S.C. to Fla., w. to Neb., Colo., Ark., Tex. and Mex.

Most of our material belongs to var. *grandiflora* Benth. (*S. Pitcheri* Nutt.) with reflexed hairs on the stem in contrast to the less common var. *azurea* with spreading or ascending hairs on the stem.

17. *Salvia reflexa* Hornem. ROCKY MOUNTAIN SAGE. Annual herb, often bushy-branched, the puberulent to glabrous stem to 7 dm. high; leaves lanceolate to linear-oblong or linear-lanceolate, obtuse to acute at apex, tapering to a slender petiole to 15 mm. long, spreading or reflexed, the larger ones to 5 cm. long and 12 mm. wide, irregularly serrate to entire, glabrescent above; flowers 1 to 3 in a whorl, with winged pedicels 2-3 mm. long, forming a slender interrupted spike; calyx 4-8 mm. long, deeply bilabiate, minutely hairy on the nerves, cleft about halfway to the base, the upper lip entire; corolla blue to whitish, only slightly exerted, the tube 4-4.5 mm. long, the erect upper lip 2.5-3 mm. high, the lower rounded lip 4.5-5 mm. in diameter. *S. lanceolata* Willd., *S. lanceaefolia* Poir. Dry soil in fields, gravel-clay flats, ledges, slopes and rocky soils generally, mostly in w. two thirds of Tex., May-Oct.; from Wisc. to Mont., s. to Ark., Tex., Ariz. and Mex.; adv. eastw.

18. *Salvia subincisa* Benth. Erect annual herb to about 4 dm. high, branched and pubescent above; leaves with petioles to 3 cm. long, oblong-elliptic to lanceolate, acute at apex, narrowly cuneate at base, 2.5-5 cm. long, rarely more than 15 mm. wide, the margins irregularly incised-serrate; flowers solitary or as many as 3 in verticils spaced 1-3 cm. apart; bracts broadly ovate, 3 mm. long, caducous; calyx 4.5-8.5 mm. long, glandular-pilose; corolla tube 4-4.5 mm. long, the upper corolla lip 2.5 mm. broad, the lower corolla lip 7-8 mm. long; lower fork of anther connective bearing its lateral lobe at the middle; style glabrous. Reported from w. Tex., w. to Ariz. and n. Mex.

19. *Salvia hispanica* L. Annual coarse much-branched herb to about 1 m. high, more or less canescent; leaves long-petioled, pale-green, ovate, acute to acuminate at apex, to 12 cm. long and 5 cm. wide, the margins crenate-serrate; flowers in heads on a long-peduncled spiciform inflorescence, with persistent foliaceous broad acuminate bracts; calyx 7.5-11 mm. long; corolla tube about 5 mm. long, the upper corolla lip about 3 mm. wide, the lower corolla lip 3.5-5 mm. long. A nat. of Mex., s. to S.A. and the W.I., introd. in Tex. and elsewhere.

20. *Salvia coccinea* Murr. TROPICAL SAGE, MIRTO, MEJORANA. Perennial with herbaceous or suffrutescent stems to 1 m. high, canescently pubescent to glabrate or hirsute toward the base with long spreading hairs; leaves with petioles 1-3.5 cm. long, membranaceous, veiny, deltoid-ovate, obtuse to acute at apex, truncate to cordate at base, crenate, mostly soft-tomentulose beneath, to 7 cm. long and 5 cm. wide; raceme virgate, the clusters few- to several-flowered and rather distant; pedicels 3-6 mm. long; calyx 6-9 mm. long, crisp-hirtellous, usually tinged with red, the lips of the calyx nearly half that of the tube; corolla usually about 25 mm. long, much-exserted, bright-red or deep-scarlet-red, pubescent or puberulent without, its narrow tube 13-17 mm. long and moderately enlarged above, the upper lip 3.5-5 mm. long, the lower lip twice the length of the upper one from which the stamens protrude; lower forks of the stamen connective long and narrowly linear; style glabrous. In sandy soils in thickets, chaparral, on edge of and in open woods in e. and s. Tex., Feb.-Nov.; from S.C. to Fla. and Tex.; also Mex.

21. *Salvia arizonica* Gray. Perennial herb with creeping woody rootstocks, 3-6 dm. high, glabrous except for 2 puberulent lines down the stem and some long straggly hairs near base of stem; leaves with slender petioles to 1 cm. long or more, deltoid-ovate, obtuse to acute, often abruptly cuneate at base, glabrous, 3-5 cm. long, 15-35 mm. wide,

coarsely and obtusely crenate or serrate, dark-green above, light-green and minutely dark-punctate beneath; inflorescence spiciform and interrupted; clusters several-flowered, at intervals of 1-3 cm.; pedicels about 2 mm. long; floral bracts membranaceous, ovate-lanceolate, caudate, equal to the flowers, caducous; calyx 5-8 mm. long, usually purplish-tinged, dark-punctate, bilabiate to the middle or nearly so, the upper lip subulate and 3-toothed, the lower lip strongly 2-toothed; corolla deep-blue to bluish-lavender or rarely pinkish, the tube 6-8 mm. long and a little exserted, the upper lip about 4 mm. long, the lower lip 6-9 mm. in diameter; style beardless. In rocky soils and among boulders in canyons and in open forests in mts. of the Trans-Pecos, July-Oct.; w. to Ariz.

22. *Salvia tiliaefolia* Vahl. Annual herb to 1 m. high, the stems sparsely crisped-hirtellous above; leaves with slender petioles 2-6 cm. long, broadly triangular-ovate to rhombic-ovate, cordate-truncate to rounded-cuneate at base, obtuse to acute at apex, thin-membranaceous, the primary leaves 3-12 cm. long, sparingly pubescent, dark-green above, sparsely crenate-serrate; verticils 6- to many-flowered, 1-2 cm. apart, in an elongate interrupted simple or branched spiciform inflorescence 15-25 cm. long; pedicels 3-5 mm. long; calyx 4.5-9 mm. long, sparsely subappressed-hispidulous on the ribs; corolla bluish, 6-8 mm. long, the tube 3.5-4 mm. long, the upper lip 1-2 mm. high, the lower lip 2-2.5 mm. long. Introduced as a street weed in Marfa, Presidio Co.; w. to Ariz. and s. to S.A.

20. MONARDA L.¹⁶⁸

MONARDA. HORSEMINT

Erect or ascending herbs or shrubs; leaves odoriferous, ovate to lanceolate or linear, entire or toothed; flowers in a few verticils closely surrounded by bracts to form head-like clusters that form interrupted spikes and/or terminate the branches; calyx tubular, 13- to 15-nerved, usually hairy in the throat; corolla elongated, strongly bilabiate, with a slightly expanded throat; lips linear or oblong, somewhat equal; upper lip erect or arched, entire or slightly notched; lower lip spreading, 3-lobed at the apex, its lateral lobes ovate and obtuse, the middle lobe narrower and slightly notched; stamens 2, elongated, ascending, inserted in the throat of the corolla.

About 20 species extending from Canada to Mexico.

1. Heads solitary and terminal, rarely two; upper lip of the corolla somewhat arcuate but usually erect and in continuation of the tube, the expanded portion of the corolla tube (the throat) as long as or longer than the cylindrical unexpanded part; stamens exserted beyond the upper corolla lip; leaves ovate to ovate-lanceolate, abruptly narrowed to truncate or subcordate at base (2)
1. Heads two or more, forming an interrupted spike; corolla sickle-shaped when viewed from the side because of the markedly falcate upper lip, the expanded portion of the corolla tube usually shorter than the cylindrical unexpanded part; stamens usually not exserted from under the upper corolla lip; leaves elliptic to oblong or even linear, mostly gradually narrowed to base (6)
- 2(1). Corolla pale-rose-purple to whitish, with purple-red dots on lower lip; leafy floral bracts with long-pilose margins; calyx teeth usually conspicuously stipitate-glandular (3)
2. Corolla white to lavender or rose-purple, not spotted; leafy floral bracts with minutely pubescent margins; calyx teeth with or without few sessile glands (4)
- 3(2). Upper lip of corolla bearded at tip, about as long as the tube which is not exserted from the calyx 1. *M. Bradburiana*.
3. Upper lip of corolla not bearded at tip, about half as long as the tube which is long-exserted from the calyx 2. *M. Russeliana*.
- 4(2). Nodes and often lower part of stem long-pilose with spreading hairs; glomerules lax and open so that component branches are readily visible; pedicels 2-5 mm. long; corolla creamy-white 3. *M. Lindheimeri*.
4. Nodes and stems essentially glabrous or with minute appressed or incurved hairs; glomerules tight and compact; pedicels 1-2 mm. long; corolla lavender or purplish, rarely whitish (5)

¹⁶⁸ Adapted mainly from Elizabeth McClintock and Carl Epling in Univ. Calif. Publ. Bot. 20:147-194. 1942; Rainer W. Scora in Univ. of Calif. Publ. Bot. 41:1-59. 1967.

- 5(4). Petioles usually more than 10 mm. long; distribution in east Texas 4. *M. fistulosa*.
5. Petioles usually less than 5 mm. long; distribution in mountains of the Trans-Pecos 5. *M. menthifolia*.
- 6(1). Calyx teeth aristate; floral bracts aristate (7)
6. Calyx teeth deltoid to narrowly triangular-lanceolate, not aristate; floral bracts acute to acuminate but not aristate (9)
- 7(6). Floral bracts similar in shape, oblong, typically reflexed at about the middle to reveal the pubescent purplish inner (adaxial) surface 6. *M. citriodora*.
7. Floral bracts dissimilar, the outer ones broad, becoming progressively narrower inwardly, rarely reflexed, essentially glabrous (8)
- 8(7). Calyx teeth stout and rigid, 4-6 mm. long; bracts elliptic, with strongly raised veins 7. *M. clinopodioides*.
8. Calyx teeth slender and somewhat flexible, 2-3 mm. long; bracts ovate, with slightly raised veins 8. *M. pectinata*.
- 9(6). Perennial or rarely annual herb, the laxly leaved stems usually with elongate internodes; largest leaves mostly more than 8 mm. wide, usually long-tapering to a distinct petiole; floral bracts usually tinged wholly or in part with yellow or white, rarely purplish 9. *M. punctata*.
9. Shrubs or woody perennials, the densely leafy stems with short internodes; largest leaves mostly less than 8 mm. wide, subsessile or shortly petiolate; floral bracts usually tinged with red or purple (10)
- 10(9). Leafy part of stem densely pubescent with long coarse spreading hairs; leaves narrowly lanceolate, coarsely toothed to well below the middle, densely pubescent with long hairs on the lower surface; floral bracts coarsely toothed above middle; along the coast in Aransas, Refugio and San Patricio counties 10. *M. maritima*.
10. Leafy part of stem minutely puberulent with appressed or decurved hairs; leaves linear to very narrowly linear-lanceolate, subentire to sparsely serrulate mostly above the middle, minutely pubescent to somewhat pilose especially below the middle on lower surface; floral bracts entire or rarely remotely toothed; distribution on the Rio Grande Plains and inland in south-central Texas (11)
- 11(10). Herbage cinereous-canescens; leaves linear, obtuse to acute; flowering from January to July; in Rio Grande Plains 11. *M. fruticulosa*.
11. Herbage typically bright-green; leaves linear to narrowly linear-lanceolate, long-acuminate; flowering from late June to October; in south-central Texas (centered in Bastrop-Guadalupe-Gonzales counties) 12. *M. viridissima*.

1. *Monarda Bradburiana* Beck. Stems 3-6 dm. high, usually simple, glabrous or very sparsely villous; leaves sessile or with petioles to 5 mm. long, ovate to deltoid-ovate or triangular-lanceolate, 5-10 cm. long, 2-5 cm. wide, acuminate at apex, rounded to subcordate at base, the margins serrate, sparsely hairy above, villous on the veins beneath; heads 15-25 mm. thick (excluding the corollas); bracteal leaves often tinged with pink or purple, spreading or reflexed, lanceolate; calyx tube 9-14 mm. long, hirsute in the throat, its subulate lobes 2-4 mm. long and often stipitate-glandular; corolla pale-rose-purple to white, dotted with purple, 25-35 mm. long, the upper lip about as long as the tube which is not exerted from the calyx. In wooded areas and thickets, known only from Kerr Co., Apr.-June; from Ala. to Tex., n. to Ind., Ia. and Kan.

2. *Monarda Russeliana* Nutt. Perennial herb 3-8 dm. high; stems slender, simple or sparingly branched from the middle, the median internodes commonly about twice the length of the subtending leaves, all correspondingly elongated and often tortuous as though growing through shrubbery, provided with a few downward curling hairs or entirely glabrous; leaves with petioles less than 5 mm. long, ovate-lanceolate to narrowly lanceolate, 4-6 cm. long, 1-2.5 cm. wide, remotely serrulate to entire, usually thinly hirsute with upwardly directed hairs (especially along the margins); glomerules to 2 cm. broad (excluding the corollas); outer bracts subfoliar, tending to membranous and often purplish tinged, usually reflexed; calyx tube 8-12 mm. long, the subulate teeth

usually about 2 mm. long and bearing stubby capitate glands, the orifice thinly hirsute, the tube puberulent with minute spreading hairs and sprinkled with longer hairs similar to those of the stems; corolla pale-lavender or white, purple-dotted, 2-3.5 cm. long, the tube conspicuously exceeding the calyx, the galea hirtellous or glabrous (not bearded), the throat hirtellous within. *M. virgata* Raf. In gravelly, rocky or sandy soils at edge of woods or in open dry flats or rolling woodlands in n.e. Tex., Apr.-June; from Ky. and Tenn., s.w. to Okla. and Tex.

3. *Monarda Lindheimeri* Gray. Perennial herb 3-6 dm. high; stems simple or branched, glabrous or finely pubescent with downwardly curled hairs or rarely densely covered with stiffish spreading hairs; largest leaves with petioles mostly less than 5 mm. long, prevailing ovate, occasionally ovate-lanceolate, varying from one half to two times as long as the internodes that they subtend, usually borne at the second to the sixth node below the glomerule, 3-5 cm. long, usually 15-25 mm. broad but as much as 4 cm. broad, broadest just above the base, glabrous or minutely puberulent or rarely covered like the stem with dense spreading hairs, serrate or occasionally subentire (particularly the upper pair); glomerules 2-5 cm. broad (excluding the corollas), the component branches visible (at least in older specimens), as much as 12 mm. long, the outer bracts subfoliar and usually reflexed; calyx 9-12 mm. long, puberulent with short spreading hairs, the acuminate teeth 1-2 mm. long, the orifice hirsute within with stiff erect hairs, sometimes bristling with stiff spreading hairs at the base of the teeth; corolla creamy-white, 1.7-3 cm. long, pubescent with short curling hairs, the upper lip comose, the tube 11-19 mm. long, gradually expanded upward, the stamens seated 1-2 mm. within the tube. Usually in sandy soils in and on the edge of woods, in meadows, on slopes and flats in e. fourth of Tex., Apr.-Aug.; also La.

4. *Monarda fistulosa* L. WILD BERGAMONT, LONG-FLOWERED HORSEMINT. Perennial herb to 15 dm. high; stems simple or usually branched, pubescent in the upper parts with downwardly curled hairs, glabrous below, sometimes with longer spreading hairs, rarely glabrous; leaves gray-green, firm (except in deep shade), narrowly triangular-ovate to lanceolate, or sometimes cuneate at base, the straightish serrate-dentate sides tapering to tip, definitely petioled, spreading-hirsute or -villous with long hairs along the nerves beneath, the larger blades to 4 cm. broad and with petioles to 15 mm. long; uppermost leaves and foliaceous reflexed bracts often pink-tinged; glomerules mostly terminal, to 3 cm. broad (excluding the corollas); calyx 7-12 mm. long, puberulent with short spreading hairs, the acuminate teeth usually 1-2 mm. long, the orifice hirsute with stiff erect hairs within, sometimes bristling with similar spreading hairs at the base of the teeth; corolla lavender, 2-3 cm. long, pubescent with short soft curling hairs, the upper lip comose, the tube 15-24 mm. long and gradually expanded upward; stamens seated about 1 mm. within the tube. In dry open woods, old fields, wet meadows and ditches, edge of woods and marshes in e. fourth of Tex., May-July; from Que. and N.E., w. to Minn., s. to Ga., Ala., La. and Tex.

5. *Monarda menthifolia* Grah. Perennial herb 3-10 dm. high; stems simple, rarely branched, pubescent in the upper parts with downwardly curled or spreading hairs and glabrous below or the entire stem glabrous; largest leaves ovate to ovate-lanceolate or lanceolate, 3.5-9 cm. long, 1-3.5 cm. broad, serrate or less often subentire (particularly in the narrow-leaved forms), the upper surfaces usually softly hirtellous with more or less appressed hairs or glabrous, the lower surfaces usually pubescent with curled hairs or sometimes subtomentose; median petioles mostly 2-5 mm. long, rarely as long as 12 mm., usually pubescent with short appressed hairs; glomerules 15-25 mm. broad (excluding the corollas), the outer bracts subfoliar, frequently pink-tinted, reflexed rather than spreading; calyx 7-12 mm. long, occasionally pink-tinted, puberulent with short spreading hairs, the acuminate teeth 1 mm. long, the orifice hirsute within with stiff erect hairs shorter than the calyx teeth, sometimes bristling with similar spreading hairs at the base of the teeth; corolla lavender or rose-purple, 25-38 mm. long, pubescent with short curling hairs, the upper lip comose, the tube 15-25 mm. long, gradually expanded upward, the stamens seated 1-3 mm. within the tube. *M. fistulosa* var. *menthifolia* (Grah.) Fern. Beneath oaks in canyons of mts. in the Trans-Pecos, May-July; from Man. to B.C., s. to Tex., N.M., Ariz. and n. Mex.

6. *Monarda citriodora* Cerv. LEMON BEEBALM, LEMON-MINT, HORSEMINT. Annual or sometimes biennial to 8 dm. high, branching chiefly in the inflorescence or unbranched,

seldom branched at the base, pubescent with small downwardly curled hairs; leaves with petioles to 3 cm. long, lanceolate or oblong, the largest mostly 3-6 cm. long, to 15 mm. wide, thinly and evenly puberulent, glabrate, their margins remotely serrate or subentire and usually ciliate near the base with longer bristles; glomerules 15-35 mm. broad (exclusive of the corollas); outer bracts subfoliar and spreading, less often reflexed; inner bracts oblong, infrequently lanceolate, commonly 6-9 mm. broad, abruptly acuminate to a spinose bristle 2-5 mm. long, usually reflexed from the middle only, thus enclosing the calyces in a bowl-like involucre, their inner surface densely canescent with minute hairs, often purple, the outer surface pubescent, the margins more or less ciliate at least below the middle; calyx tube 6-13 mm. long, puberulent with minute upwardly curled hairs, orifice densely bearded, the aristate teeth 2-7 mm. long, puberulent and more or less hirsute with bristlelike hairs; corolla white or pink, dotted with purple, its tube 7-19 mm. long (including the funnellform throat which is commonly 3-7 mm. long), the upper lip about equal to the lower lip, both shorter than the tube. *M. dispersa* Small. Rather ubiquitous, mostly in sandy loams or rocky soils on slopes and hills or in prairies, meadows and savannahs throughout Tex., Apr.-Oct.; from Mo. and Kan., s. to Tex. and n.e. Mex.; adv. eastw.

Represented in Texas by two variants.

1. Leaves 2-3.5 cm. long, 5-10 mm. wide; bracts not wider than 4 mm.; calyx tube 6-7 mm. long; calyx lobes 2-3 mm. long; unexpanded portion of corolla tube 6-7 mm. long, expanded portion 2-4 mm.; apex of upper corolla lip glabrate; confined to extreme southern Texas var. *parva* Scora.
1. Leaves 2.5-6 cm. long, 8-12 mm. wide; bracts mostly wider than 4 mm.; calyx tube 7-14 mm. long; calyx lobes ciliate; unexpanded portion of corolla tube 7-10 mm. long, expanded portion 4-6 mm.; apex of upper corolla lip with 1-2 mm. long pilosity; widespread var. *citriodora*.

7. *Monarda clinopodioides* Gray. BASIL BEEBALM. Annual, commonly 2-3 dm. high, rarely to 55 cm., sparingly branched at the base or unbranched, the stems pubescent with downwardly curled hairs with which occasional longer bristles may be found; leaves with petioles 4-15 mm. long, mostly oblong, the largest 2-5.5 cm. long, 6-15 mm. wide, rarely more, broadest near the middle, glabrous or puberulent, the margins remotely serrate or entire; glomerules 1.5-3 cm. broad (exclusive of the corollas); outer bracts similar to the leaves but usually ending in a bristle; inner bracts ovate or elliptic, 3-7 mm. broad, abruptly acuminate to a stoutish spinose bristle, the midvein and usually 2 or even 4 to 6 lateral veins well-developed and conspicuous, even costate, the inner surfaces glabrous, the outer surface evenly puberulent but not canescent, the margins regularly pectinate-ciliate with bristlelike hairs; calyx tube 8-9 mm. long, puberulent with small upwardly curled hairs (especially in the lower parts), usually more or less hirsute in the upper parts with bristlelike hairs, the orifice densely hirsute; calyx teeth subulate, stout, stiffish, usually red, 4-6 mm. long; corolla pink or nearly white, its tube 11-15 mm. long (including the funnellform throat that is usually 4-5 mm. long), the upper lip equal to or somewhat longer than the lower and equal to or somewhat shorter than the tube. In sandy or caliche soils and occasionally on granite in meadows, fields, grassy flats and grassy areas in open woodlands mostly in the e. half of Tex., Apr.-June; from Kan. through Okla., s. to Atascosa Co., Tex.

8. *Monarda pectinata* Nutt. PLAINS BEEBALM. Annual to 3 dm. high, usually branched several times from the base, often spreading and globose; stems pubescent with downwardly curled hairs and with occasional longer bristles; leaves oblong to oblong-lanceolate, with petioles to 15 mm. long, the largest 2-5 cm. long and 6-12 mm. wide, glabrous or sparingly puberulent, their margins remotely serrate or subentire; glomerules 15-25 mm. broad (exclusive of the corollas); foliar bracts nearly or quite glabrous, straight and flat, divergent from base, greenish, 2-7 mm. broad, acuminate to a spinose slender bristle, the margins regularly pectinate-ciliate with bristlelike hairs; calyx tube 6-8 mm. long, puberulent with minute upwardly curled hairs or glabrous, very rarely with a few bristlelike hairs, the orifice hirsute, the slender teeth not rigid (2-3 mm. long) and more or less hirsute with bristlelike hairs, often colored; corolla pink or nearly white, its tube 8-14 mm. long (including the funnellform throat which is usually 3-5 mm. long), the lips about equal and usually shorter than the tube. In sandy dryish soils on hills, in

pastures and along streams in w. and n.w. Tex., May-July; from Neb., Colo. and Ut. s. to Tex., N.M. and Ariz.

9. *Monarda punctata* L. SPOTTED BEEBALM, HORSEMINT. Perennial, biennial or annual, rarely as much as 1 m. high, sparingly branched at the base or unbranched below the inflorescence, the stems and leaves variously puberulent or pubescent with curled and sometimes spreading bristlelike hairs; leaves petiolate, lanceolate to oblong-lanceolate or oblong, subtentire to serrate, of varied size, 15-95 mm. long; glomerules 15-25 mm. broad (exclusive of the corollas), subtended by spreading or reflexed yellowish to whitish or rarely purplish entire or remotely serrate bracts that are suborbicular to oblong or lanceolate and usually ciliate on the margins near the base, the outer bracts foliar; calyx 4.5-9 mm. long, commonly finely pubescent; calyx teeth deltoid to narrowly triangular-lanceolate, acute to acuminate or even subspinose at the tip but not at all aristate; corolla whitish, yellowish or rarely pinkish and usually maroon-spotted, the usually falcate upper lip longer than the stamens. Usually in dryish or sandy soils.

Represented by several variants, throughout much of the eastern half of the U.S., of which, according to Scora (1967), the following are found in Texas.

1. Leaves pubescent with long hairs mainly along the midvein on lower surface (2)
1. Leaves pubescent with very short curled hairs on both surfaces (3)
- 2(1). Corolla white to cream-colored, the upper lip marked with pale maroon spots; stem with few usually not spreading bristles var. *lasiodonta* Gray.
2. Corolla deep-yellow, the upper lip marked with deep-dark-maroon spots; stem with spreading bristles var. *arkansana* McCl. & Epl.
- 3(1). Calyx teeth widely deltoid, approximately as long as broad, mostly acute; corollas cream-colored to white or pink; bracts pale- or whitish-green; leaves 3-4 cm. long, 10-13 mm. wide, uniformly pubescent var. *occidentalis* (Epl.)
Palm. & Steyerl.
3. Calyx teeth narrowly deltoid, rarely as broad as long, mostly acuminate; corollas yellowish to white and pink; bracts green to yellowish-green; leaves 4-7 cm. long, 3-25 mm. wide, variously pubescent (4)
- 4(3). Leaves linear-lanceolate to linear, not wider than 8 mm., obscurely petioled; habit predominantly shrubby [= *M. viridissima*] var. *immaculata* (Penn.)
Scora.
4. Leaves elliptic to lanceolate, commonly 8-25 mm. wide, distinctly petioled; habit commonly erect, simple or variously branched (5)
- 5(4). Calyx orifice closed with dense hirsute bristles; corollas yellow, the upper lip distinctly blotched with maroon spots; leaf blades commonly 6-8 cm. long; in Austin and Hays counties var. *Stanfieldii* (Small)
Cory.
5. Calyx orifice glabrous or only slightly bearded; corollas yellow to pale-yellow, the upper lip blotched heavily or only slightly stippled with maroon spots; leaf blades commonly 2.5-7 cm. long (6)
- 6(5). Corolla yellowish with the upper lip blotched heavily with large maroon spots; leaf blades 5-7 cm. long, 10-15 mm. wide, usually as long as or longer than the internodes they subtend var. *intermedia* (McCl. & Epl.) Waterfall.
6. Corolla pale yellow with the upper lip slightly stippled with small maroon dots; leaf blades commonly 5-6 cm. long, 7-13 mm. wide, usually shorter than the internodes they subtend var. *Coryi* (McCl. & Epl.)
Cory.

10. *Monarda maritima* (Cory) Correll. Much-branched shrub to 1 m. high or more; stems densely cottony-tomentose with long spreading white hairs; leaves numerous, crowded on the stems, linear-lanceolate, sessile or short-petioled, tapered to an acute to acuminate apex, more or less conduplicate, to about 4 cm. long and 8 mm. wide, coarsely serrate, subglabrous above, densely long-pubescent beneath with white spreading or twisted hairs; floral glomerules often approximate; outer bracts subtending the glomerules purplish, expanded toward the apex, rounded and toothed, the apical tooth abruptly

deltoid-acuminate and to 2 mm. long, with 5 or more frequently minute glandular-pointed teeth on either side; inner bracts subtending the glomerules narrow, not purplish, long-acuminate, minutely and sparsely toothed or entire, long-ciliate (especially below the middle); calyx 8-9 mm. long, the subulate teeth 1.5-2 mm. long and (at most) puberulent; corolla white. *M. punctata* var. *maritima* Cory. In deep sands in Aransas, Refugio and San Patricio cos., May-Nov.; also Cameron Parish, La.

11. *Monarda fruticulosa* Epl. Diffusely branched shrub, to about 65 cm. high; stems canescent; leaves linear, tapered at base, obtuse to acute at apex, usually 2-3 cm. long, mostly less than 3 mm. wide, prevailingly entire, sometimes toothed above the middle, typically canescent on both surfaces with short fine hairs, often with several long cilia on the basal half; floral bracts light-pink-cerise; calyx 4-5 mm. long, pubescent with short fine spreading hairs, the orifice bearing long silky curled or spreading hairs; calyx teeth about 1 mm. long, narrowly deltoid and acuminate, covered with long silky curled hairs; corolla white or pinkish, often tinged or marked with pink or lavender, usually not dotted, the expanded portion of the tube 4.5-5.5 mm. long, the throat 3-4 mm. long. *M. punctata* var. *fruticulosa* (Epl.) Scora. In deep sand or sandy loam in prairies, mesquite plains, open woods and fields, and on active dunes on the Rio Grande Plains, throughout the year but mostly Jan.-July; endemic but possibly also in adj. Mex.

12. *Monarda viridissima* Correll. Woody perennial to 8 dm. high, with one or more erect puberulent stems that are sparsely branched above; nodes rather short, often less than 4 cm. long; leaves linear to very narrowly linear-lanceolate, tapered at base to a slender petiole to about 1 cm. long, long-acuminate at apex, to about 9 cm. long, and 8 mm. wide or less, usually much smaller, typically bright-green and more or less pubescent, sometimes with a loose tomentum on lower surface along midrib below the middle or with only a few long marginal hairs near the base, rarely essentially glabrous, remotely several-toothed above the middle to subtire; flower whorls as many as 5 per stem; floral bracts broadly ovate to elliptic-lanceolate, acuminate, deep-cerise-pink to purple, the largest to about 2 cm. long, entire or remotely few-toothed above middle; calyx about 6 mm. long, often tinged with purplish-red, with a tuft of white erect hairs within mouth of orifice, the sparsely hirsute subulate teeth mostly about 1 mm. long; corolla white to creamy-white, sometimes tinged or marked with pink, with scattered reddish dots. *M. punctata* var. *immaculata* (Penn.) Scora. Deep sand or sandy soils in open oak and pine-oak forests, s.-cen. Tex. (centered in Bastrop-Guadalupe-Gonzales cos.), late June-Oct.; endemic.

21. BLEPHILIA Raf.

Perennial herbs with erect or ascending sparingly branched stems; leaves similar to those of *Monarda*; flowers numerous, pale-bluish-purple, crowded in axillary or terminal globose whorls; calyx tubular, 13-nerved, naked in the throat, distinctly bilabiate with the upper lip longest, the teeth narrowly triangular to awned; corolla bilabiate, inflated in the throat, villous, the lobes shorter than the tube; upper lip erect, entire; lower lip spreading or deflexed, 3-cleft with the rounded lateral lobes larger than the oblong notched median lobe; stamens 2, exserted.

Only two species. No Texas material has been seen. They are included here based on Fernald's report of their occurrence in the state.

1. Lobes of the lower calyx lip extending beyond the sinuses of the upper calyx lip 1. *B. ciliata*.

1. Lobes of the lower calyx lip not reaching the sinuses of the upper lip 2. *B. hirsuta*.

1. *Blephilia ciliata* (L.) Benth. Stems closely pubescent with recurved hairs, to 9 dm. high; leaves sessile, ovate-oblong to lanceolate, narrowed at base, obtuse to subacute at apex, downy-white beneath, entire to somewhat toothed, 3-6 cm. long; flower heads 3 to 5, continuous; outer bracts ovate, acute, colored, ciliate, as long as the calyx; calyx 7-9 mm. long; corolla pale-blue with purplish spots, 1-1.4 cm. long, pubescent. In dryish woods and open thickets, possibly in n.e. Tex., May-Aug.; from Vt. to Wisc. and Ia., s. to Ga., Miss., Ark., Okla. and (?) Tex.

2. *Blephilia hirsuta* (Pursh) Benth. WOOD-MINT. Stems hirsute with spreading hairs, to 1 m. high or more; leaves long-petioled, ovate to ovate-lanceolate, rounded to cordate at base, acute to subacuminate at apex; flower heads 3 to 5, each separated by a well-developed internode; bracts linear-subulate, shorter than the long-haired calyx; calyx 6-9 mm. long; corolla similar to *B. ciliata*. In moist shaded areas, possibly in n.e. Tex., May-Sept.; from Que. and Vt. to Minn., s. to Ga., Tenn., Ark. and (?) Tex.

22. PERILLA L.

About a half dozen species natives of Asia.

1. *Perilla frutescens* (L.) Britt. BEEFSTEAK PLANT. Coarse aromatic annual, often purple or suffused with purple; stem erect, branching, to about 1 m. high; leaves ovate-oblong to broadly ovate, to 15 cm. long, short-acuminate at apex, coarsely serrate or incised, obtuse to rounded at base but cuneately tapered into the long petiole; flowers small, purple or white, borne singly in the axils of small bracteal leaves to form a loose elongate spikelike 1-sided raceme to 15 cm. long; bracteal leaves oval, folded, rarely greatly enlarged; pedicels 1-3 mm. long; calyx campanulate, 10-nerved, bilabiate, the lips lobed, at anthesis about 3 mm. long, in fruit distended on the lower side and 9-12 mm. long, hairy within; corolla white, tubular, about as long as calyx or slightly longer; corolla lips about equal in length, the 5-lobes broadly rounded; stamens 4, nearly equal, straight, not connivent, about as long as the corolla; cocci globose, reticulated. In damp woods, along open-wooded streams and seepage areas in e. Tex., July-Nov.; from Fla. to Tex., n. to N.E., N.Y., O., Ind., Mo. and Kan.; a nat. of India that locally often becomes a troublesome weed.

The seeds produce an edible oil that is used in commerce.

23. LYCOPUS L. WATER-HOREHOUND. BUGLE-WEED

Perennial mostly stoloniferous herbs resembling *Mentha* but not fragrant; leaves mostly toothed or pinnatifid; floral bracts similar to leaves and much longer than the dense axillary whorls of small mostly white flowers; calyx campanulate to ovoid, 4- or 5-toothed, naked in the throat; corolla more or less campanulate; stamens 2, distant, the upper pair either sterile rudiments or wanting; cocci with thickened margins.

More than a dozen species in the North Temperate regions.

- 1. Mature cocci exceeding the lanceolate to triangular calyx lobes and mostly concealing them1. *L. virginicus*.
- 1. Mature cocci noticeably exceeded by the subulate or cuspidate calyx lobes (2)
- 2(1). Lower and median leaf blades sessile; plant tuberiferous2. *L. asper*.
- 2. Lower and median leaf blades tapering to petioles or to subpetiolar bases; tubers rarely developed (3)
- 3(2). Ridge of cocci entire, relatively soft and corky; lower and median primary leaves typically incised or pinnatifid at least at base3. *L. americanus*.
- 3. Ridge of cocci verrucose to tuberculate; lower and median leaves merely serrate4. *L. rubellus*.

1. *Lycopus virginicus* L. VIRGINIA BUGLE-WEED. Stem obtusely angled, usually puberulent with curved hairs, to about 8 dm. high, rising from a slender (not conspicuously tuberous-thickened) base; stolons filiform, mostly not tuberiferous; leaves dark-green or purple-tinged, ovate to ovate-oblong or elliptic, firm, rather abruptly acuminate at both ends, coarsely toothed, to 15 cm. long and 5 cm. broad; glomerules dense, often seemingly compound, in maturity 8-15 mm. broad, the mature cocci usually concealing the calyces; calyx ovoid-cylindric; corolla tubular, with erect lobes; stamens mostly included; cocci asymmetrical, their summits deeply muricate. Rare in marshy soils and along woodland streams in s.e. Tex., Aug.-Dec.; from Ga. to Tex., n. to N.E., N.Y., O., Ind., Wisc., Minn. and Neb.

2. *Lycopus asper* Greene. Stem strict, rather stout, simple or slightly forking, to about 5 dm. high, from elongate tubers, the internodes spreading-pubescent with long multicellular hairs; leaves sessile, lanceolate to oblong-lanceolate, acute at apex, dark-green, mostly longer than the internodes, appressed to spreading-ascending, scabrous, the larger ones 5-8 cm. long and with 6 to 12 sharp teeth on each side; bracts lanceolate, nearly equaling the glomerules, dilated; calyx teeth triangular to ovate, acuminate, 2-3 mm. long, minutely ciliolate; corolla tube scarcely exceeding the calyx; cocci about 2 mm. long and 1.7 mm. broad, with entire angles and oblique non-tuberculate summit. In wet meadows, marshes and wet shores in the Panhandle, June-Aug.; from Alas. to Calif., e. to Mich., Ill., Mo. and Tex.

3. *Lycopus americanus* Muhl. Stem erect, slender, to about 9 dm. high, glabrous or very sparingly appressed-pubescent with dark hairs, freely stoloniferous, without tubers; leaves petioled, to about 1 dm. long and 3 cm. wide; lower primary leaves incised or pinnatifid (especially at base), glabrous or minutely pubescent on veins beneath, glabrous to scabrous-punctulate above, lanceolate to narrowly ovate or oval; upper leaves lance-attenuate, sinuate to sharply toothed; bracts short; calyx teeth with long subulate tips; corolla white, the tube scarcely or barely longer than the calyx teeth, the filaments exerted; cocci 1-1.5 mm. long, 0.6-1 mm. broad, with entire or barely undulate angles, the dorsal angular face relatively soft and dark, the summit entire. *L. sinuatus* L. Low grounds and wet soils about lakes; along streams and in canyons in n.-cen. Tex. and the Panhandle, Aug.-Nov.; from Nfld. to B.C., s. to Fla., Ala., Miss., Tex., N.M. and Calif.

Those plants whose leaves are scabrous-punctulate on the upper surface are segregated as var. *scabrifolius* Fern.

4. *Lycopus rubellus* Moench. WATER-HOREHOUND. Stem arising from slender stolons and rhizomes to about 12 dm. high; leaves elliptic to elliptic-ovate or -lanceolate, petioled, at most sharply serrate or serrate-dentate, acuminate, to about 15 cm. long and 5 cm. wide; bracts minute; calyx teeth acuminate and sharp-pointed, scarcely subulate-tipped; corolla white, often with purple spots, 3.5-4 mm. long, twice as long as calyx; sterile filaments mostly included; nutlets 1-1.6 mm. long, about 1 mm. broad, firm throughout, the low dorsal angle rounded and the lateral ones often undulate, the summit definitely so. In marshes, swamps, bogs, meadows, ditches, seepage areas and shallow water in e. Tex., Aug.-Dec.; from Fla. to Tex., n. to N.E., N.Y., O., Mich., Ill. and Mo.

We have two variants in this species that are separated as follows:

1. Primary leaves sharply serrate to serrate-dentate; stem glabrous or essentially so; calyx teeth and tube subequal, glabrous, the teeth straight var. *rubellus*.
1. Primary leaves with low and depressed teeth; younger internodes and lower surfaces of leaves pubescent; calyx teeth often with recurving tips var. *arkansanus* (Fresen.)

Benner.

24. MENTHA L. MINT

Odorous perennial herbs with erect or diffuse stems; leaves sessile or petioled, usually punctate; flowers small, in whorls that are axillary or in terminal congested or interrupted spikes, of two sorts as to the fertility of the stamens in most species; calyx campanulate to cylindric, 10-nerved, regular or slightly bilabiate, 5-toothed; corolla pale-purple or whitish, bilabiate, the tube shorter than the calyx, the upper lip entire or emarginate, the lower lip 3-lobed; stamens 4, equal, erect, included or exerted; filaments glabrous; anther sacs parallel; ovary 4-parted; style 2-cleft at the summit; cocci ovoid, smooth.

About 25 species in the North Temperate regions.

1. Flower whorls all distant and in leaf axils; leaves exceeding the whorls 1. *M. arvensis*.
1. Flower whorls forming terminal spikes or some of the lower in the leaf axils and somewhat distant (2)

- 2(1). Plants tomentose or villous-tomentose; leaves sessile 2. *M. rotundifolia*.
2. Plants glabrous or nearly so; leaves more or less petiolate (3)
- 3(2). Leaves short-petioled to nearly sessile; spike slender, more or less interrupted ... 3. *M. spicata*.
3. Leaves all distinctly petioled; spikes thick and mostly dense 4. *M. piperita*.

1. *Mentha arvensis* L. FIELD MINT. Stems stoloniferous, freely branching below or nearly simple, to about 8 dm. high, more or less retrorse-pubescent (especially on the angles); leaves oblong to ovate or lanceolate, rounded at base to a distinct petiole, usually rather closely serrate, minutely pubescent or short-villous, the larger leaves to about 5 cm. long, the upper leaves not much smaller than the lower ones; flower whorls all axillary; calyx pubescent, about 3 mm. long, the triangular-subulate teeth about equaling the tube; corolla pink to violet or white, about twice as long as the calyx, nearly or quite glabrous. Incl. var. *villosa* (Benth.) S. R. Stewart and var. *glabrata* (Benth.) Fern., *M. canadensis* L. In moist rich soils in w. and n.w. Tex., May-Oct.; circumboreal.

2. *Mentha rotundifolia* (L.) Huds. APPLE MINT, ROUNDFOLI MINT. Plant with leafy stolons, the herbage more or less tomentose and viscid; stems mostly erect, to about 15 dm. high, simple or branched; leaves sessile or short-petioled, elliptic to ovate-oblong, subcordate to rounded at base, obtuse at apex, the larger leaves to 5 cm. long, crenate-serrate, more or less rugose-reticulate beneath; flower whorls approximate or the lower especially somewhat distant, forming rather slender spikes to 1 dm. long in fruit; bracts ovate-lanceolate to lanceolate, acuminate, usually shorter than the flowers; calyx campanulate, greenish, velvety, barely 2 mm. long, the subulate teeth about as long as the tube and connivent in fruit; corolla white or pink, about 4 mm. long, puberulent. Along roadsides, in old fields, thickets and waste places in cen. and w. Tex., May-Sept., a nat. of Eur. that has become naturalized in various parts of N.A.

3. *Mentha spicata* L. SPEARMINT. Plant with stolons, glabrous or sparingly pubescent at the nodes; stems usually branched, to 12 dm. high, often purplish; leaves sessile or short-petioled, oblong-lanceolate to ovate-lanceolate, acute to acuminate at apex, obtuse to somewhat rounded to subcordate at base, unequally sharply serrate, the larger leaves 3-6 cm. long; flower whorls in slender terminal leafless spikes often 6-8 cm. long in fruit; bracts subulate-lanceolate, equaling or surpassing the calyx, green, glabrous or ciliate; calyx teeth subulate, about equaling the tube, ciliate on the margins, the inflorescence otherwise glabrous; corolla pale-lavender. In moist fields and meadows, mostly near settlements, in cen. and w. Tex., June-Oct.; a nat. of Eur. that has become naturalized in much of N.A.

4. *Mentha piperita* L. PEPPERMINT. Plant with underground sometimes leafy-bracted stolons; stems erect or somewhat decumbent, branched, to about 8 dm. high, often purplish; leaves petioled, lanceolate to ovate-lanceolate, acute, sharply serrate, dark-green and firm, glabrous or sparsely pubescent on the veins beneath; whorls of flowers in terminal dense or interrupted spikes, to 12 cm. long in fruit; bracts narrowly lanceolate, acuminate, not surpassing the flowers; pedicels elongate; calyx tube glabrous, the teeth about equaling or shorter than the tube and hirsute (sometimes sparingly so), ciliate; corolla glabrous, rose-purple to white. In wet places mostly in w.-cen. Tex., June-Oct.; a nat. of Eur. that has become naturalized in much of N.A.

25. POLIOMINTHA GRAY

ROSEMARY-MINT

Low shrubs, commonly canescent throughout; leaves entire; flowers pink or purple, clustered in the leaf axils; calyx tubular, 13- to 15-striate, barbate in the throat, the 5 teeth equal or nearly so; corolla bilabiate, the upper lip erect and emarginate, the lower lip 3-cleft, the tube equaling or longer than the calyx; stamens 2.

About a half dozen species in Mexico and southwestern United States.

1. Leaves usually linear, sessile; calyx villous-hirsute 1. *P. incana*.
1. Leaves oblong to suborbicular, shortly petioled; calyx tomentulose 2. *P. glabrescens*.

1. *Poliomintha incana* (Torr.) Gray. Shrub usually about 5 dm. high, very much branched, silvery with very close and minute simple hairs, the branches virgate; leaves sessile, linear or the lower sometimes oblong, 1-3 cm. long, densely white-tomentulose with simple hairs, veinless and the midrib obscure, the upper floral leaves usually shorter than the 1 to 3 subsessile flowers in their axils; calyx 15-nerved, oblong or cylindraceous, densely white-villous, 6-7 mm. long, the subulate teeth conspicuous; corolla 1-1.4 cm. long, lavender to whitish with purplish dots on the lower lip, the tube pilose-annulate at the summit. On gypsum hills and flats, eroded slopes and in sandy soil in the Trans-Pecos, Apr.-June; from w. Tex. to Ut. and Ariz; also n. Mex.

2. *Poliomintha glabrescens* Gray. Shrub to about 6 dm. high, puberulent, at length somewhat glabrate, the stems typically with numerous short spreading-ascending lateral leafy branches; leaves linear-oblong, obtuse at apex, rounded at base to a short petiole, 1-2 cm. long, veinless and glabrate above, conspicuously punctate; calyx cylindrical, 4-5 mm. long, commonly purplish-tinged, the short teeth erect; corolla white or lavender with purple dots on the lower lip, about 12 mm. long, the tube pilose-annulate within and about as long as the calyx. In rocky soils in the Trans-Pecos, June-Oct.; also n.e. Mex.

26. HEDEOMA PERS.¹⁶⁹

MOCK PENNYROYAL

Annual to suffrutescent perennial herbs with several erect ascending or decumbent shoots, arising from a woody caudex, usually variously retrorsely pubescent in the upper parts, puberulent below, tomentose with branched hairs in *H. molle*; leaves petiolate or subsessile, membranous to coriaceous, ovate to oblong or elliptical to lanceolate, occasionally rhombic, entire or serrate, nerves prominently raised to inconspicuous, both surfaces variously pubescent, glandular-dotted or punctate; axillary cymes 1- to 15-flowered, usually well-spaced along the axis, occasionally spicate; pedicels usually shorter than the calyces; calyx tubular, 13-nerved, not distended (as in *H. molle* and *H. apiculatum*) or variously gibbous or saccate below, upwardly tapering in *H. Drummondii*, variously pubescent, with a ring of hairs occurring near the summit of the tube to form an annulus that may be included or exerted; upper calyx teeth slightly to strongly connate to form a conspicuous upper lip with the connate portion usually continuous with the tube (the lobes deltoid to subulate, laterally spreading and sharply reflexed to laterally and dorsiventrally convergent to close the calyx orifice, hirsute or hirtellous-ciliate); lower calyx teeth typically subulate, recurved (reflexed in *H. molle*) and exceeding the length of the upper lip, hirsute-ciliate; corolla distinctly bilabiate, the slender or funnelform tube dilated upwardly, glabrous or pubescent within, annulate or not; upper corolla lip ligulate or obcordate in outline, straight or reflexed upwardly, flat or subgaleate, emarginate at its apex; lower corolla lip three-lobed and spreading; stamens 4, consisting of a lower fertile pair and of an upper staminodal pair, the lower pair ascending under the upper lip or somewhat exerted beyond it with the anthers divaricate on a well-developed connective, the upper pair reduced to short naked filaments; style unequally forked at the apex, glabrous; cocci oblong, about twice as long as broad, brown, areolate, glaucous, mucilaginous when moistened.

A genus of about 42 taxa (36 species) concentrated in the American southwest and adjacent areas in Mexico. Five species occur in South America and 2 in eastern and mid-western United States.

1. Suffrutescent perennials, evenly tomentose throughout with profusely branching hairs 1. *H. molle*.
1. Plants of various habits, variously pubescent with simple hairs (2)
- 2(1). Plants caespitose perennials that form dense mats; leaves coriaceous, apiculate; corolla large and showy, to 2 cm. long 2. *H. apiculatum*.
2. Plants annuals or perennials but not caespitose to form mats; leaves and corollas various but not as above (3)

¹⁶⁹ Contributed by Robert S. Irving. See Appendix.

- 3(2). Calyx teeth both laterally and dorsiventrally convergent at maturity and (to varying degrees) closing the calyx orifice; leaves obovate to oblong or linear; annuals or suffrutescent perennials3. *H. Drummondii*.
3. Calyx teeth spreading and reflexed at maturity; leaves and habits various (4)
- 4(3). Leaves serrate; plants perennials (5)
4. Leaves entire or very obscurely crenate; plants annual or biennial (6)
- 5(4). Calyx annulus seated about 1 mm. below the juncture of the upper and lower calyx teeth; leaves obovate-rhombic, the elevated nerves straight and unbranched4. *H. plicatum*.
5. Calyx annulus seated at the juncture of the upper and lower calyx teeth; leaves ovate with the nerves variously raised but usually curved and branched5. *H. costatum* var. *pulchellum*.
- 6(4). Calyx conspicuously and markedly saccate with a broad expanded foliaceous upper lip; leaves linear-lanceolate6. *H. hispidum*.
6. Calyx not as above; leaves ovate (7)
- 7(6). Calyx tube markedly gibbous or saccate below with the width of the distended region over one half the tube's length, the annulus dense; corolla tube abruptly dilated, with the upper lip concave and not upwardly reflexed; plants annual or biennial7. *H. nanum* var. *nanum*.
7. Calyx tube gibbous but with the width of the distended region about a fourth the tube's length, the annulus of a few short hairs; corolla tube not abruptly dilated, small with the upper lip ligulate and reflexed upwardly; plants delicate, ephemeral spring annuals8. *H. acinoides*.

1. *Hedeoma molle* Torr. Robust suffrutescent perennial or semishrub 16-55 cm. high, tomentose-canescens throughout with profusely branching hairs; shoots herbaceous, long-ascending and numerous, with branching almost completely confined to the basal region; leaves petiolate, cinereous or canescent, produced along the entire length of the stems, elliptical to oval, 8.5-22 mm. long, 3-10 mm. wide, the margins entire or obscurely crenate, broadly or narrowly attenuate to base, somewhat acute at apex; axillary cymes occurring along the upper third of the stems, well-spaced or more commonly congested to form a dense spike of cymes, 3- to 15-flowered (typically about 10); calyces 5.2-7 mm. long, the tube radially symmetrical and 4.2-6 mm. long, tomentose with highly branched hairs evenly distributed from the calyx base to the only slightly differentiated upper and lower sets of teeth; upper calyx teeth connate for a third their length to form a short upper lip, the laterally subulate lobes spreading or convergent and erect to sharply outwardly curling; lower calyx teeth subulate, 0.6-1.3 mm. long, erect or reflexed away (not recurved); annulus dense, of unbranched pilose hairs well-exserted from the tube; corolla lavender with maroon markings, 13.2-14 mm. long, pilose-pubescent within but not annulate; upper corolla lip ligulate, about 2.2 mm. long, straight; lower corolla lip 4-5 mm. broad; cocci narrowly oblong in outline, 3 to 5 times longer than wide, about 1.2 mm. long and 0.3 mm. wide. *Poliomintha mollis* (Torr.) Gray. Rocky slopes and ledges in the mts. of the Trans-Pecos, July-Nov.; endemic.

2. *Hedeoma apiculatum* W. S. Stewart. Small suffrutescent perennial forming dense mats; stems herbaceous, arising from a woody caudex, numerous, unbranched, densely clothed with minutely retrorsely curling hairs; leaves crowded in pairs, sessile, coriaceous, lanceolate-elliptic, entire, tapered to a conspicuous apiculate apex, 7-15 mm. long, 1.5-3.5 mm. wide, glabrate; flowers solitary or in 2- or 3-flowered axillary cymes, 3 or 4 cyme-pairs per stem crowded toward the apex; calyx 8.5-9 mm. long, chartaceous; calyx tube tubular-funnelform, slightly or not at all gibbous below, flaring above, 5.5-6.5 mm. long, minutely hispidulous-tuberculate below, glabrous above; upper calyx teeth connate for about a fourth or less their length to form an upper lip 2-2.2 mm. long, the broadly triangulate or deltoid lobes apiculate at their apices and laterally spreading and reflexed, hirtellous-tuberculate-ciliate; lower calyx teeth ascending, narrowly triangular-aristate, about 1.2 mm. wide; annulus ring dense, included within the tube; corolla long and showy, pink, about 20 mm. long, sparsely pubescent within the tube but not annulate;

upper corolla lip broadly obcordate, about 5 mm. long, straight; lower corolla lip very broad and spreading, 9-10 mm. wide; cocci narrowed oblong in outline and somewhat pointed at the apex, about 2 mm. long, 0.7-0.9 mm. wide. Restricted to the Guadalupe Mts., frequent among the rocks of the streamway and canyon sides of the s. fork of McKittrick Canyon and in limestone crevices on adj. Pine Top Mt., July-Aug.; endemic.

3. *Hedeoma Drummondii* Benth. Annual to robust perennial 15-60 cm. high; shoots few to numerous, ascending and/or decumbent, variously branched, densely pubescent or puberulent with the hairs tightly retrorsely curling; leaves usually deciduous at maturity, petiolate or sessile, linear to elliptic-oblong or ovate, 5-14 mm. long, 1-5 mm. wide, entire or obscurely crenate, rounded to attenuated at base, glabrate above, densely pubescent below and on the margins; axillary cymes crowded or well-spaced along the shoots (developing unsymmetrically to 1 side with 2 to 4 flowers per cyme or symmetrically with 1 to 5 flowers per cyme); calyces 5-7 mm. long, the tube 3-5 mm. long, conspicuously saccate for about two thirds its length, the tube above the distended region quickly constricted and tapered into a narrow neck that completely or partially closes the orifice after anthesis, finely pubescent to hoary-pilose (the hairs spreading and/or antrorsely curving); upper calyx teeth not connate or only slightly so, subulate or very narrowly triangulate, 1-1.5 mm. long, to various degrees laterally and dorsiventrally convergent partially or completely to seal the calyx orifice, hirsute to hirtellous-ciliate; annulus very dense, 0.8-1.5 mm. wide, seated about 1 mm. below the juncture of the upper and lower teeth and included; corolla blue or white-marked in the throat, variable in size, 7-15 mm. long, sparsely pubescent in the throat (more densely so in the tube to form a well-defined annulus); upper corolla tip ligulate, straight, concave and subgaleate, 1-5 mm. long; lower corolla lip spreading, 2.5-5 mm. wide; cocci oblong in outline, 1-1.7 mm. long, 0.4-0.6 mm. wide. Limestone soil, roadcuts, bluffs and rocky shoulders nearly throughout though rare in extreme e. Tex., May-Sept.

In Texas represented by the following varieties, broadly overlapping geographically.

1. Plants seldom suffruticose, typically annuals or herbaceous perennials, averaging less than 25 cm. in height; leaves linear or elliptic-oblong, usually more than 3 times longer than wide and commonly 5 times; cymes typically 1- to 5-flowered, developing symmetrically; calyx 5-6 mm. long, hirsute, with the upper and lower teeth convergent completely to close the orifice; corolla blue, 7-11 mm. long
 var. *Drummondii*.

1. Plants not as above (2)

2(1). Plants suffruticose perennials 15-40 cm. tall, branching freely along the lower two thirds of the shoots; leaves elliptic to oblong, usually less than 3 times longer than broad, averaging 8.3 mm. long and 3 mm. wide; cymules 2- to 4-flowered and developing asymmetrically (to one side preferentially); calyx 5-6 mm. long, coarsely hirsute, the upper teeth erect or only slightly laterally spreading and only partially closing the orifice by convergence with the lower teeth; corolla small, 8-10 mm. long, typically white, the tube only slightly dilated upwardly
 var. *serpyllifolium* (Small)

Irving.

2. Plants suffruticose perennials 25-60 cm. tall, branching usually restricted to the base and the upper half of the shoots; leaves elliptic-oblong, less than 3 times longer than broad, averaging 11.7 mm. long and 4 mm. wide; calyx 6-7 mm. long, very coarsely hirsute or hoary-pilose, the upper teeth widely spreading and only slightly onvergent with the lower teeth to close the orifice; corolla large, 10-15 mm. long, white or blue, the tube conspicuously dilated upwardly
 var. *Reverchonii* Gray.

4. *Hedeoma plicatum* Torr. Perennial herb 15-37 cm. high; shoots numerous, ascending or very shortly decumbent, copiously branched toward the base (sparsely so above), hirtellous-pubescent with the hairs retrorsely curving; leaves glabrate above, puberulent below and on margins, elliptic-oval or rhombic, 6.5-10 mm. long, 3-6 mm. wide, the margins conspicuously coarsely serrate, broadly attenuate and shortly petiolate at base, acute at apex, the elevated nerves with secondaries of about 5 subopposite straight or slightly curved unbranched pairs; axillary cymes 3- to 7-flowered, well-spaced along the

upper two thirds of the stems; calyces 4.5-6 mm. long, the tube 3.5-4.3 mm. long and gibbous for about half its length, typically puberulent with short spreading hairs; upper calyx teeth connate about half their length to form a conspicuous upper lip, the narrowly triangulate-lanceolate lobes about 1.5 mm. long and laterally spreading and sharply reflexed, hirsute or hirtellous-ciliate; lower calyx teeth recurved, subulate, hirsute-ciliate; annulus moderately dense, about 0.5 mm. wide and seated at least 1 mm. below the juncture of the upper and lower teeth and included; corolla blue, 7-10 mm. long, short-pubescent in the tube but not annulate; upper corolla lip straight and subgaleate, about 1.5 mm. long; lower corolla lip 2.5-3 mm. wide; cocci oblong in outline, about 1.2 mm. long and 0.6 mm. wide. Pine-oak woodlands in the mts. of the Trans-Pecos, July-Aug.; also Mex.

5. *Hedeoma costatum* Gray var. *pulchellum* (Greene) Irving. Densely tufted perennial to 15 cm. high; shoots numerous, canescent with retrorsely curling hairs, ascending or shortly decumbent, branching in the lower half; leaves ovate or elliptic, 5-10 mm. long, 3-6.5 mm. wide, puberulent to villous above, strigose to villous below, coarsely serrate, rounded or shortly cuneate to a short-petiolate base, sharply acute at apex, the nerves not conspicuously raised; axillary cymes 3- to 5-flowered, typically congested in the upper half of the stems; calyces 6.5-8 mm. long, the tube 4.5-5.5 mm. long, saccate below for about half its length, hoary-villous with hairs spreading or antrorsely curving; upper calyx teeth connate for about a fourth their length, the upper lip 2-3 mm. long with the subulate lobes slightly reflexed-spreading and about 2 mm. long, hirsute-ciliate; lower calyx teeth recurved, subulate, 2-3 mm. long, hirsute-ciliate; annulus dense, about 0.5 mm. wide and seated at the juncture of the upper and lower teeth, included; corolla variable, well-exserted from the calyx or nearly included, 1-2 cm. long, pubescent in the throat and tube but not annulate; upper corolla lip ligulate, slightly upwardly reflexed, about 1.5 mm. long; lower corolla lip 3-4 mm. wide; cocci oblong, about 1.2 mm. long and 0.6 mm. wide. Open rocky limestone outcrops and road embankments of w. Tex., Apr.-June; also N.M. and Mex.

6. *Hedeoma hispidum* Pursh. Coarse annual 9-40 cm. high, densely pubescent with hairs retrorsely curling; stems usually solitary, occasionally numerous, erect or shortly decumbent, the branches absent or few and usually confined to the lower third of the plant; leaves coriaceous with the margins frequently becoming revolute upon drying, linear or linear-elliptic, obtuse, 11-21 mm. long, 1.6-3 mm. wide, entire, attenuated and subsessile at the base, glabrate above, the margins and nerves below typically strigulose; axillary cymes borne along the upper two thirds of the stems or occasionally along its entire length, well-spaced or congested to form a spike of cymes, 3- to 15- (typically 5- to 8-)flowered; calyces highly zygomorphic, 4.9-6 mm. long, the tube 2.8-3.3 mm. long, markedly saccate below for about three fourths of its length, hirsute with the hairs primarily spreading or antrorsely curving; upper calyx teeth connate for about half of their length to form a broad expanded foliaceous upper lip 1.2-2 mm. long (with its margins outwardly flaring and exceeding the width of the tube below), the narrowly triangular acute lobes 0.6-1 mm. long and gradually or sharply reflexed but not markedly laterally spreading, hirtellous-ciliate; lower calyx teeth recurved-subulate, 2-2.5 mm. long, scarcely exceeding the length of the upper lip, hirsute-ciliate; annulus dense, about 0.5 mm. wide and seated at juncture of the upper and lower teeth, slightly exserted from the tube; corolla dimorphic, in the first form scarcely exserted from the calyx, in the second form the corolla 6-7 mm. long and well-exserted from the calyx, both forms glabrous within; upper corolla lip subgaleate, about 1 mm. long; lower corolla lip about 3 mm. wide; cocci oblong, about 1.2 mm. long and 0.6 mm. wide. Loamy soil of prairies and pastures, e. half of Tex.; Apr.-June; to the Atl. Coast, n. to Alta., and e. to N.Y.

7. *Hedeoma nanum* (Torr.) Briq. var. *nanum*. Annual or perennial herb; shoots pilose or hirsute, solitary to numerous, erect to ascending or shortly decumbent, branching at or near the base, typically unbranched above; leaves petiolate, glabrate above, hirtellous below, ovate to oval, variable in dimensions, 5.5-13 mm. long, 2.5-6 mm. wide, entire, broadly rounded to narrowly attenuate at base, broadly acute to narrowly obtuse at apex; axillary cymes 3- to 15-flowered (usually 8 to 10), very dense and compact, well-spaced along the entire length of the shoots or commonly congested to form a dense spike of cymes; calyces 4-5.2 mm. long, the tube 2.5-3.7 mm. long, saccate below for a third to

two thirds the length, the distended region typically wider than half the tube's length, hirsute to hirtellous with hairs spreading; upper calyx teeth connate for slightly less than half their length to form a conspicuous upper lip (1-1.3 mm. long), the narrowly triangulate-lanceolate lobes 0.4-0.7 mm. long and markedly laterally spreading and reflexed, hirtellous-ciliate, the inner face of the lip pubescent as an upward continuation of the annulus; lower calyx teeth subulate, recurved and not conspicuously exceeding the lower lip in length, 1.2-3 mm. long and seated about 0.8 mm. below the juncture of the upper and lower teeth; corolla distinctive, 8-9 mm. long, dark-violet and longitudinally striped, pubescent within the throat in 2 decurrent lines on each side of an adaxial groove, the throat markedly and abruptly dilated; cocci oblong in outline about 1.1 mm. long and 0.5 mm. wide. *H. thymoides* Gray. Rocky limestone outcrops and roadcuts from Del Rio (Val Verde Co.), w. through w. Tex., Apr.-July; Tex., N.M., Ariz., and s. Nev., s. through cen. Mex.

8. *Hedeoma acinoides* Scheele. Delicate ephemeral annual 5-30 cm. high; shoots densely pubescent, nearly lanate, solitary to numerous, erect, ascending or very shortly decumbent, branching restricted to the lower half; leaves with petioles 1-4 mm. long, broadly ovate to elliptic or rhombic-elliptic, 9-25 mm. long, 3.5-8 mm. wide, glabrate, entire or obscurely serrate, rounded to narrowly attenuate at base, obtuse at apex; axillary cymes 3- to 15-flowered and typically congested toward the apices to form a short dense spike of cymes; calyces 5-6.1 mm. long, thin-membranous, the tube relatively long and slender, 4-4.5 mm. long, the lower third distinctly saccate below, glabrate or sparsely hirtellous; upper calyx teeth united for about a third their length to form a small but definite upper lip (0.9-1.2 mm. long), the broadly to narrowly triangulate lobes 0.8-1.1 mm. long and parallel or convergent and only slightly reflexed, densely hirtellous-ciliate; the lower calyx teeth narrowly triangulate to subulate, recurved, 1-1.2 mm. long, only very slightly exceeding the length of the upper lip, hirtellous-ciliate; annulus very weakly represented, consisting of only a few short pilose hairs, about 0.4 mm. wide and seated about 0.3 mm. below the juncture of the upper and lower teeth; corolla 9-13 mm. long, pink, glabrous within, the upper lip ligulate and sharply reflexed backwardly, the lower lip spreading; cocci oblong, about 0.8 mm. long and 0.4 mm. wide. Common in wet years in rocky limestone soil of the e. periphery of the Edwards Plateau and Lampasas Cut Plain, also scatteringly in limestone pockets of the s. Coastal Plain, Apr.-May; also disjunct in Mex.

27. RHODODON EPL.¹⁷⁰

A monotypic genus endemic to Texas.

1. *Rhododon ciliatus* (Benth.) Epl. Annual herbs 15-25 cm. tall; stems erect, branching freely, usually villous in the upper parts with coarse decurved hairs, pubescent below; leaves subsessile, elliptic-oblong, spreading or ascending, 15-20 mm. long, entire, obtuse at apex, rounded-truncate at base, the margins long-ciliate, on both surfaces green and glabrous; axillary cymes 3- to 7-flowered, crowded in the axils of the uppermost leaves to form a compact thyrses 3-6 cm. long; pedicels about half as long as calyx, densely retrorse-pubescent; calyx 15-nerved, slightly distended below, strongly setulose in the lower half with coarse cilia 2 mm. long, the tapering tube 4.5-5 mm. long; calyx teeth connivent or parallel, deltoid-lanceolate, acute, subequal, about as long as the tube, the lower teeth scarcely longer than the upper, strongly annulate at base, the dense annulus exerted, sinuses membranous; corolla pale pink to purple, 5-6 mm. long, the tube strongly villous-annulate near the middle and equal to or shorter than the lower lip; stamens 2, seated at or above the middle of the tube; anthers connate, contained completely within the tube on very short filaments, the sacs widely spreading; style hirtellous-pubescent. *Hedeoma texanum* Cory, *Stachydeoma angulata* Tharp, *S. Duvalii* Tharp. Local in sandy soil, Smith and Robertson cos. to Refugio Co., May-July; endemic.

¹⁷⁰ Contributed by Robert S. Irving.

28. MICROMERIA BENTH.

About 100 species widely distributed.

1. *Micromeria Brownei* (Sw.) Benth. var. *pilosiuscula* Gray. Weak plants with slender sprawling or diffusely spreading sparsely pilose-pubescent stems, to about 4 dm. high or long; leaves petioled, suborbicular to broadly ovate, obscurely crenate, the larger ones to 25 mm. long and 2 cm. wide, thin, glabrous to sparingly pubescent; pedicels filiform, to 15 mm. long; flowers 1 to 3 in axillary one-flowered cymes; calyx sparingly pilose to glabrate, 4-5 mm. long, somewhat villous in the throat; calyx lobes 5, subequal, ovate-deltoid, 1-1.5 mm. long, those of the upper lip abruptly acute or even acuminate; corolla 2-lipped, 7-8 mm. long, pink to lavender-pink or whitish, the tube much-dilated, the mid-lobe of the lower lip about as wide as long and notched; stamens 4, more or less exerted. *M. pilosiuscula* (Gray) Small, *Satureja Brownei* (Sw.) Briq. In swamps, marshes, on stream banks, in woods and along ditches in coastal and s. Tex., throughout year; from Fla. to Tex.

29. SATUREJA L.

More than 100 species mostly in warmer regions of the world.

1. *Satureja arkansana* (Nutt.) Briq. Perennial with odor of pennyroyal, freely stoloniferous, the repent stolons usually with short ovate to elliptic leaves; stems slender, mostly erect, 1-4 dm. high, simple or branching, glabrous or scarcely bearded at the nodes; cauline leaves linear to linear-oblongate, nearly or quite entire, the larger ones to 25 mm. long and 5 mm. wide; cymes few- to many-flowered, their bractlets 3-5 mm. long; calyx tubular, about 3 mm. long, strongly ribbed, sharply toothed; corolla about 1 cm. long, bluish; corolla with straight tube and an inflated throat, distinctly 2-lipped, the upper erect lip flattish and entire or notched, the lower spreading lip 3-parted with the middle lobes usually largest; stamens 4, somewhat ascending; filaments very slender, 4 to 5 times as long as anther; style branches both elongate, strongly curling. *Satureja glabra* (Nutt.) Fern., *S. glabella* (Michx.) Briq. var. *angustifolia* (Torr.) Svens., *Clinopodium glabrum* (Nutt.) O. Ktze., *Calamintha arkansana* (Nutt.) Shinners. On calcareous rocks in ravines, on banks and in barrens in e. and cen. Tex., Apr.-Aug.; from Ont. to Minn., s. to Ark. and Tex.

30. PYCNANTHEMUM MICHX.¹⁷¹

MOUNTAIN-MINT. BASIL

Perennial erect herbs with a pungent mintlike flavor, corymbosely branched above, the floral leaves often whitened; the many-flowered whorls dense, crowded with bracts and usually forming terminal heads or close cymes; calyx about 13-nerved, naked in the throat; corolla short, whitish or purplish, more or less 2-lipped, the lips mostly dotted with purple, the upper lip straight, nearly flat, entire or slightly notched, the lower lip 3-cleft with its lobes all ovate to oblong and obtuse; stamens exerted or included in different flowers; lower pair of stamens rather longer than the upper; anther cells parallel.

About 21 species, mostly in eastern United States.

1. Leaves linear, entire, rarely more than 4 mm. wide ... 1. *P. tenuifolium*.
1. Leaves ovate to narrowly lanceolate, subentire to remotely toothed, more than 5 mm. wide (2)
- 2(1). Floral bracts and leaves green, not whitened; leaves typically narrowly lanceolate 2. *P. clinopodioides*.
2. Floral bracts and often the lower surface of leaves whitened; leaves typically ovate to ovate-lanceolate (3)

¹⁷¹ Ref.: Elizabeth Grant and Carl Epling in Univ. Calif. Publ. Bot. 20:195-239. 1943.

- 3(2). Calyx bilabiate, the upper and lower lips definitely unequal; flowers in irregular corymbs to form glomerules3. *P. albescens*.
 3. Calyx nearly regular, all its teeth essentially equal in length; flowers in tight globose heads4. *P. muticum*.

1. *Pycnanthemum tenuifolium* Schrad. Plant to about 1 m. high, glabrous, forming dense colonies by horizontal roots, usually bearing abundant sterile simple or forking axillary branches; leaves sessile, linear, to about 6 cm. long and 5.5 mm. wide, tapering to apex, firm and sometimes with revolute margins, glabrous or sparsely puberulent, entire; glomerules solitary and terminal, disposed in rather crowded or open corymbs that are simple or made up of several to many secondary corymbs; appressed lance-attenuate bracts and glabrescent lance-subulate calyx teeth 1-2 mm. long, with firm sharp tips; corolla white to pale-lavender, usually purple-spotted; corolla tube 3-4.5 mm. long, pubescent within the throat, the upper lip 2-2.5 mm. tall. *P. flexuosum* of auth. In grassy moist open woods, bogs, savannahs, old fields, meadows and marshes in the e. fourth of Tex., May-Oct.; from Ga. to Tex., n. to N.E., N.Y., Ont., O., Mich., Wisc. and Minn.

2. *Pycnanthemum clinopodioides* T. & G. Plant to about 1 m. high, bearing short leafy branches in the axils of the leaves and branching in the inflorescence; stem pubescent with short curving and longer spreading hairs, the median internodes about equal to the subtending leaves; leaves with petioles 3-6 mm. long, narrowly lanceolate, acuminate, entire or shallowly serrate, the largest 45-95 mm. long and 1-2.5 cm. broad, pale-green, membranous, the upper surface sprinkled with a few hairs, the lower surface pubescent with longer spreading hairs (especially on the midrib and other veins); glomerules terminal, 1 to 3 on a peduncle, disposed in loose corymbs, each subtended by a pair of leaflike bracts that may be canescent, the inner bracts with a few long jointed bristles; calyx pubescent with short hairs, 4-6 mm. long; calyx teeth narrowly deltoid, somewhat acuminate, ciliate with several jointed bristles at the tip, the upper three somewhat connate at the base and about two thirds as long as the lowest pair that are commonly 1-1.5 mm. long; corolla tube rather abruptly narrowed above the middle, 4-5.5 mm. long, the upper lip 3-4 mm. tall; cocci glabrous or sometimes hairy at the tip. *P. pilosum* of auth. Uncommon in and on edge of woods from Mass. along mts. to N.C., with a disjunct station in e. Tex., June-Oct.

3. *Pycnanthemum albescens* T. & G. Plant to 15 dm. high, branching in the upper parts, the branches ascendent or divaricate-ascendent; median internodes about equal to the subtending leaves, the upper internodes pubescent with short curled hairs and bearing a few longer spreading hairs or pubescent with short curled hairs only; leaves with petioles 4-12 mm. long, ovate to ovate-lanceolate or elliptic, all but the lower strongly whitened, paler and minutely pubescent beneath, serrate, 2.5-7 cm. long, 1-2.5 cm. broad, glomerules terminal and solitary or occasionally 2, loose, disposed in irregular corymbs, the branches apparent, canescent; bracts of the involucre foliar and strongly whitened, canescent, rarely with a few longer hairs; calyx canescent throughout with minute appressed hairs, without bristles at the tip, 3.5-5 mm. long, the lower pair of ovate or oblong teeth obtuse and 1-1.3 mm. long, the upper deltoid teeth connate to the middle or more and obtuse; corolla white or lavender, usually spotted; corolla tube gradually enlarged upward, 3-4.5 mm. long, the upper lip 2-4 mm. tall. In low open woods, often along streams, in savannahs and in thicket areas in e. Tex., July-Nov.; from Fla. to Tex., n. to Mo. and e. Okla.

4. *Pycnanthemum muticum* Pers. Plant to 11 dm. high, usually smaller, branching chiefly in the inflorescence, simple below or with a few weak lateral branches; stem minutely hoary-pilose to puberulent, the median internodes usually somewhat longer than the subtending leaves or shorter; leaves subsessile to short-petioled, ovate-lanceolate or narrowly ovate, the largest (usually median) 2.5-8 cm. long and 1.5-4 cm. broad, acuminate at apex, rounded to subcordate at the base, bearing 5 or 6 pairs of lateral veins or more with the intermediate veins apparent, the upper surface glabrous, the lower surface glabrous or pubescent along the veins (especially the midvein), shallowly serrate or rather entire; glomerules solitary and terminal or occasionally 2, subtended by diminished leaflike but canescent velvety bracts; calyx closely pubescent in the upper parts, 3-5 mm. long; calyx teeth narrowly deltoid, somewhat acuminate but scarcely apiculate,

usually about 0.7 mm. long, essentially equal; corolla tube gradually enlarged upward, 3-3.5 mm. long, the upper lip 1.5-2 mm. tall; stamens sometimes normal and about equaling the corolla in length, more frequently minute, scarcely exerted from the throat, apparently nonfunctional. From Me. to Mich. and Ill., s. to Fla. and n.-cen. Tex. where it is very rare in dry open woods, July-Nov.

31. CUNILA L.

DITTANY. STONE MINT

About 15 species from the United States to Uruguay.

1. *Cunila origanoides* (L.) Britt. Perennial herb, woody at base, tufted, corymbosely much-branched, glabrous, to about 4 dm. high; leaves subsessile, ovate to deltoid-ovate smooth, rounded to cordate at base, acute at apex, subentire to irregularly serrate, dotted, 2-4 cm. long; peduncled cymes (axillary) 3- to 9-flowered, usually shorter than the subtending leaf, the flowers mingled with linear bracts about 1 mm. long, the terminal cymes larger and more loosely branched; calyx obconic, regular, about 3 mm. long, strongly 10-nerved, villous in the throat; calyx teeth triangular, equal or nearly so, about a fourth as long as the tube; corolla nearly regular, rose-purple to white, 6-8 mm. long, the tube exerted from the calyx, pubescent, the upper lip erect and shallowly obcordate, the lower lip spreading and about equally 3-lobed; stamens 2, the straight filaments elongate and surpassing the corolla. In dry open woods and thickets in n.-cen. Tex., Sept.-Oct.; from Fla. to Tex., n. to N.Y., Pa., W.Va., O., Ind., Ill., Mo. and Okla.

FAM. 159. SOLANACEAE JUSS.

POTATO OR NIGHTSHADE FAMILY

Herbs, shrubs or trees; leaves alternate or fascicled, sometimes with some opposite, entire to odd-pinnate; flowers in umbels, cymes or panicles, or solitary and lateral, perfect, regular or nearly so, 4- to 6-merous; calyx usually 5-toothed or 5-cleft (rarely 4-toothed), rotate, campanulate or tubular, usually persistent; corolla tubular, campanulate, infundibuliform or rotate, usually more or less 5-lobed, with the lobes valvate or imbricate and usually plicate in bud; stamens usually 5, distinct or slightly united by the anthers; filaments distinct, inserted on the corolla tube alternate with the lobes; anthers opening by slits or pores; styles 1; stigma entire or 2-lobed; ovary superior, usually 2-celled; fruit a berry or capsule.

A family of about 2,100 species in about 90 genera, widely distributed but mostly in the Western Hemisphere.

1. Corolla rotate to broadly campanulate (2)

1. Corolla salverform to funnellform or urceolate (6)

2(1). Calyx accrescent in fruit to invest entirely (or nearly so) the berry (3)

2. Calyx usually not noticeably accrescent in fruit, spiny if investing the fruit (4)

3(2). Calyx becoming much-enlarged and membranaceous-inflated to entirely and permanently enclose the berry, reticulate-veiny; corolla usually lacking tomentose pads on the lower part of lobes 1. *Physalis*, p. 1387.

3. Calyx herbaceous and closely investing the berry or most of it, not angled; corolla with tomentose pads alternating with the filaments . . 2. *Chamaesaracha*, p. 1392.

4(2). Anthers connate into a pointed cone, terminated by a sterile tip, the cells dehiscent longitudinally down the inner face 3. *Lycopersicon*, p. 1393.

4. Anthers not as above (5)

5(4). Anthers typically yellow, much longer than the filaments, connivent or lightly connate around style, the cells opening at apex by pores or slits 4. *Solanum*, p. 1394.

5. Anthers bluish, scarcely longer than the filaments, not connivent around the style, without pores, the cells dehiscent longitudinally . . . 5. *Capsicum*, p. 1399.

- 6(1). Calyx becoming much-enlarged and membranaceous-inflated to enclose the berry, reticulate-veiny; corolla urceolate 6. *Margaranthus*, p. 1399.
6. Calyx not as above (7)
- 7(6). Shrubs or rarely small trees more than 4 dm. high (8)
7. Herbs or suffrutescent perennials less than 3 dm. high, rarely viny (10)
- 8(7). Corolla 35 mm. long or more; petioles 3 cm. long or more 17. *Nicotiana*, p. 1407.
8. Corolla less than 20 mm. long; petioles less than 2 cm. long (9)
- 9(8). Plant native, usually thorny at the nodes, becoming intricate 7. *Lycium*, p. 1400.
9. Plant escaped from cultivation, unarmed, rather open .. 8. *Cestrum*, p. 1402.
- 10(7). Leaves evenly 1- or 2-pinnatisect, the segments entire to somewhat incised; perfect stamens 2 9. *Schizanthus*, p. 1403.
10. Leaves entire or unevenly pinnatisect; perfect stamens more than 2 (11)
- 11(10). Corolla to 1 cm. long (12)
11. Corolla more than 1 cm. long (14)
- 12(11). Plants more or less climbing; leaves ovate-rhombic to suborbicular, 15 mm. long or more; fruit a berry 10. *Salpichroa*, p. 1404.
12. Plants decumbent or creeping; leaves linear to linear-spatulate, to 15 mm. long; fruit a bivalved capsule (13)
- 13(12). Corolla salverform, 7-10 mm. long, the filaments inserted on its upper portion .. 11. *Nierembergia*, p. 1404.
13. Corolla funnellform, about 6 mm. long, the filaments inserted below its middle 12. *Petunia*, p. 1404.
- 14(11). Capsule prickly-armed; calyx circumscissile at base; corolla lobes terminated by abruptly acuminate-attenuate points 13. *Datura*, p. 1404.
14. Capsule unarmed; calyx not circumscissile; corolla lobes not as above (15)
- 15(14). Leaves oblong-spatulate to elliptic-obovate or sometimes lanceolate, tapered at base, to about 1 cm. wide (16)
15. Leaves various, rarely noticeably tapered at base, much more than 1 cm. wide (17)
- 16(15). Plants viscid-pubescent; corolla salverform, purplish 14. *Leptoglossis*, p. 1406.
16. Plants minutely appressed-puberulent, not viscid; corolla funnellform, white or at most lavender-tinged 15. *Bouchetia*, p. 1406.
- 17(15). Leaves with slender petioles, the broadly ovate blade cordate at base and acuminate at apex; corolla tube extended as a crown beyond the spreading lobes of the limb 16. *Nectouxia*, p. 1406.
17. Leaves and corolla not as above 17. *Nicotiana*, p. 1407.

1. *PHYSALIS* L.¹⁷²

GROUND CHERRY

Annual or perennial herbs, ours from a few centimeters to a meter tall, erect or decumbent, some species rhizomatous; leaves petioled, alternate but sometimes 2 or 3 apparently together due to internode reduction; leaf blades usually ovate to lanceolate but varying toward linear, their margins variously toothed (often coarsely and irregularly so) to entire; vestiture various, of long multicellular hairs, or short hairs, or glandular ones, or stellate, or plant nearly glabrous; flowers pedicelled, solitary (in ours) in the leaf axils; flowering calyx 5-lobed or 5-toothed; corollas campanulate to reflexed-rotate, usually yellowish, sometimes blue, rarely white, often with 5 darker contrasting maculations near the base of the limb (these solid in color) or each of several smaller spots, sometimes the maculations not strongly contrasting, sometimes absent; varying quantities

¹⁷² Contributed by U. T. Waterfall.

and sizes of hairs usually present in the corolla tube near the points of filament divergence, sometimes as 5 hairy pads, sometimes these areas more or less glandular; stamens 5; anthers oblong or linear-oblong to ovate, yellow to violet, blue or greenish-blue, or so lined or tinged; filaments filiform to nearly as wide as the anthers; fruiting calyx usually inflated around the 2-carpellate many-seeded often dryish berry, rarely tightly investing it, sometimes invaginated basally.

About 90 species of the New World, mostly in Mexico and Central America, and a few in the Old World.

1. Herbage covered with stellate or variously branched trichomes or with added jointed simple hairs (2)
1. Herbage nearly glabrous or variously hairy but branched hairs (when rarely present) are small, inconspicuous and usually much less numerous than unbranched ones (4)
- 2(1). Hairs stellate 1. *P. viscosa*.
2. Herbage with simple hairs or long-stiped jointed hairs in addition to stellate or 2- or 3-branched ones (3)
- 3(2). Long hairs (1-4 mm. long) on at least the calyx or the base of the stem in addition to a covering of small stellate hairs 2. *P. variovestita*.
3. Indument usually of long bristly hairs, some of which are 2- or 3-divided and sometimes rebranched 3. *P. pumila*.
- 4(1). Anthers (2-) 3-5 mm. long; fruiting calyx slightly 10-angled to 10-ribbed and nearly terete (5)
4. Fruiting calyx 5-angled (10)
- 5(4). Anthers usually yellow, sometimes with a bluish tinge or with bluish edges or lines; plants perennial (6)
5. Anthers blue or violet, sometimes greenish-tinged; plants annual (8)
- 6(5). Flowering pedicels usually 3-8 (-13) mm. long .. 6. *P. hederæfolia*.
6. Flowering pedicels usually 10-15 mm. long (7)
- 7(6). Filaments usually clavate; vestiture villous, at least in part; leaf blades ovate 4. *P. heterophylla*.
7. Filaments not clavate; leaf blades ovate and vestiture sometimes villous only in var. *virginiana*, otherwise the leaf blades are narrower and plants not villous 5. *P. virginiana*.
- 8(5). Corolla maculate; anthers about 3 mm. long, becoming twisted; flowering pedicels usually 3-5 mm. long 7. *P. philadelphica*.
8. Corolla immaculate or inconspicuously spotted; anthers 1-3 mm. long, not twisted or rarely so in *P. acutifolia*; flowering pedicels 5-40 mm. long (9)
- 9(8). Corolla campanulate-funnelform; anthers 1-2.5 mm. long 8. *P. angulata*.
9. Corolla rotate to reflexed-rotate; anthers 2.5-3 mm. long 9. *P. acutifolia*.
- 10(4). Corolla blue (rarely white) 10. *P. lobata*.
10. Corolla yellow (11)
- 11(10). Fruiting calyx glabrous or essentially so 11. *P. cordata*.
11. Fruiting calyx hairy (12)
- 12(11). Fruiting calyx 30-40 mm. long, the lobes tending to be narrowly lanceolate-attenuate 13. *P. turbinata*.
12. Fruiting calyx 15-30 (-32) mm. long, the lobes triangular or ovate-triangular to narrowly lanceolate and subulate-tipped (13)
- 13(12). Fruiting pedicels thick, about 1 mm. in diameter .. 12. *P. subulata* var. *neomexicana*.
13. Fruiting pedicels filiform, less than 0.5 mm. in diameter 14. *P. pubescens*.

1. *Physalis viscosa* L. Erect or decumbent perennial, more or less covered with stellate or several-branched hairs; corolla yellowish, usually dark-maculate; anthers yellow, about 3 mm. long; flowering pedicels 7-35 mm. long; fruiting calyx 15-35 mm. long and 15-28 mm. wide, half-filled by the berry.

Var. *mollis* (Nutt.) Waterfall. Plants erect or spreading; leaves large, ovate, coarsely and irregularly few-toothed, stellate-tomentose beneath; flowering calyces usually 7-10 mm. long; varying in these features into the next variety. Uncommon in and near woods in n.e. Tex., May-July; from adj. Ark. and Okla.

Var. *cinerascens* (Dun.) Waterfall. Plant erect to usually decumbent, more or less covered with stellate or dendritic hairs of varying size and density; leaf blades ovate to rarely reniform, of varying size, their margins toothed, undulate or entire; petioles 1-5 cm. long; corollas yellowish, usually dark-maculate, rotate-reflexed when fully expanded; flowering calyx (3-) 5-7 (-9) mm. long; small-leaved forms have been segregated as *P. mollis* Nutt. var. *parvifolia* Rydb. Throughout Tex. but especially common in the s. and w. areas, Apr. through the growing season, most of the year in s. Tex.; Chis. and Oax. through Okla., barely reaching Ark., Kan. and N.M.

Var. *spathulaefolia* (Torr.) Gray. Leaves spatulate to lanceolate or ovate, the blades basally tapering or gradually extending into winged petioles, those with broad blades and winged petioles approach var. *maritima* (Curtis) Waterfall of the southern Atlantic seacoast. Sandy beaches and plains along the Gulf Coast, a few collections somewhat inland may be intermediates with var. *cinerascens*, mostly Mar.-May but throughout the year; along the coast into La.

2. *Physalis variovestita* Waterfall. Plant erect, from a slender rhizome, with long branched or simple hairs on at least the calyx or the base of the stem in addition to a vestiture of stellate hairs; leaf blades ovate, varyingly dentate (often coarsely and irregularly so), usually more densely vestite on lower surfaces; petioles of principal leaves about equaling the blades in length; corolla yellowish, dark-maculate, 1.5-2 cm. long and 2-3 cm. wide when fully expanded; anthers yellow, about 3 mm. long; flowering calyx about 1 cm. long, about one third divided into ovate or ovate-lanceolate lobes; flowering pedicels 2-3 cm. long, Gulf Coast sands and occasionally inland to Wilson and Gonzales cos., Mar.-June and sometimes later; endemic.

Apparently varying into *P. viscosa* var. *cinerascens*.

3. *Physalis pumila* Nutt. PRAIRIE GROUND CHERRY. Perennial 15-45 cm. tall, branching above; vestiture of jointed hairs 1-2 mm. long, some 1- to 3-branched, spreading at right angles to the stem; leaf blades ovate to ovate-lanceolate or lanceolate, sometimes somewhat rhombic, tapering to a more or less winged petiole; leaf margins usually entire but sometimes slightly and irregularly sinuate-dentate; pedicels 15-30 mm. long; corolla yellowish, only slightly maculate, 12-20 mm. long, 15-25 mm. wide; anthers yellow, 2.5-3 mm. long; flowering calyx 10-15 mm. long, the upper one-third divided into sepal tips; fruiting calyx 3-4 cm. long and 15-20 mm. wide, much-inflated about the berry; fruiting pedicels reflexed, 25-40 mm. long. Prairies and open woods, n.e. Tex. to Brazos Co., Apr.-June; from e. Okla. and adj. Kan. and Mo., barely reaching Ark. and Ill.

4. *Physalis heterophylla* Nees var. *heterophylla sens. lat.* CLAMMY GROUND CHERRY. Stems usually erect from a deeply buried rootstock, 15-90 cm. tall, simple or branched; vestiture of varying proportions of short usually viscid-glandular hairs and long jointed hairs 1-2 mm. long, sometimes with only a few long hairs; leaf blades ovate, usually the principal ones 5-10 cm. long and 3.5-6 cm. wide, with petioles 3-6 cm. long; corollas 10-18 mm. long and 12-18 mm. wide when fully open, yellow, maculate but not always with a strong contrast; flowering calyx 7-12 mm. long, 5-12 mm. wide at the base of the lobes; anthers usually 3-4.5 mm. long, yellow, sometimes tinged with blue or violet; filaments thickened, often as wide as the anthers, sometimes clavate; fruiting calyx usually 2.5-3 cm. long and 2-3 cm. wide, much-inflated about the fruit, with pedicels 1.5-4 cm. long. *P. ambigua* (Gray) Britt., *P. sinuata* Rydb. Various habitats, e. Tex. to Kenedy Co., Apr.-Oct.; widespread in e. U.S. and adj. Can., local in the n. and cen. Rocky Mts. and Great Basin.

Var. *villosa* Waterfall. Stems densely covered with jointed hairs 2-4 mm. long. From Morris Co., in open pine woods, May; also in Ala. and Fla.

5. *Physalis virginiana* Mill. Stems from a deep rhizome; plants from nearly glabrous to long-hairy or with short curved trichomes; leaf blades from ovate and very rarely cordate to linear-lanceolate; corolla 15-25 mm. long, yellow, dark-maculate; anthers 2-4 mm. long, solid-yellow or blue- or violet-tinged; filaments nearly as wide as the anthers to one third as wide; flowering pedicels about equaling the flower to 1.5 times as long; fruiting calyx varyingly inflated about the berry. The variants tend to intergrade.

Var. *virginiana*. The vestiture varies from villous to short and retrorse; leaf blades ovate (rarely cordate) to lanceolate, their margins irregularly and coarsely toothed to sinuate-dentate; corolla usually 15-20 mm. long; anthers yellow, sometimes with a blue or violet tinge. In open woods, adj. prairies and disturbed areas, e. Tex., Apr.-June; from e. U.S. and adj. s. Can., with a few collections from the cen. Rocky Mts.

Forma *macrophysa* (Rydb.) Waterfall. Has larger, much-inflated fruiting calyces 4-5 cm. long and 3-4 cm. broad and anthers light-blue or tinged with light blue. *P. macrophysa* Rydb. Sporadic in e. half of Tex., fruiting material (recognizable condition) from June on; sporadic n.e. to Ind. and Neb.

Var. *texana* (Rydb.) Waterfall. Plant usually several-branched from the base, glabrous or nearly so; principal leaves ovate and usually entire. *P. texana* Rydb. Gulf Coast and occasionally slightly inland, Mar.-June, sometimes in the winter; endemic.

Var. *sonorae* (Torr.) Waterfall. Usually single-stemmed, often branching above; leaf blades usually lanceolate, varying to linear-lanceolate or (rarely) ovate; herbage sparsely covered with short antrorse hairs, sometimes nearly glabrous; calyx often with short antrorse hairs in 10 lines; anthers yellow. *P. longifolia* Nutt., *P. rigida* Pollard & Ball. Open woods, hills, prairies, plains and deserts in most of Tex., May-Sept.; primarily a prairie taxon extending to parts of the e. U.S., the Rocky Mts. and n. Mex.

Var. *hispida* Waterfall. Rhizomatous plant with thick leaf blades varying from ovate-lanceolate to linear-lanceolate; herbage subglabrous, having varying amounts of stiff more or less divergent trichomes about 1 mm. long on at least the flower buds or the margins of the leaves. Plains, often in sand, Panhandle, May-June; from Okla., Kan., Neb. and e. Colo.

6. *Physalis hederifolia* Gray. Erect or spreading from a perennial base, simple or many-stemmed; vestiture various as indicated under the varieties; corollas 10-15 mm. long, yellow or greenish-yellow, maculate (sometimes obscurely so); limb of corolla often reflexed when fully open; anthers usually yellow, 1.5-4 mm. long; flowering calyx about half as long as the corolla, with pedicels 2-7 mm. long; fruiting calyx 10-angled or 10-ribbed, varyingly vestite, 2-3 cm. long and 15-25 mm. wide, on pedicels 1-2 cm. long.

Var. *hederifolia*. Flowering calyx 4-8 mm. wide; anthers 3-4 mm. long; vestiture a varying mixture but including long jointed hairs. *P. Palmeri* Gray. Desert plains and mts., also sandy areas and sometimes open woods, s.w. Tex., sporadic e. to Bastrop and Free-stone cos., Mar.-July, sometimes later; also in N.M., e. Ariz. and adj. Mex.

Var. *puberula* Gray. Herbage with short antrorse hairs only or these mixed with varying amounts of glandular-capitate trichomes. Trans-Pecos, May-Nov.; also n. Mex.

Var. *comata* (Rydb.) Waterfall. Flowering calyces 8-11 mm. wide; anthers 1.5-3 mm. long; leaf blades ovate to rotund, toothed to entire; herbage with long jointed hairs mixed with shorter ones, sometimes viscid or glandular. *P. comata* Rydb. Plains, Dallam Co., June; from w. Neb. to w. Kan. and e. Colo.

Var. *cordifolia* (Gray) Waterfall. Stellate or several-branched hairs present in varying quantities, at least on the margins of the calyx; leaf blades ovate to ovate-lanceolate. *P. Fendleri* Gray. Mts. and plains, s.w. Tex., usually July-Sept.; s.w. U.S.

7. *Physalis philadelphica* Lam. TOMATILLO or MEXICAN GROUND CHERRY. Annual, glabrous to sparsely vestite with short appressed hairs, sometimes long pilosity also present; leaf blades 2-7 cm. long, ovate to ovate-lanceolate, the margins dentate to sinuate-dentate or entire; petiole one half the length of the blade to equaling it; corolla yellowish, maculate, 10-18 mm. wide, rotate-reflexed when fully opened; anthers blue or yellowish with bluish margins, about 3 mm. long, usually strongly twisted after dehiscence; fruiting calyx 10-ribbed, 2-3 cm. long, well-filled by the fruit which may be slightly oily at maturity and is sessile in the calyx; fruiting pedicels 3-8 mm. long. *P. ixocarpa* Hornem. Sporadic, probably as an escape from cult., flowering through most of the growing season; rare in much of the U.S. as a seldom-raised escape, more common in Mex., extending from C.A. and the W.I.

8. *Physalis angulata* L. Annual, 25-100 cm. tall, glabrous or with a few short antrorsely appressed hairs; leaf blades usually ovate to ovate-lanceolate, rarely narrower, usually deeply and irregularly incised-toothed to undulate-toothed or (sometimes) entire, principal ones 5-11 cm. long and 3.5-8 cm. wide, with petioles 4-8 cm. long; flowering calyx (3-) 4-7 mm. long, divided into lobes 1.5-3 mm. long, width 2-4 mm. at base of lobes, on pedicels 5-40 mm. long; corolla yellowish, immaculate or with indistinct spots, 4-12 mm. long, 6-12 mm. wide; anthers bluish or violet, 1-2.5 mm. long, on slender filaments 3-5 mm. long; fruiting calyces 10-angled or 10-ribbed, 20-35 mm. long, 15-25 mm. wide, on pedicels 1-4 cm. long; berry 10-12 mm. in diameter, on a gynobase about 1 mm. long.

Var. *angulata*. Leaf blades ovate to ovate-lanceolate or oblongish, coarsely and irregularly toothed to entire; flowering calyx usually 4-7 mm. long, with lobes 2-3 mm. long; corolla usually immaculate, sometimes with indistinct spots, 6-12 mm. long; anthers 2-2.5 mm. long; fruiting pedicels 2-3 cm. long, shorter than to about equaling the fruiting calyx. *P. ramosissima* Mill., *P. capsicifolia* Dun., *P. Linkiana* Nees. Open woods and disturbed habitats, e. and coastal Tex., summer and throughout much of the year in the s.; from Mex., C.A. and the W.I.

Var. *lanceifolia* (Nees) Waterfall. Differs in having leaf blades lanceolate to linear-lanceolate, corolla usually 4-6 mm. long and anthers usually 1-2 mm. long. *P. lanceifolia* Nees. Occurs in the range of var. *angulata* and w. through s.w. Tex.; from s.w. U.S. and Mex.

Var. *pendula* (Rydb.) Waterfall. Similar to var. *angulata* but leaves sometimes narrower; flowering calyx usually 3 (sometimes 4) mm. long, its lobes about 1 mm. long; fruiting pedicels usually 2-4 cm. long, equaling the fruiting calyx to 3 times its length. *P. pendula* Rydb. E. half of Tex. and rare as far w. as the Panhandle, in valleys and disturbed sites, May-Sept.; extending n.e. to Ill.

9. *Physalis acutifolia* (Miers) Sandw. Annual, usually nearly glabrous, the few appressed hairs short, stiff and flattish; leaf blades ovate-lanceolate to linear-lanceolate, principal ones 4-12 cm. long, with petioles 1.5-7 cm. long; leaf margins usually irregularly and often coarsely toothed; flowering calyx usually 4-5 mm. long, on pedicels 5 to 12 times its length; corolla light-yellow, sometimes with a greenish tinge, rotate with a short tube, 15-23 mm. wide when fully open, with 5 hairy pads on base of limb alternating with stamens; anthers about 3 mm. long, yellow with a blue or blue-green tinge; fruiting calyx usually 2-2.5 cm. long and 1.7-2 cm. wide, on pedicels 2.5-6 cm. long. *P. Wrightii* Gray. Type from "Prairies along the San Pedro River, southwestern Texas;" no other Texas collections seen, summer-fall; Ariz. to Calif. and adj. Mex.

10. *Physalis lobata* Torr. PURPLE GROUND CHERRY. Perennial, branching from the base, spreading or procumbent; indument of varying amounts of crystalline vesicles sparse or abundant enough to give the plant a scurfy appearance; leaf blades ovate-lanceolate to linear-lanceolate, cuneately narrowed to winged petiole, principal ones 4-10 cm. long and 5-30 mm. wide, usually pinnatifid, sometimes sinuate or entire; corollas blue or violet (rarely white), rotate, 1.5-2 cm. broad, with 5 hairy pads alternating with the bases of the filaments; anthers yellow, 1.5-2 mm. long; style twisted and bent to one side; flowering calyx 3-4 mm. long, on pedicels 1-3 (-5) mm. long; fruiting calyx 1.5-2 cm. long, pentagonal-ovoid, inflated, the pedicel 1-2.5 (-3) cm. long; berry spheric-ovoid, 4-7 mm. in diameter. *P. sabaena* Buckl., *Quincula lobata* (Torr.) Raf. Various habitats, w. half of state, Mar.-Sept. or all year in the extreme s.; w. Okla., N.M., Ariz., adj. Mex. to w. Kan. and e. Colo. In f. *lobata* the corolla is blue or violet. Forma *albiflora* Waterfall has white corollas; Val Verde and Brown cos.; otherwise known from one collection in Ariz. and two in Okla.

11. *Physalis cordata* Mill. Annual, appearing glabrous but sparse very short antrorse trichomes usually present, rarely with a few long hairs; leaves ovate to rarely broader, the margins several-toothed; flowering calyx 5-6 mm. long, divided about halfway into narrow acuminate segments; pedicels 4-10 cm. long; corolla yellowish, maculate, hairy in the throat, 5-10 mm. long, 9-22 mm. wide when fully expanded; anthers bluish or greenish-blue, 1.8-3 mm. long, on slightly to densely hairy filaments of similar length; fruiting calyx 5-angled, often somewhat turbinate, basally cordate, glabrous, 25-43 mm. long, 10-15 mm. wide, the narrow teeth acuminate and 7-10 mm. long, sometimes somewhat porrect; berry nearly spheric, 7-15 mm. in diameter; fruiting pedicels 10-25 mm. long. Included on the basis of a Drummond specimen, locality unknown; if present, it should occur along the Gulf Coast, towards the s.; nat. of Mex.

12. *Physalis subulata* Rydb. var. *neomexicana* (Rydb.) Waterfall. Annual, 1-6 dm. tall, spreading-hairy with varying mixtures of short and longer multicellular trichomes (few or many terminating in glands); leaf blades ovate to broadly ovate, sometimes basally oblique, the margins irregularly and usually shallowly toothed, sometimes sinuately so; flowering calyx hairy, 3-4.5 mm. long, upper one half to two thirds divided into lanceolate often subulate-tipped lobes, on pedicels 1.5-3 (-5) cm. long; corolla yellowish, maculate, 6-7 mm. long, 5-11 mm. wide when fully expanded; anthers violet or bluish, (0.3-) 1-1.5 (-2) mm. long, on filaments 2-3 mm. long; fruiting calyx hairy, 5-angled, basally cordate, 2-3 cm. long, 2-2.5 cm. wide, the upper 6-10 mm. divided into narrow teeth, usually subulate-tipped; fruiting pedicels 5-7 (-10) mm. long, reflexed; berry nearly spheric, 6-10 mm. in diameter. *P. neomexicana* Rydb. Jeff Davis and Presidio cos., mts. and adj. areas, June-Oct.; Ariz. and s. Colo. to N.M. and Baja Calif.

The leaves are less deeply and more regularly toothed than in var. *subulata* of Chihuahua and Durango.

13. *Physalis turbinata* Medic. Annual, 15-100 cm. tall; stems spreading-hairy, the trichomes jointed and often gland-tipped; leaf blades ovate, often attenuate-tipped, the margins entire to irregularly (often sinuately) toothed with 1 to 15 teeth on each side; principal leaf blades 5-11 cm. long, 4-8 cm. wide, with appressed jointed hairs in varying abundance on both sides (sometimes restricted to the veins), sometimes some hairs reduced to mere bases; petioles of principal leaves 2-7 cm. long; flowering calyx (3-) 4-6 mm. long, upper one-half to two-thirds divided into narrowly lanceolate lobes; corolla yellowish, maculate, hairy in the throat, 6-12 mm. long, 7-15 mm. wide; anthers bluish, 2-2.8 mm. long, on filaments 3-4 mm. long; fruiting calyx 5-angled, basally cordate, pubescent, 3-4 cm. long, 2-3 cm. wide, its lobes 5-10 mm. long and usually somewhat attenuate; berry nearly spheric, 9-13 mm. in diameter, on a gynophore 1-2 mm. long, it and the lower inner surface of the fruiting calyx sometimes with gland-tipped hairs. *P. barbadosis* Jacq. Open woods, brushland and valleys, e. Tex. and along the Gulf to the lower Rio Grande, July-Nov.; s. U.S., Mex., C.A. and W.I.

Similar to *P. pubescens*, but flowers and fruiting calyces larger, the latter often with longer and narrower lobes, thus resembling *P. cordata* which has glabrous fruiting calyces.

14. *Physalis pubescens* L. TOMATE FRESADILLA, DOWNY GROUND CHERRY. Annual, 8-90 cm. tall, usually villous and sometimes viscid to more or less glabrate; leaf blades ovate, often acuminate, the margins usually irregularly several-toothed or sometimes entire; principal blades usually 4-9 cm. long and 2-4 cm. wide, on petioles 2-7 cm. long; flowering calyx 4-10 mm. long and 3-12 mm. wide at base of lobes, upper 1-4 mm. divided into ovate-deltoid to lanceolate lobes; flowering pedicels 3-6 mm. long; corolla yellowish, dark-maculate, more or less matted-hairy below the maculations, 7-10 (-12) mm. long, 10-15 mm. wide; anthers bluish or violet, 1.5-3 mm. long, on filaments 2-3 mm. long; fruiting calyx 5-angled (usually prominently so), usually soft-hairy, 18-30 mm. long, 13-22 mm. wide, on pedicels 5-13 mm. long; berry 10-18 mm. in diameter, sessile or subsessile on the invaginated calyx base.

Var. *pubescens*. Plants more or less villous; leaf blades usually with 5 to 8 teeth on each side and not translucent. Summer, e. Tex; s. U.S., Mex. and W.I.

Var. *integrifolia* (Dun.) Waterfall. Leaf blades often entire, sometimes with 3 or 4 (rarely more) more or less prominent teeth on each side, usually translucent. Open woods, thickets and adj. areas, e. half of state, Apr.-Nov.; s. U.S., Mex., C.A. and W.I.

2. CHAMAESARACHA GRAY*

FALSE NIGHTSHADE

Perennials with entire to pinnatifid leaves that are decurrent on the petioles; peduncles solitary or in fascicles of 2 to 4 from the axils of the leaves; calyx campanulate, 5-lobed, in fruit somewhat enlarged but not bladdery-inflated, close-fitting to the berry, thin, not angled nor ribbed, faintly (if at all) veiny, open at the mouth, not exceeding the berry; corolla rotate, white or yellowish, often tinged with purple, the limb plicate; stamens inserted near the base of corolla; filaments long and slender; anthers oblong, opening by a longitudinal slit; style and stigma as in *Physalis*; seeds reniform, flattened, rugose-favose or punctate.

About 10 species from western United States to northern South America. This genus

* See Appendix.

is sorely in need of a critical modern revision. There could be as many as six or more entities involved in what we here consider to be three species.

1. Plant more or less stellate-puberulent or stellate-pubescent with sessile or stalked hairs, sometimes with scattered simple hairs and/or glandular hairs, rarely essentially glabrous except for the calyx which is adorned with simple white hairs 1. *C. Coronopus*.
1. Plant densely or rarely sparsely invested with long simple or branched hairs, also typically glandular-viscid (2)
- 2(1). Plants sparsely to copiously villous with weak segmented unbranched hairs; corolla more than 1 cm. in diameter; calyx lobes in anthesis 3 mm. long or more 2. *C. sordida*.
2. Plants densely villous with commonly branching hairs (especially on the calyx and upper part of stem); corolla less than 1 cm. in diameter; calyx lobes about 2 mm. long 3. *C. villosa*.

1. *Chamaesaracha Coronopus* (Dun.) Gray. Plant green, branched and diffuse from a perennial base, varying from subglabrous to densely and finely stellate-pubescent with sessile or stipitate white hairs; leaves sessile or short-petioled, linear to lanceolate, to about 6 cm. long, tapering at the base, more or less sinuately lobed to occasionally subentire or sometimes pinnatifid; peduncle elongated; calyx 4 mm. long, the triangular lobes obtuse to acute; corolla white to greenish or yellowish, usually about 13 mm. in diameter; berry 5-8 mm. in diameter, nearly white, with all but the apex closely invested by the herbaceous calyx. Ubiquitous, mainly in rocky soils and in clays in thickets and on dry plains and mesas in the Edwards Plateau and s. and w. Tex., flowering throughout the year; from Kan. to Ut. and Ariz., s. to Tex. and n. Mex.

As here treated, this is an extremely variable species. Included are essentially glabrous plants whose remnant pubescence is simple, linear-leaved plants with sparse but conspicuous sessile coarse stellate-pubescent, plants with a dense covering of fine pubescence and sometimes also with glandular-pubescent or scattered hairs.

2. *Chamaesaracha sordida* (Dun.) Gray. Plant much-branched from the base, the stems upright to spreading, sometimes forming clumps as much as 7 dm. in diameter, more or less viscid, somewhat cinereous, sparsely to copiously villous with weak segmented unbranched hairs, also usually copiously glandular-puberulent; leaves usually distinctly petioled, ovate to oblong or oblanceolate to obovate, to 1 dm. long and 45 mm. wide, entire to shallowly repand-dentate or pinnatifid; peduncles elongated; calyx shaggy-villous, the triangular acutish lobes 3 mm. long or more; corolla usually about 15 mm. in diameter, white or yellowish, sometimes violet-purplish; berry 5-8 mm. in diameter, with all but the apex closely invested by the herbaceous calyx. *C. coniodes* (Moric.) Britt. Rather ubiquitous on dry plains and mesas, often in limestone, in the w. two thirds of Tex., flowering throughout the year; from Kan. and Colo. to Tex. and s.e. Ariz. and n. Mex.

3. *Chamaesaracha villosa* Rydb. Stems slender and striate, arising from a woody base, sparsely branched, commonly more than 4 dm. long, the entire plant glandular-villous with branching hairs (especially on the calyx and the upper part of the stem); leaves rhombic-ovate to ovate-lanceolate, acute at apex, the margins irregularly crenate or sinuately dentate and decurrent on the slender petiole; peduncle filiform, to about 25 mm. long; calyx lobes triangular, obtuse to acute, about 2 mm. long; corolla yellowish, less than 1 cm. in diameter; berry small, about 5 mm. in diameter, containing about 6 seeds. In gravelly-sandy soil along streams in the s. Trans-Pecos, Mar.-July; also n. Mex.

3. LYCOPERSICON MILL.

Native of the warmer parts of America; several species, the most commonly cultivated is *L. esculentum*.

1. *Lycopersicon esculentum* Mill. TOMATO. Annual or perennial with spreading hairy-pubescent and more or less glandular and strong-smelling, to 15 dm. high or more, the young growth on mature plants erect; leaves odd-pinnate, with small interstitial petiolulate

leaflets, to about 4 dm. long; primary leaflets 5 to 9, stalked, ovate to oblong, to 75 mm. long, acuminate, irregularly incised or toothed, the margins tending to roll inward; flowers 3 to 7, nodding, to about 2 cm. across or more, on jointed pedicels that are reflexed in fruit; calyx 5-parted to base, the lanceolate lobes to 1 cm. long; corolla yellow, the 5 lanceolate lobes recurved-reflexed, a little more than 1 cm. long; anther dehiscent from top to bottom, projected into sharp or narrow sterile tips; fruit a pulpy berry, red or yellow, usually flattened at the ends, to 75 mm. across, the sides often furrowed or angled, seeds numerous. A nat. of w. S.A. that is cult. for its edible fruit.

The plant that occurs in palm groves, thickets and open woodlands in extreme southern Texas, commonly called "cherry tomato," is referable to var. *cerasiforme* (Dun.) Alef. It has thinner leaflets that are mostly smaller and usually less acuminate than in the typical material, the flowers are prevailingly in longer clusters, and the red or yellow regular and globular fruit has fewer cells and is only about 2 cm. in diameter.

4. SOLANUM L.* NIGHTSHADE

Herbs, shrubs or trees of various habit; larger leaves often accompanied by a smaller lateral (rameal) one; peduncles mostly lateral (or becoming lateral) and extra-axillary; calyx and corolla more or less 5-parted or 5-cleft (rarely 4- to 10-parted); corolla plaited in the bud, valvate or induplicate; stamens exserted; filaments usually very short; anthers converging around the style, opening at the tip by two pores or chinks; berry usually 2-celled.

A polymorphous and largely tropical genus of perhaps as many as 1,750 species.

1. Pubescence of lower leaf surface and stems all or chiefly composed of stellate hairs (2)
1. Pubescence of the lower leaf surface and stems composed entirely of simple hairs or lacking; plants without spines or prickles, or with some spines in *S. aculeatissimum* (10)
 - 2(1). Shrub or rarely small tree, without spines or prickles (3)
 2. Annuals or herbaceous perennials, more or less adorned with spines or prickles (4)
 - 3(2). Leaves less than 2 cm. wide, tapered at base, the lower surface thinly pubescent to glabrate; flowers solitary or several in lateral fascicles 1. *S. capsicastrum*.
 3. Leaves more than 3 cm. wide, rounded at base, the lower surface tomentose; flowers borne in definite furcate terminal inflorescences 2. *S. erianthum*.
 - 4(2). Leaves entire to shallowly lobed less than midway to the midvein; calyx merely with stellate pubescence or with 1 to few spines, in fruit not covering the berry (5)
 4. Leaves deepy pinnate to bipinnately lobed; calyx densely spiny, in fruit wholly or partially covering the berry (8)
 - 5(4). Stems and lower leaf surface silvery-canescens because of the dense and close scurflike pubescence, having a velvety appearance .. 3. *S. elaeagnifolium*.
 5. Stems and lower leaf surface not as above, the typically tawny pubescence not so dense (6)
 - 6(5). Anthers 5 mm. long or less; calyx accrescent with age; fruit cherry-red at maturity; confined to extreme southern Texas 4. *S. campechiense*.
 6. Anthers 6 mm. long or more; calyx not noticeably accrescent with age; fruit yellow at maturity (7)
 - 7(6). The 4- to 8-rayed stellate hairs sessile on lower leaf surface; calyx 5-7 mm. long; corolla 2-3 cm. in diameter; anthers 6-8 mm. long; fruit 1-2 cm. in diameter, confined to eastern Texas 5. *S. carolinense*.
 7. At least some of the usually 8- or more-rayed stellate hairs stipitate on lower leaf surface; calyx 8-13 mm. long; corolla 3-5 cm. in diameter; anthers 8-12 mm. long; fruit 2.5-3 cm. in diameter; distribution mostly on prairies west of the eastern pinelands 6. *S. dimidiatum*.

* Ref.: G. Ledyard Stebbins, Jr. and Elton F. Paddock in *Madroño* 10: 70-81. 1949.

- 8(4). Corolla yellow; inflorescence stellate-hairy only, not glandular-villous
 7. *S. rostratum*.
8. Corolla violet or purplish-blue; inflorescence glandular-villous as well as somewhat
 stellate (9)
- 9(8). Anthers unequal, the lowest violet-tinged anther longer and incurved; fruiting
 pedicels erect; berry wholly enclosed by the close-fitting and often adherent calyx
 8. *S. citrullifolium*.
9. Anthers about equal, straight or nearly so, all yellow; fruiting pedicels spreading;
 calyx loosely covering the red berry 9. *S. sisymbriifolium*.
- 10(1). Leaves odd-pinnate, with 3 to 11 leaflets; perennial by subterranean tubers; pedi-
 cels distinctly articulate at or above the middle (11)
10. Leaves simple; annuals or woody perennials (13)
- 11(10). Corolla stellate, white; leaflets typically linear-oblong to oblong-lanceolate;
 pseudostipular and extra-axillary leaves similar to the regular leaves
 10. *S. Jamesii*.
11. Corolla rotate to rotate-stellate, light-purple-lavender to rarely white; leaflets typically
 ovate to ovate-elliptic; pseudostipular leaves semiovate (12)
- 12(11). Plant essentially glabrous; interstitial leaflets minute or lacking; corolla rotate-
 pentagonal 11. *S. leptosepalum*.
12. Plant more or less pilose; interstitial leaflets usually prominent; corolla rotate
 12. *S. Fendleri*.
- 13(10). Leaves deeply pinnatifid, oblong in outline 13. *S. triflorum*.
13. Leaves entire or merely sinuate, sometimes hastately lobed (14)
- 14(13). Plant conspicuously armed with slender yellow spines
 14. *S. aculeatissimum*.
14. Plants unarmed (15)
- 15(14). Plants woody perennials, erect or scandent shrubs; leaves typically oblong or
 hastately ovate (16)
15. Plants annual or rarely a bushy perennial; leaves typically ovate (17)
- 16(15). Leaves broadest at about or above the middle, tapered at base
 15. *S. pseudocapsicum*.
16. Leaves broadest below the middle, not tapered at base
 16. *S. triquetrum*.
- 17(15). Plants conspicuously and persistently villous or hirsute; ripe berries yellow or
 reddish; seeds usually 1.8-2.2 mm. long 17. *S. villosum*.
17. Mature growth of plants sparsely pubescent or glabrous; ripe berries black; seeds
 1.2-1.8 mm. long (18)
- 18(17). Flowers large; corolla 6-11 mm. long from base to apex; anthers 2.6-4 mm. long;
 style exerted about 2 mm. beyond the anthers; stigma very slightly expanded;
 bushy perennial 18. *S. Douglasii*.
18. Flowers smaller; corolla lobes 3-7 mm. long; anthers 1.2-2.6 mm. long; style barely
 exerted beyond the anthers; stigma usually enlarged and capitate (19)
- 19(18). Annual or perennial; leaves firm in texture; calyx lobes all distinct from each
 other, reflexed at maturity; stone cell concretions absent or few, rarely more than 3
 19. *S. nodiflorum*.
19. Strictly annual; leaves thin in texture; calyx lobes unequal in length, some of them
 partly fused, not reflexed at maturity; stone cell concretions always present, usually
 4 to 8 per berry 20. *S. americanum*.

1. *Solanum capsicastrum* Link. FALSE JERUSALEM-CHERRY. Small perennial shrub somewhat resembling *S. pseudocapsicum*, to about 6 dm. high, more or less pubescent throughout with stellate hairs, becoming glabrate; leaves oval to oblong or sometimes slightly ovate, about 6 cm. long and 15 mm. wide, narrowed at the base, obtuse at apex,

the margins entire or only slightly repand; pedicels about 7 mm. long; flowers small, white, less than 15 mm. in diameter; fruit orange-red or scarlet, about 13 mm. in diameter. A nat. of S.A. that is occasionally cult. and becomes an escape in s. Tex.

2. *Solanum erianthum* D. Don. POTATO TREE, SALVADORA. Shrub or small tree to 3 m. high, very soft velvety-tomentose throughout with stellate hairs; leaves with a petiole to 4 cm. long, ovate to ovate-elliptic or elliptic, rounded at base, acute to acuminate at apex, to 3 dm. long, entire, very hoary on lower surface; peduncle usually terminal, erect, rather long and stout, bearing a many-flowered cyme; calyx lobes ovate, obtuse, ciliate; corolla white, 15-18 mm. in diameter, the ciliate lobes ovate to ovate-oval and acute; anthers oblong; ovary woolly; berry globose, 1-2 cm. in diameter, yellow. *S. verbascifolium* of auth. In open woods and thickets in extreme s. Tex. n. to Kenedy Co., Apr.-Oct.; also in s. Fla. and throughout trop. and subtrop. Am.

3. *Solanum elaeagnifolium* Cav. SILVER-LEAF NIGHTSHADE, BULL-NETTLE, TROMPILLO, WHITE HORSE-NETTLE. Perennial to about 1 m. high, with deep running rootstocks, silvery-canescens all over by the dense and close scurflike pubescence that is composed of many-rayed stellate hairs; stem often woody at base; prickles small and acicular, copious to very sparse; leaves with a petiole to 5 cm. long, oblong to linear or oblong-lanceolate, to about 15 cm. long, usually tapered at base, mostly obtuse, entire to sinuate-repand; cymes at first terminal, short-peduncled, few-flowered; pedicels rather long, recurved or reflexed in fruit; calyx 5-angled, with slender lobes fully as long as the tube; corolla violet or rarely white, lightly 5-lobed, 2-2.5 cm. in diameter, the lobes triangular-ovate; ovary white-tomentose; berry globose, to about 15 mm. in diameter, yellowish or eventually black. *S. texense* Engelm. & Gray, *S. Roemerianum* Scheele. In dry sterile soils in open woods, prairies, waste places and disturbed soils throughout most of Tex., Mar.-Oct.; from Mo. and Kan., s. to La., Tex., Ariz. and adj. Mex.; adv. elsewhere in the U.S.

The white-flowered plant is known as f. *albiflorum* Cockll.

4. *Solanum campechiense* L. Herbs to 6 dm. high, annual, adorned with stellate pubescence and spines to 6 mm. long; stems herbaceous, branched, greenish, the branches spreading; leaves oblong, somewhat 5-lobed with the lobes more or less repand-dentate, more or less cordate at base, to 12.5 cm. long (including the petiole), about 65 mm. wide; raceme few-flowered, on a peduncle to about 15 cm. long, usually much less; calyx cyathiform, 6-8 mm. long, with ovate-lanceolate acute lobes, accrescent with age; corolla pale-violet, about 2 cm. in diameter; anthers 4-5 mm. long; berries cherry-red, 1-1.5 cm. in diameter. In extreme s. Tex., summer-fall; also Mex. and W.I.

5. *Solanum carolinense* L. CAROLINA HORSE-NETTLE, BALL-NETTLE. Coarse erect branching perennial to about 1 m. high, with a creeping subterranean rhizome, spiny and loosely pubescent throughout with 4- to 8-rayed sessile stellate hairs; leaves with a petiole to 3 cm. long, ovate to ovate-elliptic in outline, rounded at base, to 12 cm. long, greenish, typically with several large teeth or shallow lobes on each side, more or less spiny along the main veins; inflorescence several-flowered, elongating at maturity to form a simple racemiform cluster; calyx 5-7 mm. long, the lobes lance-acuminate; corolla pale-violet to white, 2-3 cm. in diameter; anthers 6-8 mm. long, equal; fruit globose, yellow when mature, 1-2 cm. in diameter. In fields, open woodlands and waste places, generally, mostly in sandy or light soils, confined to e. Tex., Apr.-Oct.; from Tex., n. to Minn. and e. to the Atl. Ocean.

The white-flowered plants are known as f. *albiflorum* Benke.

6. *Solanum dimidiatum* Raf. WESTERN HORSE-NETTLE. Plant perennial, to about 1 m. high, with deep running rootstock, cinereous with a somewhat furfuraceous stellate pubescence composed of 9- to 12-rayed frequently stipitate hairs; prickles small, subulate, scanty along the stem and midribs of leaves or sometimes nearly wanting; leaves with short stout petioles, ovate in outline, the base broadly rounded to truncate or somewhat cordate, to about 15 cm. long, some of the stellate hairs on lower surface distinctly stipitate, typically sinuately 5- or 7-lobed, the lobes entire or undulate and unarmed; cymes at first terminal, laxly 2- or 3-divided; pedicels recurved or reflexed in fruit; calyx lobes often 6, short-ovate with a long abruptly acuminate apex, 8-13 mm. long; corolla bluish-purple to violet or rarely white, 3-5 cm. in diameter, its 5 lobes broadly ovate; anthers lanceolate to linear-lanceolate, 8-12 mm. long; berries globose, 2.5-3 cm. in diameter, pale-yellow when mature. *S. Torreyi* Gray. Mostly in prairies and sandy soils throughout Tex. except in extreme e. and w., May-Oct.; from Kan., Mo. and Ark., s. to Tex.

The white-flowered plant is known as f. *album* (Waterfall) Correll.

7. *Solanum rostratum* Dun. BUFFALO BUR, KANSAS-THISTLE, MALA MUJER. Annual to about 7 dm. high, somewhat hoary or yellowish with a copious wholly stellate pubescence, copiously armed with straight prickles; leaves mostly once- or twice-pinnatifid, similar to those of *S. citrullifolium*; racemes with pedicels soon ascending; calyx nearly hidden by spinelike prickles; corolla yellow, about 25 mm. in diameter, hardly irregular, the short lobes broadly ovate; stamens and style much-declined, the lowest anther much larger and longer than the others and with an incurved beak; berry wholly enclosed by the close-fitting and often adherent calyx; seeds coarsely undulate-rugose. An aggressive weedy plant of over-grazed land, flats and waste places, generally, throughout Tex., Apr.-Oct.; from Neb. to Tex. and adv. eastw. and northw.

8. *Solanum citrullifolium* A. Br. MELON-LEAF NIGHTSHADE. Annual, much-branched and spreading, to about 7 dm. high, pubescent with gland-tipped simple hairs mixed with scattered few-rayed stellate hairs, armed with straight prickles; leaves irregularly or interruptedly bipinnatifid, the lobes rounded or obtuse and repand; pedicels spreading; corolla violet, to about 37 mm. in diameter, somewhat irregularly 5-cleft, the lobes ovate and acuminate; anthers linear-lanceolate, with 4 yellow and a larger one tinged with violet; fruit enclosed by the close-fitting and very prickly calyx; seeds thickish, coarsely undulate-rugose. *S. heterodoxum* Dun. Roadsides and waste places in cen. and w. Tex., Apr.-Oct.; from Tex. and N.M., locally n. to Ia. and e. to Atl. States.

9. *Solanum sisymbriifolium* Lam. STICKY NIGHTSHADE. Annual to about 7 dm. high, green, stout, villous-pubescent with simple or more or less glandular and viscid hairs, mixed (especially on the leaves) with some few-rayed stellate hairs whose middle division is elongated, heavily armed throughout with long-subulate straight unequal prickles; leaves deeply pinnatifid, the oblong lobes sinuate or even again somewhat pinnatifid; pedicels spreading at maturity; flowers several or numerous in terminal or soon lateral pedunculate racemes; lobes of the 5-parted calyx lanceolate to ovate-lanceolate; corolla light-blue or white, to 25 mm. in diameter or more, 5-lobed; anthers equal, yellow; berry red, globose, 1.5-2 cm. in diameter, loosely and completely or incompletely enclosed by the spiny calyx; seeds minutely reticulate-pitted. Roadsides, waste places and other such areas mostly in e. Tex., May-Sept.; a nat. of Braz. that is adv. or escaped from cult. from Tex. to Fla., n. to N.E. and O.

10. *Solanum Jamesii* Torr. WILD POTATO. Plant usually short, erect or spreading and bushy, to 5 dm. high, usually less than 3 dm., essentially glabrous (in ours), somewhat bluish-green, stoloniferous and tuber-bearing; tubers small, sometimes as many as 50, 5-20 mm. in diameter, globose to ellipsoid, creamy-white or light-brown in color; stem slender, usually much-branched; leaves odd-pinnate, to 15 cm. long, rarely with several small obsolescent interstitial leaflets; leaflets 7 to 11, linear-oblong to somewhat lanceolate, to 6 cm. long and 2 cm. wide, usually much smaller; inflorescence few-flowered, cymosely paniculate; pedicels 1-2 cm. long, prominently articulate at about or above the middle; calyx 4-8 mm. long, irregularly lobed to about the middle; corolla white, stellate, about 25 mm. in diameter, the lobes ovate-lanceolate to triangular-lanceolate and acutish; fruit globose, about 1 cm. in diameter. Rare in mts. of the Trans-Pecos, July-Sept.; from w. Neb., Colo., s.e. Ut., Ariz., N.M. and w. Tex. to Son. and S.L.P.

11. *Solanum leptosepalum* Correll. WILD POTATO. Plant slender, bushy, lax, 4 dm. or more high, essentially glabrous or sparsely and finely pilose throughout, pale-green, probably tuber-bearing; stem stramineous, provided with fine short incurved hairs; leaves odd-pinnate, very thin-herbaceous, with scattered hairs on margin, granulose-appearing or finely pilose on lower surface, to 2 dm. long; interstitial leaves absent or minute; leaflets 5 or rarely 7, broadly ovate to ovate-elliptic, the lowermost pair much-reduced, to 7 cm. long and 35 mm. wide; inflorescence few-flowered; pedicels about 12 mm. long, articulate at about or well above the middle; calyx 6-8 mm. long, the lobes ovate-lanceolate and long-acuminate; corolla light purplish-lavender to white, rotate-pentagonal, about 25 mm. in diameter; fruit globose, about 15 mm. in diameter. In mts. of the Trans-Pecos, Aug.-Oct.; also n. Mex.

12. *Solanum Fendleri* Gray. WILD POTATO. Plant slender to somewhat bushy, erect or ascending, to 5 dm. high, more or less coarsely pilose throughout, stoloniferous and tuber-bearing; tubers small, globose to ellipsoid, white to purplish, to 3 cm. long; stem simple to much-branched; leaves odd-pinnate, to 25 mm. long, with or without small interstitial leaflets; leaflets 5 to 9, ovate to oblong-elliptic or rarely obovate, obtuse to acute at apex, to 8 cm. long and 35 mm. wide; inflorescence several-flowered, racemose

or paniculate; pedicels to 3 cm. long, articulate well above the middle or sometimes just below the calyx; calyx 4-7 mm. long, with ovate-lanceolate lobes; corolla blue or purplish to rarely white, rotate-stellate, rarely more than 3 cm. in diameter, the lobes broadly triangular-ovate; fruit globose, about 1 cm. in diameter. Rare in mts. of the Trans-Pecos, July-Sept.; from Colo., s. through Ariz., N.M., w. Tex. and n. Mex. to Zac.

The var. *texense* Correll is a taller and more open plant than var. *Fendleri*. The inflorescence, especially the calyx, is grayish in color which is caused, in part, by the dense grayish pubescence. The white to white-lavender corolla is more deeply lobed, with narrower and more acute acumens, and the calyx is irregularly and more deeply lobed than usual.

13. *Solanum triflorum* Nutt. CUTLEAF NIGHTSHADE. Annual, with more or less pubescent stem commonly branching and again branching from near base, to about 4 dm. high or long; leaves with a petiole to 15 mm. long, oblong, deeply pinnatifid, with rounded sinuses, to about 4 cm. long and 2 cm. wide, the lobes linear; peduncles 1- to 3-flowered, the pedicels soon reflexed; corolla white, scarcely 1 cm. broad; berry globose, green, 1-1.5 cm. in diameter. Dry plains and open woods, often as a weed of fields and roadsides in the Trans-Pecos, Apr.-Sept.; from B.C. to Calif., e. across the plains to Minn., Ia., Kan. and Okla., and as an adv. weed occasionally e. to the Atl. States.

14. *Solanum aculeatissimum* Jacq. COCKROACH BERRY, SODA APPLE NIGHTSHADE, BERENJENA. Perennial, slightly woody, usually much-branched, to about 12 dm. high, villous with scattered long and weak jointed hairs or soon nearly glabrate, beset throughout with slender-subulate straight prickles; leaves rather large, thin, ovate in outline, pinnately lobed or repand, often slightly cordate at base, to about 15 cm. long and wide; peduncle lateral, short, few-flowered; calyx about one third as long as the corolla, with stout prickles, its lobes ovate-lanceolate lobes acute; corolla white, rotate, 12-25 mm. in diameter, its lobes ovate-lanceolate; anthers ovate-lanceolate; berry globose, scarlet, glabrous, 2-5 cm. in diameter; seeds very flat and thin, with a membranaceous border. In open woodlands along rivers and in waste grounds in s.e. Tex., Apr.-Oct.; in s. U.S., Berm., W.I. and cont. trop. Am.

15. *Solanum pseudocapsicum* L. JERUSALEM-CHERRY. Small branching leafy shrub to about 12 dm. high, erect and glabrous throughout; leaves narrowly lanceolate to oblong or oblanceolate, to 1 dm. long, entire or the margins slightly repand, narrowed at the base to a short petiole, mostly obtuse at apex, the surface bright-green and shining, the veins prominent; flowers solitary or few in lateral clusters, small; calyx lobes lanceolate, eciliate, about 2.5 mm. long; corolla white, 11-14 mm. in diameter, the eciliate lobes ovate-oval to oval; anthers elliptic; berry globose, scarlet to orange or yellow, 1-2 cm. in diameter. Along roadsides, cult. ground and waste places, thickets and woodlands in s.e. Tex., May-Sept.; nat. of the Old World that has become naturalized throughout trop. and subtrop. regions in the World.

16. *Solanum triquetrum* Cav. TEXAS NIGHTSHADE, HIERBA MORA. Perennial, nearly glabrous, varying from a short shrub to a somewhat elongated scandent shrub to 2 m. high; stems suffruticose, flexuous or sarmentose, the branches angled but hardly triquetous; leaves deltoid-cordate, to 5 cm. long or more, varying to hastate or even hastately 3- or 5-lobed, with the middle lobe lanceolate to linear and prolonged; cymes commonly umbellately few-flowered, the peduncles slender; pedicels nodose-articulated at base, in fruit clavate-thickened at the summit; corolla stellate, white or tinged violet, to about 15 mm. in diameter; berry globose, red, 1-1.5 cm. in diameter. S. *Lindheimerianum* Scheele. On low hills, slopes and in thickets and on breaks in cen., s. and w. Tex., flowering throughout the year; also adj. Mex.

This is a highly variable species, especially in regard to its habit and leaf shape.

17. *Solanum villosum* Mill. HAIRY NIGHTSHADE. Low somewhat viscid-pubescent or villous plants, resembling small-leaved forms of *S. americanum* but cinereous with dense appressed villosity or pilosity; leaves small, conspicuously angulate-dentate; the 1 to 5 umbellate small flowers on slenderly clavate stiff pedicels; calyx as in *S. americanum* but densely pubescent; corolla white, the lobes 4-5 mm. long; berries yellow or red; seeds usually 1.8-2.2 mm. long. On rocky slopes and waste places in the Trans-Pecos, July-Oct.; from Mass. southw.

Plants here previously referred to the *S. nigrum* L. complex.

18. *Solanum Douglasii* Dun. Perennial, often suffrutescent, sometimes to 3 m. high, usually much smaller, sparsely to densely cinereous-puberulent or short-pilose, the hairs mostly appressed or subappressed; leaves entire to variously angulate-toothed; flowers commonly in umbelliform cymes or sometimes solitary, these borne on peduncles nearly as long as or longer than the pedicels; corolla white or purple-tinged, 1-1.8 cm. in diameter; fruiting calyx erect; berries black at maturity, many seeded, persistent. In igneous soil or on sandy banks in mts. of the Trans-Pecos, June-Oct.; w. to Calif. and adj. Mex.

Plants here previously referred to the *S. nigrum* complex.

19. *Solanum nodiflorum* Jacq. Plant slender, annual or perennial, often tall, sparsely puberulent to strigose or glabrate; leaves firm, entire to sparsely sinuate-dentate, acuminate; flowers commonly in umbelliform cymes or sometimes solitary, these borne on peduncles nearly as long as to longer than pedicels; calyx firm, the lobes all distinct and reflexed in fruit; corolla white or sometimes tinged with purple, not more than 8 mm. wide; berries black at maturity, concretions of stone cells absent or few (rarely more than 3). Reported from coastal Tex. but no material matching this has been seen; probably referable to *S. americanum*.

Plants here previously referred to the *S. nigrum* complex.

20. *Solanum americanum* Mill. AMERICAN NIGHTSHADE, HIERBA MORA NEGRA. Slender usually divergently branched glabrous or glabrescent annual, to 1 m. high; leaves slender-petioled, ovate to oval or ovate-lanceolate, entire to sinuate-dentate, pale-green, membranaceous, to 1 dm. long, translucent to transmitted light; peduncles filiform, to 3 cm. long; umbels 2- to 4-flowered, with filiform soon reflexed pedicels; calyx of unequal acutish to blunt spreading lobes 1-1.5 mm. long; corolla white or purple-tinged, its lobes 4.5-7 mm. long; anthers 1.3-2 mm. long; berry lustrous-black, 5-9 mm. in diameter, with 4 to 8 stone cell concretions in most berries, quickly falling when ripe; seeds 1.2-1.8 mm. long. In rocky or dry open woods, thickets, shores or openings, often spreading to cult. or waste ground, throughout Tex., blooming throughout year; from N.E. to N.D., s. to Fla., La. and Tex.

Plants here previously referred to the *S. nigrum* complex.

5. CAPSICUM L. CAYENNE PEPPER

About 50 species, all of which are indigenous to tropical or subtropical America.

1. *Capsicum annum* L. var. *minus* (Fing.) Shinners. BIRD PEPPER, CHILE PIQUÍN, CHIL-LIPIQUIN. An intricate shrub with slender divergent brittle green branches, to 3 m. high (or long), glabrous or very sparsely puberulent; leaves ovate to elliptic-lanceolate or lanceolate, acute to acuminate, to 6 cm. long and 3 cm. wide, exceeding the slender petioles; pedicels long and slender, often in pairs, spreading or somewhat reflexed, somewhat stoutish in fruit; calyx small, shallowly toothed in flower but truncate and cup-shaped in fruit; corolla stellate, whitish, about 7 mm. wide; anthers generally bluish; fruit ovoid to nearly globose, persistent, red or yellowish, to about 15 mm. long, pungently aromatic. *C. baccatum* and *C. frutescens* of Tex. auth. On ledges along rivers, in thickets and groves and along arroyos on the Edwards Plateau and in s. Tex., flowering throughout the year; from Tex. to Ariz.; also s. Fla. and throughout trop. Am.

The extremely pungent berries are used as a condiment and medicinally as a local stimulant.

6. MARGARANTHUS SCHLECHT.

A monotypic genus.

1. *Margaranthus solanaceus* Schlecht. NETTED GLOBE-BERRY. Nearly glabrous erect slender annual closely resembling *Physalis*, to about 6 dm. high, more or less sparingly divergently-branched from the base; leaves petioled, membranaceous, ovate to lanceolate, entire to somewhat sinuate, occasionally 1- or 2-toothed, 2.5-5 cm. long; pedicels short, recurving; corolla greenish, yellow or lurid-purple, cylindrical-urceolate, merely dentate at the orifice, barely 4 mm. long; berry small, entirely included in the globular-conical

fruiting calyx that is 8-12 mm. long; seeds 20 to 30. In fields and pastures in s. and w. Tex., July-Nov.; from Tex. to Ariz. and n. Mex.

7. LYCIUM L.¹⁷³WOLFBERRY. DESERT-THORN. SQUAW-BERRY
TOMATILLO. CILINDRILLO

Plants shrubby, usually spiny; leaves mostly fascicled, entire; flowers chiefly axillary, solitary or in small clusters; calyx campanulate, irregularly toothed or cleft into 4 to 6 lobes; corolla campanulate, tubular-funnelform or salverform, the limb 4- to 7-lobed; stamens 4 or 5; style slender, the stigma capitate or 2-lobed; berry fleshy or dry, globose or ovoid, subtended by the persistent calyx.

About 85 species, mostly in warmer regions in America. Some species produce abundant quantities in insipid, slightly bitter, juicy berries that are eaten raw or prepared as a sauce. The species also provide winter forage for livestock.

1. Calyx lobes from two thirds as long to as long as or longer than tubular portion, or if not two thirds as long as tube then at least 2 mm. long; calyx cleft equally, never noticeably 2-lipped, therefore the lobes about equal in length (2)
1. Calyx lobes less than two thirds as long as tube, usually less than 2 mm. long; calyx frequently irregularly cleft or more or less 2-lipped (5)
- 2(1). Corolla lobes more than one third as long as tube . . . 1. *L. carolinianum* var. *quadrifidum*.
2. Corolla lobes not over one third as long as tubular portion, usually much less (3)
- 3(2). Leaves densely glandular-puberulous, not glaucous . 2. *L. puberulum*.
3. Leaves glabrous, smooth, glaucous (4)
- 4(3). Pedicels about 10 mm. long; corolla 2 cm. long, the tube 4 mm. or more in diameter at summit; leaves glaucous-green 3. *L. pallidum*.
4. Pedicels to 4 mm. long; corolla 1 cm. long, the tube less than 4 mm. in diameter at summit; leaves glaucous-gray 4. *L. berberioides*.
- 5(1). Leaves densely hispidulous-puberulous; pedicels (at anthesis) about 1.5 mm. long 5. *L. texanum*.
5. Leaves essentially glabrous; pedicels (at anthesis) 3-6 mm. long (6)
- 6(5). Corolla lobes shortly but densely white-lanate-ciliate, pubescence usually visible to the unaided eye as a white fringe 6. *L. Torreyi*.
6. Corolla lobes smooth, not densely lanate-ciliate (7)
- 7(6). Flowers 6-8 mm. long 7. *L. Berlandieri* f. *Berlandieri*.
7. Flowers 4-6 mm. long 7. *L. Berlandieri* f. *parviflorum*.

1. *Lycium carolinianum* Walt. var. *quadrifidum* (Dun.) C. L. Hitchc. CAROLINA WOLFBERRY. A rather sparingly branched armed shrub, erect or slightly spreading, to 1 m. tall, glabrous; young branchlets often with short thick spines about 1 cm. long or branchlets unarmed; older branchlets with spinose branchlets, tan to dark-gray; leaves 3 to 10 in a fascicle, narrowly terete-spatulate to spatuloid, somewhat succulent, 1-2.5 cm. long, 1-2 mm. broad, the midnerve scarcely visible, rounded or occasionally somewhat acute at apex, attenuate at base, practically sessile, glabrous; pedicels to 3 cm. long; calyx cup-shaped, glabrous, about 3 mm. long; calyx lobes 4, triangular, obtuse, nearly equaling the tube, margins sometimes remotely ciliate; corolla lavender to purple, rotate-campanulate, 7-10 mm. long; corolla tube about equal to lobes or slightly shorter, 1-1.5 mm. in diameter at top of ovary, 3-5 mm. in diameter at summit, glabrous without; corolla lobes 4, rarely 5, ovate, abruptly contracted at base, rounded or slightly emarginate at apex, spreading, their margins not ciliate or but very sparsely so; stamens exerted due to spreading of lobes of the corolla; filaments adnate to about midway from the base of the tube,

¹⁷³ Adapted partly from C. L. Hitchcock in Ann. Missouri Bot. Gard. 19:179-374. 1932.

equaling or somewhat shorter than corolla lobes, densely pilose on their lower one-third or one-fourth of free portion, the adjacent corolla tube only very sparsely hairy; anthers 1-1.5 mm. long; style scarcely as long as filaments; berry ovoid, fleshy, red, about 1 cm. in diameter, with 50 or more seeds, purple in old or dried material. About ponds, along and in ditches, marshes, on wet clay flats, salt flats, and in sandy-gravelly soil on brush-covered hills in coastal and s. Tex., Jan.-Nov.; from Miss. to Tex. and n.e. Mex.

2. *Lycium puberulum* Gray. **DOWNY WOLFBERRY.** A sparingly branched spiny shrub to 15 dm. tall; branches usually slender and flexuous, well-armed with slender needlelike spines 5-10 mm. long, dark-grayish-green to olive-purple, glabrous at least in age; leaves 3 to 6 in a fascicle, broadly elliptic to oblong-obovate, 5-15 mm. long, about one third as broad as long, rounded at apex, sessile or subsessile, densely glandular-puberulent, not fleshy, midnerve evident; flowers 1 or 2 in the leaf fascicles, the pedicels about 2 mm. long; calyx broadly campanulate, 4-6 mm. long, very densely glandular-puberulent, the 5 lobes oblong-ovate and equal to or twice the length of the calyx tube, glandular-puberulent on both surfaces; corolla tubular-campanulate; corolla tube white, 9-12 mm. long, 1.5 mm. wide at base, about 3 mm. in diameter at top, glabrous without; corolla lobes 5, ovate, one fifth to one fourth the length of the tube, commonly spreading, their margins not ciliate; stamens equal to corolla tube or slightly shorter; filaments equal or subequal, adnate to the corolla tube for about two thirds of its length, glabrate but the lower two thirds of the corolla tube densely hairy; anthers 1 mm. or less long; style equaling or slightly shorter than filaments, included in corolla tube; fruit sclerenchymatous, 1 or 2 seeds in each cell. In limestone desert hills and shrubby grasslands in the Trans-Pecos, Mar.-Aug.; apparently endemic.

3. *Lycium pallidum* Miers. **PALE WOLFBERRY.** Densely branched spreading spiny shrub 1-2 m. tall; branches often somewhat flexuous, yellow to gray or more commonly reddish to purple, glabrous or rather sparsely pubescent, the slender spines sharp and 5-10 mm. long, the longer spines usually somewhat blunt; leaves glaucous-green, glabrous or glabrate, oblong-spatulate to broadly elliptic or nearly ovate, acute or occasionally rounded at apex, 1-4 cm. long, 3-15 mm. broad, attenuate at base into a short petiole, midnerve and primary lateral nerves usually visible; flowers borne singly or in pairs, the pedicels equaling or slightly exceeding the calyx; calyx cup-shaped to campanulate, blue-glaucous and glabrous, 5-8 mm. long, two thirds as broad at summit, 5-lobed; calyx lobes lanceolate to ovate or elliptic, equaling or even exceeding the tube, their margins sometimes sparsely pubescent; corolla tube elongate-funnelform, 1.2-2 cm. long, about 1.5 mm. in diameter above the ovary, 5-6 mm. in diameter at top where it is expanded conspicuously, greenish with purple veins, often blue-glaucous on outside; corolla lobes 5, oval or rhombic, one fifth to one third the length of the tube, their margins commonly very remotely ciliolate; stamens usually slightly exerted, sometimes extending only to the base of the corolla lobes; filaments adnate to a little below the middle of the corolla tube, free base of the filaments and the adjacent corolla tube hairy; anthers 1.5 mm. long; style varying in length from about equal to corolla tube to 4 or 5 mm. longer than tube; berry red or reddish-blue due to glaucescence, ovoid, about 1 cm. or slightly less in diameter, 20- to 50-seeded. In limestone soils on steep rocky slopes and among grasses in canyons in the Trans-Pecos, Feb.-May; from s. Colo. and Tex. to s. Ut., Ariz. and n. Mex.

4. *Lycium berberoides* Correll. **SILVERY WOLFBERRY.** Intricate shrub to about 15 dm. tall, profusely branched and spiny, the entire plant (when observed in nature) silvery- or dusty-gray; leaves gray-glaucous, elliptic to elliptic-obovate, obtuse to rounded at apex, veiny and somewhat marginate, to 1 cm. long and 3.5 mm. wide; flowers borne 1 or 2 at the nodes; pedicels stout, 1-4 mm. long at anthesis; calyx herbaceous, 4-5 mm. long, the usually reflexed ovate obtuse lobes as long as the tubular portion; corolla greenish-white, green-lined within the tube, about 1 cm. long, the triangular-ovate subacute lobes about 3 mm. long and usually reflexed; stamens and style included. On rocky hills or on stony flats in creosote shrub association in the s. Trans-Pecos, Mar.-Apr.; endemic.

5. *Lycium texanum* Correll. **TEXAS WOLFBERRY.** Intricate thorny shrub, the young branchlets brownish and hispidulous; leaves linear-oblancoate to narrowly spatulate, hispidulous-puberulous, often mucronulate at the obtusely rounded apex, to 2 cm. long and 3 mm. wide, usually much smaller; flowers borne 2 to a node; pedicels (at anthesis) about 1.5 mm. long, becoming much longer in fruit, hispidulous; calyx minute, scarious,

hispidulous, 2-3 mm. long, minutely lobed and somewhat 2-lipped; corolla 7-8 mm. long, the small slightly ciliate lobes strongly revolute; stamens and style somewhat exserted. In sandy soil and rocky areas in canyons of the Trans-Pecos, July-Oct.; endemic.

6. *Lycium Torreyi* Gray. Much-branched spreading shrub to 3 m. tall, with heavy spines 5-10 mm. long or practically unarmed; branches densely leafy, glabrate; leaves usually spatulate but sometimes elliptic or oblanceolate, to 5 cm. long and 15 mm. broad, usually somewhat acute at apex, attenuate at base to a short petiole 2-3 mm. long, the midnerve visible; flowers 1 to 3 in a fascicle; pedicels 5-20 mm. long; calyx cup-shaped to tubular, 2.5-4.5 mm. long, about 2 mm. in diameter, sparsely pubescent to glabrate; calyx lobes 5, one fourth to one half the length of the tube, triangular, the margins somewhat ciliate; corolla tube narrowly obconic, 8-15 mm. long, somewhat constricted at top of ovary, flared slightly at summit, 1.5-2 mm. in diameter at base, 3-4 mm. in diameter at top, greenish-lavender or whitish, usually glabrous without but sometimes with few scattered hairs; corolla lobes 5 (less commonly 4), rounded to oval or even lanceolate, 1 to 3 times as long as broad, and one fifth to one fourth the length of the tube, spreading, their margins densely ciliate-lanate with branched hairs which are apparent as a tiny white fringe; stamens equaling or slightly shorter than the corolla lobes; filaments adnate to about the middle of the corolla tube, rather densely hairy for about the first 1.5 mm. of their free portion, the adjacent corolla tube also hairy; anthers 1-1.5 mm. long; style slightly longer than the stamens, usually exserted 2-3 mm. beyond corolla tube; berry ovoid, 6-10 mm. long, two thirds as thick, bright-red, 8- to 30-seeded; fruit very juicy, sweet and not unpalatable. In silty soils, along canals and on flats in the Trans-Pecos, Apr.-Oct.; from Tex. to s.e. Nev. and Calif., s. to Hgo.

7. *Lycium Berlandieri* Dun. var. *Berlandieri*. A rather sparingly branched glabrous or pubescent shrub to 25 dm. tall, armed with few needlelike spines at ends of young branches or practically unarmed; branches somewhat crooked, decumbent, sparingly leafy, slender, silvery-gray to reddish; leaves glabrate, sometimes finely pubescent, linear to elliptic-spatulate, to 25 mm. long and 2.5 mm. broad, rounded or sometimes acute at apex, 1 to 3 in a fascicle; flowers borne singly or in pairs, the pedicels 3-20 mm. long; calyx cup-shaped, 1-2 mm. long and nearly as wide, the 3 to 5 lobes equal and about one third as long as tube or unequal, the calyx frequently splitting nearly to base on one side, glabrous except for a small tuft of hair at the tip of each lobe, infrequently the whole calyx pubescent; corolla blue or pale-lavender; tubular portion of corolla obconic-infundibuliform, much-constricted immediately above calyx, 4-8 mm. long, 2-4 mm. in diameter at the summit, 1 mm. in diameter or less just above the calyx, glabrate without, sometimes with few scattered hairs just above and below the summit of calyx; corolla lobes 4 or 5, one sixth to one third the length of the tube, usually reflexed and sometimes recurved; stamens unequal or subequal, about equal to corolla lobes; filaments adnate to a point about one third way from base of tube, hairy for the first one fourth to one third of their free portion, the adjacent corolla tube only slightly hairy; anthers about 1 mm. long; style equaling or very slightly exceeding stamens; berry globose-ellipsoid, red, about 4 mm. in diameter, 8- to 30-seeded. On gravelly-rocky hills, limestone and clay flats, alkali flats, gypsum soil in arroyos, scrubland and thickets from coastal and s. Tex. to the Trans-Pecos, Feb.-Oct.; from Tex. to e. N.M. and n. Mex.

Plants with stouter and more leafy branches, nodes frequently cottony and smaller flowers (4-8 mm. long) than in typical material are designated as var. *parviflorum* (Gray) Terrac. (var. *brevilobum* C. L. Hitchc.). It occurs in similar habitats to those of var. *Berlandieri* but seems to be confined to w. Tex. and n. Mex.

 Matrimony-vine (*L. halimifolium* Mill.), an old-fashioned garden plant, occasionally spreads from cultivation into thickets and waste ground. Long, sarmentose, recurved-drooping, essentially unarmed branches and greenish-purple flowers are characteristics of the plant.

8. CESTRUM L.

Deciduous or evergreen shrubs or small trees; leaves alternate, simple and entire; flowers in axillary or terminal cymes; calyx 5-toothed, short; corolla salverform or funnel-

form, variously colored, with long slender tube, enlarged or contracted at mouth, with short limb; stamens inserted about the middle of the corolla tube, included; filaments filiform, often pilose below, sometimes with a toothlike appendage; anthers small, their sacs parallel; ovary 2-celled, usually short-stipitate; ovules few; style filiform, the dilated stigma entire or 2-lobed; fruit a small berry; seeds oblong, smooth.

About 150 species in tropical and subtropical America. Several species cultivated for their fragrant flowers.

1. Lobes of corolla becoming distinctly reflexed; berry black 1. *C. diurnum*.
1. Lobes of corolla erect or spreading; berry not black (2)
- 2(1). Leaves ovate-oblong to elliptic, short-acuminate; berry white 2. *C. nocturnum*.
2. Leaves lanceolate, very long-tapering; berry violet-brown 3. *C. Parqui*.

1. *Cestrum diurnum* L. DAY JESSAMINE. A shrub to about 2 m. high, the slender twigs and inflorescence glabrous or more or less pubescent; leaves with slender petioles to 12 mm. long, oblong to oblong-elliptic, membranous, light-green, to 11 cm. long and 25 mm. wide, obtuse to acute at apex, narrowed to obtuse at base; panicles several-flowered, about as long as the leaves or shorter, often with some leaflike bracts; flowers fragrant; calyx campanulate, 3-3.5 mm. long; corolla white, 1-1.8 cm. long, its oblong lobes obtuse and reflexed at anthesis; stamens straight, edentate; berry black, ellipsoid, 6-7 mm. long.

A West Indian species that occasionally escapes from cultivation.

2. *Cestrum nocturnum* L. NIGHT JESSAMINE. Shrub to about 3 m. high, with glabrous angled slender branchlets; leaves thin, with a distinct petiole to 2 cm. long, mostly ovate-oblong to elliptic, short-acuminate, to 15 cm. long, mostly about 35 mm. wide, glabrous and more or less shining on both sides; panicles large, several- to many-flowered, longer than the leaves; pedicels short or the lower ones 5-9 mm. long; flowers yellow or greenish-yellow, pungently fragrant (especially at night); calyx tubular-campanulate, about 3 mm. long, its teeth short; corolla narrowly funnelform, 18-25 mm. long, the limb about one fourth as long as the tube, the acute lobes erect or only spreading; filaments toothed near the base; berry ellipsoid, white, about 1 cm. long. Nat. to W.I., occasionally escapes from cult. in s. Tex.

3. *Cestrum Parqui* L'Hér. WILLOW-LEAVED JESSAMINE. Upright shrub to 2 m. high, glabrous; leaves with petioles 5-10 mm. long, lanceolate, 5-14 cm. long, usually not much exceeding 25 mm. wide, cuneate at base, acuminate at apex, bright-green, slightly paler beneath; flowers in axillary and terminal cymes that form panicles at end of branches; corolla yellowish-green, pungently fragrant at night, the slender tube 2-2.5 cm. long and dilated at mouth, with spreading acute lobes; fruit violet-brown, 3- or 4-seeded. A Chilean species, allied to *C. nocturnum*, that is cult. for its fragrant flowers, occasionally escapes.

9. SCHIZANTHUS R. & P.

BUTTERFLY-FLOWER

A small South American genus of 15 or more species, several of which are cultivated.

1. *Schizanthus pinnatus* R. & P. Annual or biennial, thinly hairy and somewhat glandular, to 12 dm. high, usually much smaller, slender-branching; leaves linear-oblong in outline, to 1 dm. long or more, 1- or 2-pinnatisect, the segments entire to toothed or incisedly pinnatifid; inflorescence elongate, of numerous flowers in paniced racemes; calyx 6-7 mm. long, cleft to base to form linear to oblanceolate obtuse lobes; corolla tubular, 2-3 cm. across, varying in depth of color and markings, the lower lip usually violet or lilac, the upper lip paler, its middle segment with a yellow blotch toward the base, spotted with purple or violet; corolla tube shorter than the calyx; stamens prominently showing at the throat; ovary oblong, 2-celled; capsule with 2-cleft valves; seeds numerous. A Chilean species that occasionally escapes from cult. or occurs in waste places in s. Tex.; Apr.-Aug.

10. SALPICHROA MIERS

About 25 species of southwestern United States and extra-tropical South America.

1. *Salpichroa origanifolia* (Lam.) Baill. COCKS-EGGS. Weedy perennial climber from a fleshy root, somewhat woody, with green flexuous branches and a strong odor, puberulent to nearly glabrate; leaves subopposite, ovate-rhombic to suborbicular, 1.5-4 cm. long and wide, narrowed to a slender petiole that is shorter than the blade; flowers nodding, on filiform pedicels scarcely shorter than the petioles; calyx lobed to near the base, about 2.5 mm. long; corolla short, white, urceolate, constricted below the middle and at the throat, 7-10 mm. long, the 5 short lobes revolute, the inside of the tube with a woolly ring; stamens inserted at about the middle of the corolla tube or even higher; style slender, commonly exserted; berry ovoid-oblong, yellow or white, many-seeded, said to be edible but of poor flavor. *S. rhomboidea* (Gill. & Hook.) Miers, *Pertzoma rhomboidea* ("Hooker") Small. A nat. of S.A. that occasionally escapes from cult. in s.e. Tex., Mar.-July.

11. NIEREMBERGIA R. & P. CUP-FLOWER

About 30 species, mainly in tropical and subtropical America.

1. *Nierembergia hippomanica* Miers var. *coerulea* (Miers) Millan. Plant to about 2 dm. high, somewhat scabrous-pubescent, with suberect branches; leaves alternate, solitary and fascicled, linear to linear-spatulate, to 16 mm. long, usually much smaller, less than 2 mm. wide; flowers borne singly at or near the tips of the branchlets; pedicels at anthesis 3-5 mm. long; calyx tubular, scarious, 6-10 mm. long, with 10 conspicuous green ribs, the 5 narrowly triangular acuminate lobes more than half as long as the tube; corolla similar in appearance to *Leptoglossis texana*, bright-blue, the filiform tube 7-10 mm. long, the broadly 5-lobed saucer-shaped limb about 2 cm. in diameter; stamens subequal, 6-7 mm. long, inserted on the upper part of the corolla tube, more or less exserted, often with 4 of them paired and the fifth smaller; style exserted about 6 mm. beyond the corolla tube; capsules bivalved, the valves mostly 2-cleft. A S.A. species that occasionally escapes from cult., especially in s. Tex.

12. PETUNIA Juss.

About 40 species, mostly in South America.

1. *Petunia parviflora* Juss. WILD PETUNIA, SEASIDE PETUNIA. Annual; stems leafy, prostrate and rooting at the nodes, diffusely branched to form mats to 3 dm. wide or more, glandular-puberulent; leaves linear-oblong to spatulate, fleshy, about 1 cm. long; flowers solitary, lateral, on very short peduncles; calyx 5-parted to below middle; sepals in fruit to 11 mm. long and 1.5 mm. wide, linear-oblong to linear-spatulate, obtuse; corolla funnelform, purple or reddish-violet, with yellow or whitish tube and 5 minute unequal retuse lobules that are plicate in bud, the tube about 6 mm. long; stamens inserted low in corolla; filaments 3 short and 2 longer; capsules 3-4 mm. long, ovoid-ellipsoid, acute, 1-celled, bivalved, the valves leathery-chartaceous; seeds numerous, angular and more or less raised-reticulate. In moist or wet soil in beds of streams, along beaches and on muddy flats in most of Tex., Apr.-Sept.; from s. Fla. to Calif., n. to Va., s. to trop. Am.

Our plant is a "poor" relative of the showy cultivated petunias that are derived from *P. axillaris* (Lam.) B.S.P. and *P. violacea* Lindl. of South America.

13. DATURA L.¹⁷⁴ STRAMONIUM. JIMSON-WEED. THORN-APPLE

Rank weeds, narcotic-poisonous, herbaceous (in ours), some tropical species woody and arborescent; leaves ovate to elliptic in outline; flowers usually large and showy, mostly

¹⁷⁴ Ref.: W. E. Safford in Jour. Wash. Acad. 11:173-189. 1921.

fragrant, produced all summer and autumn on short peduncles in the forks of the branching stem; calyx prismatic or cylindrical, 5-toothed, separating transversely above the base in fruit, the upper part falling away; corolla funnelform to tubular, with a usually large and spreading 5- or 10-toothed plaited limb; stigma 2-lipped; capsule globular, usually prickly, 4-valved, 4-celled except near the 2-celled top; seeds rather large, flat.

About a dozen species mainly in warm and tropical regions of the World.

1. Fruit nodding, usually bursting irregularly at maturity, globose or nearly so; leaves entire to repand or sinuate-dentate; corolla more than 10 cm. long (2)
1. Fruit erect, regularly dehiscent, ovoid, 4-valved; corolla not more than 10 cm. long (3)
- 2(1). Plants (especially new growth) densely villous or glandular-villous with spreading hairs; lower surface of leaves soon glabrate except for the primary veins 1. *D. inoxia*.
2. Plants merely cinereous-puberulent with short appressed or curved hairs; lower surface of leaves velvety to the touch 2. *D. Wrightii*.
- 3(1). Spines of the fruit numerous, subequal, less than 1 cm. long, relatively slender, sometimes much-reduced or wanting; leaves repand to coarsely sinuate-dentate; corolla 7 cm. long or more, whitish or purplish 3. *D. Stramonium*.
3. Spines of the fruit relatively few, very unequal, the longer ones more than 1 cm. long, very stout; leaves usually pinnately lobed; corolla not more than 7 cm. long, purplish 4. *D. quercifolia*.

1. *Datura inoxia* Mill. INDIAN-APPLE. Plant annual from a perennial rootstock, widely branching, to 1 m. high or more, the herbage (especially new growth) densely villous and sometimes also glandular with spreading hairs; leaves ovate, to 25 cm. long, asymmetric at base, acute to acuminate at apex, entire or coarsely sinuate-dentate, the lower surface soon glabrate except for the primary veins, the petiole shorter than to nearly equaling the blade; calyx 8-12 cm. long, unequally 5-toothed, the basal persistent part reflexed in fruit; corolla white, funnelform, 12-15 cm. long, with a spreading limb to 12 cm. across, the limb with 5 (rarely 10) subulate teeth about 1 cm. long; capsule globose, nodding, 3-4 cm. long, densely spiny and glandular-puberulent or short-villous with spreading hairs, when mature rupturing irregularly, the spines mostly less than 1 cm. long; seeds light-brown, 5-6 mm. wide, reniform, plump but compressed. In various types of soils, rocky stream beds, canyons, base of bluffs and on ledges in the Edwards Plateau, Rio Grande Plains and Trans-Pecos, Mar.-Nov.; Tex. and N.M., s. to cen. Mex.

2. *Datura Wrightii* Regel. Plant erect, widely branching, annual from a perennial rootstock, to 15 dm. high, the herbage cinereous-puberulent and somewhat glaucescent-velutinous (especially new growth); leaves ovate, entire to slightly sinuate-repand, to 15 cm. long, asymmetric at base, obtuse to shortly acuminate at apex, the puberulent lower surface soft to touch, the petiole shorter than to nearly equaling the blade; calyx 7-12 cm. long, unequally 5-toothed, the basal persistent part reflexed in fruit; corolla white, commonly suffused with violet or lavender, infundibuliform, to about 15 cm. long, with a spreading limb to about 15 cm. wide, the limb with 5 slender teeth 1-1.5 cm. long; anthers white, about 15 mm. long; capsule globose, nodding, 3-4 cm. in diameter, densely prickly and puberulent with retrorse hairs, the spines less than 1 cm. long; seeds sub-orbicular-reniform, flattened, light-brown, 5-6 mm. wide, smooth on the sides, the margin cordlike. *D. meteloides* of Tex. auth. In loose sand and on floodplains and bottomlands from e. Tex. to the Trans-Pecos, May-Nov.; from Tex., w. to Calif. and n. Mex.

3. *Datura Stramonium* L. JIMSON-WEED, TOLOACHE. Simple to spreading branched erect annual, to 15 dm. high, with green sparsely puberulent to glabrate stems and foliage; leaves ovate to elliptic, to 2 dm. long, sinuately to lanciniately lobed, the petioles about one half as long as the blade; calyx 35-45 mm. long, the unequal teeth 5-10 mm. long, the persistent basal part reflexed in fruit; corolla white, commonly tinged with lavender [var. *Tatula* (L.) Torr.], 6-8 cm. long, the limb 3-5 cm. across and bearing 5 subulate teeth that are 5-8 mm. long; capsule erect, ovoid, 3.5-5 cm. long, usually armed with spines mostly less than 5 mm. long, finely and sparsely puberulent to glabrate, dehiscent from apex by 4 valves; seeds black, rugulose and finely pitted. In cult. areas and waste places throughout Tex., Apr.-Nov.; a weedy species widely distributed in the World.

4. *Datura quercifolia* H.B.K. OAK-LEAF THORN-APPLE. Plant green, annual, to 15 dm. high, the younger parts commonly somewhat downy or pubescent; leaves sparingly but mostly deeply sinuate-pinnatifid; flowers erect; calyx prismatic, 5-toothed, about one half as long as the corolla; corolla tubular, pale-violet to purple, 4-7 cm. long, the limb to about 2 cm. across and with 5 minute teeth; anthers purple; capsule ovoid, 3-4 cm. long, strictly erect, dry, 4-valved, armed with large and very unequal flattened prickles, some of the upper spines as much as 25 mm. long; seeds dark-colored, somewhat scrobiculate-rugose. In sandy or sandy-clayey soils in the Panhandle and Trans-Pecos, May-Oct.; from w. Okla. and Tex. through s. N.M. to adj. Mex.

14. LEPTOGLOSSIS BENTH.

Several species in southwestern United States and northern Mexico.

1. *Leptoglossis texana* (Torr.) Gray. TEXAS CUP-FLOWER. Low perennial, diffusely much-branched from a suffrutescent base, to about 25 cm. high, viscid-pubescent; leaves spatulate-obovate to elliptic-oblongate, obtuse to acute at apex, narrowed at base, to 3 cm. long and 1 cm. wide, the lowermost leaves with a short margined petiole; pedicels mostly shorter than the herbaceous campanulate-funnelform 5-toothed calyx; corolla salverform, light-purple or purple-pink, the filiform tube 16-18 mm. long, the almost regular broadly 5-lobed plane limb to 23 mm. in diameter, the very short campanulate throat scarcely over 2 mm. in height and width; stamens 4, didynamous, the fifth a sterile filament, included in the throat of the long-tubed corolla; winged appendages under the stigma narrower than wide; capsule membranous, 2-valved, only half the length of the 10-nerved calyx; seeds somewhat reniform, coarsely transverse, rugose. *Nierembergia viscosa* Torr., *Browallia texana* Torr. In limestone soil on hills on w. edge of Edwards Plateau, Feb.-May; probably in adj. Mex.

15. BOUCHETIA DC.

A monotypic genus.

1. *Bouchetia erecta* DC. Much-branched from a perennial root, ascending, about 23 cm. high, minutely appressed-puberulent; leaves oblong-spatulate or the lower oval and petioled and the upper lanceolate and sessile, to 5 cm. long and 1 cm. wide, usually much smaller; peduncles terminal or lateral and scattered; calyx oblong-campanulate, 5-cleft with narrow lobes; corolla white, sometimes tinged with lavender, 12-18 mm. long, about twice the length of the calyx, the broadly funnelform limb deeply 5-lobed, the lobes roundish; stamens 5, perfect; anthers connivent, the yellow cells somewhat confluent at summit; stigmas transversely dilated, greenish, somewhat reniform; pod ellipsoid, at length 4-valved, about 8 mm. long; seeds numerous, brown, pitted. *B. anomala* of auth. In clayey or sandy soils and on shell mounds along the coast and in prairies and on rocky slopes in cen. and s. Tex., Mar.-Oct.; apparently endemic.

16. NECTOUXIA H.B.K.

A monotypic genus.

1. *Nectouxia formosa* H.B.K. Annual, erect-ascending, more or less glandular-pubescent throughout, somewhat malodorous; stems simple or branched from base; leaves alternate to subopposite, with slender petioles shorter than the blade, ovate, cordate at base, acuminate at apex, to at least 4 cm. long and 25 mm. wide; peduncle axillary, shorter than the calyx; calyx lobes 5, linear-subulate, about 12 mm. long, densely hirsute; corolla 2.5-3 cm. long, the salverform tube dilated just below the 5-lobed limb, the tubular crown about 4 mm. high; corolla lobes elliptic, obtuse to acute, spreading, about 15 mm. long and 6 mm. wide; stamens attached above the middle of the corolla tube, subincluded, the filaments filiform; anthers oblong, with a dorsal winged connective lengthwise on both sides, with the parallel cells dehiscing lengthwise; disk small; ovary oblong, 2-celled; style filiform, the stigma somewhat expanded; fruit not seen but probably oblong. In Trans-Pecos Tex. and Mex.

17. NICOTIANA L.¹⁷⁵ TOBACCO

Annual or perennial herbs or rarely small trees or shrubs, narcotic-poisonous and heavy-scented, usually viscid-pubescent; leaves entire or sometimes repand or panduriform, petiolate or sessile; flowers few to many in racemes or panicles; calyx tubular-campanulate, 5-cleft; corolla funnelform or salverform, usually with a long tube, the plaited 5-lobed limb usually spreading; stamens 5, variously inserted on the corolla; stigma capitate; capsule ovoid to narrowly ellipsoid, acute or blunt, 2-celled, 2- or 4-valved from the apex; seeds numerous, minute.

About 60 species in North America, South America, Australia and the South Pacific.

1. Trees or large shrubs; leaves glaucous, glabrous; flowers yellow 1. *N. glauca*.
1. Plants herbaceous; leaves green, more or less viscid-pubescent; flowers mostly white, often variously tinged with green, violet or red (2)
- 2(1). Leaves commonly repand or panduriform 2. *N. repanda*.
2. Leaves entire or the margins more or less undulate or crisped (3)
- 3(2). Corolla 12-23 mm. long, greenish; capsule 11 mm. long or less; native to western half of Texas 3. *N. trigonophylla*.
3. Corolla 25 mm. long or more, not noticeably greenish; capsule more than 11 mm. long; introduced in south and east Texas (4)
- 4(3). Stem leaves ample; inflorescence rather compact; filaments elongated, inserted below middle of tubular portion of corolla 4. *N. Tabacum*.
4. Stem leaves much smaller than those of the basal rosette; inflorescence lax and elongated; filaments abbreviated, inserted slightly below mouth of corolla tube (5)
- 5(4). Corolla 4-12 cm. long 5. *N. longiflora*.
5. Corolla 2.5-3.5 cm. long 6. *N. plumbaginifolia*.

1. *Nicotiana glauca* Grah. TREE TOBACCO, MUSTARD TREE, RAPÉ, GIGANTE, BUENA MOZA. Glabrous shrub or small tree to 8 dm. high; leaves long-petiolate, glaucous, somewhat leathery, ovate to oblong-lanceolate, 5-18 cm. long, cuneate to subcordate at the base, obtuse to acute at the apex, entire to slightly repand; flowers in lax terminal panicles; calyx tubular-campanulate, 8-12 mm. long, 5-toothed, the teeth much shorter than the tube; corolla tubular, greenish-yellow, 35-45 mm. long, minutely villosulose, the limb narrow; filaments inserted below middle of the tubular portion of corolla; capsule ovoid, acute, 1-1.2 cm. long, 4-valved at the summit; seeds reddish-brown, slightly shining, finely favose-reticulate. In sandy or clayey soils along stream banks, roadsides, on talus slopes and ledges along the coast and in extreme s. Tex., w. to the Trans-Pecos, flowering throughout the year; a nat. of S.A. that has become naturalized northw. to Tex. and Calif.

2. *Nicotiana repanda* Willd. FIDDLE-LEAF TOBACCO, WILD TOBACCO, TABACO CIMABRÓN. Annual, minutely pubescent or above glabrate, to about 9 dm. high, with loose slender branches extending into open racemose or somewhat paniculate naked inflorescences; leaves thin, ovate or the lower ones obovate and sometimes panduriform, commonly repand, to 2 dm. long and 1 dm. wide, rarely larger, the lowest leaves contracted into a winged petiole, the upper ones deeply cordate-clasping; bracts minute or often wanting; flowers; vespertine; calyx lobes slender, fully as long as the short-campanulate acutely 10-ribbed tube; corolla with tube frequently 5-6 cm. long, somewhat clavate or funnelform at the open throat; corolla limb spreading, white or sometimes tinged with rose, or dorsally brown-striped, to 4 cm. in diameter, its lobes short and obtuse or acute; capsule ovoid, about 1 cm. long, 4-valved; seeds brown, pitted-reticulate, shiny or dull. *N. Roemeriana* Scheele. In sandy or clayey soils along streams, on flats and in depressions, shelter of boulders, thickets and wooded ravines on the Edwards Plateau and in s. Tex., Feb.-July; also adj. Mex.

3. *Nicotiana trigonophylla* Dun. DESERT TOBACCO, TABAQUILLO. Biennial or perennial, viscid-pubescent, to about 9 dm. high, with a simple or virgately branched stem; leaves

¹⁷⁵ Ref.: Thomas H. Goodspeed, The Genus *Nicotiana*. 1954.

all sessile or only the lower ones tapering into a winged petiole and obovate-oblong, the upper ones elliptic-lanceolate to oblong-elliptic with a broader cordate half-clasping base, some spatulate-lanceolate with a dilated auriculate-clasping base, the largest leaves to about 22 cm. long and 6 cm. wide, rounded to acuminate at apex; inflorescence at length loosely paniculate-racemose, with the later bracts very small or wanting and somewhat unilateral pedicels about the length of the calyx; flowers open throughout the day; calyx lobes subulate-lanceolate but rather obtuse, shorter than or equaling the campanulate tube, attaining the middle of the corolla tube, about equaling the 4-valved capsule, somewhat callous-margined; corolla tubular-campanulate, greenish-white or yellowish, 12-23 mm. long, somewhat pubescent, a little constricted at the orifice, the tube slightly enlarging upward, the sinuately 5-lobed limb about 8 mm. in diameter; capsule ovoid, 8-11 mm. long; seeds brown, shining, pitted-reticulate. On breaks of arroyos and canyons, in gravelly-sandy soils on slopes, at base of boulders and on ledges of mesas and mts. in the Rio Grande Plains, South Plains and Trans-Pecos, Mar.-Nov.; from Tex., w. to Calif. and n. Mex.

4. *Nicotiana Tabacum* L. TOBACCO. Stout viscid annual (with us), usually about 2 m. high, erect, with few leafy branches; leaves decurrent, ovate to elliptic or lanceolate, the largest at least 5 dm. long, tapering or winged-subpetiolate at base, acute to acuminate at apex; flowers in a rather close panicle; calyx cylindrical-campanulate, 12-25 mm. long, the 5 unequal triangular-acuminate teeth shorter than or equaling the calyx tube; corolla tubular-campanulate, pale-cream-color, often tinged with pink or red, to about 5 cm. long, usually smaller, the limb 1-1.5 cm. wide; capsule narrowly elliptic to ovoid or globose, 1.5-2 cm. long; seeds spherical or broadly elliptic, brown, the ridges fluted. A nat. of Latin Am. that occasionally occurs as a waif in e. Tex.

This is the plant whose cured leaves constitute the "tobacco" of commerce.

5. *Nicotiana longiflora* Cav. LONG-FLOWERED TOBACCO. A vigorous annual or short-lived herbaceous perennial, to 1 m. high, sparsely branched, the slender stems sparingly pubescent, usually slightly tubercled and sometimes viscid; leaves in basal rosette to 5 dm. long, oblanceolate and subpetiolate to elliptic-ovate, the cauline leaves much smaller and sessile-auriculate; flowers vespertine, somewhat fragrant, racemose; calyx tubular, 1.5-2 cm. long, 10-ribbed, the 5 subulate segments usually equaling the tube; corolla tubular, pale-yellow, tinged with gray or purple, 4-12 cm. long, the limb 12-25 mm. across (the 5 lobes ovate and acute); capsule ovoid, 11-16 mm. long; seeds light-brown, with wavy-reticulate surface. A common garden plant, nat. of S.A., sometimes found as an escape in s.e. Tex.

6. *Nicotiana plumbaginifolia* Viv. Annual to about 1 m. high, the erect stem slender and tuberculate-hispid, with long basal branches; basal rosette leaves few, spatulate to obovate-spatulate or oblanceolate, hispid, to about 25 cm. long; cauline leaves progressively smaller and becoming lanceolate or linear-lanceolate to the widely branched inflorescence, sessile or clasping and auriculate at base, abruptly acuminate and somewhat twisted at apex, usually strongly undulate-plicate; flowers few, vespertine; calyx tubular, 8-13 mm. long, the long narrow segments subulate-filiform and about equal to the tube; corolla puberulent on outer surface, the slender tube 25-35 mm. long, greenish-white and lavender or purplish-tinged, the limb about 1 cm. wide and with ovate acute lobes; capsule narrowly ovoid, 8-11 mm. long; seeds light-brown with wavy-reticulate surface. In resacas in the Brownsville region (Cameron Co.), Jan.-Apr.; from Tex. through Mex., W.I. and C.A. to S.A.

FAM. 160. SCROPHULARIACEAE JUSS.¹⁷⁶ FIGWORT FAMILY

Mainly herbs, occasionally shrubs or rarely trees; leaves various; flowers perfect, in racemes or panicles, never terminal (in ours); sepals 4 or 5, free or united; corolla bilabiate or more or less irregular, rarely almost regular, the 4 or 5 lobes imbricated in bud; stamens didynamous, sometimes only 2 (rarely 5), inserted on the corolla tube; style single, the stigma entire or bilobed; capsule 2-celled and usually many-seeded, with the placentae in the axis; seeds anatropous or amphitropous.

¹⁷⁶ Unless otherwise noted, mostly adapted from publications by F. W. Pennell in Proc. Acad. Phila. 73:459-536. 1921; 92:289-308. 1940, and Mono. Acad. Phila. 1. 1935.

More than 3,000 species in about 220 genera of cosmopolitan distribution.

1. Corolla with the upper lobes external and overlapping in the bud (2)
1. Corolla with the lower lobes external and overlapping in the bud (19)
- 2(1). Stigmas distinct, usually flattened (except in *Scoparia* and *Bacopa Monnieri*); seeds reticulate, wingless; capsule walls membranous; inflorescence simply racemose, the bracts foliaceous (except in *Mazus*) and the flowers axillary; stamens 4, didynamous, or reduced to 2; leaves opposite or whorled (*Gratiolae*) (3)
2. Stigmas wholly united, punctiform or capitate; seeds not simply reticulate, either smooth, tuberculate, ridged or winged; stamens 4, didynamous, or 5 in *Verbascum* (13)
- 3(2). Cells of anther parallel; corolla with throat anteriorly rounded or flattened, obscurely or not ridged within; sepals distinct; pedicels often bibracteolate (4)
3. Cells of anther divergent; corolla with throat 2-ridged within anteriorly; sepals often united; pedicels never bracteolate (10)
- 4(3). Corolla rotate, yellow or white, densely pilose within on all sides, the lobes longer than the tube, the posterior 2 lobes united so as to simulate a single lobe; genitalia well-exserted 7. *Scoparia*, p. 1416.
4. Corolla campanulate, tubular or salverform, the lobes about equaling or shorter than the tube; genitalia not exserted (5)
- 5(4). Corolla campanulate, nearly regular, the lobes equaling or only slightly shorter than the tube, the posterior lobes united a little farther than the others; sepals unequal; stems creeping or floating, usually ascending at apex 1. *Bacopa*, p. 1412.
5. Corolla narrower than above, decidedly zygomorphic, the lobes distinctly shorter than the tube, the posterior lobes united for over half their length or throughout (6)
- 6(5). Leaf blades (at least some) pinnatisect, often bipinnatifid; pedicels not bracteolate; seeds commonly pale-greenish-yellow, nearly colorless; corolla pink or lavender (7)
6. Leaf blades entire or merely toothed; pedicels bibracteolate or (rarely in *Gratiola*) with bractlet single or lacking; seeds yellow to brown or blackish (8)
- 7(6). Plant terrestrial, the short bushy-branched stem erect; flowers numerous with slender pedicels 5 mm. long or more 5. *Leucospora*, p. 1416.
7. Plant aquatic, the elongate sparsely branched stem floating; flowers few, sessile 6. *Limnophila*, p. 1416.
- 8(6). Anther cells separated on short arms of the connective; corolla violet-blue; sepals uniform 4. *Stemodia*, p. 1415.
8. Anther cells proximate; corolla yellow or white; sepals usually somewhat unequal either in width or length (9)
- 9(8). Pedicels bibracteolate at the base; outer sepals much wider than the inner; fertile stamens 4; leaf blades pinnately veined 2. *Mecardonia*, p. 1413.
9. Pedicels bibracteolate at the apex; sepals nearly equal in width; fertile stamens 2; leaf blades palmately veined 3. *Gratiola*, p. 1413.
- 10(3). Filaments attached to the base of the corolla, always simple and both pairs antheriferous; capsule loculicidal; seeds more or less reticulate; sepals united; corolla 9-40 mm. long (11)
10. Filaments attached to corolla for most of length, the anterior each with a projecting knoblike process; capsule not loculicidal; seeds marked with fine transverse lines or smooth; sepals distinct or united (12)
- 11(10). Sepals united for over half their length; corolla yellow or violet, the posterior lip slightly shorter than the anterior and with its free lobes rounded; capsule 4-12 mm. long, longer than wide, quite enclosed within the erect calyx; bracts foliose 8. *Mimulus*, p. 1416.
11. Sepals united for less than half their length; corolla blue-violet, the posterior lip much shorter than the anterior and with its free lobes acute; capsule 2 mm. long, globose, distally exposed by the spreading calyx; bracts minute, subulate 9. *Mazus*, p. 1418.

- 12(10). Corolla violet-blue, 5-12 mm. long; the postero-lateral filaments present and antheriferous; capsule 1-6 mm. long, ellipsoid to ovoid, 2-celled, septicidal, the platelike septum persisting; sepals 5 10. *Lindernia*, p. 1418.
12. Corolla white, 1-2 mm. long; the postero-lateral filaments lacking; capsule 0.5-1 mm. long, globose, 1-celled (by lack of septum distally), rupturing irregularly; sepals 4 11. *Micranthemum*, p. 1419.
- 13(2). Capsule primarily septicidal, its walls firm or woody; corolla neither saccate nor spurred; shrubs or perennial herbs (14)
13. Capsule partly or wholly loculicidal; corolla saccate or spurred at base, strongly zygomorphic, yellow, blue or violet; perennial or annual herbs (17)
- 14(13). Leaves opposite; inflorescence simple or compound; posterior filament developed although lacking anther; corolla very strongly zygomorphic, variously colored; herbs, glabrous or with simple hairs (*Cheloneae*) (15)
14. Leaves alternate; inflorescence simple; filaments all with anthers; corolla only slightly zygomorphic; plants often with stellate hairs (16)
- 15(14). Sterile filament slender, filiform; corolla rarely less than 15 mm. long, the anterior lobes spreading; sepals distinct 14. *Penstemon*, p. 1421.
15. Sterile filament flattened, nearly as wide as or wider than long; corolla 6-12 mm. long, the antero-lateral lobes vertically projecting and its mid-anterior lobe deflexed; inflorescence compound, relatively lax, the flowers disposed in peduncled cymes 15. *Scrophularia*, p. 1425.
- 16(14). Corolla rotate, yellow, purple or white, not spotted, its lobes longer than the tube; anther cells wholly confluent; filaments 5, at least the posterior villous; inflorescence a raceme or spike; herbaceous (*Verbasceae*) 12. *Verbascum*, p. 1419.
16. Corolla campanulate, purple, deep-pink or rarely white, usually marked with orange within throat, its lobes shorter than the tube; anther cells distinct; filaments 4, glabrous; flowers remote, axillary; much-branched shrub (*Leucophylleae*) 13. *Leucophyllum*, p. 1420.
- 17(13). Leaves opposite; corolla pouched at base posteriorly, the mid-anterior lobe sagittally folded, the antero-laterals flattened and the much paler or white posterior lobes erect; capsule thin-walled, longitudinally dehiscent septicidally and loculicidally (*Collinsieae*) 16. *Collinsia*, p. 1426.
17. Leaves alternate; corolla pouched or spurred at base anteriorly, the anterior lobes plane or usually raised medianly into a ridged palate, the posterior lobes ascending but not differently colored; capsule dehiscing by transverse loculicidal ruptures (*Antirrhineae*) (18)
- 18(17). Seeds angled or with thin wings; leaf blades entire or hastate-lobed at base, pinnately veined; corolla violet-blue or yellow, spurred; stems erect 17. *Linaria*, p. 1426.
18. Seeds with several thick corky wings; leaf blades palmately veined and lobed; corolla violet-blue, its orifice closed by a yellow palate; stems climbing or extensively trailing 18. *Maurandya*, p. 1427.
- 19(1). Upper lobes of corolla flattened or widely arched, often spreading; anthers all distinct (20)
19. Upper lobes of corolla narrowly arched to form a definite galea that encloses the anthers; stigmas wholly united; anthers frequently cohering, the pollen being shed in a mass; stamens 4, didynamous; capsule loculicidal (except in *Schwalbea*); commonly root-parasites (*Euphrasieae*) (27)
- 20(19). Stamens 2, the postero-lateral pair alone developed; corolla 2-5 mm. long, the posterior lobes wholly united; plants not parasitic (*Veroniceae*) (21)
20. Stamens 4, didynamous; corolla 7 mm. long or more, the lobes all evident; root-parasites (*Buchnereae*) (22)

- 21(20). Capsule acute, much longer than wide, slightly flattened, dehiscent by short apical septical and loculicidal slits; seeds turgid, slightly reticulate; corolla lobes much shorter than the tube; plant 1-2 m. high, with leaves in whorls of 3 to 5 19. *Veronicastrum*, p. 1427.
21. Capsule rounded to deeply notched, little (if at all) longer than wide, flattened, dehiscent by longer loculicidal slits; seeds more or less flattened, smooth; corolla lobes nearly as long as or usually longer than the tube; plants lower, with leaves opposite or alternate 20. *Veronica*, p. 1428.
- 22(20). Stamens with only one anther cell developed, the other wholly abortive; corolla salverform, blue to violet-purple or white, the throat very narrow and filled with short stiff hairs; filaments and style less than half the length of the corolla tube; capsule nearly or quite included in the calyx tube; pedicel bibracteolate 26. *Buchnera*, p. 1438.
22. Stamens with both anther cells equally developed; corolla neither salverform nor blue, its throat wide; filaments and style nearly as long as or longer than the corolla tube; capsule partly or nearly wholly exerted from the calyx; pedicel not bracteolate (23)
- 23(22). Anther cells glabrous or rarely with a few bristlelike hairs at apex; corolla semi-rotate, 7-16 mm. long; stigma punctiform or capitate (24)
23. Anther cells villous; corolla semicampanulate, 10-60 mm. long; stigma somewhat elongate (25)
- 24(23). Corolla densely pubescent within on all sides; filaments clearly didynamous; anther cells somewhat cuspidate at base, each opening its entire length; styles short, thick, distally parted, persistent and reflexed on the capsule; pedicels 1-2 mm. long; plant stout, 15-20 dm. high, the leaves large 22. *Dasistoma*, p. 1431.
24. Corolla glabrous or nearly so (except about the bases of the nearly equal filaments); anther cells obtuse at base, each opening less than half of its length; styles slender, united to apex, deciduous, straight; pedicels usually longer; plants lower, the leaves relatively small 23. *Seymeria*, p. 1431.
- 25(23). Corolla yellow; anther cells with rigid awns at base; stigma ovoid-capitate; capsule acute to acuminate; leaf blades lanceolate to ovate, entire to bipinnatifid 21. *Aureolaria*, p. 1429.
25. Corolla purple or pink, nearly always with red-purple spots within on anterior side; anther cells rounded or mucronate-setaceous at base; stigma linguiform; capsule rounded, with a mucro; leaf blades or segments lanceolate to linear or subulate (26)
- 26(25). Leaf blades lanceolate to ovate in outline, usually lobed at base or bipinnatifid; calyx lobes ovate to widely lanceolate, longer than the tube; corolla without yellow lines within throat; anther cells of posterior pair of stamens smaller; reticulations of seed coat somewhat raised; stem retrorse-hispid . . 24. *Tomanthera*, p. 1432.
26. Leaf blades lanceolate to filiform or subulate, entire or sometimes lobed at base (in *A. heterophylla*); calyx lobes linear to subulate, about as long as to much shorter than the tube; corolla usually with 2 yellow lines within throat on anterior side; anther cells of both pairs of stamens equal; reticulations of seed coat not raised; stem ascending-scabrous to glabrous 25. *Agalinis*, p. 1433.
- 27(19). Pedicel bibracteolate; calyx lobes 5; capsule turgid, septical and tardily also somewhat loculicidal; seeds narrow, winged . . . 27. *Schwalbea*, p. 1438.
27. Pedicel not bracteolate; calyx lobes 4; capsule loculicidal; seeds wide (28)
- 28(27). Cells of anther equal in size and position; seed coat close, not obviously reticulate (29)
28. Cells of anther unequally placed, the upper one attached by its middle; seed coat loose, evidently reticulate (30)

- 29(28). Capsule symmetrical, both cells dehiscent equally; anther cells mucronate-tipped; stem leaves sessile and clasping 28. *Parentucellia*, p. 1439.
29. Capsule asymmetrical, usually decurved, opening on the distal side; anther cells not mucronate-tipped; stem leaves prominently petiolate 29. *Pedicularis*, p. 1439.
- 30(28). Calyx tube surrounding the proximal portion of the corolla, its 4 (or by fusion 2) lobes laterally placed 30. *Castilleja*, p. 1439.
30. Calyx tube surrounding base of corolla or usually wholly to its dorsal side, extending as a narrow linguiform dorsal structure that is entire or only slightly bidentate at apex 31. *Cordylanthus*, p. 1442.

1. BACOPA AUBL.

WATER-HYSSOP

Low succulent perennial herbs; flowers axillary; calyx 5-parted, the uppermost divisions broadest, the innermost often very narrow; upper lip of corolla entire to notched or 2-cleft and the lower lip 3-lobed or the limb almost equally 5-lobed; style dilated or bilobed at apex; seeds numerous.

About 100 species, primarily in warm regions.

1. Leaves cuneate to narrow bases, 1-nerved; pedicels much-exceeding the subtending leaves, conspicuously 2-bracted below the calyx ... 1. *B. Monnieri*.
1. Leaves rounded to broad or more or less clasping bases, 3- or more-nerved; pedicels mostly shorter than the subtending leaves (2)
- 2(1). Leaves ovate, pellucid-punctate; flower usually closely subtended by a pair of minute bractlets; ovary surrounded by a slenderly 10- to 12-toothed disk; upper lip of corolla obcordate 2. *B. caroliniana*.
2. Leaves suborbicular to broadly obovate, not obviously punctate; flowers not subtended by bractlets; disk at base of ovary none or without slender teeth; upper lip of corolla merely emarginate 3. *B. rotundifolia*.

1. *Bacopa Monnieri* (L.) Wettst. Plant with prostrate to decumbent or loosely ascending stems, forming mats, fleshy, glabrous; leaves spatulate to cuneate-obovate, obtuse to rounded at apex, entire or nearly so, to about 2 cm. long; flowers single in nodes, with 2 linear bracts at base of calyx; pedicels to 25 mm. long, soon exceeding the subtending leaves; larger sepal lanceolate to ovate, to 5 mm. wide; corolla campanulate, only obscurely bilabiate, white to lilac or pale-blue, 8-10 mm. long, glabrous within; capsule slenderly conic to ovoid, 5-7 mm. long, shorter than the calyx. Incl. var. *cuneifolia* Fern., *Bramia Monnieri* (L.) Penn. In mud and sand in depressions among dunes, about ponds, along streams and ditches in e., cen. and s. Tex., Apr.-Sept.; from Fla. to Tex., n. to Va.

2. *Bacopa caroliniana* (Walt.) Robins. BLUE HYSSOP. Stems from creeping rhizome, floating or ascending, to about 4 dm. high, lanate at summit; plant (when bruised) lemon-scented; leaves in subapproximate pairs, ovate to ovate-elliptic, obtuse, clasping, to 25 mm. long, entire, pellucid-punctate, fragrant, the nerves pedately radiating from base; flowers single, scarcely exerted beyond leaves, with short pedicels; calyx often with 2 minute subulate basal bracts, the outer sepal cordate; corolla blue, about 1 cm. long, pubescent within, its upper lip obcordate; ovary surrounded by a slenderly 10- to 12-toothed disk; capsule ovoid, acute, about 5 mm. long. *Hydrotrida caroliniana* (Walt.) Small. On margins of ponds and streams, and in bogs in pinelands in e. Tex., May-Oct.; from Fla. to Tex., n. to Va.

3. *Bacopa rotundifolia* (Michx.) Wettst. DISC WATER-HYSSOP. Plant creeping, with elongate and lax terminally pubescent branches to 6 dm. long, forming mats on mud or attached and floating; leaves thin, suborbicular to broadly obovate, with subcuneately narrowed but clasping bases, clearly palmately many-nerved, the larger ones to 35 mm. long and 25 mm. wide; flowers usually 2 to 4 from upper nodes; pedicels 2 or 3 times as long as calyx, slender, pubescent, to 2 cm. long; outer sepals ovate, 6-8 mm. long; corolla exerted, campanulate, 6-10 mm. long, the wide-spreading limb about as broad, white, with yellow throat; capsule globose to subglobose, about as long as sepals. *Macuillamia*

rotundifolia (Michx.) Raf. In mud and water in and about lakes, pools, ditches and ponds throughout Tex., May-Nov.; from Miss. to Tex., n. to Ind., Ill., Minn., N.D. and Mont.

2. MECARDONIA R. & P.

Erect or diffuse much-branched glabrous herbs from a perennial root, often becoming black upon drying; stems 4-angled; leaves opposite, narrowed to a sessile base, toothed, glandular-punctate; flowers axillary in leaflike bracts; bractlets 2, at the base of the slender pedicel and much shorter than the bracts; sepals 5, unequal, the outer ones much wider than the inner ones; corolla bilabiate with the lobes shorter than the tube, the posterior lip more or less united and pubescent within at base; stigmas liplike; capsule cylindrical to ovoid, acute, glabrous, septicial, the valves only slightly loculicidal at apex; seeds numerous, cylindrical, reticulate, wingless.

About a dozen species in warmer parts of America.

- 1. Corolla yellow, its upper bearded lobes essentially united or forming only a slightly notched lamina; 3 outer sepals broadly ovate to ovate-elliptic, more than 3 times as wide as the 2 inner sepals; leaves typically ovate or oval, abruptly cuneate at base, less than 25 mm. long; plant procumbent or ascending 1. *M. vandellioides*.
- 1. Corolla white, often with purplish stripes, its upper bearded lobes typically separated at least one third their length, 3 outer sepals lanceolate, rarely more than 2 times as wide as the 2 inner sepals; leaves typically oblanceolate, tapering to the narrow base, more than 3 cm. long; plant erect or diffusely branched 2. *M. acuminata*.

1. *Mecardonia vandellioides* (H.B.K.) Penn. Plant very variable, glabrous throughout; stems procumbent to erect-ascending, often branched and widely spreading from the base, to about 4 dm. long; leaves opposite, sessile, ovate to oval or obovate-oblong, obtuse to subacute, more or less serrate or serrulate above the middle, 1-2.5 cm. long; pedicels axillary, solitary, usually noticeably exceeding the subtending leaf and the 2 small basal bracteoles; calyx 5-parted, the 2 interior lobes linear, the 3 outer lobes broadly ovate to ovate-elliptic, acutish, sometimes serrulate above the middle; corolla 6-12 mm. long, always longer than the calyx, bilabiate, yellow with longitudinal dark veins on the essentially united upper pair of lobes; capsule ellipsoid, about as long as or shorter than the calyx. *M. procumbens* (Mill.) Small, *M. peduncularis* (Benth.) Small, *M. viridis* Small, *M. montevidensis* (Spreng.) Penn., *Pagesia peduncularis* (Benth.) Penn., *P. vandellioides* (H.B.K.) Penn. In mud and water of ditches, lagoons, ponds and streams, and in moist soils of depressions, mostly in cen., s. and w. Tex., Mar.-Nov.; from Fla. to Tex., Ariz. and Mex., s. to s. S.A.

2. *Mecardonia acuminata* (Walt.) Small. Stems from a subligneous crown, erect or ascending, glabrous, simple to branched, to about 7 dm. high; leaves oblanceolate to oblong-lanceolate, mostly narrowly obtuse, tapering below to a narrowly cuneate base, firm, serrate above the middle, mostly 2-4 cm. long; pedicels filiform, equaling or surpassing the subtending leaves and 2 small basal bractlets; outer 3 sepals oblong-lanceolate, broader than the lanceolate inner 2 sepals; corolla white, often tinged or lined with purple, 7-10 mm. long, bearded within at the base of the upper obviously bilobulate lip. *Bacopa acuminata* (Walt.) Robins., *Pagesia acuminata* (Walt.) Penn. In ditches, bogs, depressions in fields and prairies, swamps and flat pinelands in e. Tex., Aug.-Oct.; from Del. and Md., s. to Fla., Tex. and Mo.

3. GRATIOLA L. HEDGE-HYSSOP

Low mostly perennial or some biennial or annual herbs; leaves sessile; two (rarely 1) bractlets usually at base of calyx; the 5 narrow divisions of calyx more or less subequal; corolla tubular or narrowly campanulate, bilabiate; upper lip of corolla entire or 2-cleft, the lower lip 3-cleft; style dilated or bilabiate at apex; capsule 4-valved, many-seeded.

About 20 species that are widely distributed.

1. Plant villous-hirsute; anthers with contiguous vertical cells; flowers subsessile; calyx lobes very unequal; corolla only slightly exceeding the calyx 1. *G. pilosa*.
1. Plant glabrous or at most puberulent; anthers with a broad connective, the cells transverse; flowers mostly distinctly pedicellate; calyx lobes equal or nearly so; corolla much-exceeding the calyx (2)
- 2(1). Capsule 1-3 mm. long, much-exceeded by the calyx lobes; cauline leaves clasping by a wide base, usually at least the upper with resinous dots; rhizomes perennial, slender, stoloniferous 2. *G. brevifolia*.
2. Capsule 3-6 mm. long, equal to or only slightly exceeded by the calyx lobes; cauline leaves narrowed to a sessile or scarcely clasping base, obscurely glandular-punctate; roots annual, the main root thick and producing many fibers (3)
- 3(2). Corolla golden-yellow (especially the limb); capsule ovoid-pyramidal, nearly twice as long as calyx lobes; stem less than 1 dm. high, thin, not fleshy; in central and south Texas 3. *G. flava*.
3. Corolla white (at least as to the limb); capsule globose to globose-ovoid, nearly or quite equaled by the calyx lobes; stems usually more than 1 dm. high, relatively thick and fleshy, mostly in east Texas (4)
- 4(3). Pedicels slender, over 1 cm. long; hairs on upper side of corolla throat clavate; capsule 4-5 mm. long, globose-ovoid, about equal to the calyx lobes 4. *G. neglecta*.
4. Pedicels stout, mostly much less than 1 cm. long; hairs on upper side of corolla throat filiform; capsule globose, usually slightly exceeding the calyx lobes 5. *G. virginiana*.

1. *Gratiola pilosa* Michx. HAIRY HEDGE-HYSSOP. Perennial, the firm tufted stems from a subligneous crown, villous-hirsute, to 75 cm. high; leaves sessile by broad rounded clasping bases, to about 2 cm. long, ovate to ovate-lanceolate, crenate-serrate; flowers subsessile or very short-stalked in the axils; calyx segments very unequal; corolla white or purple-tinged, 5-9 mm. long, little-exceeding the calyx; anthers with contiguous vertical cells; capsule 4-5 mm. long, slenderly conical. *Sophronanthe pilosa* (Michx.) Small, *Tragiola pilosa* (Michx.) Small & Penn. In bogs, swamps and moist sandy woods in e. third of Tex., June-Aug.; from Fla. to Tex., n. to N.J., Md., N.C., Ky., Ark. and Okla.

2. *Gratiola brevifolia* Raf. STICKY HEDGE-HYSSOP. Annual or short-lived perennial, puberulent and somewhat viscid, to about 35 cm. high; leaves lanceolate to linear-lanceolate, acute to acuminate, sparsely and acutely serrate, to 35 mm. long and 1 cm. wide, equal to or shorter than the pedicels; sepals and bractlets linear-subulate, much longer than the capsule; corolla whitish, 1-1.2 cm. long; sterile filaments short. *G. ramosa* [var.] *Drummondii* (Benth.) Penn., *G. Drummondii* Benth., *Ilysanthes inaequalis* (Walt.) Penn. In bogs, marshes, wet meadows and in and on the edge of water in ponds and lakes in e. Tex., Apr.-Sept.; from Ga. to Tex. and Ark.

3. *Gratiola flava* Leavenw. GOLDEN HEDGE-HYSSOP. Annual, glabrous throughout, less than 1 dm. high, the slender stems clustered at base and erect-ascending; leaves few, opposite, linear-oblancoate, entire or with few obscure serrations, to 15 mm. long and 5 mm. wide, clasping at the sessile base, obtuse at apex; bracteole 1, linear-spatulate, about as long as the sepals; calyx lobes 3-5 mm. long, linear to linear-lanceolate, obtuse; corolla with orange-yellow tube and golden-yellow limb, about 12 mm. long; capsule brown, ovoid-pyramidal, noticeably exceeding the sepals; seeds brown, with coarse reticulations. *G. pusilla* Torr. In sandy soil in prairies and fields in cen. and s. Tex., Feb.-Apr.; also La.

4. *Gratiola neglecta* Torr. Annual with simple or loosely branched soft stem to 4 dm. high, the upper internodes, pedicels and expanding leaves more or less clammy-puberulent; leaves thin, rhombic-lanceolate to lanceolate, tapering to base and apex, undulate-dentate or entire, to 55 mm. long; pedicels filiform, elongating to 25 mm. long; bractlets foliaceous, equal to or exceeding the calyx; corollas honey-color to creamy-white, with yellowish tube, the earlier ones 8-12 mm. long, the inside of the throat with clavate beard-

ing; sterile stamens minute or none; capsule 3-5 mm. long, globose-ovoid; seeds thick-cylindric, about 0.5 mm. long. *G. gracilis* Benth., *G. Torreyi* Small. In wet or muddy places about ponds and in woods in e. third of Tex., Mar.-June; from Que. and Me. to B.C., s. through most of the U.S.

5. *Gratiola virginiana* L. Rather coarse plant, the fleshy base often biennial; stems simple or with few ascending branches, to 45 cm. high, usually glabrous; leaves lanceolate to elliptic or oblong-obovate, shallowly undulate to sharply serrate, to 7 cm. long; pedicels stoutish, usually less than 5 mm. long; calyx 4-8 mm. long; corolla milk-white or pink-tinged to honey-colored, the earlier ones to 15 mm. long, with filiform hairs inside at throat; capsule globose, slightly exceeding to shorter than the calyx, 4-7 mm. long; seeds slender-cylindric, about 0.8 mm. long. In water of streams, lakes, ponds and ditches, in boggy areas and in open flats in forest in e. third of Tex., Mar.-May; from Fla. to Tex., n. to N.J., Md., W.Va., O., Ind., Ia. and Kan.

4. STEMODIA L.

Herbs or low shrubs, mostly glandular-pubescent and odorous; leaves opposite or verticillate, sessile and clasping; flowers solitary in axils or in terminal often leafy-bracted spikes or racemes; pedicels 2-bracteolate; calyx 5-parted, the imbricated sepals nearly distinct and equal; corolla with a subcylindric tube and a bilabiate limb, the erect upper lip notched or entire, the lower lip 3-lobed; stamens 4, didynamous, included; filaments filiform, the anther sacs distinct and stipitate; capsule attenuate, bivalved, the valves 2-cleft; seeds small, striate, tuberculate.

About 30 species, mostly in tropical regions.

1. Foliage white-woolly; stems and branches prostrate or procumbent, often long-trailing; flowers essentially sessile 1. *S. tomentosa*.
1. Foliage merely minutely glandular-pubescent, viscid; stems and branches erect or ascending; flowers distinctly pedicellate (2)
1. Foliage white-woolly; stems and branches prostrate or procumbent, often long-trail-narrowly lanceolate; corolla less than 1 cm. long ... 2. *S. durantifolia*.
2. Stems and branches weakly ascending; leaves of a cuneate type, obtuse; calyx lobes linear; corolla more than 1 cm. long 3. *S. Schottii*.

1. *Stemodia tomentosa* (Mill.) Greenm. & Thomps. WOOLLY STEMODIA. Perennial, the herbage white woolly-lanose, not glandular; stems more or less branched with the branches prostrate or procumbent, often long-trailing and rooting at nodes, to 4 dm. long or more; leaves oblong-elliptic to elliptic-obovate, cordate and clasping at base, obtuse to rounded at apex, the upper margins dentate to crenate-serrate, to 4 cm. long, usually much smaller; flowers nearly sessile; bractlets subulate, much less than half as long as the subulate calyx lobes; corolla 7-8 mm. long, purplish or bluish-purple, the throat whitish with violet veins; seeds black, ovoid. *S. lanata* R. & P. In dunes and sandy soils on slopes, in scrublands and plains, mainly along the coast and in the Rio Grande Plains of s. Tex., rare in s. Trans-Pecos, Apr.-Aug.; also adj. Mex.

2. *Stemodia durantifolia* (L.) Sw. Annual, glandular-pubescent, rather rigidly erect, often much-branched, the branches slender, to about 9 dm. high; leaves sessile and amplexicaul, opposite or several at the nodes, oblong-elliptic to linear-oblong or linear-lanceolate to oblanceolate, the upper ones linear, acute to acuminate or obtuse at apex, serrate or serrulate, those of the stem to 9 cm. long, with narrowed bases; flowers nearly sessile, solitary in the axils or in spiciform leafy-bracted racemes; bractlets 2, linear, shorter than the calyx; sepals about 5 mm. long, lanceolate, acuminate; corolla blue or purple, glandular-pubescent, longer than the calyx. In wet soil along streams in s. Tex., Feb.-Oct.; from Calif. to Tex., southw. in Latin Am.

3. *Stemodia Schottii* Holz. Annual with woody base or perennial, to about 25 cm. high, diffusely slender-branched with the stem and branches weakly spreading-ascending, minutely stipitate-glandular throughout, viscid; leaves sessile, narrowly cuneate to cuneate-obovate and more or less auricled at the clasping base, coarsely toothed above the base, obtuse at apex, 2 cm. long or less; flowers single in axils of upper leaves that are only slightly (if at all) smaller than those on lower part of stem; pedicels 3-5 mm. long,

with 2 linear bracts below calyx; calyx lobes narrowly linear, about as long as pedicel; corolla 12-15 mm. long, the tube dilated upward, blue at the limb, yellow on the underside and toward base of tube, somewhat hairy on inner surface, the large upper lobe outermost; longer pair of stamens reaching the small notches in the corolla limb; capsule slightly shorter than calyx lobes; seeds light-brown, cylindric. In open thickets, roadside ditches and fields in s. Tex., throughout the year; also Tam.

5. LEUCOSPORA Nutt.

A monotypic genus.

1. *Leucospora multifida* (Michx.) Nutt. Low much-branched annual herb, diffusely spreading, to about 2 dm. high and about as wide, puberulent throughout; leaves opposite, petioled, triangular-ovate in outline, 2-3 cm. long, pinnately parted, the divisions oblong to linear-cuneate; pedicels naked, solitary in axils, 5-10 mm. long; calyx 5-parted, the sepals linear; corolla tubular, bilabiate, pale-lavender, about 4 mm. long, scarcely exceeding the calyx, upper lip bilobed, the lower lip 3-parted; anthers approximate; stigma bilobed, the lobes cuneiform; capsule ovoid, septicial, many-seeded. *Conobea multifida* (Michx.) Benth. In mud and sand-gravel along streams and on shores, mostly in cen. and e. Tex., June-Oct.; from Ont. to Ia. and Kan., s. to Ga., Ala., La. and Tex.

6. LIMNOPHILA R. BR.

About 30 species that are native mainly in Africa and Australia.

1. *Limnophila sessiliflora* Bl. Aquatic glabrous herbs with mostly branched leafy stems that are to 5 dm. long or more; leaves 3 to 6 in a whorl, all pinnatisect or the uppermost opposite, linear-spatulate and toothed, gland-dotted, usually 2-2.5 cm. long; flowers axillary, solitary, sessile or very shortly pedicelled; calyx about 8 mm. long, with 5 ovate acuminate lobes, the tube hemispheric in fruit; corolla about 12 mm. long, pink or lavender-pink, bilabiate, the upper lip entire or bifid, the lower lip nearly equally 3-lobed and spreading, the tube cylindric; capsule orbicular, swollen, about 5 mm. thick. Attached to bottom of lake and in current of river at San Marcos (Hays Co.) where it has been introd. and has become well-established, July-Nov.; a nat. of Asia.

7. SCOPARIA L. BROOMWORT

About 20 species, mostly in tropical America.

1. *Scoparia dulcis* L. SWEET BROOMWORT. Annual, glabrous, to 1 m. high, often much-branched, the branches slender; leaves short-petioled, ovate to elliptic-lanceolate, opposite or verticillate in threes or fours, coarsely serrate or the upper ones subentire, acute at apex, narrowed or cuneate at base, punctate, the lower leaves 2-4 cm. long; pedicels filiform, as long as the upper leaves or shorter, often borne in most of the axils; sepals 4, oblong to oblong-obovate, acute, sometimes ciliate, about 1.5 mm. long; corolla white or light lavender, 3-4 mm. broad, essentially rotate, 4-cleft, densely bearded in throat, its obtuse lobes nearly equal; stamens 4, subequal, the filaments filiform, the distinct anther sacs parallel or divergent, style clavate above, the stigma truncate or notched; capsule globose-ovoid, slightly longer than sepals, septically dehiscent, its entire valves membranous; seeds numerous, angular. In disturbed soils and moist or dry soils in open woods in e. Tex., Apr.-Nov.; from s. U.S. to S.A.; also Old World trop.

8. MIMULUS L.¹⁷⁷ MONKEY-FLOWER

Herbs (in ours) with perennial rhizomes or stolons; flowers axillary; calyx tubular, angled or prismatic, regular or irregular, the lobes shorter than the tube; corolla

¹⁷⁷ Adapted mainly from Adele L. Grant in Ann. Missouri Bot. Gard. 11:99-388. 1924.

irregular, bilabiate; lobes of upper corolla lip erect to reflexed; lobes of lower corolla lip spreading or deflexed, arched in the throat or with 2 elevated ridges partially or completely closing the orifice; stamens 4, didynamous, inserted near middle of corolla tube, the anthers approximate in pairs with their sacs divergent; style elongate, the stigmas 2 and platelike; capsule cylindric, loculicidal, many-seeded.

More than 100 species that are world-wide in distribution, mostly in western United States.

1. Corolla blue to white; calyx teeth essentially equal; distribution in east Texas (2)
1. Corolla yellow or purple-red; calyx teeth usually unequal with the posterior tooth larger than the others; distribution in central and west Texas (3)
- 2(1). Leaves mostly sessile; pedicels more than one half as long as the leaves 1. *M. ringens*.
2. Leaves petioled; pedicels mostly less than one half as long as the leaves 2. *M. alatus*.
- 3(1). Leaves mostly suborbicular, more or less covered with short stiff white hairs; corolla laciniately lobed or erose 3. *M. dentilobus*.
3. Leaves broadly ovate to suborbicular or elliptic-lanceolate, glabrous or nearly so; corolla lobes mostly entire (4)
- 4(3). Calyx lobes ciliate, equal; corolla about 8 mm. long, purple-red or yellow; cauline leaves elliptic-oblong to elliptic-lanceolate, narrowed to a sessile base; stem and pedicels glandular-puberulent 4. *M. rubellus*.
4. Calyx lobes not ciliate, the posterior one longest; corolla 9-16 mm. long, yellow; cauline leaves broadly ovate to suborbicular, the larger conspicuously petioled; stem and pedicels glabrous 5. *M. glabratus*.

1. *Mimulus ringens* L. Perennial by stoloniferous rootstocks, glabrous; stems simple or branched, 4-angled, to 13 dm. high; leaves thin, oblong to oblong-lanceolate, to 1 dm. long and 3 cm. wide, acute to obtuse at apex, tapering to a broad often auriculate-clasping sessile base, serrate to rarely entire; pedicels stout, to 35 mm. long, mostly shorter than the subtending leaves; calyx tubular, 14-17 mm. long, strongly angled, with slender subulate or aristate teeth about one fourth as long as tube, with broad ciliate sinuses; corolla 25-35 mm. long, blue, rarely pink or white, the exerted tube slightly funnellform, the throat nearly closed, upper lip erect and strongly reflexed, lower lip longer and the stigma broadly bilamellate; capsule included, broadly oblong; seeds oblong, papillate, spreading with the margins erose; upper pair of stamens slightly exerted; style exerted, the stigma broadly bilamellate; capsule included, broadly oblong; seeds oblong; papillate. In wet places in n.e. Tex., June-Sept.; from Can. to Fla., w. to N.D. and s. to Okla. and (?) Tex.

Reported from Texas but no material seen. It should be looked for in some of the marsh areas in northeast Texas.

2. *Mimulus alatus* Ait. Stems stoloniferous, glabrous, simple or branched, to 7 dm. high, 4-angled, the angles more or less winged; leaves broadly ovate to ovate-lanceolate, acute, to 15 cm. long and 6 cm. wide, serrate, tapering to a narrow-margined petiole to 25 mm. long; pedicels stout, mostly shorter than the calyx; calyx oblong, 14-17 mm. long, with sharp angles, the broad mucronate teeth about 1.5 mm. long; corolla blue or violet, sometimes tinged with pink or rarely white, 2-2.5 cm. long, the tube slightly exerted, the throat nearly closed, lobes of the upper lip erect and strongly reflexed, the lower lip longer and spreading; stamens and style included; capsule ovoid, obtuse; seeds oval, papillate. In wet areas (especially along wooded streams) in e. Tex., w. to Blackland Prairies, June-Nov.; from Mass., s. to S.C. and w. to Tex.

3. *Mimulus dentilobus* Robins. & Fern. Low creeping plants, rooting from the nodes and forming dense mats, the terete stems nearly glabrous or sparsely pubescent, to 5 cm. high; leaves broadly ovate to suborbicular, 2-7 mm. long, 2-5 mm. wide, dentate to crenate or nearly entire, mostly with winged petioles shorter than the blade, more or less covered with stiff white hairs; flowers few, axillary or terminal; pedicels slender, almost filiform, pubescent, much-exceeding the leaves; mature calyx turbinate, 5-7 mm. long, sparsely pubescent or rarely glabrous, with triangular acute teeth; corolla 9-13 mm.

long, the throat spotted with red below the lower lip, the lobes erose or somewhat lacinate; style puberulent or glabrous; capsule oblong, less than half as long as calyx, compressed; seeds brownish, oval, sometimes 3-sided, longitudinally striate and often bearing stiff scattered hairs. In permanently wet places in mts. of the Trans-Pecos, June-Aug.; from w. Tex. and N.M. to n. Mex.

4. *Mimulus rubellus* Gray. Annual, glandular-puberulent to almost glabrate, the erect stems often much-branched, to 2 dm. high; leaves sessile or with the lowest smaller and petioled, elliptic-oblong to elliptic-lanceolate, entire or only slightly toothed, 3-veined, to about 2 cm. long; pedicels to 22 mm. long; calyx 5-9 mm. long, often reddish, ridge-to wing-angled, its ciliate lobes low-triangular or its mucronate tips less than 0.5 mm. long; corolla yellow throughout or the lobes purple-red, 7-9 mm. long, the throat narrow, ventrally 2-ridged and puberulent, the orifice open and the slightly spreading lobes notched; anthers glabrous; capsule 4 mm. long, not dehiscing through septum apex. In moist or wet places in extreme w. Tex., Apr.-June; from w. Tex., N.M. and s. Colo. to Calif.

5. *Mimulus glabratus* H.B.K. Low perennial, glabrous or nearly so, stoloniferous or with creeping stems that root freely at the lower nodes; stems usually numerous, hollow, weak, to 75 cm. long; leaves broadly ovate to suborbicular, to 7 cm. long and 6 cm. wide, irregularly dentate, sometimes shallowly lobed at the base, 3- or 5-nerved, the basal leaves cuneate to subcordate or with margined petioles at base, upper leaves subcordate at the sessile base; flowers axillary, mainly on upper part of stem; pedicels slender, glabrous or pubescent, longer or shorter than leaves; calyx campanulate, often spotted or tinged with red, to 1 cm. long, glabrous or pubescent, larger in fruit, the broad short unequal teeth spreading; corolla tubular, to 15 mm. long, the tube slender, lower lip heavily bearded, middle lobe much longer than the lateral ones; style glabrous; capsule oblong, rounded, constricted at the base but not stipitate, shorter than the calyx tube; seeds oval, longitudinally striate. Incl. var. *Fremontii* (Benth.) Grant. In shallow water of streams or muddy places with the stems often floating or creeping and more or less procumbent, on the Edwards Plateau and in the Trans-Pecos, throughout the year; from Ont. and Man., s. to Tex., Nev. and Mex.

9. MAZUS LOUR.

About 20 species, all Australasian.

1. *Mazus japonicus* (Thunb.) O. Ktze. Plants slender, loosely pubescent, to about 2 dm. high; leaves opposite, mostly basal or near base of stem, obovate to cuneate-oblong, coarsely few-dentate, the radical leaves 2-5 cm. long; racemes loosely 2- to 7-flowered, terminal, subsecund, with minute or obsolete bracts and ebracteolate or minutely bracteolate alternate pedicels 5-7 mm. long; calyx lobes 5, ovate-lanceolate, equaling the campanulate tube; corolla 7-10 mm. long, scarcely twice the length of calyx, with slightly bifid erect upper lip, the 3-lobed lower lip much larger, with 2 gibbosities at throat, blue, the yellow or whitish palate bordered by reddish-brown; style with 2 ovate lobes; fertile stamens 4, the contiguous anther cells divaricate; capsule 3-4 mm. long, somewhat globose, shorter than calyx, with 2 entire valves. In grasslands and along roadsides in e. Tex., Mar.-Oct.; from Pa. to Mo., La. and Tex.; also Pac. slope; naturalized from e. Asia.

10. LINDERNIA ALL.

FALSE PIMPERNEL

Diffuse annual herbs; leaves opposite, denticulate to nearly entire; bracteoles none; flowers in axils of most leaves; sepals 5, distinct; corolla blue-violet, bilabiate, the upper lip with 2 short erect acutish lobes, the lower lip much larger and spreading, with 2 hairy yellow ridges within the throat; filaments 4, didynamous, the upper short and antheriferous, the lower forming the hairy ventral ridges of the corolla and projecting from apex as sterile knobs; stigmas distinct, lamelliform; capsule septicidal, ovoid to ellipsoid, the septum persisting as a thin plate; seeds smooth or finely lined transversely.

About 80 species, mainly in warm regions of Asia and Africa.

- 1. Lower pedicels shorter than their subtending leaves; main leaves obovate to elliptic or ovate, rounded or narrowed to base; capsule often equaled or exceeded by the calyx lobes1. *L. dubia*.
- 1. Lower and upper pedicels exceeding their subtending leaves; main leaves ovate to elliptic, broadest at the rounded to cordate base; capsule mostly exceeding the calyx lobes2. *L. anagallidea*.

1. *Lindernia dubia* (L.) Penn. Plant glabrous, the simple or much-branched stems erect-ascending, to 35 cm. high; leaves narrowly elliptic to oblong or obovate, to 3 cm. long, the lower ones narrowed but the upper ones rounded and clasping at base, entire to remotely dentate; pedicels 5-12 mm. long, stoutish; calyx lobes linear; corolla 7-10 mm. long, those of the later flowers mostly falling unopened; style 2.5-3.5 mm. long; capsule obliquely ellipsoid, about 4 mm. long. Incl. subsp. *major* Penn., *Ilysanthes gratioloides* (L.) DC., *I. dubia* (L.) Barnh. In mud of swamps and stream margins in e. Tex., June-Aug.; from throughout most of U.S., s. to S.A.

2. *Lindernia anagallidea* (Michx.) Penn. Plant glabrous, the slender stems diffusely branched, to about 2 dm. high; leaves ovate to ovate-elliptic, to 2 cm. long, broadest at the rounded or clasping base, the lowermost leaves often slightly narrowed at base, essentially entire; pedicels filiform, to about 25 mm. long; calyx lobes linear; corolla 7-9 mm. long, apparently all opening; capsules 4-5 mm. long. Sandy margins of streams and ponds throughout most of Tex. except the Trans-Pecos, Apr.-Oct.; from throughout most of the U.S., s. to S.A.

11. MICRANTHEMUM MICHX.

Two species in the Western Hemisphere.

1. *Micranthemum umbrosum* (Walt.) Blake. SHADE MUD-FLOWER. Stems repent, freely branched, to 3 dm. long or more; leaves sessile, opposite, succulent, rotund, 4-9 mm. wide; flowers small, white or purplish, solitary in the axils of some of the middle leaves; pedicels to 1 mm. long; calyx 1.5-2 mm. long, equally 4-cleft into oblanceolate lobes; corolla obliquely salverform, barely equaling the calyx, the 4-lobed limb longer than the tube with upper lip developed; appendage of the 2 stamens a mere tooth, the filaments with an appendage; stigmas short; capsule about 1 mm. in diameter, globose, thin, with an evanescent partition, several- to many-seeded. *Globifera umbrosa* (Walt.) J. F. Gmel. On mud or wet sand in low woods and along streams in e. Tex., Apr.-Sept.; from Fla. to Tex., n. to Va.; also trop. Am.

12. VERBASCUM L. MULLEIN

Tall and usually coarse hairy biennial herbs; leaves in radical rosettes and alternate cauline, those of stem sessile and often decurrent; flowers in large terminal spikes, racemes or panicles, ephemeral; calyx deeply 5-parted; corolla 5-lobed, open or concave, with very short tube, the lobes broad and rounded, somewhat asymmetrical; stamens 5, all fertile, with 3 or all of the filaments villous; style flattened at the apex; capsule globular, ovoid to ellipsoid, septicidal, many-seeded.

About 300 species that are native mainly in North Temperate Eurasia.

- 1. Plants tomentose to woolly or scurfy with branching nonglandular hairs; only upper filaments villous with slender yellow hairs; capsule ovoid to ellipsoid, densely tomentose1. *V. Thapsus*.
- 1. Plants glabrous and green or with glandular simple hairs; filaments all villous with violet hairs; capsule subglobose, minutely pubescent to glabrate (2)
- 2(1). Pedicels 10-15 mm. long, longer than calyx; flowers solitary2. *V. Blattaria*.
- 2. Pedicels 3-5 mm. long, shorter than calyx; flowers as many as 5 together3. *V. virgatum*.

1. *Verbascum Thapsus* L. FLANNEL MULLEIN, COMMON MULLEIN. Plant densely grayish- or brownish-woolly throughout; stem erect and stout, simple, to about 2 m. high, winged by the decurrent bases of the leaves; lower leaves petioled, oblong to oblanceolate, to about 3 dm. long, the upper leaves sessile and progressively smaller; flowers in an elongate and very dense cylindrical spike to 5 dm. long; corolla yellow, 1.5-3 cm. broad; lower filaments usually beardless. In fields, on rocky or gravelly banks and in open woodlands throughout most of Tex., Mar.-Nov.; adv. from Eur. in much of N.A.

2. *Verbascum Blattaria* L. MOTH MULLEIN. Plant green, glabrous below and somewhat glandular-pubescent above, to about 1 m. high, the stems slender; lower leaves petioled, oblong, to 25 cm. long, sometimes lyrate, doubly serrate, the upper leaves partly clasping; racemes loose, virgate; pedicels longer than the calyx; sepals linear-elliptic, subacute; corolla 2-3 cm. broad, yellow or white with purplish base [f. *albiflora* (C. Don) House]; filaments all bearded with violet wool. Roadsides and old fields in e. Tex., Mar.-Aug.; from N.E. to Ont., s. to Fla. and Tex.; adv. from Eur.

3. *Verbascum virgatum* Stokes. Similar to *V. Blattaria* but more glandular, early-withering; pedicels 1 to 5 in the axil of each bract, much shorter than the calyx lobes; corolla yellow or whitish. Along roadsides in e. Tex., Mar.-Aug.; from Can. s. to Tex. and westw.; adv. from Eur.

13. LEUCOPHYLLUM H. & B. CENIZO

Low and much-branched shrubs, mostly densely scurfy-tomentose with usually silvery-white branched woolly hairs; leaves alternate, entire, subsessile to shortly petioled; flowers showy, solitary on short bractless pedicels in the leaf axils; calyx 5-cleft; corolla funnelform-campanulate, usually purplish or violet-purple, rarely whitish, the 5 rounded lobes subequal; stamens 4.

More than a dozen species in southwestern United States and Mexico. The species usually flower in response to rainfall.

1. Corolla purple, its throat relatively inflated, 1-1.5 cm. long, only the lower lobes hairy within; anther cells 1.5 mm. long, distally narrowed; leaves elliptic-obovate, closely pubescent, to 25 mm. long, the midrib evident 1. *L. frutescens*.
1. Corolla violet, its throat narrow, less than 1 cm. long, all the lobes somewhat hairy within; anther cells to 1 mm. long, not narrowed distally; leaf blades with obscure midribs (2)
- 2(1). Leaf blades longer than wide, cuneate-spatulate, closely pubescent, usually 7-10 mm. long; corolla lavender-violet, the upper much less hairy than the lower lobes; old branches tending to persist as spines 2. *L. minus*.
2. Leaf blades about as wide as long, obovate-oval, relatively loosely pubescent, 5-18 mm. long; corolla deep violet, all its lobes hirsute; old branches less spinelike ... 3. *L. candidum*.

1. *Leucophyllum frutescens* (Berl.) I. M. Johnst. CENIZO, PURPLE SAGE, TEXAS SILVER-LEAF. Shrub to about 25 dm. high, densely stellate-tomentose throughout; leaves sessile or nearly so, elliptic-obovate, to about 25 mm. long, obtuse to rounded at apex, cuneate at base; calyx lobes oblong-lanceolate; corolla almost campanulate, its limb about 25 mm. wide, delicately soft-villous within. *L. texanum* Benth. Rocky limestone hills, bluffs, ravines, arroyos and brushlands in the Rio Grande Plains and s. Trans-Pecos, throughout the year; also Mex.

2. *Leucophyllum minus* Gray. BIG BEND SILVER-LEAF. Small shrub to about 1 m. high, usually much smaller, finely stellate-tomentose throughout; leaves minutely silvery-canescens, greenish, obovate-spatulate with a long-tapering base, rounded at apex, to 15 mm. long, usually much smaller; calyx-lobes linear; corolla lavender or purplish, 18-25 mm. long, with narrow and funnelform tube and a throat that much-exceeds the limb (about 14 mm. in diameter), sparsely pubescent within. Rocky or gravelly hills, flats and brushlands in the Trans-Pecos; June-Nov.; also N.M. and Mex.

3. *Leucophyllum candidum* I. M. Johnst. Shrub to about 12 dm. high, stiffly and intricately closely branched, the branches leafy to apex, the young growth tomentose-

silvery or faintly yellowish; leaves obovate-oval to nearly orbicular, with obscure midrib, 5-18 mm. long, cuneate to a sessile base; pedicels to 3 mm. long; sepals 3-5 mm. long, lanceolate to ovate, obtuse, in fruit incurved around the capsule; corolla 1-1.8 cm. long, deep-violet, the throat purplish-violet, anteriorly pale and with orange-yellow blotches, externally pubescent, internally hirsute-pubescent on all lobes; anther cells each 0.7-1 mm. long, oblong, rounded, not tapering distally. *L. violaceum* Penn. Rocky or gravelly hills and flat brushlands in Brewster Co., Sept.-Oct.; also Mex.

14. PENSTEMON MITCH.¹⁷⁸ **BEARD-TONGUE**

Herbs or shrubs; leaves opposite, decussate, the lower often petiolate, the upper sessile; pubescence (if present) glandular in the inflorescence, simple below; inflorescence usually a narrow terminal panicle; sepals 5; corolla tubular, the upper lip 2-lobed, the lower lip 3-cleft, the lower inner surface (floor) of the throat and tube often with colored lines; stamens 4; staminode 1, filamentlike, often bearded apically; anthers 2-chambered, these confluent if dehiscent across the connective; capsules septicidal or else 4-valved; seeds many, usually multiangular, with a rough coat. Flowering from spring to fall.

About 300 species; indigenous to America from Alaska to Guatemala.

- 1. Shrubs (2)
- 1. Herbs (3)
- 2(1). Flowers red, campanulate; leaves toothed, oblanceolate to obovate; stem puberulent; inflorescence densely glandular-pubescent; on limestone bluffs 1. *P. baccharifolius*.
- 2. Flowers white or pinkish, salverform; leaves entire, linear; stem and inflorescence glabrous; in sandy soils 2. *P. ambiguus*.
- 3(1). Leaves thick and fleshy, glaucous (4)
- 3. Leaves not thick and fleshy, not glaucous (10)
- 4(3). Flowers red or pink (5)
- 4. Flowers blue or lavender (8)
- 5(4). Orifice of corolla golden-bearded; anther sacs incompletely dehiscent 8. *P. cardinalis* subsp. *regalis*.
- 5. Orifice of corolla glabrous; anther sacs dehiscent throughout (6)
- 6(5). Corolla 14-19 mm. long; staminode pubescent apically 6. *P. Wrightii*.
- 6. Corolla 20-30 mm. long; staminode glabrous (7)
- 7(6). Upper leaves connate-perfoliate; corolla ventricose, the lower lip surpassing or equaling the upper 9. *P. Murrayanus*.
- 7. Upper leaves merely sessile; corolla straight, the upper lip projecting past the lower 7. *P. Havardii*.
- 8(4). Corolla 40-50 mm. long, well-inflated; sepals 7-9 mm. long 10. *P. Bradburii*.
- 8. Corolla 12-20 mm. long; sepals 4-7 mm. long (9)
- 9(8). Leaves and bracts mostly longer than the internodes; inflorescence leafy, the bracts mostly longer than the pedicels 11. *P. Buckleyi*.
- 9. Leaves and bracts shorter than the internodes; inflorescence bare, the bracts mostly shorter than the pedicels 12. *P. Fendleri*.
- 10(3). Corolla red; staminode glabrous (11)
- 10. Corolla blue, white, lavender, rose or pink; staminode hairy (except in *P. dasyphyllus*) (13)

¹⁷⁸ Contributed by Frank S. Crosswhite.

- 11(10). Stem and leaves glabrous; inflorescence glabrous; anther sacs opening from the free ends, remaining saccate at the connective; upper corolla lip projecting past the lower lip 3. *P. barbatus*.
11. Stem and leaves pubescent or puberulent; inflorescence glandular-pubescent; anther sacs not opening from the free ends, not saccate; lower lip up to or exceeding the upper lip (12)
- 12(11). Leaves entire; sepals 5-7 mm. long; anther sacs not peltate-explanate 4. *P. lanceolatus*.
12. Leaves toothed to subentire; sepals 8-9 mm. long; anther sacs peltate-explanate ... 15. *P. triflorus*.
- 13(10). Corolla blue; staminode glabrous; anther sacs twisted, the sutures with long teeth 5. *P. dasyphyllus*.
13. Corolla white, lavender, rose or pink; staminode hairy; anther sacs peltate-explanate or cymbiform, the sutures without long teeth (14)
- 14(13). Seeds 1.5 mm. or less long; herbage glabrous or lightly puberulent (15)
14. Seeds 2-3 mm. long; herbage pubescent or strongly puberulent (18)
- 15(14). Floor of corolla strongly pleated; staminode densely bearded with golden hairs for most of its length, exerted 23. *P. laxiflorus*.
15. Floor of corolla rounded; staminode more lightly bearded with yellow hairs, included (16)
- 16(15). Corolla pink, 15-17 mm. long; leaves regularly sharply but shallowly toothed 20. *P. tenuis*.
16. Corolla white, 16-30 mm. long; leaves subentire or unevenly toothed (17)
- 17(16). Corolla trumpet-shaped, the lobes spreading 22. *P. tubaeflorus*.
17. Corolla ventricose, abruptly expanded, the lobes extending 21. *P. Digitalis*.
- 18(14). Corolla 35-60 mm. long, widely inflated; leaves 25-50 mm. wide 13. *P. Cobaea*.
18. Corolla 10-35 mm. long, bell-shaped or moderately inflated; leaves 2-30 mm. wide (19)
- 19(18). Corolla 10-20 mm. long, bell-shaped (20)
19. Corolla 20-35 mm. long, moderately inflated (21)
- 20(19). Leaves roughly pubescent, resembling fine sandpaper to the touch 19. *P. albidus*.
20. Leaves glabrous or puberulent, not rough to the touch .18. *P. guadalupensis*.
- 21(19). Corolla lavender to purple, 20-30 mm. long; leaves of the midstem 0.2-2 mm. wide (22)
21. Corolla pink or rose, 30-35 mm. long; leaves of the midstem 1.5-3 mm. wide 14. *P. Helli*.
- 22(21). Lower lip of corolla lightly bearded; sepals 5-8 mm. long; leaves of the midstem 2-10 mm. wide 16. *P. brevibarbus*.
22. Lower lip of corolla prominently bearded; sepals about 10 mm. long; leaves of the midstem 9-20 mm. wide 17. *P. Jamesii*.

1. *Penstemon baccharifolius* Hook. Shrub 1.5-4 dm. tall; stem puberulent below, densely glandular-pubescent above and in the inflorescence; leaves of the midstem 5-30 (-40) mm. long, oblanceolate to obovate; corolla scarlet-red, 22-27 mm. long, gradually expanded; sepals densely glandular-pubescent, about 5 mm. long; anther sacs opening from the fixed ends, the free ends remaining somewhat saccate; staminode glabrous; capsules 7-10 mm. long; seeds 1.5-2 mm. long. Limestone bluffs of the Edwards Plateau and Trans-Pecos, June-Sept.; also adj. Mex.

2. *Penstemon ambiguus* Torr. PINK PLAINS PENSTEMON. Shrub 1.5-5 (-15) dm. tall, to 18 dm. in diameter, the stem and leaves minutely pubescent or glabrous; leaves entire, linear, (5-) 10-25 (-40) mm. long, 0.5 mm. wide; inflorescence glabrous; corolla white,

suffused with pink, 17-28 mm. long, the very narrow tube about two thirds the total length of the corolla, the lower lip projecting, the upper lip reflexed, the floor lined with red, the orifice puberulent; sepals 2-3 mm. long; staminode glabrous; capsules 6-8 mm. long; seeds 1 mm. \times 2 mm. Sandy soil in the Trans-Pecos and on the Llano Estacado and Rolling Plains in the Panhandle, May-Aug.; from Colo. to Chih.

3. *Penstemon barbatus* (Cav.) Roth. Plants (2-) 4-7 (-15) dm. tall, the stem and leaves glabrous or very lightly puberulent; leaves entire, those of the stem narrowly lanceolate, 4-8 (-15) cm. long, less than 1 cm. wide; inflorescence glabrous; corolla scarlet-red, 28-32 mm. long, straight or gradually expanded, the upper lip projecting, the lower lip deffected, usually with a few yellow hairs at the orifice, the floor with deep red lines; sepals 5-6 mm. long; anther sacs opening from the free ends, remaining saccate, the dehiscence not proceeding to the connective; staminode glabrous; seeds 1.5-2 mm. long. Throughout the Trans-Pecos, mid-June-Sept.; widespread in cen. Rocky Mts. and Mex.

Typical specimens of *P. barbatus* from Mexico have a prominent golden beard at the corolla orifice. This decreases clinally to the north. Specimens with little or no beard have been referred to var. *Torreyi* (Benth.) Gray (*P. Torreyi* Benth.). Texas specimens are intermediate.

4. *Penstemon lanceolatus* Benth. Plants 2-5.5 dm. tall, the stem and leaves puberulent or pubescent; leaves entire, those of the midstem 25-85 mm. long, 4-8 mm. wide, narrowly lanceolate; inflorescence moderately glandular-pubescent; corolla red, 25-32 mm. long, white-pubescent externally, straight; sepals 5-7 mm. long, glandular, red-margined; staminode glabrous; seeds about 2.5 mm. long. A Mex. species known from the U.S. only in the Chisos Mts., Brewster Co., July.

5. *Penstemon dasyphyllus* Gray. Plants 20-45 cm. tall, the stem and leaves densely white-pubescent; leaves entire or occasionally toothed, those of the midstem to 65 mm. long, 4 mm. wide, narrowly lanceolate to sublinear; inflorescence glandular-pubescent; corolla blue, fading to lavender, 27-35 mm. long, moderately inflated; sepals 5-8 mm. long; staminode glabrous; anther sacs twisted, the sutures with long teeth; seeds about 2 mm. long. Restricted to Brewster Co., Apr.-May; also n. Mex., s. Ariz. and N.M.

6. *Penstemon Wrightii* Hook. Plants (3-) 4-7 (-9) dm. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem (3.5-) 5-7 (-9) cm. long, 1.5-4 (-5) cm. wide; inflorescence glabrous; corolla cerise-red or pink, 14-19 mm. long, gradually expanded to a narrow bell-shape, the floor rounded; sepals 3-5 mm. long; staminode with short retrorse hairs at tip; seeds about 1 mm. in diameter. Mts. of the Trans-Pecos, common in Jeff Davis Co., Apr.-June; endemic.

7. *Penstemon Havardii* Gray. Stems several from a crown, commonly 1-2 m. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem 5-10 cm. long, 2.5-7 cm. wide; inflorescence commonly much-branched; corolla red (drying to yellow), 2-3 cm. long, straight and tubular, the upper lip projecting, the lower lip glabrous; calyx and pedicels lightly glandular-pubescent; anther sacs peltate-explanate; staminode glabrous; seed to 2.5 mm. long when mature, black. Mts. of the Trans-Pecos, common in Brewster Co., Apr.-Oct.; endemic.

8. *Penstemon cardinalis* Woot. & Standl. subsp. *regalis* (A. Nels.) Nisbet & Jackson. Plants mostly 4-6 dm. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem 5-6 cm. long, 4-5 cm. wide, cordate, widely ovate or suborbicular; inflorescence glabrous; corolla scarlet-red, 26-30 mm. long, the upper lip projecting, the lower lip densely bearded with golden hairs; anther sacs opening from the free ends, remaining somewhat saccate, not dehiscing quite to the connective, spinose on the suture; staminode glabrous; capsule eventually prominently 4-valved; seeds 1.5-2.5 mm. long. Endemic to the Guadalupe Mts. of Culberson Co., Tex. and Eddy Co., N.M., May-July.

9. *Penstemon Murrayanus* Hook. Plants 5-10 (-15) dm. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem 5-10 cm. long, 2.5-5 cm. wide, connate-perfoliate above; inflorescence glabrous; corolla bright-red, about 3 cm. long, gradually expanded; sepals 5-7 mm. long; staminode glabrous; capsules 14-18 mm. long, including a beak about 5 mm. long; seeds 3-4 mm. long. Sandy soil throughout e. Tex. and in adj. parts of Okla., Ark. and La., Apr.-May.

10. *Penstemon Bradburii* Pursh. Plants 8-12 dm. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem 3-8 cm. long, 2.5-5 cm. wide;

inflorescence glabrous; corolla lavender, rarely white, 4-5 cm. long, well-inflated; sepals 7-9 mm. long; anther sacs dehiscent throughout but not at all explanate; staminode with short golden hairs at the dilated tip. *P. grandiflorus* Nutt. Sandy soil of the n. Great Plains States, s. to a few scattered stations in Tex., Apr.-May.

11. *Penstemon Buckleyi* Penn. Plants 4-7 dm. tall, the stem and leaves glabrous; leaves entire, thick and glaucous, those of the midstem 3-7 cm. long, 1-3 cm. wide; inflorescence glabrous, the lower bracts large and leaflike, acuminate, varicose with age; corolla lavender, 12-16 mm. long, the floor with lavender lines; sepals 4-5 mm. long, somewhat acuminate; staminode prominently bearded at the tip with short golden hairs; seeds 3-4 mm. long. Sand dunes of the Great Plains, w. Tex., Okla. and w. Kan., Apr.-May.

12. *Penstemon Fendleri* T.&G. Plants commonly 3-4 dm. tall, virgate, the stem and leaves glabrous; leaves entire, thick and glaucous, those just below the inflorescence 2-5 cm. long, 1-3 cm. wide; inflorescence glabrous and usually glaucous, often more than half the height of the plant; corolla 14-20 mm. long, lavender-violet or pink-lavender, often with a prominent concave curvature of the upper surface (especially in bud), the floor white with purplish lines; sepals 4-7 mm. long; anther sacs cymbiform when dehiscent; staminode prominently bearded at the tip with short golden hairs; seeds to 4 mm. long, brown. Calcareous, rocky, sandy soil throughout w. Tex., e. Ariz., N.M., Okla. and w. Kan., Apr.-Aug.

13. *Penstemon Cobaea* Nutt. FOX-GLOVE. Plants commonly 3-6 dm. tall, the stem and leaves pubescent; leaves toothed, petiolate below, sessile at midstem, those of the midstem commonly 5-8.5 cm. long, 2.5-5 cm. wide; inflorescence densely glandular-pubescent; corolla white to pale-lavender, streaked with purple lines, 35-60 mm. long, widely inflated and campanulate, the lower lip glabrous within; sepals densely glandular, commonly 7-12 mm. long; staminode usually included, moderately bearded for most of its length with retrorse yellow hairs; anther sacs dehiscent throughout and usually cymbiform; pollen golden-yellow; seeds 2-3 mm. long. Loamy soil of prairies, common from the Rolling Plains to the Blackland Prairies, s. to the Gulf, May-June; from Neb. to Tex.

14. *Penstemon Helleri* Small. Plants 3-6.5 dm. tall, the stem and young leaves lightly puberulent; leaves well-toothed, those of the midstem (3-) 5.5-9.5 (-11) cm. long, (1.2-) 1.5-3 cm. wide; inflorescence densely glandular-pubescent; corolla light-pink or rose, 30-35 mm. long, campanulate, 12-13 mm. wide when pressed, the floor lined within; sepals (8-) 9-11 mm. long, densely glandular-pubescent; staminode lightly bearded for one-half its length with yellow hairs; seeds about 3 mm. long. *P. triflorus* var. *integrifolius* (Penn.) Cory. Endemic to the Edwards Plateau, Apr.-May.

15. *Penstemon triflorus* Heller. Plants 45-65 cm. tall, the stem and leaves lightly puberulent; leaves subentire to shallowly toothed, those of the midstem 4-7.5 cm. long, 1.2-3 cm. wide; inflorescence moderately glandular-pubescent; corolla red, 25-35 mm. long, glandular within and without, narrowly ventricose, less than 1 cm. wide when pressed, the floor lined within; sepals 8-9 mm. long, densely glandular-pubescent; staminode glabrous; anther sacs peltate-explanate; seeds 3-3.5 mm. long. Endemic to the Edwards Plateau, Apr.-May.

Florally, one of our most brilliant beard-tongues.

16. *Penstemon brevisbarbatus* Crosswhite. Plants 25-55 cm. tall, the stem and leaves puberulent or glabrescent; leaves entire or occasionally toothed, those of the midstem commonly 5-14 cm. long, 2-10 mm. wide, linear to lanceolate; inflorescence glandular-pubescent; corolla lavender, 2-3 cm. long, inflated, the floor with purplish lines, the lower lip very lightly bearded; sepals 5-8 mm. long; staminode lightly bearded for most of its length; seeds about 2.5 mm. long, dark-brown. Endemic to the w. half of the Edwards Plateau and the Trans-Pecos, Apr.-June.

17. *Penstemon Jamesii* Benth. Plants 15-35 cm. tall, the stem and leaves somewhat pubescent; leaves toothed to entire, those of the midstem 5-10 cm. long, 9-20 mm. wide; inflorescence glandular-pubescent; corolla pale-lavender to purple, 20-25 mm. long, inflated, the lower lip prominently bearded within; sepals attenuate, about 1 cm. long; anther sacs dehiscent throughout and finally peltate-explanate; staminode exerted, bearded with yellow hairs for about half its length. On the Llano Estacado in the Panhandle, June; also Ariz., Colo. and N.M.

18. *Penstemon guadalupensis* Heller. Plants 25-35 cm. tall, the stem and leaves puberulent to glabrescent; leaves entire or somewhat toothed, those of the midstem 3-7

cm. long, 2-18 mm. wide, linear to lanceolate; inflorescence glandular-pubescent; corolla white or nearly so, 13-20 mm. long, gradually little-inflated, the floor with purple lines; sepals 5-7 mm. long; anther sacs dehiscent throughout but usually not peltate-explanate; staminode with a few white hairs. Incl. var. *Ernestii* (Penn.) Cory. Endemic to cen. Tex. from the e. Edwards Plateau to the Lampasas Cut Plains, Mar.-May.

19. *Penstemon albidus* Nutt. Plants (1.5-) 3-6 dm. tall, the stem and leaves roughly pubescent (like fine sandpaper to the touch); leaves entire or somewhat toothed, those of the midstem 4-8 cm. long, 8-18 mm. wide, lanceolate; inflorescence densely glandular-pubescent; corolla white to lavender, densely glandular-pubescent within and without, 1-2 cm. long, narrowly funnellform, the lower lip projecting or somewhat deflected, the upper lip reflexed, the floor with prominent purplish lines; sepals densely glandular-pubescent, 5-8 mm. long; anther sacs dehiscent throughout, hippocrepiform and then peltate-explanate; staminode with a few short yellow hairs; capsules 10-15 mm. long; seeds about 3 mm. long. Sandy rocky soil of the Great Plains; in Tex., restricted to the Llano Estacado and Gypsum Plains, Apr.-June.

20. *Penstemon tenuis* Small. Plants 4-9 dm. tall, the stem very lightly puberulent; leaves sharply but shallowly toothed, those of the midstem 7-10 cm. long, 1.5-3 cm. wide, oblong-lanceolate; inflorescence glabrous; corolla pink, 15-17 mm. long, abruptly inflated, the floor rounded, with violet lines; sepals 3-5 mm. long; staminode with yellow hairs on apical half. Uncommon in low poorly drained loamy soils, restricted to the Gulf Prairies and Marshes, Apr.-May; also La. and Ark.

21. *Penstemon Digitalis* Nutt. Plants mostly 5-9 dm. tall, the stem and leaves glabrous; leaves subentire or obviously toothed, those of the midstem mostly 9-12 cm. long, 15-25 mm. wide, lanceolate; inflorescence glabrous or a little glandular; corolla white, 16-30 mm. long, moderately ventricose, the lobes extending, the floor rounded and commonly unlined; sepals 5-6 mm. long, glabrous or a little glandular; staminode lightly bearded with yellow hairs; anther sacs cymbiform, spiny or hairy on the backs; seeds less than 1 mm. long. An Ozarkian species which has been widely spread as a weed in poorly drained soils; occasional in n.e. and e. Tex., Apr.-May.

22. *Penstemon tubaeformis* Nutt. Plant 8-15 dm. tall, the stem and leaves essentially glabrous; leaves entire or somewhat toothed, those of the midstem broadly elliptic to elliptic-lanceolate, obtuse to acute, 7-15 cm. long, 2-4 cm. wide; inflorescence glabrous; corolla white, lightly glandular within and without, 17-23 mm. long, trumpet-shaped, the lips spreading, the floor rounded, without lines; sepals 2-4 mm. long; anther sacs dehiscent throughout, hemispheric; staminode lightly bearded. An Ozarkian species which has spread as a weed elsewhere; sporadic in e. Tex., May-June.

23. *Penstemon laxiflorus* Penn. Plants 3-7 dm. tall, the stem and leaves glabrous to puberulent; leaves well-toothed, those of the midstem 3.2-10.5 cm. long, 4-17 mm. wide, narrowly lanceolate; inflorescence lightly glandular-pubescent; corolla white to pink, 22-30 mm. long, narrow, little-expanded, the floor prominently pleated, lined within; sepals 2-5 mm. long; staminode densely bearded with golden hairs for most of its length, exserted; anther sacs cymbiform; seeds 1-1.5 mm. long. Acid soils of the Gulf Coastal Plain; throughout e. Tex., Mar.-June.

15. SCROPHULARIA L. FIGWORT

About 300 species, mostly in Temperate Zone throughout the world.

1. *Scrophularia marilandica* L. CARPENTER'S SQUARE. Robust perennial herb to about 2 m. high; stem with rounded 4 angles and grooved sides, glabrous; leaves opposite, with slender petioles to 8 cm. long, lanceolate to ovate, acuminate, with strongly rounded to cordate bases, to 25 cm. long and 1 dm. wide, serrate or serrate-dentate; terminal panicle laxly pyramidal to subcylindric, with spreading ascending branches and filiform pedicels; corollas 5-8 mm. long, brown, dull, the tube ventricose and globular or ellipsoid, the 2 upper suborbicular lobes projected forward, the 2 lateral lobes short and rounded with the lowest drooping and reflexed; stamens 4, declined, usually included, the anther cells transverse and confluent into 1; rudimentary stamen brown or purplish, clavate, longer than broad, 1-1.2 mm. long; capsule globose-ovoid, 4-7 mm. long; seeds rugose, margin-

less. On river terraces in rich woods and thickets in n.e. Tex., July-Sept.; from Me. and Que. to Minn., s. to S.C., Ga., Ala., La., Tex. and Okla.

16. COLLINSIA Nutt.

About 20 species, mainly in northwest America.

1. *Collinsia violacea* Nutt. **VIOLET COLLINSIA**. Annual; stems weak, to about 6 dm. high, usually much smaller, glabrous below, often finely glandular-puberulent above; main cauline leaves oblong to lanceolate or elliptic, 1.5-4 cm. long, entire to obscurely serrate, usually widest at or near the middle; flowers parti-colored, 2 to 5 in axillary whorls; calyx lobes 5, ovate-lanceolate, 3-4 mm. long; corolla tube 4-5 mm. long, each lobe cleft to a depth of 2-3 mm., the lower lip violet-color, the upper lip pale-violet to white; fifth stamen glandlike; seeds 6 to 12, 1-1.5 mm. long, the ventral concavity small and inconspicuous. In sandy post oak woods in n.-cen. Tex., Mar.-May; from Mo. to Kan., s. to Tex.

17. LINARIA Mill. TOAD-FLAX

Erect or diffuse annual- or perennial-rooted glabrous herbs; leaves sessile, narrow and scattered; flowers in erect terminal spicate racemes, the bracts short; bracteoles none; sepals 5, distinct; corolla yellow or violet, very irregular, ventrally spurred at base, bilabiate, the lower lip often raised into a palate; stamens 4, didynamous, the glabrous anthers distinct; stigmas united, scarcely capitate; capsule ovoid to cylindrical or globose, rupturing irregularly at the summit; seeds various.

About 150 species in the Northern Hemisphere.

1. Corolla yellow, with prominent orange palate, the stout spur straight or nearly so; capsule longer than wide; seed with wide circular wing; root perennial 1. *L. vulgaris*.
1. Corolla violet or purplish-violet, with a pale palate, the slender spur decurved; capsule as wide as long; seeds cylindrical, prismatic-angled; root annual or biennial (2)
- 2(1). Surfaces and rounded angles of seeds densely tuberculate; corolla over 1 cm. long (excluding spur which is 5-9 mm. long) 2. *L. texana*.
2. Surfaces of seeds smooth or sparsely tuberculate, the angles thin and usually sharp; corolla less than 1 cm. long (excluding spur which is 2-6 mm. long) 3. *L. canadensis*.

1. *Linaria vulgaris* Mill. **BUTTER-AND-EGGS**. Strong-scented perennial spreading by rhizomes, with stems to 1 m. high; leaves numerous, pale-green, linear, to about 5 cm. long and 4 mm. wide; flowers numerous in a compact spike; corolla 1.5-2 cm. long (excluding the spur), its orifice closed by the palate; capsule 9-12 mm. long, rupturing near apex; seeds 1.5 mm. wide, flattened. Rare in n.-cen. Tex., Mar.-Sept.; nat. of Euras. that has become established in various parts of N.A.

2. *Linaria texana* Scheele. **TEXAS TOAD-FLAX**. Annual or winter biennial, the flowering stems erect and to 7 dm. high, with short spreading prostrate branches often produced at base; leaves narrowly linear, rather sparse distally; corolla violet or nearly so, 1-1.4 cm. long (excluding spur); capsule 2.5-3.5 mm. long, rupturing one third to one half its depth; seeds with rounded densely tuberculate angles. *L. canadensis* [var.] *texana* (Scheele) Penn. In sandy soils in fields, open woods and grassy pinelands, mostly in e. two thirds of Tex., rare westw., Feb.-May; from B.C. to Mex., e. to the Atl. Coast.

3. *Linaria canadensis* (L.) Dum. **OLD FIELD TOAD-FLAX**. Annual or winter biennial, the erect flowering stem to 7 dm. high, glabrous, with short spreading prostrate sterile branches often produced at base; leaves narrowly linear, sparse distally, to about 3 cm. long; raceme congested at anthesis, later elongated; corolla violet or nearly so, 8-10 mm. long (excluding spur); capsule 2-3 mm. long, rupturing one third to one half its depth; seeds smooth or sparsely tuberculate and with sharp angles. In sandy-grassy areas in open

woodlands, rare in caliche, in e. third of Tex., Mar.-May; widespread over much of U.S. and s. Can.

18. MAURANDYA ORT.

Diffuse or twining perennial herbs; leaves subopposite to usually scattered or alternate, petiolate; flowers axillary to foliose bracts; bracteoles none; sepals 5, distinct or slightly united at base; corolla bilabiate, ventrally pouched at base, the ventral ridges prominent or united distally into a palate; stamens 4, somewhat didynamous, the anthers tending to adhere and discharge pollen together; stigmas united, small, slightly capitate; capsule globose, rupturing across the distal portion of each cell; seeds irregularly cylindrical, with many longitudinal corky-thickened wing-ridges or lines of tubercles.

About 10 species in the Western Hemisphere.

1. Pedicels 1 cm. or more long; calyx moderately accrescent in fruit, the lower portion not becoming much-thickened or strongly carinate or reticulate; corolla throat partly closed by a large hairy palate; style slender, moderately dilated below; seeds thick, corky-tuberculate; leaves seldom more than 2 cm. long, mostly as wide as or wider than long1. *M. antirrhiniflora*.

1. Pedicels less than 1 cm. long; calyx greatly accrescent in fruit, the lower portion becoming much-thickened, strongly carinate and reticulate; corolla without a palate; style flattened and broadly triangular below; seeds thin, narrowly winged; leaves to 6 cm. long, mostly longer than wide2. *M. Wislizenii*.

1. *Maurandya antirrhiniflora* Willd. SNAPDRAGON VINE. Plant glabrous, the much-branched stems diffuse and extensively twining, the petioles and pedicels also incurved and somewhat flexuous; leaves with petioles 1-3 cm. long, hastate-ovate, 15-25 mm. long and wide, both main blade and lateral lobes acuminate, narrowly cordate at base; pedicels slender, becoming 1-3 cm. long; sepals 1-1.3 cm. long, linear-lanceolate, entire; corolla 2-2.5 cm. long, its tube pale and dull, its lobes violet to purple or rarely whitish, with an upraised yellowish white dark-lined pubescent palate that partly closes the orifice; capsule about 6 mm. long; seeds brown, about 1 mm. long, irregularly corky-winged, the wings broken and some mere lines of tubercles. Climbing over shrubs and boulders and sprawling in dunes, beach areas and dry salt marshes, also limestone hills and on bluffs from the s.-coastal region, through the Rio Grande Plains to the Trans-Pecos, Feb.-Oct.; from Tex. to Calif. s. to s. Mex.

2. *Maurandya Wislizenii* Engelm. Plants glabrous, mostly low-climbing; leaves with petiole 3-5 cm. long, hastate or some of them sagittate, to about 5 cm. long, the lowest ones obtuse, the others acuminate and with pointed basal lobes; pedicels short, stout, less than 1 cm. long; sepals in anthesis linear-lanceolate, becoming in fruit triangular-lanceolate and gradually acuminate, much-enlarged, rather rigid, very veiny-reticulated and strongly saccate-carinate at base to enclose the capsule, about the length of the sword-shaped indurated style; corolla pale-blue, about 25 mm. long, with lips about half the length of the rather ample tube; capsule globose-ovoid, coriaceous; seeds compressed, oval, surrounded by a narrow entire wing, the sides chaffy-rugose. Climbing on shrubs and sprawling over dunes, limestone slopes and in plains in the South Plains and Trans-Pecos, Apr.-July; from Tex. to Ariz. and n. Mex.

19. VERONICASTRUM FABR.

Two species, one in North America, the other in Asia.

1. *Veronicastrum virginicum* (L.) Farw. CULVER'S-ROOT or -PHYSIC. Tall perennial, erect, smooth or minutely pubescent, to about 2 m. high; leaves mostly in whorls of 3 to 7, lanceolate to ovate-lanceolate, acuminate, sharply serrate, glabrous to villous beneath, those of midstem to about 12 cm. long and 3 cm. wide; spikes paniced, terminal, erect, to 15 cm. long, with numerous crowded divergent bracted flowers; calyx deeply 4- or 5-parted; corolla salverform, the tube much longer than the lobes, white or purplish, 7-9 mm. long; stamens and style much-exserted, the 2 stamens inserted low on the tube;

capsule narrowly ovoid, turgid, 4-5 mm. long; seeds numerous, terete, minutely reticulated. *Veronica virginica* L. In rich woodlands in n.e. Tex., June-Sept.; from N.E. to Man., s. to Fla., Miss., La. and Tex.

20. VERONICA L. SPEEDWELL

Erect or repent perennial, biennial or annual herbs; leaves mostly opposite; bracteoles none; flowers in axillary or terminal racemes or solitary in axils of leaves; sepals 4 or 5, distinct; corolla with very short tube, nearly rotate, 4-lobed due to fusion of upper pair; stamens 2; stigmas united and slightly capitate; capsule flattened, loculicidal; seeds flattened, smooth or rarely roughened.

About 300 species, mostly in the North Temperate Zone.

- 1. Flowers in axillary racemes (2)
- 1. Flowers in terminal racemes or solitary in leaf axils (3)
- 2(1). Leaves of flowering stems noticeably petioled; flowers usually less than 30 per raceme; corolla light bluish-violet1. *V. americana*.
- 2. Leaves of flowering stems sessile with at least the upper ones cordate-clasping; flowers usually more than 30 per raceme; corolla lavender and violet2. *V. Anagallis-aquatica*.
- 3(1). Flowers in racemes, essentially sessile, the bracts often passing gradually into the leaves but the uppermost ones usually very different from them (4)
- 3. Flowers distinctly pedicelled, solitary in axils of leaves resembling the cauline leaves but the uppermost ones sometimes smaller (5)
- 4(3). Bracts all much longer than flowers; corolla whitish .3. *V. peregrina*.
- 4. Bracts (at least the upper ones) shorter or scarcely longer than flowers; corolla bluish4. *V. arvensis*.
- 5(3). Lobes of capsule divergent; flowers 8-12 mm. in diameter5. *V. persica*.
- 5. Lobes of capsule not divergent; flowers less than 8 mm. in diameter6. *V. polita*.

1. *Veronica americana* (Raf.) Schwein. AMERICAN BROOKLIME. Fleshy and more or less succulent glabrous perennial with creeping to decumbent bases; stems to about 1 dm. long; principal leaves of middle and upper part of flowering stems distinctly petioled, narrowly ovate to lanceolate, somewhat acute, to about 9 cm. long, the margins serrate to dentate; racemes lax, with arching rachises, axillary below the prolonged tip, 6- to 30-flowered; pedicels to about 11 mm. long, the lower mature ones filiform and divergent; corolla light bluish-violet; capsule turgid, suborbicular. In shallow water or wet sandy soil of gravelly streams in Edwards Plateau (Kendall Co.), June-Aug.; from Nfld. w. to Alas., s. to N.C., Tex., Mex. and Calif.; also n.e. Asia.

2. *Veronica Anagallis-aquatica* L. WATER SPEEDWELL, BROOK-PIMPERNEL. Usually perennial, glabrous throughout or obscurely glandular-puberulent in the inflorescence; stems shortly creeping and rooting at base, then ascending to erect, to 1 m. high; leaves sessile, rounded to clasping bases, oblong-lanceolate, acute, serrate to merely denticulate, those of autumnal shoots smaller and rounded; flowers many in small-bracted axillary racemes; pedicels 6-8 mm. long; sepals 4, lanceolate, acute, 4-4.5 mm. long; corolla 5-6 mm. wide, pale-lavender, the lobes with violet lines; style 1.8-2.5 mm. long; capsule 4 mm. long, more or less orbicular, obtuse at the narrowed obscurely notched apex; seeds about 0.5 mm. long. Usually in water of streams and in gravelly-sandy soils in cen. and n.-cen. (Fannin Co.) Tex., Mar.-June; throughout N.A., naturalized from Euras.

3. *Veronica peregrina* L. PURSLANE SPEEDWELL, NECKLACE WEED. Annual, erect, simple or with spreading branches, to 3 dm. high, glabrous throughout or pubescent with gland-tipped hairs; leaves sessile or with the lower somewhat petioled, usually linear-oblong, obtuse, dentate to entire; flowers in spiciform leafy-bracted terminal racemes; pedicels 1-2 mm. long; sepals 4, linear-oblong to oblanceolate, obtuse, about 3 mm. long; corolla

white, 2-2.5 mm. wide; filaments very short; style about 0.3 mm. long; capsule 3-3.5 mm. long. In water of tanks and streams, open flatwoods, swamps, prairies and dune areas throughout most of Tex., Feb.-June; throughout most of N.A., introd. in many parts of the world.

Represented in Texas by two variants.

- 1. Plant glabrous var. *peregrina*.
- 1. Plant pubescent with short gland-tipped hairs that are usually present even on the capsules var. *xalapensis* (H.B.K.) Penn.

4. *Veronica arvensis* L. COMMON SPEEDWELL, CORN SPERRY. Annual, erect or ascending, the stems simple or branched at base, to 3 dm. long, pubescent and sometimes glandular; leaves sessile or the lower rounded at base to short petioles, ovate, rounded-obtuse, crenate-dentate, to 15 mm. long; flowers in spiciform leafy-bracted terminal racemes; pedicels abbreviated; sepals 4, linear-lanceolate, acutish, 3.5-4 mm. long, the lower pair slightly the longest; corolla bright-violet-blue, 2-2.5 mm. long; filaments short; style about 0.7 mm. long; capsule 2-2.5 mm. long, rounded, deeply obcordate, its lobes flaring, ciliate-pubescent; seeds 1 mm. long. On moist open-wooded slopes, in fields and sandy flatwoods in e. Tex., Mar.-June; throughout most of U.S. and s. Can., naturalized from Euras.

5. *Veronica persica* Poir. PERSIAN SPEEDWELL. Annual, branched at base, the stems ascending, to 4 dm. high, pilose with glandless hairs; leaves scattered or alternate, truncate to petioles shorter than the blades, ovate, obtuse, to 3 cm. long, dentate with rounded lobes; flowers in axils of foliaceous bracts; pedicels 2-3.5 cm. long, much-exceeding leaves; sepals 4, ovate-elliptic, obtuse, short-ciliate, 5-6 mm. long; corolla 7-11 mm. wide, violet-blue, pale ventrally, all lobes darker veined; filaments 2 mm. long; style 2 mm. long; capsule 2.5-3 mm. long, widely notched, the rectangular lobes widely flaring; seeds 1.5 mm. long. Waste ground and lawns in w. and cen. Tex., Feb.-May; in much of N.A., naturalized from Euras.

6. *Veronica polita* Fries. WAYSIDE SPEEDWELL. Annual with prostrate or reclining pilose stems that are usually branched at base, to about 2 dm. high; leaves short-petioled, ovate to oval, to about 15 mm. long, rounded to subcordate at base, coarsely and irregularly crenate-serrate; flowers in axils of foliaceous bracts; pedicels equal to or shorter than leaves; sepals ovate to elliptic, obtuse, little if at all longer than the capsule; corolla 4-8 mm. wide, usually uniformly bright-blue; style 1 mm. long; capsule broader than long, the lobes erect, with both short glandless and longer glandular hairs; seeds 9 to 12 in each cell. In waste places, lawns and along roadsides in e. and n.-cen. Tex., in e. U.S. and Mex., naturalized from Euras.

21. AUREOLARIA RAF. FALSE FOXGLOVE

Large annual or perennial herbs with branched or rarely simple stems; lower leaves opposite, entire to deeply lobed, progressively smaller upward to become irregularly alternate, the uppermost subtending the large solitary pedicellate flowers; calyx tube campanulate to cup-shaped, the often unequal lobes triangular to linear; corolla yellow, zygomorphic, campanulate, the tube somewhat oblique; corolla lobes 5, shorter than the tube, all equally distinct and broadly rounded; stamens 4, didynamous, the lower pair the longest; filaments slender, villous; anthers pubescent with each anther sac awned at base; style slender, with 1 stigma; capsule ovoid to ellipsoid, loculicidal, the few to several seeds winged or wingless.

About 10 species from southern Canada to Mexico.

- 1. Annual, glandular-hirsute throughout; leaves bipinnatifid, pectinately toothed; calyx lobes pectinately toothed; capsule glandular pubescent 1. *A. pectinata*.
- 1. Perennial, glabrous to densely cinereous-puberulent but not glandular; leaves entire to pinnatifid, not pectinately toothed; calyx lobes entire to dentate; capsule glabrous (2)

- 2(1). Plant more or less densely cinereous-puberulent; floral bracts usually dentate; calyx lobes evidently dentate to entire2. *A. grandiflora*.
- 2. Plant glabrous to minutely and sparsely puberulent; floral bracts mostly entire; calyx lobes entire (3)
- 3(2). Stem finely puberulent, not glaucous; pedicels and calyx externally sparsely puberulent3. *A. dispersa*.
- 3. Stem glabrous, often glaucous; pedicels and calyx externally glabrous 4. *A. flava*.

1. *Aureolaria pectinata* (Nutt.) Penn. Annual to about 75 cm. high, diffusely much-branched, the glandular-pubescence of the herbage densely villous; leaves thin, spreading, lanceolate to ovate-lanceolate in outline, deeply bipinnatifid, the larger 2-4 cm. long; pedicels 3-10 mm. long; calyx tube nearly hemispherical, hirsute to lanate, the pinnately cut lobes 8-15 mm. long; corolla 3-4 cm. long, yellow, often tinged with reddish-purple, glandular-pubescent outside, the lobes orbicular; capsule ovoid, glandular, about 12 mm. long, with only its base embraced by the calyx tube; seeds wingless, about 1 mm. long. *A. Pedicularia* (L.) Raf. var. *pectinata* (Nutt.) Gl., *Dasistoma pectinata* (Nutt.) Benth. In sandy soil of grasslands and open woodlands in s.e. Tex., Sept.-Nov.; from Fla. to Tex., n. to N.C., Ky. and Mo.

2. *Aureolaria grandiflora* (Benth.) Penn. Perennial to 15 dm. high, widely branched, pubescent; lower leaves ovate in outline, more or less pinnatifid, the upper progressively reduced; bracteal leaves laciniate to entire, finely pubescent; pedicels stout, 5-14 mm. long at anthesis, abruptly upcurved, densely but minutely pubescent; calyx pubescent similarly to the pedicels, the tube hemispheric, almost invariably longer than the lanceolate or triangular lobes; corolla yellow, about 4 cm. long; capsule glabrous, ovoid, 1.5-2 cm. long. *Gerardia grandiflora* Benth. In dry open woods and along streams in woods mostly in forest belt of e. Tex., June-Oct.; from the Lake States, s. to Tex.

Represented in Texas by the following variants.

- 1. Calyx lobes broadly lanceolate, evidently dentate; petioles mostly 5-6 mm. long; bracts coarsely toothedvar. *grandiflora*.
- 1. Calyx lobes linear to lanceolate, entire or only slightly dentate; petioles mostly 10-15 mm. long (2)
- 2(1). Bracts serrate to entire, oblong, acute; upper leaf blades (similar to the bracts) abruptly smaller than the lower, relatively small; pedicels rather slender, in fruit 7-13 mm. longvar. *serrata* (Torr.) Robins.
- 2. Bracts entire to shallowly serrate, lanceolate, acuminate-attenuate; upper leaf blades gradually smaller than the lower, relatively large; pedicels stouter, in fruit 5-9 mm. longvar. *cinerea* Penn.

3. *Aureolaria dispersa* (Small) Penn. Stem to about 12 dm. high, sparsely puberulent; leaves ovate-lanceolate to ovate, nearly entire to deeply and coarsely lobed, finely puberulent, the larger to about 12 cm. long and with as many as 4 pairs of lateral lobes; pedicels 4-10 mm. long; calyx lobes 5-7 mm. long, triangular-lanceolate to lanceolate; corolla 3.5-5 cm. long, the depressed orbicular lobes 1-1.3 cm. long; capsule 14-18 mm. long, ovoid. *Gerardia dispersa* (Small) K. Schum. In sandy soil of open woodlands and thickets in s.e. Tex., Aug.-Oct.; also e. to Ala.

4. *Aureolaria flava* (L.) Farw. Perennial, to about 22 dm. high, branched above, the stems glabrous and glaucous; lower leaves deeply pinnatifid to half or more of their width (often nearly to the midrib), the lobes oblong to lanceolate, entire or dentate, widely divergent, separated by broad sinuses, the upper leaves less deeply lobed; bracteal leaves narrowly lanceolate to linear-lanceolate, entire or merely serrate; pedicels stout, abruptly upcurved, 4-10 mm. long at anthesis; calyx glabrous, its lobes 2-14 mm. long; corolla yellow, 3.5-6 cm. long; capsule ovoid, 12-27 mm. long. On open-wooded slopes, edge of woods and along streams in s.e. Tex., May-Sept.; from Me. to Ont., Mich. and Wisc., s. to Fla. and Tex.

Our plants are usually referred to var. *macrantha* (Penn.) Fern., characterized by having more permanently puberulent leaves and calyx lobes 5-14 mm. long in contrast to var. *flava* with calyx lobes 2-5 mm. long.

22. DASISTOMA RAF.

MULLEIN FOXGLOVE

A monotypic genus. Sometimes misspelled *Dasystoma* in some works.

1. *Dasistoma macrophylla* (Nutt.) Raf. Annual, rather pubescent, to about 2 m. high, branched, said to be parasitic on *Aesculus*; leaves opposite, ovate to lanceolate in outline, the margins subentire to crenate-serrate, to about 3 dm. long and 1 dm. wide, the lower ones pinnately divided and with the broad lanceolate divisions pinnatifid and incised, progressively smaller up the stem with the uppermost ones narrowly lanceolate; flowers in an elongate leafy spike; calyx slightly zygomorphic, about 1 cm. long, the tube cup-shaped, the 4 lower oblong lobes obtuse and about equaling the tube, the upper median lobe shorter and narrower; corolla tube narrowly campanulate, incurved, about 1 cm. long, woolly within, the spreading limb about 15 mm. wide; stamens 4, strongly didynamous; filaments villous, inserted near middle of corolla tube and barely exerted; anthers oblong, completely dehiscent; style somewhat dilated and notched at apex; capsule globose-ovoid, about 1 cm. long, loculicidal, each valve terminated by a short flat triangular beak; seeds angular, 2-3 mm. long, the papery coat reticulate. *Seymeria macrophylla* Nutt. In rich woods and on banks of streams in n.-cen. Tex., June-Sept.; from W.Va. to Wisc., Ia. and Neb., s. to Ga., Ala., Miss., La. and Tex.

23. SEYMERIA PURSH

Erect branching annual or perennial herbs; leaves pinnatifid to bipinnatifid or variously dissected, opposite or the uppermost alternate and bractlike; flowers in interrupted racemes or spikes; calyx regular, campanulate, deeply 5-cleft; corolla zygomorphic, yellow, with a short and thick tube not longer than the 5 ovate to oblong or lanceolate nearly equal and spreading lobes; stamens 4, equal; filaments short, inserted in the corolla tube, pubescent at base; anthers approximate by pairs, oblong, 2-celled, the cells equal and acute or pointless; style filiform, elongate; capsule loculicidal, many-seeded.

About 20 species, primarily in the United States and Mexico.

1. Leaf segments and calyx lobes filiform-linear; corolla lobes lanceolate; capsule about 5 mm. long, urceolate, acuminate, glabrous; distribution in east Texas 1. *S. cassioides*.
1. Leaf segments and calyx lobes lanceolate to linear-oblong, not filiform; corolla lobes suborbicular to ovate; capsule more than 5 mm. long, ovoid, acuminate, with short glandular hairs or glandular-tomentose (2)
- 2(1). Leaf blades strongly bipinnatifid, the primary ones mostly 2-4 cm. long; pubescence long, soft, cottony; distribution on Edwards Plateau 2. *S. texana*.
2. Leaf blades pinnatifid or rarely with some slightly bipinnatifid, less than 2 cm. long; pubescence short and often scabrous (3)
- 3(2). Herbage manifestly hispidulous-scabrous; all primary leaf blades pinnatifid; corolla glabrous on outer surface; capsule sparsely short-glandular; distribution in mountains of Trans-Pecos Texas 3. *S. scabra*.
3. Herbage not noticeably scabrous; some leaf blades slightly bipinnatifid; corolla glandular-tomentose on outer surface; capsule glandular-tomentose; distribution in Rio Grande Plains of south Texas 4. *S. Havardii*.

1. *Seymeria cassioides* (Walt.) Blake. Annual to about 1 m. high, much-branched, the stems slender, finely pubescent; leaves ovate in outline, 1-2 cm. long, deeply pinnatifid or bipinnatifid with the segments filiform-linear; flowers solitary in the upper leaf axils, with filiform pedicels to 8 mm. long; calyx lobes setaceous, 2-3 mm. long; corolla lemon-yellow, sometimes marked with purple within, 6-10 mm. long; filaments woolly at base; anthers about 3 mm. long, dehiscent from apex; capsule urceolate, acuminate, about 5 mm. long. *S. tenuifolia* Pursh, *Afzelia cassioides* (Walt.) J. F. Gmel. In sandy pinelands, e. Tex., Sept.-Oct.; Bah. I., Fla. and La. n. to Va., Tenn. and Ala.

2. *Seymeria texana* (Gray) Penn. Plant to 1 m. high and wide, the stems widely branched, densely pubescent throughout with viscid-glandular cottony hairs; leaves rela-

tively few, to about 4 cm. long, narrowly triangular-lanceolate in outline, mostly bipinnatifid, the lower leaves sometimes tripinnatifid and the upper ones often merely pinnatifid, the segments linear to oblong; pedicels weak and slender, to about 1 cm. long; calyx lobes pubescent, oblong to oblong-lanceolate, 3-4 mm. long, obtuse; corolla about 1 cm. long, broadly campanulate, softly glandular-pubescent on outer surface, the stout limb less than 1 cm. wide and lobes oval to oval-orbicular; filaments pubescent; capsule ovoid, 6-8 mm. long, glandular. *Afzelia texana* (Gray) Small. On limestone cliffs and slopes of calcareous hills on Edwards Plateau, Sept.-Oct.; endemic.

3. *Seymeria scabra* Gray. Plant hispidulous-scabrous throughout, not conspicuously glandular, with slender erect or wide-spreading branches, to about 6 dm. high and wide; leaves 1-1.5 cm. long, sparingly pinnatifid into few narrow linear divisions or the upper leaves essentially entire; pedicels short and stout, mostly less than 6 mm. long; calyx lobes linear-subulate, to about 5 mm. long; corolla about 7 mm. long, glabrous on outer surface but the obovate to oval lobes marginally ciliate; filaments broad, pubescent below the middle; capsule ovoid, gradually acuminate, 8-12 mm. long, more or less glandular. On dry rocky mt. slopes in the Trans-Pecos, July-Sept.; also adj. Mex.

4. *Seymeria Havardii* (Penn.) Penn. Stem about 4 dm. high, much-branched, pubescent with retrorse-spreading to -incurved hairs, with longer similar gland-tipped hairs; leaves lanceolate to ovate-lanceolate, slightly bipinnatifid, with the lanceolate segments falcately spreading, glandular-hirsute; stem leaves 15-17 mm. long, 6-8 mm. wide, with 5 or 7 pairs of lateral lobes; pedicels slender, in flower 6-10 mm. long, in fruit 7-12 mm. long; calyx glandular-hirsute; calyx lobes 3-4 mm. long, lanceolate, acute, dentate; corolla 7.5-8 mm. long; corolla lobes 5 mm. long, ovate, rounded, spreading, the 2 posterior lobes united one-half to three-fifths of their length, externally glandular-tomentose, within pubescent in a ring about the bases of the filaments but glabrous below the posterior sinus, the lobes irregularly ciliate; filaments 2.5 mm. long, stout, posterior ones incurved, dilated and pubescent for two-thirds their length, anterior ones straight, less dilated, pubescent only one-half their length; connective glabrous; anthers 3 mm. long, linear-oblong, opening one-half their length; capsule 9-12 mm. long, narrowly ovoid, acuminate, glandular-tomentose; seeds 1-1.2 mm. long, pale-brown, the raised reticulations thin and somewhat winglike. *Afzelia Havardii* Penn. Limestone hills near Eagle Pass, Maverick Co. Only locality known.

24. TOMANTHERA RAF.

Annual herbs with the stems retrorsely pubescent; leaves opposite, numerous and crowded; flowers sessile in the upper axils to form a leafy spike; calyx regular or nearly so, the lobes longer than the tube; corolla zygomorphic, purplish, often variously marked, the tube campanulate and somewhat distended on lower side, the limb about equally 5-lobed with the lower lip spreading and the upper lip arched; stamens 4, didynamous, the lower pair longer; filament and anthers villous; style elongate, the stigma linear; capsule loculicidal.

Two species in temperate North America.

1. Leaves lanceolate to broadly lanceolate, the upper ones auricled at base, all scabrous on the upper surface; stem with numerous long hairs; spike rather lax; capsule broadly ovoid, 10-13 mm. long 1. *T. auriculata*.
1. Leaves pinnatifid, the segments linear or nearly so, nearly glabrous on the upper surface; stem with few or no long hairs; spike densely crowded; capsule obovoid, 8-10 mm. long 2. *T. densiflora*.

1. *Tomanthera auriculata* (Michx.) Raf. Scabrous annual with retrorse-hirsute 4-angled simple or sparingly branched rigid stems to about 8 dm. high; leaves subsessile, lanceolate to ovate-lanceolate, to 55 mm. long and 2 cm. wide, the uppermost with divergent basal auricles; flowers sessile in leafy-bracted spikes; calyx campanulate, with unequal ovate-lanceolate lobes 9-12 mm. long; corolla 2-2.5 cm. long, purple, the upper lobes longer than the lower ones, the throat dark-spotted; upper filaments 5-6 (lower about 10) mm. long; upper anthers about 2 mm. long, the lower 2.2-5 mm. long and

blunt-based; capsule thick-ovoid; seeds ellipsoid-ovoid, 1.3-1.6 mm. long. *Gerardia auriculata* Michx., *Otophylla auriculata* (Michx.) Small. Prairies, open woods and fields in n.-cen. Tex., Aug.-Sept.; from N.J. to Minn., s. to Va., Ala., Tenn., Ark. and Tex.

2. *Tomanthera densiflora* (Benth.) Penn. Plant hispid and rough, very leafy, much-branched, to about 8 dm. high; leaves rigid, nearly glabrous on upper surface, pinnately parted into 3 to 7 narrowly acute divisions, those subtending the densely spicate flowers similar and much-crowded; calyx tube one third to one half the length of the capsule, minutely scabrous-puberulent to glabrate, the lobes ascending-scabrous-puberulent and the margins ciliate; corolla pale-mallow-purple, anteriorly with dark-purple spots, 23-32 mm. long; style glabrous; capsule 8-10 mm. long; seeds 1.5-1.8 mm. long, ovoid-triangular, sharply angled. *Gerardia densiflora* Benth., *Otophylla densiflora* (Benth.) Small. In dry limestone soils on prairies in cen. Tex., Aug.-Oct.; from Kan. to Tex.

25. AGALINIS RAF.

Annual (in ours) or perennial herbs with usually thin stems and branches; leaves linear, mostly entire, opposite, tending to become alternate on the branches; flowers often large for the plant, arising from the axils of the somewhat reduced upper leaves to form a raceme or (by reduction) appearing to be terminal, frequently only one flower of pair developed; calyx regular, gamosepalous, the tube campanulate to hemispheric, usually much longer than the lobes; corolla zygomorphic, membranous, pink to purple, sometimes white, commonly with yellow lines and reddish-purple spots in throat; corolla tube campanulate, often somewhat distended on the lower side; corolla lobes all equally distinct, commonly marginally ciliate, the lower 3 spreading, the upper 2 arched and spreading or somewhat recurved; stamens 4, didynamous, the lower pair the longer; filaments pubescent (at least toward base); anther sacs obtuse to cuspidate at base; capsule typically globose or sub-globose, loculicidal.

About 60 species in temperate America.

- 1. Pedicels mostly 1 cm. long or more, typically filiform and always much longer than the calyx at anthesis (2)
- 1. Pedicels mostly less than 1 cm. long, stoutish or slender and about as long as or shorter than the calyx at anthesis, rarely with some slightly longer than calyx (10)
- 2(1). Plants yellowish-green, not tending to blacken in drying; calyx tube evidently reticulate-venose; corolla pinkish; seeds yellow or yellowish-brown (3)
- 2. Plants relatively dark-green, tending to blacken in drying; calyx tube slightly or not reticulate-venose; corolla purplish-pink or deep-pink; seeds dark-brown or blackish (4)
- 3(2). Capsule globose to globose-ovoid, 4-5 mm. long; corolla 12-20 mm. long; seeds more or less rounded and turgid; calyx tube 2.5-3.5 mm. long, its lobes mostly less than 1.5 mm. long; stem slender, rather evenly branched; leaves wide-spreading 1. *A. Gattereri*.
- 3. Capsule globose-obovoid, 5-7 mm. long; corolla 8-13 mm. long; seeds angled, not turgid; calyx tube 3.5-4 mm. long, its lobes 1.5-2 mm. long; stem much-branched, the primary branches long and widely ascending, the secondary branches shorter; leaves erect-ascending, often paralleling the stems .. 2. *A. viridis*.
- 4(2). Plant fleshy and succulent, bushy-branched below and with elongated racemes above; leaves and calyx lobes obtuse or essentially so; in saline habitats 3. *A. maritima*.
- 4. Plant not fleshy, more uniformly branched; leaves and calyx lobes acute to acuminate; in nonsaline soils (5)
- 5(4). Upper lobes of corolla reflexed-spreading, subequal to lower lobes; corolla often pubescent within, its outer surface somewhat pubescent to glabrate (6)
- 5. Upper lobes of corolla arching or projecting forward over stamens and style, shorter than the lower lobes; corolla essentially glabrous within (8)

- 6(5). Stem scabrous; leaves linear-setaceous, 1 mm. wide or less, axillary fascicles usually conspicuously developed; corolla 2.5-3 cm. long; intrareticular areas of seeds hexagonal; distribution in southeast Texas 4. *A. pulchella*.
6. Stem glabrous or nearly so; leaves linear, mostly with some more than 1 mm. wide; corolla mostly smaller than above (7)
- 7(6). Calyx lobes 1-2 mm. long; corolla strongly upcurved, with a narrow line of hairs below the posterior sinus; intrareticular areas of seeds hexagonal; leaves typically strict to often parallel the branches; distribution mainly in Rio Grande Valley and adjacent coastal region 5. *A. strictifolia*.
7. Calyx lobes shorter than above; corolla slightly upcurved, with hairs commonly diffused over bases of upper lobes; intrareticular areas of seeds narrowly elongated; leaves spreading; distribution in northeast Texas . . . 6. *A. caddoensis*.
- 8(5). Upper lobes of corolla much-abbreviated, less than half the length of the lower lobes, flattened-projected 7. *A. homalantha*.
8. Upper lobes of corolla more than half the length of the lower lobes, concave-arched (9)
- 9(8). Corolla pubescent within in a narrow line below posterior sinus; racemes relatively short, of 3 or 4 pairs of pedicels; distribution on Edwards Plateau in central Texas 8. *A. edwardsiana*.
9. Corolla glabrous within below the posterior sinus; racemes elongated, of more than 4 pairs of pedicels; distribution mostly in northeast Texas 9. *A. tenuifolia*.
- 10(1). Plant fleshy and succulent, bushy-branched below and with elongated racemes above; leaves and calyx lobes obtuse; in saline habitats 3. *A. maritima*.
10. Plant not fleshy, more uniformly branched; leaves and calyx lobes acute to acuminate; in nonsaline soils (11)
- 11(10). Calyx lobes nearly as long as to longer than the tube, the sinuses narrow; leaf blades linear-lanceolate to lanceolate or sometimes linear, to 6 mm. wide, the lower occasionally 3-cleft at base (12)
11. Calyx lobes typically much-abbreviated, much shorter than the tube, the sinuses broad and open; leaf blades linear to filiform or subulate, always entire (13)
- 12(11). Distribution in mountains of Trans-Pecos Texas; pedicels more than 5 mm. long 10. *A. calycina*.
12. Distribution in east and south Texas; pedicels 3 mm. long or less 11. *A. heterophylla*.
- 13(11). Capsule ovoid-ellipsoid, subcylindric, distinctly longer than wide; the fastigately branched stem, subrigid leaves and erect pedicels harshly scabrous; distribution along the Red River in north-central Texas . . 12. *A. aspera*.
13. Capsule globose to globose-ovoid, shorter than to slightly longer than wide; the variously spreading branches, usually more flexible leaves and spreading to ascending pedicels smooth to scabrous; distribution in east and central Texas (14)
- 14(13). Main leaf blades greatly reduced, less than 1 cm. long, scalelike 13. *A. oligophylla*.
14. Main leaf blades not reduced, typically more than 2 cm. long (15)
- 15(14). Primary leaves to 4 cm. long, spreading or widely arcuate-ascending; stem smooth to more or less scabridulous, commonly angled; stigma 2-3 mm. long 14. *A. purpurea*.
15. Primary leaves mostly less than 2.5 cm. long, erect-ascending or closely arcuate-ascending, often somewhat appressed to stem, typically with well-developed axillary fascicles; stem scabrous-puberulent, subterete; stigma 3-4 mm. long 15. *A. fasciculata*.

1. *Agalinis Gattingeri* (Small) Small. Plant to about 7 dm. high, the smoothish stem nearly terete and with many spreading-ascending branches, the slender lateral branches

bearing a few small leaves and several or rarely more than a single apparently terminal flower; leaves linear, acuminate, the primary ones 2-3 cm. long and to 1.2 mm. wide; upper bracteal leaves one half to nearly as long as the pedicels; a terminal raceme scarcely developed; pedicels to 25 mm. long; calyx tube campanulate, 2.5-3.5 mm. long, its triangular-lanceolate teeth to 1.8 mm. long and scarcely callous-thickened; corolla rose-pink, 1.2-2 cm. long, its lobes 4-6 mm. long; capsule globose to globose-ovoid, 4-5 mm. long. *Gerardia Gattingeri* Small. In moist or dry soils on slopes and in open woodlands and barrens in e. Tex., Sept.-Oct.; from Ont. to Minn. and Neb., s. to Ala., La. and Tex.

2. *Agalinis viridis* (Small) Penn. GREEN GERARDIA. Stem to about 6 dm. high, with long slender widely divergent branches and many shorter secondary branchlets, essentially glabrous; leaves strictly erect-ascending, linear, acuminate, finely scabrous on upper surface, those of the stem 15-22 mm. long and to 1.3 mm. wide, gradually reduced above; racemes somewhat elongate, up to 9-flowered, often only one flower of pair developed; pedicels spreading, slender, clavate, in flower to 15 mm. long (often with many less than 1 cm. long), in fruit to 22 mm. long; calyx tube obovoid-campanulate, often stramineous, evidently reticulate-veiny, 3.5-4 mm. long, somewhat truncate, the triangular-lanceolate to lanceolate lobes 1.5-2 mm. long and not or scarcely callose; corolla pale-pink, 8-13 mm. long, its tube 6-9 mm. long and slightly upcurved, its truncate to erose lobes 2-4 mm. long and spreading; capsule globose-obovoid, light-brown, 5-7 mm. long. *Gerardia viridis* Small. In sandy soils in pinelands and prairies in e. Tex., Sept.-Oct., rarely in spring; from Mo. to La., Tex. and Okla.

3. *Agalinis maritima* (Raf.) Raf. SEASIDE GERARDIA, SALT MARSH GERARDIA. Plant to about 6 dm. high, usually much smaller, with short leafy branches below, smooth; leaves fleshy, broadly linear, obtuse, to about 3 cm. long and 3 mm. wide; flowers few, in a more or less naked simple raceme; pedicels 2-10 mm. long, shorter to longer than the floral bracts; calyx tube broadly campanulate, 2-3 mm. long in anthesis, slightly longer in fruit; calyx lobes broad, short and thick, 0.5-1 mm. long, very obtuse to acutish; corolla rose-pink, glabrous, 1.2-2 cm. long; anther cells mucronulate at base, 1.3-2.3 mm. long, villous to glabrous; capsule globular to ovoid, 4-6 mm. long. *A. spiciflora* (Engelm.) Penn., *Gerardia maritima* Raf. In salt marshes and beach dunes along the coast, May-July; from N.S. to Fla. and Tex.; also Mex. and W.I.

Our material is usually referred to var. *grandiflora* (Benth.) Shinners, characterized by having anther cells 1.8-2.3 mm. long and usually villous with long white hairs; pedicels mostly equaling or longer than the bracts; calyx lobes typically obtuse; corolla 1.5-2 cm. long.

4. *Agalinis pulchella* Penn. Stem 6-10 dm. high, slender, with numerous ascending-spreading branches, striate-quadrangular, scabrous; leaves spreading, narrowly linear to subfiliform, acute, very scabrous on upper surface, those of the stem 2-3 cm. long and 0.4-0.9 mm. wide, reduced above; axillary fascicles often well-developed, rarely equaling the subtending leaves; racemes slightly elongated, often but one flower of pair developed, 4- to 6-flowered; pedicels ascending-spreading, very slender, minutely scabrous, in flower 1.5-3 cm. long, in fruit 2.5-4 cm. long; calyx tube 3-4 mm. long, hemispheric, truncate, apex of tube within sparingly puberulent; calyx lobes to 0.5 mm. long, subulate, callose and usually recurved; corolla rose-purple to deep-lavender, 2.5-3 cm. long, its tube 16-23 mm. long and moderately upcurved, its spreading lobes 9-12 mm. long and emarginate; capsule 5-6 mm. long, globose, brown. *Gerardia pulcherrima* (Penn.) Penn. In sandy or clayey soils in longleaf pinelands and grasslands on slopes in s.e. Tex., Sept.-Oct.; from n. Fla. and Ga. to Tex.

5. *Agalinis strictifolia* (Benth.) Penn. Stem 5-8 dm. high, slender, with numerous rigidly ascending or ascending-spreading branches, more or less strongly quadrangular-striate, glabrous; leaves on stem and primary branches spreading or often reflexed, linear, acuminate, 2-3.5 cm. long, 1-3 mm. wide; leaves of flowering branchlets linear-subulate, erect and somewhat appressed to stem, to about 13 mm. long, all the leaves finely scabrous to scabro-roughened or nearly glabrous on upper surface; racemes slightly elongated, often but one flower of pair developed, 4- to 10-flowered; pedicels ascending-spreading, slender, glabrous, in flower usually 1-2.5 cm. long, in fruit 1.5-3 cm. long; calyx tube 3-4 mm. long, campanulate-hemispheric, obscurely to evidently rib-veined, scarcely truncate, apex of tube and lobes within minutely pubescent; calyx lobes 1-2 mm.

long, triangular-lanceolate to subulate, acuminate; corolla rose-pink to lavender, 2-2.5 cm. long, its tube 12-15 mm. long and strongly upcurved, its spreading lobes 8-10 mm. long and truncate-erose; capsule broadly quadrangular, nearly as broad as long, irregular, to about 6 mm. long, the testa dark and with firm reticulations. *Gerardia strictifolia* Benth. In old fields, open sandy mesquite plains, open areas and on ridges in scrub, from Austin and Travis cos., s. and w. to the Rio Grande, Sept.-Nov. and May; also adj. Mex.

6. *Agalinis caddoensis* Penn. Stem 4-6 dm. high, slender, with numerous loosely ascending branches, finely striate, 4-angled above, very sparingly scabrellous; leaves spreading, filiform, acuminate, scabrous above, strongly involute, those of the stem 2.5-3 cm. long and about 0.8 mm. wide, reduced above; racemes scarcely elongated, interrupted, 1- to 5-flowered; pedicels ascending-spreading, slender, sparingly scabrellous to glabrous, in flower 13-22 mm. long, equaling to slightly longer than the bracts, many on the branches appearing as terminal; calyx tube 4-5 mm. long, hemispheric-campanulate, obscurely 5-ribbed, truncate, apex of tube and lobes within evidently puberulent; calyx lobes 0.7-1 mm. long, triangular-subulate, not callose; corolla rose-pink, 2-3 cm. long, spreading 23-28 mm. wide, its tube 19-23 mm. long and slightly upcurved, its spreading lobes 6-7 mm. long and rounded to retuse. *Gerardia caddoensis* (Penn.) Penn. In dry loam in oak woods, undoubtedly in n.e. Tex. (no material seen), Sept.-Oct.; in extreme n.w. La.

7. *Agalinis homalanthia* Penn. Stem 4-7 dm. high, slender, with numerous ascending-spreading branches, slightly scabrellous; leaves spreading, linear, acuminate, those of the stem 2.5-3 cm. long and 1-1.5 mm. wide, reduced above, somewhat scabrous on upper surface; axillary fascicles strongly developed, shorter than the subtending leaves; racemes elongated, 4- to 10-flowered; pedicels ascending-spreading, slender, slightly clavate, somewhat scabrellous, in flower 1-2 cm. long, in fruit to 3 cm. long, 1.5 to 2.5 times the length of the bracts; calyx tube 3-3.5 mm. long, truncate, apex of tube and lobes within densely puberulent; calyx lobes 1-1.2 mm. long, rarely much longer, lanceolate, acuminate; corolla lavender to pinkish, 23-27 mm. long, its straight tube 15-18 mm. long, the lower lobes spreading and 8-9 mm. long, the upper lobes 3-4 mm. long and flat-extended over stamens and style; capsule subglobose, about 6 mm. long. *Gerardia homalanthia* (Penn.) Penn. In sandy soil of post-oak woods, cut-over fields and plains in e. and n.-cen. Tex., Aug.-Oct.; also s. Okla.

8. *Agalinis edwardsiana* Penn. Stem 4-8 dm. high, slender, with many laxly ascending-spreading branches, essentially glabrous; leaves spreading or the lower frequently somewhat reflexed, linear, acuminate, scabro-roughened to nearly glabrous on upper surface, those of the stem 2-3.5 cm. long and 0.5-0.9 mm. wide, reduced above; racemes slightly elongated, 2- to 9-flowered; pedicels ascending-spreading, slender, glabrous, to 3 cm. long at anthesis; calyx tube 3.5-4.5 mm. long, hemispheric, truncate, the triangular-subulate to subulate acuminate lobes to 0.5 mm. long; corolla 2-2.3 cm. long, its tube 12-14 mm. long, its lobes erose to emarginate, the spreading lower lobes 8-9 mm. long, the upper lobes 5-6 mm. long and broadly arched over stamens and style; capsule 6-7 mm. long, globose to obovoid-globose, dark-brown. Incl. var. *glabra* Penn., *Gerardia edwardsiana* (Penn.) Penn. In thin soil and adobe on limestone hills of the Edwards Plateau, Aug.-Oct.; endemic.

9. *Agalinis tenuifolia* (Vahl) Raf. Plant usually smooth, to about 5 dm. high, usually much smaller, paniculately much-branched; leaves mostly narrowly linear and plane, spreading, to 6 mm. wide, about equaling the lower but mostly shorter than the uppermost pedicels; inflorescence racemose; pedicels filiform, widely divergent, commonly 1-2 cm. long at anthesis; calyx tube 2-4 mm. long; calyx lobes broadly triangular to subulate, usually less than 1 mm. long, rarely to 2 mm.; corolla pink to mallow-purple or paler, 1-2.3 cm. long, glabrous except for the ciliate margins of the nearly equal lobes, its upper lip arching over the stamens; anther cells cuspidate-mucronate at base, densely to sparingly villous; capsules 3-7 mm. long. *Gerardia tenuifolia* Vahl. and var. *leucanthera* (Raf.) Shinn. In moist areas along streams, about ponds, in meadows, fields and low flatwoods, mostly in n.e. Tex., Sept.-Nov.; from Me. to Man. and N.D., s. to Fla. and Tex.

Our material is usually referred to subsp. *leucanthera* (Raf.) Penn. characterized by having a corolla 15-23 mm. long and calyx lobes less than 1 mm. long.

10. *Agalinis calycina* Penn. Stem at least 4 dm. high, with numerous divergent-ascending branches, relatively slender, glabrous; leaves spreading, linear, acuminate,

entire, more or less scabro-roughened on the upper surface, those of the stem 2-4 cm. long and to 1.5 mm. wide; bracts scarcely reduced; racemes somewhat irregular, 4- to 12-flowered; pedicels ascending, slender, glabrous, usually 5-7 mm. long at anthesis, at least 8 mm. long in fruit; calyx tube 5-6 mm. long, campanulate, obscurely veined, not truncate, its nearly linear lobes 5-7 (-15) mm. long, the apex of tube and lobes within finely granular-puberulent; corolla deep pink, 2-2.5 cm. long, its tube 17-21 mm. long, its spreading ciliate lobes 3-5 mm. long and rounded-truncate, externally pubescent with ascending hairs, within nearly glabrous to slightly pubescent in a ring about the bases of the filaments, pubescent in a narrow line below posterior sinus; anther cells 2.5-3 mm. long, acuminate-tipped at base. *Gerardia calycina* (Penn.) Penn. Moist places in the Trans-Pecos; also Coah.

11. *Agalinis heterophylla* (Nutt.) Small. PRAIRIE AGALINIS. Plant to about 6 dm. high, the stem smoothish, paniculately branched or the branches virgate; leaves rather erect, thickish or rigid, the lowest or primary ones broadly linear (to 45 mm. long and 8 mm. wide) and 3-cleft or lacinate, the others narrowly linear and mucronate-acute, those of the branchlets short and somewhat subulate, scabrous above and on the margins; pedicels to 2 mm. long; calyx tube 3.5-5 mm. long, the midvein keeled into the lobes; calyx lobes triangular-lanceolate or subulately attenuate from a broad base, very acute, in age spreading, 3.5-6.5 mm. long, almost always as long as or longer than the tube; corolla deep-pink to white and lavender-tinged, 2.5-3 cm. long; capsule subglobose, about 8 mm. long. *Gerardia heterophylla* Nutt. In prairies and plains, grasslands and fallow fields, sometimes on rocky soils or in open woodlands, usually somewhat moist, in Tex. in a line from Grayson Co. to Cameron Co. and eastw., June-Oct.; from Mo. and Okla. to La. and Tex.

12. *Agalinis aspera* (Benth.) Britt. Stem 2-8 dm. high, simple or with many ascending branches, relatively stout, somewhat quadrangular, sparingly scabrelous; leaves ascending, narrowly linear, acicular-acuminate, densely ascending-scabrous on upper surface, those of the stem 2.5-4 cm. long and 0.8-1.5 mm. wide, reduced above; axillary fascicles abundantly developed; racemes elongated, 4- to 18-flowered; pedicels nearly erect, slender, glabrous or nearly so, mostly less than 1 cm. long, in flower to 13 mm. long, in fruit to 18 mm. long, shorter than the bracts; calyx tube 4-6 mm. long, campanulate, obscurely veined, not truncate, apex of tube and lobes within densely puberulent; calyx lobes 1.5-3 mm. long, triangular-lanceolate to lanceolate; corolla pale-pink to lavender-pink, 18-25 mm. long, its straight tube 15-17 mm. long, its lobes 5-6 mm. long and rounded to emarginate, the upper lobes ascending or somewhat spreading; capsule 7-11 mm. long, oblong to ovoid-oblong, dark-brown. Prairies and dry sandy soil or rocky hills in n.-cen. Tex., Aug.-Oct.; from Man., s. to Okla. and (?) Tex.

No material of this species has been seen from Texas but it should be found in the area of Wilbarger and Hardeman counties, only 30 miles south of its nearest known locality in Oklahoma.

13. *Agalinis oligophylla* Penn. Stem 3-8 dm. high, slender, with few to many ascending branches, striate-ridged, minutely hispidulo-roughened on the ridges, terete below, obscurely quadrangular above; leaves spreading to ascending, linear-setaceous to subulate, acuminate, somewhat involute, scabrous on upper surface, those of the stem 5-10 mm. long and 0.2-1 mm. wide, those on the flowering branchlets reduced to minute subulate bracts; racemes scarcely elongated, 1- to 8-flowered; pedicels stoutish, clavate, minutely hispidulo-roughened to glabrous, rarely to 1 cm. long; calyx tube 2-3 mm. long, hemispheric, obscurely veined, truncate, apex of tube and lobes within puberulent; calyx lobes 0.4-0.6 mm. long, triangular-subulate, becoming somewhat callose; corolla pink, 15-22 mm. long, its tube 11-15 mm. long and somewhat upcurved, its spreading lobes 4-7 mm. long and truncate to emarginate; capsule globose to globose-ovoid, about 5 mm. long. *Gerardia microphylla* (Gray) Small, *G. aphylla* of auth. In sandy or clayey soils in prairies, savannahs and longleaf pine regions in s.e. Tex., Sept.-Nov.; also La.

14. *Agalinis purpurea* (L.) Penn. Plant to 12 dm. high, usually much smaller, smooth to scabridulous, commonly angled, with virgate rather wide-spreading branches; leaves usually spreading or widely arcuate-ascending, narrowly linear, to about 4 cm. long and 4 mm. wide, either somewhat scabrous or smooth with merely scabrous margins; axillary fascicles sometimes slightly developed; flowers few to many; pedicels 1-4 mm. long, shorter than the calyx; calyx tube 2-4 mm. long; calyx lobes triangular, acute to acuminate,

1 mm. long or more; corolla rose-pink to pink, 2.5-3 cm. long; capsule globular, 4-6 mm. long. *Gerardia purpurea* L. Moist sandy soil in bogs, seepage areas, moist prairies, open pinelands, barrens and along shores in e. Tex., Aug.-Nov.; from N.S. to Minn., s. to Fla. and Tex.; also Mex. and the W.I.

15. *Agalinis fasciculata* (Ell.) Raf. Plant to about 7 dm. high, the stem scabrous-puberulent, nearly terete at base, the branches angled; leaves erect-ascending to closely arcuate-ascending, scabrous, commonly 1-2 mm. wide, the axillary fascicles usually well-developed; bracteal leaves reduced, much shorter than the flowers; racemes elongate, 12- to 30-flowered; pedicels 2-4 mm. long at anthesis; calyx tube 3-4 mm. long, with subquadrate sinuses, the acuminate lobes to 2 mm. long; corolla 2-3.5 cm. long, rose-pink, with rounded to truncate spreading lobes 7-10 mm. long; anther cells 2.5-3.5 mm. long, with acute to cuspidate bases; capsule globose-ovoid, 5-6 mm. long; seeds to 0.8 mm. long. *Gerardia fasciculata* Ell. In dry or moist soils in savannahs, open weedy areas, open flatwoods and in dune hollows and tidal marshes in e. and n.-cen. Tex., Sept.-Oct.; from Fla. to Tex., n. to Md., Mo. and Ark.

26. BUCHNERA L. BLUEHEARTS

Perennial rough-hairy herbs that turn black in drying, apparently root-parasitic; leaves sessile, opposite or the uppermost alternate; flowers opposite in a terminal spike, bracted and with 2 bractlets; calyx tubular, obscurely nerved; corolla with a straight or curved tube and an almost equally 5-cleft limb, the lobes oblong to cuneate-obovate, flat; stamens included, the anthers 1-celled; style clavate and entire; capsule bivalved and many-seeded.

About 100 species, mostly in the Old World tropics and subtropics.

1. Leaf blades clearly 3-veined, ovate-lanceolate, sinuate-dentate to somewhat lacerate; corolla lobes 5-8 mm. long; capsule usually 6-7 mm. long; stem usually hirsute-pubescent 1. *B. americana*.

1. Leaf blades obscurely or not 3-veined, elliptic-lanceolate, repand-dentate to entire; corolla lobes 2-5 mm. long; capsule about 5 mm. long; stem pilose to glabrate ..
..... 2. *B. floridana*.

1. *Buchnera americana* L. Plant rough-hairy, the virgate stem to about 8 dm. high; lower leaves lanceolate to obovate-oblong, to 1 dm. long, the others ovate-oblong to linear-lanceolate, sparingly and coarsely toothed, scabrous, veiny; spike interrupted; calyx pubescent, 6-7 mm. long, exceeding the bracts; corolla deep-purple, the tube about 1 cm. long, the lobes 5-8 mm. long; capsule ovoid-oblong, about 7 mm. long. In moist sandy soil of open woods, prairies, meadows and marshy areas in e. Tex., June-Dec.; from Fla. to Tex., n. to N.J., N.Y., Ont., Mich., Ill., Mo. and Kan.

2. *Buchnera floridana* Gand. Stem to about 6 dm. high, slightly pilose to glabrate above, commonly from thickened root; leaves rough-pubescent, the larger ones elliptic-oblong and to 1 dm. long and 18 mm. wide; bracts 2-3 mm. long, spreading; calyx lobes triangular, acute, to 1 mm. long, the anterior sinus the deeper; corolla violet to purplish or rarely white, the tube 7-8 mm. long, the triangular-obovate lobes 3-5 mm. long; capsule about 5 mm. long. *B. breviflora* Penn. In sandy or gravelly soils throughout most of the s. half of Tex., Apr.-Nov.; from Fla. to Tex., n. to N.C.

27. SCHWALBEA L. CHAFF-SEED

A monotypic genus.

1. *Schwalbea americana* L. Minutely pubescent upright perennial herb; stems simple, to 8 dm. high; leaves alternate, sessile, 3-nerved, entire, ovate to oblong or lanceolate, the upper gradually reduced to narrow bracts, to about 5 cm. long and 15 mm. wide; flowers solitary in axils of uppermost leaves; bractlets about 1 cm. long; calyx tubular, 10- to 12-ribbed, 5-toothed, the posterior tooth much the smallest, the 2 anterior lobes united higher than the others, about 2 cm. long; corolla 3-3.5 cm. long, bilabiate, yellowish on tube, suffused above with purple, the upper lip oblong and entire, the erect shorter lower lip 2-plaited and with 3 very short and broadly obtuse lobes; capsule ovoid,

1-1.2 cm. long; seeds linear, with a loose chafflike coat. *S. australis* Penn. Moist to dry pinelands, oak woods and clearings, local from Fla. to e. Tex., n. to Mass., Conn., N.Y., Ky. and Tenn., summer.

28. PARENTUCELLIA Viv.

Four species native to Eurasia.

1. *Parentucellia viscosa* (L.) Caruel. Erect glandular-pubescent annual, to about 5 dm. tall; stem simple or branched above the middle; leaves opposite to subopposite or spirally arranged, 3-5 cm. long, ovate-lanceolate to triangular-lanceolate, acute, sessile and clasping at the rounded base, saliently toothed, pubescent except between ribs on lower leaf surface; flowers essentially sessile in spicate racemes terminating the main stem and branches; bracteoles none; calyx with 4 lanceolate lobes; corolla golden-yellow, 15-17 mm. long, 2-lipped with the upper lip galeate; capsule about 8 mm. long, distally brown-hirsute; seeds 0.3 mm. long. In moist to wet sandy soil in s.e. Tex. (Jasper Co.), Apr.-June; an Old World species introd. in n. Calif., Ore. and Tex.

29. PEDICULARIS L.

LOUSEWORT. WOOD-BETONY

About 500 species in the Northern Hemisphere.

1. *Pedicularis canadensis* L. COMMON LOUSEWORT. Perennial, hairy; stems simple, closely clustered, to about 4 dm. high; leaves scattered, the lowest pinnately parted, the others partly pinnatifid, all or nearly all petioled, the blade to about 15 cm. long and 5 cm. wide; large-bracted raceme dense and short (3-5 cm.) in flower, elongated to 2 dm. in fruit; calyx 7-9 mm. long, split in front, otherwise almost entire, oblique; corolla yellow or yellowish, to 23 mm. long, strongly bilabiate, the incurved upper lip hooded and 2-toothed under the apex; lower corolla lip erect at base, 2-crested above, 3-lobed; lobes commonly spreading, the lateral ones rounded and larger; anthers transverse, the cells pointless; capsule lance-oblong-flattened, several-seeded, twice as long as calyx. In open forests, on the edge of forests, on open seepage slopes, also in clearings and prairies, in e. Tex., Mar.-May; from Me. and Que. to Man., s. to Fla., Miss., La., Tex. and n. Mex.

30. CASTILLEJA L.f.¹⁷⁹

INDIAN PAINTBRUSH. PAINTEDCUP

Perennial or annual herbs, sometimes woody at the base; leaves alternate, entire or pinnately lobed; flowers in bracteate spikes; bracts prominent, usually more conspicuously colored than the flowers; calyx tubular, terminating in 4 or (if wholly united laterally) 2 lobes; corolla extremely zygomorphic, with a long narrow galeate (hooded) upper lip and a shorter often vestigial lower lip, the tube long and narrow; stamens 4, didynamous, each pair of anther sacs unequally placed; capsule ovoid, bilocular, loculicidal; seeds numerous, the testa loose and alveolately reticulate.

More than 150 species, concentrated in western North America, Mexico and Central America; 1 species in the West Indies, about 5 species in South America and about 10 species in Eurasia. The common name "Indian blanket" is sometimes loosely applied to this genus but that name should be reserved for *Gaillardia* of the Compositae.

1. Corolla tube long, falcate, exerted from the calyx, 25-45 mm. long, the corolla purplish to yellow, sometimes cream-white; calyx and bracts inconspicuous, wholly green or sometimes pink-tipped (2)
1. Corolla tube shorter, usually enclosed by the calyx, 16-25 mm. long (to 33 mm. long in *C. integra*), the corolla usually greenish except for the colored ventral margins of the galea and often the teeth of the lower lip; calyx and bracts bearing most of the attractive coloration on distal parts (3)

¹⁷⁹ Contributed by Noel H. Holmgren.

- 2(1). Calyx segments long and narrow, 8-14 mm. long; lower lip of the corolla 5-6 mm. long, not glandular-pubescent; stems short-villose to somewhat lanate 1. *C. sessiliflora*.
2. Calyx segments shorter, 2-6 mm. long; lower lip of the corolla 6-8.5 mm. long, glandular-puberulent; stems hispid-hirsute 2. *C. tortifolia*.
- 3(1). Calyx segments distinct for at least one third the length of the primary lobes, the lateral clefts 3-16 mm. deep (4)
3. Calyx segments wholly united laterally forming entire or (at most) emarginate primary lobes, never cleft for more than 1 mm. deep (7)
- 4(3). Leaves pinnately divided, at least the upper ones; calyx segments 7-16 mm. long, linear to subulate; lower lip of the corolla prominent, 1.5-7 mm. long, the lobes somewhat flaring to widely flaring; throughout central Texas 3. *C. purpurea*.
4. Leaves entire; calyx segments shorter, 3-11 mm. long, broadly linear to lanceolate; lower lip of the corolla very reduced, 1-2 mm. long, the teeth short and incurved; western Texas (5)
- 5(4). Stems whitish-tomentose or lanate; bracts glandular-puberulent on the colored portions; widespread in western Texas 6. *C. integra*.
5. Stems glabrous, hispidulose or (at most) finely villose; bracts not glandular-pubescent; local endemics (6)
- 6(5). Stems and leaves finely villose; dorsal surface of the galea minutely puberulent; known only from the Chisos Mountains, Brewster Co. 4. *C. elongata*.
6. Stems and leaves glabrous or hispidulose; leaves sometimes ciliate; dorsal surface of the galea tomentulose; known only from Mount Livermore in the Davis Mountains, Jeff Davis Co. 5. *C. ciliata*.
- 7(3). Annual; galea 6-9 mm. long; upper leaves usually pinnately lobed; eastern Texas 9. *C. indivisa*.
7. Perennial; galea 11-16 mm. long; leaves all entire; Trans-Pecos Texas (8)
- 8(7). Stems, leaves, bracts and calyces densely white-lanate, no gland-tipped hairs; bracts narrow-elliptic, usually with a pair of narrow lateral lobes 7. *C. lanata*.
8. Stems, leaves, bracts and calyces finely pubescent with spreading hairs, some hairs gland-tipped; bracts obovate to elliptic, entire 8. *C. latebracteata*.

1. *Castilleja sessiliflora* Pursh. Perennial; stems villose to somewhat lanate, clustered, 1-3 dm. tall, usually simple; leaves all entire or the upper with a pair of divergent narrow lateral lobes, linear, finely villose; bracts broader and shorter than the leaves and with a pair of lateral lobes, green, sometimes pink-tipped, finely villose; flowers yellow, sometimes pinkish to purplish; calyx 25-40 mm. long, the primary lobes 12-20 mm. long, the segment long and linear, 8-14 mm. long; corolla 35-55 mm. long, conspicuously exerted beyond the bracts, the galea 9-13 mm. long, the prominent lower lip 5-6 mm. long, with flaring lobes, the long falcate tube 25-45 mm. long. Incl. f. *purpurina* Penn. Dry rocky or sandy hills of the Panhandle and w. Tex., Mar.-May (Sept.); throughout the Great Plains, from s. Sask., s. Man. and Ill., s. to s.e. Ariz., n. Mex. and w. Tex.

2. *Castilleja tortifolia* Penn. Annual or at most a short-lived perennial; stems hispid-hirsute, strict or few-branched from the base, 8-25 (-30) cm. tall; leaves entire below, 3-parted above, margins of the midblade becoming crisped distally, linear, hispid; bracts 3- to 5-parted; flowers lemon-yellow; calyx 18-28 mm. long, the primary lobes 6-14 mm. long, the lanceolate segments 2-6 mm. long; corolla 35-55 mm. long, conspicuously exerted beyond the calyx and the bracts, glandular-puberulent, the galea 9-14 mm. long, the prominent lower lip with conspicuously flaring lobes, 6-8.5 mm. long, the long falcate tube 25-45 mm. long. *C. tortifolia* may belong to *C. mexicana* (Hemsl.) Gray. Open grassy hillsides in the cen. Trans-Pecos, Apr.-May (July); also s. to cen. Chih.

3. *Castilleja purpurea* (Nutt.) G. Don. Perennial; stems villose-lanate, several, clustered, 2-3 (-4) dm. tall; leaves 1 or 2 (rarely 3) pairs of divergent narrow lateral

lobes, linear to lanceolate, finely villose-cinereous; bracts with 1 or 2 pairs of lateral lobes, lanceolate to broad-lanceolate; bracts and calyces distally colored, the corolla bearing little of the coloration; calyx (20-) 25-34 mm. long, the primary lobes (10-) 13-22 mm. long, the segments linear to lanceolate and 7-16 mm. long; corolla 25-40 mm. long, the galea 9-13 mm. long, the lower somewhat protruding lip 2-7 mm. long, the tube 16-28 mm. long. Usually on calcareous gravelly or sandy soils in the humid region from s. Kan. and s. Mo., s. through Okla. and cen. Tex. to the Edwards Plateau and n. Rio Grande Plains.

Represented in Texas by the following variants.

1. Lower lip of the corolla long and widely flaring, 3-7 mm. long; bracts and calyces distally greenish-yellow to bright-yellow var. *citrina*.
1. Lower lip of the corolla shorter, 1.5-3 (-4) mm. long; bracts and calyces distally purple through red to orange and yellow-orange (2)
- 2(1). Bracts and calyces distally purple to purplish-red .. var. *purpurea*.
2. Bracts and calyces distally yellow-orange to red, sometimes brownish-orange
..... var. *Lindheimeri*.

Var. *citrina* (Penn.) Shinnars. *C. citrina* Penn., *C. labiata* Penn. Gravelly and sandy calcareous hills and prairies in cen. Tex. from the Red River in the Western Cross Timbers, s. to the s. edge of the Edwards Plateau and w. to Ector Co., Apr.-May; from s.-ccn. Kan., s. through w. Okla. and across Tex.

Var. *purpurea*. *Euchroma purpurea* Nutt. Local on limestone outcrops in the n. Blackland Prairies and Eastern Cross Timbers, common in the Grand Prairie, extending w. into the Western Cross Timbers and s. into the Central Mineral Region, Apr.-May; from s.w. Mo., across e. Okla. and s.w. through cen. Tex.

Var. *Lindheimeri* (Gray) Shinnars. *C. Lindheimeri* Gray, *C. Mearnsii* Penn., *C. Williamsii* Penn. Calcareous gravelly, sandy or clay soils on hills and prairies in the s. Blackland Prairies and the Grand Prairie to the s.e. part of the Edwards Plateau and the n. Rio Grande Plains, Mar.-May; endemic.

4. *Castilleja elongata* Penn. Perennial; stems 2-4 dm. tall, branched; stems, leaves and bracts finely villulose; leaves entire, linear; bracts entire or 3-parted, lanceolate, obtuse or rounded; bracts and calyces reported to be red-colored distally; calyx 17-23 mm. long, the primary lobes about 7 mm. long, the lanceolate segments 3.5-5 mm. long; corolla 25-28 mm. long, the galea about 12 mm. long, the lower lip reduced with incurved vestigial teeth. Habitat of the type, wooded slopes in the Chisos Mts., June-Aug.; a rarely collected endemic.

5. *Castilleja ciliata* Penn. Perennial; stems 2-6 dm. tall, usually strict; stems, leaves and bracts glabrous or scarcely hispid, the leaves and bracts sometimes ciliate; leaves entire, rarely 3-parted, linear, attenuate; bracts entire at first, becoming 3-parted, lanceolate to broadly lanceolate; bracts and calyces distally red; calyx 20-25 mm. long, the primary lobes 12-14 mm. long, the lanceolate acute segments 4-6 mm. long; corolla 25-37 mm. long, the galea 11-13 mm. long, with a tomentulose dorsal surface, the lower lip reduced. High elev. on rocky slopes of Mt. Livermore, Davis Mts., June-Oct.; a rarely collected endemic.

6. *Castilleja integra* Gray. Perennial; stems whitish-tomentose or lanate, clustered, 1-4 dm. tall; leaves entire, linear to narrow-lanceolate, often involute, short-villose on the lower surface, glabrous above, green on both sides; bracts lanceolate to ovate, sometimes oblanceolate or obovate, entire or usually 3-lobed; bracts and calyces distally scarlet to cerise, sometimes yellowish, also finely glandular-pubescent distally and villose proximally; calyx 21-37 mm. long, the primary lobes 10-18 mm. long, the lanceolate segments 4-11 mm. long; corolla 26-45 mm. long, the galea 8-15 mm. long, the lower lip reduced and short-toothed, the tube 17-33 mm. long. Dry gravelly soil on hills and plains in the Trans-Pecos and an outlying segment in Crockett Co., on the Edwards Plateau, Apr.-Oct.; Colo., s. to Ariz., N.M., w. Tex. and n. Mex.

A careful study of the Crockett County population may show it to be distinct from *C. integra*. It appears to differ from the species in having yellowish inflorescences and shorter floral measurements.

7. *Castilleja lanata* Gray. Perennial; stem to 9 dm. tall, often with woody bases, clustered and frequently branched; stems, leaves and proximal parts of the bracts and calyces densely white-lanate; leaves entire, linear, pubescence somewhat less dense than on the stem; bracts entire to 3-parted, oblanceolate; bracts and calyces red, sometimes pinkish or orange distally, colored portions less pubescent than the lanate bases; calyx 20-27 mm. long, the entire primary lobes 10-14 mm. long, rounded or retuse; corolla 23-33 mm. long, the galea 11-15 mm. long, the lower lip reduced, the tube 12-17 mm. long. Dry rocky slopes of the Trans-Pecos, Mar.-Aug. (continues to flower over a long period of time); s. Ariz., s. N.M., n. Mex. and w. Tex.

8. *Castilleja latebracteata* Penn. Perennial; stems several, clustered, 2-4 dm. tall; stems, leaves and proximal parts of the bracts and calyces finely viscid-glandular pilose; leaves entire, oblanceolate to linear, prominently 3-nerved; bracts obovate to elliptic, broadly rounded, prominently 3-nerved; bracts and calyces distally red to violet-red; calyx 22-35 mm. long, the entire primary lobes 8-11 mm. long, distally expanded, truncate-rounded to emarginate; corolla 25-40 mm. long, the galea 11-14 mm. long, the lower lip reduced, its teeth short and incurved, the tube 19-27 mm. long. Dry rocky slopes of mts. and canyons in the Trans-Pecos, Mar.-Dec. (continues to flower over a long period of time); w. Tex. and n. Mex.

Castilleja sp. described in Pennell, Proc. Acad. Nat. Sci. Phila. 92:307. 1940, from Ft. Davis, is similar to *C. latebracteata* except for the lobing of the bracts and calyx, and the wider leaves.

9. *Castilleja indivisa* Engelm. TEXAS PAINTBRUSH. Annual with a slender taproot; stems pilose below and villose in the inflorescence, usually strict, 2-4 dm. tall; leaves entire or often with 1 or 2 pairs of short divergent lobes, linear to lanceolate, nerves and margins pilose-ciliate, the lamina puberulent; bracts rhombic to broadly oblanceolate, frequently with very short lateral lobes near the apex 7-13 (-18) mm. broad, the broad midlobe mucronate-tipped; bracts and calyces distally various shades of red; calyx 18-25 (-28) mm. long, the entire primary lobes 6-9 mm. long, truncate-rounded to emarginate; corolla 20-28 mm. long, the galea 6-9 mm. long, the lower lip reduced but projecting forward, the tube 15-20 mm. long. *C. indivisa* f. *vivida* Cory. Wet sandy loam soils throughout the Coastal Plain and e. half of Tex., a few collections from low elev. in the Grand Prairie, Mar.-June; s.e. Okla., Tex.

31. CORDYLANTHUS NUTT.

CLUB-FLOWER. BIRD-BEAK

About 40 species centered in western North America.

1. *Cordylanthus Wrightii* Gray. Annual to about 6 dm. high, loosely and freely branched, almost glabrous to somewhat puberulent-scabrous, apparently somewhat root-parasitic; stems leafy, mostly erect and much-branched; leaves alternate, 3- or 5-parted, with setaceous-filiform segments; outer bracts 3- to 7-lobed, with the lobes very narrow; flowers several in dense terminal heads; calyx with a tubular base and a spathe-like lobe that is often opposed by a more or less similar bract to give the appearance of a bilobed calyx; corolla narrow, bilabiate, 2-3 cm. long, tubular, purplish, with rather long nearly equal lips; stamens 4, the anther cells dissimilar and villous; style hooked at apex; capsule compressed; seeds coarsely favose. On dry hills and plains in the Trans-Pecos; from Tex. to Ariz.

FAM. 161. BIGNONIACEAE JUSS.

CATALPA FAMILY

Shrubs, trees or woody vines; leaves opposite or the uppermost alternate, simple to pinnately compound, without stipules, entire to toothed or lobed; flowers rather large and showy, perfect, irregular, in terminal panicles or spikelike racemes, or axillary and paired or whorled; calyx short, bilabiate or unequally 4- or 5-toothed; corolla bilabiate or nearly regular, 5-lobed; stamens 2 or 4; pistil 1, the style and stigma 1; fruit a capsule; placentae parietal; seeds numerous, compressed, winged, sometimes comose.

About 650 species in more than 120 genera, mostly tropical, in both hemispheres.

1. Corolla bright-yellow or greenish-yellow to red-orange; leaves more or less compound, all opposite; trailing to high-climbing vines, viny shrubs or shrubs (2)
1. Corolla white to rosy-lavender or violet-color, often with orange-color or purple markings within; leaves simple, the uppermost usually alternate; trees or large shrubs (4)
- 2(1). Tendrils present; leaflets 2 or sometimes 1, entire, evergreen; flowers axillary; corolla curved-funnelform, the outer surface dull-red 1. *Bignonia*, p. 1443.
2. Tendrils absent; leaflets 5 to 13, sharply toothed, not evergreen; flowers terminal; corolla subcylindrical or funnelform, the outer surface bright-yellow or orange-color (3)
- 3(2). Viny shrub with aerial rootlets; leaflets petiolulate, mostly ovate; corolla thick-tissued, red-orange within; capsule stipitate ... 2. *Campsis*, p. 1443.
3. Shrub without aerial rootlets; leaflets sessile, mostly linear-lanceolate; corolla thin-tissued, yellow within; capsule not stipitate 3. *Tecoma*, p. 1444.
- 4(1). Leaves subsessile, linear-lanceolate, entire, glabrous 4. *Chilopsis*, p. 1444.
4. Leaves petioled, broadly ovate, often pubescent beneath, the larger ones sometimes lobed (5)
- 5(4). Calyx thin, distinctly bilobed; capsule cylindrical, long and narrow; seeds with tuft of hairs at each end 5. *Catalpa*, p. 1444.
5. Calyx thick, with 5 subequal lobes; capsule ovoid, beaked, woody; seeds winged ... 6. *Paulownia*, p. 1445.

1. BIGNONIA L.

A monotypic genus.

1. *Bignonia capreolata* L. CROSS-VINE, QUARTER-VINE. Evergreen high-climbing woody glabrous vine to 20 m. long; leaves opposite, with a petiole 1-2 cm. long, bifoliolate, the rachis ending in a tendril whose several branches are terminated by small disks; leaflets short-stalked, ovate-oblong to broadly elliptic or elliptic-lanceolate, to 15 cm. long and 5 cm. wide, obtuse to acuminate at apex, cordate at base; cymes axillary, short-stalked, 2- to 5-flowered; pedicels 2-4 cm. long; calyx campanulate, 6-8 mm. long, shallowly 5-lobed or truncate; corolla funnelform-campanulate, red-orange, lighter within, thickish, 4-5 cm. long, the rounded recurved lobes about one fourth as long as the tube, with a spreading slightly bilabiate limb; stamens 4, included, inserted near base of corolla; disk annular; ovary linear, many-ovuled; capsules linear, flattened parallel to the partition, 10-17 cm. long, septifragally dehiscent, with leathery valves; seeds elliptic, winged. *B. crucigera* L., *Anisostichus capreolata* (L.) Bur. Climbing in trees in moist woods in the e. Tex. pinelands, Mar.-May; from Md. and Va., w. to s. Ill., s. to Fla. and e. Tex.

2. CAMPSIS LOUR. TRUMPET-CREEPER

Two species, one in North America, one in eastern Asia.

1. *Campsis radicans* (L.) Seem. TRUMPET-HONEYSUCKLE, COW-ITCH VINE. Deciduous viny shrub climbing to 10 m. or more, with aerial rootlets; leaves opposite, odd-pinnate; leaflets 9 to 11, with a tuft of hairs on the leaf rachis between the short petiolules, broadly ovate to ovate-oblong or elliptic-lanceolate, acuminate at apex, broadly rounded to cuneate at base, to 9 cm. long and 4 cm. wide, serrate, usually somewhat pubescent beneath; pedicels stout, about 1 cm. long; flowers in terminal panicles; calyx tubular-campanulate, 2-2.5 cm. long, reddish-brown, leathery, the 5 triangular lobes much shorter than the tube; corolla thick-tissued, tubular-funnelform, orange to orange-red outside, with a scarlet limb, 6-9 cm. long, the tube about 3 times as long as the calyx, the limb 4-5 cm. broad; anthers 4 mm. long, glabrous; capsules stipitate, cylindrical-oblong, 8-12 cm. long, beaked, keeled along the sutures, loculicidally dehiscent, with leathery valves

that separate from the septum; seeds numerous, compressed, with 2 large wings. *Tecoma radicans* L. Climbing over shrubs and trees, and along fences in the e. half of Tex., May-Oct.; from N.J. to O. and Ia., s. to Fla. and Tex.

3. TECOMA JUSS. TRUMPET-FLOWER

About 16 species in the Western Hemisphere.

1. *Tecoma stans* (L.) JUSS. ESPERANZA, TRONADORA, MIÑONA. Erect deciduous shrub to 8 dm. high, usually much smaller; leaves opposite, with a petiole to 4 cm. long, odd-pinnate; leaflets 5 to 13, membranous, cuneate at the sessile base, ovate-lanceolate to elliptic or linear-lanceolate, acute to acuminate at apex, mostly glabrous but occasionally pubescent beneath, somewhat serrate or incised, to 1 dm. long and 2 cm. wide; pedicels to 1 cm. long, with 1 or 2 bracteoles near base; flowers in terminal racemes or panicles; calyx tubular-campanulate, 3-6 mm. long, 5-dentate at apex; corolla bright-yellow, funnel-form-campanulate, 35-65 mm. long, 5-lobate, the limb somewhat bilabiate and 3-5 cm. broad; stamens 4, included; anthers about 4 mm. long, pubescent; pistil filiform, about 25 mm. long; capsule compressed, linear, subterete, loculicidally dehiscent, with leathery valves, to 2 dm. long, about 6 mm. thick; seeds about 6 mm. long, oval to narrowly elliptic, flat, with 2 large thin scarious entire wings. Rocky areas in mts. of the Trans-Pecos, Apr.-Nov.; from Fla., Tex., N.M. and Ariz., s. through Mex. and the W.I. to S.A.

A specimen of var. *stans* has been collected "in alluvium" near San Antonio. All other material of this species is found only in Trans-Pecos Texas where it occurs on ledges and cliffs and at the base of bluffs in mountain canyons. This western plant, which seldom exceeds 3 m. in height and which has very narrow, more deeply incised, and often more numerous leaflets than in var. *stans*, is referred to var. *angustata* Rehd. [*Stenolobium incisum* Rose & Standl., *Tecoma Tronodora* (Loes.) I. M. Johnst., *T. incisa* (Rose & Standl.) I. M. Johnst.].

4. CHILOPSIS D. DON DESERT WILLOW. MIMBRE

One species native in North America.

1. *Chilopsis linearis* (Cav.) Sweet. Laxly ascending or spreading deciduous shrub or small tree to 10 m. high; sterile branchlets glabrous to somewhat woolly, without terminal buds; leaves opposite or alternate, short-petioled to sessile, entire, linear to linear-lanceolate, to 3 dm. long, rarely to 1 cm. wide, gradually narrowed at both ends, glabrous, often viscid; flowers fragrant, in terminal racemes or panicles to 3 dm. long; pedicels stout, pubescent, about 5 mm. long; calyx pubescent, bilabiate, 1-1.5 cm. long; corolla funnel-form-campanulate, slightly bilabiate, variously colored, usually whitish tinged with pale-purple, also purplish-red or pinkish with purple stripes, 2-3.5 cm. long and nearly as wide; stamens 4, included; staminodia 1; capsule slender, 2-valved, to 3 dm. long, about 6 mm. thick; seeds numerous, oval, flat, winged, with a fringe of hair at each end, 6 mm. long. *C. saligna* D. Don. Commonly along water courses and in dry stream beds of w.-cen. and far w. Tex., Apr.-Sept.; from Tex. to Calif., southw.

The plant with glutinous sterile branchlets and young leaves, segregated as var. *glutinosa* (Engelm.) Fosb., occurs in the Trans-Pecos, especially along the Rio Grande.

Frequently planted as an ornamental in central and southern Texas.

5. CATALPA v. WOLF. CIGAR-TREE

Deciduous trees; winter-buds with several outer scales; terminal bud wanting; leaves opposite, sometimes whorled, long-petioled, entire or very coarsely lobed, 3- to 5-veined from base, usually with a purple glandular spot in the axils of the primary veins beneath; flowers in terminal panicles or racemes; calyx irregularly splitting or bilabiate; corolla campanulate, bilabiate, with 2 small upper and 3 larger lower lobes; fertile stamens 2, included; style slightly longer than the stamens; capsules cylindric, very long and narrow, separating into 2 valves; seeds numerous, oblong, winged on each side with the wings cut into a fringe.

About a dozen species in North America and eastern Asia.

1. Leaves long-tapering at apex; panicle several-flowered; corolla sparsely spotted with purple-brown, about 4 cm. wide, its lower lobe notched; valves of capsules remaining semiterete after dehiscence 1. *C. speciosa*.
1. Leaves abruptly short-acuminate at apex; panicle many-flowered; corolla densely spotted with purple-brown, 2-3 cm. wide, its lower lobe entire; valves of capsules flattening after dehiscence 2. *C. bignonioides*.

1. *Catalpa speciosa* Warder. CATAWBA-TREE, CIGAR-TREE. Tree to 30 m. high, the crown pyramidal; bark red-brown, broken into thick scales; leaves with a petiole to 15 cm. long, ovate to ovate-oblong, 15-30 cm. long, long-acuminate at apex, truncate to cordate at base, bright-green and glabrous above, densely pubescent beneath, odorless; panicle relatively few-flowered, about 15 cm. high; corolla to 5 cm. long and 4 cm. wide, with slightly oblique limb, the lower lobe emarginate, whitish, with 2 yellow stripes within and inconspicuously spotted purple-brown; capsule 2-4.5 dm. long, about 1.5 cm. thick, with a thick wall; seeds 4-5 mm. wide. In damp woods and on the edge of swamps and along streams in e. Tex., Mar.-June; from s. Ill. and Ind., s. to e. Tex., occasionally escaped from cult.

2. *Catalpa bignonioides* Walt. COMMON CATALPA. Tree to 15 or rarely 20 m. high, with wide-spreading branches to form a broad roundish crown; bark light-brown, separating into thin scales; leaves often whorled, with a petiole up to 16 cm. long, ovate, 1-2 dm. long, abruptly short-acuminate at apex, truncate to subcordate at base, sometimes with a pair of small lobes, light-green and nearly glabrous above, pubescent beneath (especially on the veins), with an unpleasant odor when crushed; panicle broad-pyramidal, 15-20 cm. high; corolla 2.5-4 cm. long, 2-3 cm. wide, white, with 2 yellow stripes within and thickly spotted purple-brown, with oblique limb and entire lower lobe; capsule to 4 dm. long and 1 cm. thick, with thin walls, its valves flattening after dehiscence; seeds 2.5-4.5 mm. wide, the hairs of the terminal tufts connivent into a point. Uncommon in e. Tex., Mar.-June; a s. U.S. species that occasionally escapes cult. farther n.

6. PAULOWNIA SIEB. & ZUCC. PRINCESS-TREE

About 17 species that are native to eastern Asia. Placed by some authors in the family Scrophulariaceae.

1. *Paulownia tomentosa* (Thunb.) Steud. Deciduous tree to 15 m. high, with stout spreading branches to form a round crown; bark grayish; branchlets densely soft-pubescent when young, becoming glabrous; leaves opposite, with a petiole 8-20 cm. long, broadly ovate to ovate, to 3 dm. long or (on vigorous shoots) much longer, acuminate at apex, cordate at base, entire or sometimes shallowly 3-lobed, pubescent above, densely pubescent or tomentose beneath; panicle pyramidal, terminal, 2-3 dm. long; calyx 1-1.5 cm. long, broad-campanulate, with 5 ovate obtuse lobes, rusty-tomentose like the pedicels; corolla funnelform-campanulate, 5-6 cm. long, pale violet, with darker spots and yellow stripes within, glandular-pubescent outside, with a spreading oblique 5-lobed limb; stamens 4, with distinct spreading anther cells, sterile stamen wanting; capsules ovoid, beaked, 3-4 cm. long, woody, loculicidally dehiscent by 2 valves; seeds small, numerous, winged. An e. Asia ornamental species that escapes cult. and occurs along roadsides, in clearings and on the edge of woods in e. Tex., Apr.-May; from Fla. to Tex., n. to W.Va. and N.Y.

FAM. 162. MARTYNIACEAE STAFF¹⁸⁰

UNICORN-PLANT FAMILY

Coarse stout annual or perennial herbs with branching stems, viscid to glandular-pubescent and usually strongly scented; leaves exstipulate, simple, long-petioled, opposite to alternate; flowers usually large and showy in loose terminal racemes; calyx bi-

¹⁸⁰ Contributed by Richard H. Hevly.

bracteate, composed of 5 irregular sepals or spathaceous and 5-lobed; corolla sympetalous, 5-lobed and somewhat bilabiate; fertile stamens 4, didynamous (the rudiment of the 5th usually obvious), or 2, the second pair forming staminodes; filaments attached to the corolla; anthers gland-tipped and with 2 divergent cells; carpels 2, united to form a 1-celled ovary with 2 parietal intruded placentae expanded into 2 broad lamellae, the ovary apparently inserted on an annular glandular disk; ovules anatropous; style 1, slender; stigma with 2 flat sensitive lobes; fruit a drupaceous capsule, bivalved and loculicidally dehiscent or indehiscent, imperfectly 5-celled, frequently crested and always terminated by a prominent incurved 2-horned beak; exocarp fleshy, separating in age from the woody reticulate-sculptured or spinose endocarp; seeds 4 or many, the testa corky-tuberculate or membranous-reticulate; endosperm none; embryo straight; cotyledons large and fleshy.

About 20 species in 5 genera, native to the Western Hemisphere.

1. PROBOSCIDEA SCHMID.

UNICORN-PLANT. DEVIL'S CLAW.

CINCO LLAGAS

Erect to decumbent herbs arising from well-developed annual taproots or perennial tuberous roots; leaves opposite to alternate, orbicular-reniform to ovate-lanceolate and entire to palmately or pinnately lobed; flowers 2-7 cm. in length, few to many in terminal racemes which usually exceed the foliage, axis of inflorescence lengthening in fruit; pedicels erect to spreading but lengthening, thickening and becoming deflexed in fruit; pedicel bracts linear to oblanceolate, deciduous or absent; calyx spathaceous, membranous, more or less unequally 5-lobed, split ventrally to the base, deciduous, with 2 frequently fleshy-thickened linear to orbicular bracts; corolla reddish-purple, pinkish-lavender, creamy-white or orange-yellow, tubular-cylindric to campanulate or infundibular, more or less gibbous and ventricose, 5-lobed; fertile stamens 4, didynamous, adhering by their edges; filaments arcuate and glabrous or pubescent in part; pistil about as long as to longer than stamens; ovary ovate to lanceolate and usually glabrous; style slender, stigma lobes obovate-oblanceolate; fruit dehiscent, crested ventrally and also sometimes dorsally, beak exceeding the fruit body in length one and one fourth to three and one half times; endocarp reticulate-sculptured; seeds 6-8 mm. long, angled, numerous, with a thick corky tuberculate black or rarely white testa.

About 12 species, most of which are confined to North America.

1. Plant perennial, arising from a tuberous root; corolla light-yellow to bronze; fruit crested on two sides 1. *P. altheaefolia*.
1. Plants annual, arising from a taproot; corolla purplish, reddish, pinkish, creamy-yellow or white; fruit crested on only one side (2)
- 2(1). Corolla tube usually lacking spots or blotches internally but (if these are present) they are few, scattered and restricted to the lower half of the tube; filaments glandular at and below their point of attachment but glabrous above; flowers 2-4 cm. long, reddish-purple, pink or white, 10 or fewer in lax racemes surpassed by the foliage 2. *P. parviflora*.
2. Corolla tube with conspicuous reddish-purple spots and smaller more pale-lavender blotches extending internally the entire tube-length; filaments glabrous or sparsely villous or tomentose below their point of attachment, glandular on the arcuately curved portion; racemes 10- or more-flowered and exceeding the foliage except in *P. sabulosa* (3)
- 3(2). Corolla purplish-violet to reddish-purple or rarely white, 35-65 mm. long; leaves broadly ovate to deltoid in outline, 5- or 7-lobed, dentate 3. *P. fragrans*.
3. Corolla pinkish-lavender, creamy-yellow or dull-white (lobes purple or purplish-red in *P. spicata* and *P. sabulosa*); leaves broadly ovate to suborbicular or subreniform, entire to undulate-repand or sinuate (4)

- 4(3). Corolla tubular-cylindric, about 2 cm. long, the lobes 4-5 mm. in diameter; inflorescences with fewer than 6 flowers and surpassed by the foliage 4. *P. sabulosa*.
4. Corolla funnelform to campanulate, 2-5.5 cm. long, the lobes 5 mm. or more in diameter; inflorescences 8- or more-flowered and exceeding the foliage (5)
- 5(4). Flowers 20 or more in a spicate raceme; pedicels mostly about 15 mm. long; corolla about 20 mm. long, funnelform-campanulate, scarcely ventricose, the lobes 5-10 mm. long; leaves to 1 dm. long and wide 5. *P. spicata*.
5. Flowers 8 to 20 in a loose raceme; pedicels 20-30 mm. long; corolla 35-55 mm. long, campanulate, ventricose, the lobes 15-30 mm. long; leaves to 3 dm. long and wide 6. *P. louisianica*.

1. *Proboscidea altheaefolia* Dcne. DESERT UNICORN-PLANT. Coarse spreading viscid-pubescent perennial with a large fusiform root; branches decumbent, spreading to 6 dm. and ascending to 3 dm.; petioles 3-18 cm. long; blades nearly reniform or suborbicular to broadly ovate, 2-7 cm. long and 2-8 cm. wide, the margins nearly entire to crenate or undulate-sinuate and unlobed to deeply 5- to 7- (9)-lobed, 3- to 7-nerved; flowers fragrant, 3 to 16 in short racemes having an initial axis length of 5-12 cm. but lengthening in fruit to 1-2 dm.; pedicels 2-8 cm. long, slender, ascending in anthesis and with a linear basal bract; calyx bracts orbicular or broadly ovate to oblong-falcate, 5-10 mm. long, 2-5 mm. wide; calyx 1-1.5 cm. long, the lobes cut one third to one half its length, viscid-pubescent without, glabrous within, the margins glandular-ciliate; corolla yellowish-brown externally, yellow to bronze-orange internally, the tube with pale blotches and frequently with maroon, reddish-brown or rust-colored spots forming 2 rows internally, 2-3 cm. long, slightly to strongly ventricose, infundibular to campanulate, the lobes spreading, 1-1.5 cm. long, 1.5-3 cm. wide, occasionally with maroon or brownish reticulations or flecks in the throat and on the lobes; filaments viscid-pubescent at their base; pistil about as long as or longer than the stamens; fruit body very slender, 5-6 cm. long, about 12 mm. thick, the horns about twice as long as the body, crested on two sides, the distal tooth on the dorsal suture often forming a slender horn. In sandy soil and on dunes and gravelly hills in the s. Plains Country and Trans-Pecos, June-Sept.; from w. Tex. and e. N.M. to s. Calif. and n. Mex.

The yellow-flowered species of *Proboscidea* from Texas has previously been referred to *P. arenaria* (Engelm.) Dcne. for the most part, but that species, contrary to various reports, is perennial and conspecific with *P. altheaefolia*.

2. *Proboscidea parviflora* (Woot.) Woot. & Standl. Plant large, annual, sprawling, as much as 1.5 m. across and to 5 dm. high, the herbage glandular-pubescent throughout; stem thick and heavy; petioles to 25 cm. long or more; blades broadly triangular-ovate to suborbicular-ovate, cordate or inequilateral, rounded to obtuse at apex, to 25 cm. long and nearly as broad, the margins nearly entire to shallowly 3- to 7-lobed, the sinuses obtuse, denticulate; flowers 10 or fewer, borne in a short slender raceme to 1 dm. long that is overtopped by the leaves; pedicels rather stout, 1.5-3 cm. long in anthesis, lengthening in fruit to about 45 mm.; pedicel bract obovate to oblanceolate, 3-5 mm. long; calyx bracts ovate to elliptic or oblong in outline, obtuse, 5-8 mm. long, 3.5 mm. wide, 2 mm. thick; calyx thin-herbaceous, 1-1.5 cm. long, the lobes unequally cut one fourth to one half the length of the calyx; corolla tubular-campanulate, only slightly ventricose, 2.5-4 cm. long, viscid-glandular without and only slightly so within but with short articulate hairs at throat; corolla tube reddish-purple, pink or white, 1.75-3 cm. long, 7.5-15 mm. wide across orifice, with cylindrical base 4-8 mm. long, usually lacking spots or blotches externally but (if these are present) they are few, small, scattered and restricted to the lower half of the tube, a bright-yellow band extending along the lower portion of the tube and out into the lower lobe; corolla lobes the same color as tube but the upper lobes frequently with a single large purple or reddish-purple blotch each, subequal, broadly rounded, 5-10 mm. long and 10-15 mm. wide, upper and lateral lobes wide-flaring or reflexed, 1.75-2.25 cm. across the lobes when spread out; filaments glandular at and below their point of attachment, glabrous above; fruit body ellipsoid,

strongly keeled on the ventral side, 5.5-10 cm. long, 1.5-3 cm. thick, tapered above into a stout curved horn that is 1.25 to 3.5 times as long as the body; seeds rarely white in semicultivated strains utilized by certain southwestern aboriginal groups for the fiber obtained from the horns. *Proboscidea crassibracteata* Correll. In sandy, gravelly or clay soils in the Trans-Pecos, June-Sept.; from w. Tex. and N.M. to s. Calif. and n. Mex.

3. *Proboscidea fragrans* (Lindl.) Dcne. Viscid-pubescent annual, spreading to 2 m. in diameter and to 6 dm. in height, dichotomously branched, the stems thick and heavy; petioles to 2 dm. long; blades broadly triangular to broadly ovate, nearly entire to 5- or 7-lobed, the sinuses acutish, cordate or inequilateral at base, obtuse at apex, to 25 cm. long and nearly as broad; flowers fragrant, 8 to 20 in a loose raceme surpassing the foliage; pedicels 1-2.5 cm. long in anthesis, lengthening in fruit to about 45 mm.; pedicel bracts elliptic-ob lanceolate, 5-10 mm. long or apparently absent; calyx bracts oblong to ovate or linear-elliptic, becoming plano-convex and spongy with age, to 12 mm. long; calyx papery, to 25 mm. long, the unequal lobes cut one third to one half the length of the calyx, the lateral lobes 1 cm. or more broad, glandular-pubescent without and glabrous within; corolla strongly ventricose, 3.5-6 cm. long, cylindrical portion of the tube to 5 mm. long, flaring portion of the tube 2.5-4 cm. long, purplish-violet to reddish-purple or rarely white, orifice 1.75-3 cm. wide, the limb often with deeper colored blotches on the upper lobes but flaring, lobes 1-2 cm. long and 2-3 cm. wide, viscid-glandular without and slightly so within, the tube interior with violet blotches and darkish reddish-purple spots, a bright-yellow band extending along the lower portion of the tube and out onto the lower lobe; filaments glabrous or sparsely villous or tomentose below their point of attachment, glandular on the arcuately curved portion; fruit slender, the body about 1 dm. long and the horns up to 2 times as long. In sandy, gravelly or clay soils in the Trans-Pecos, June-Sept.; from Tex. to n. Mex.

4. *Proboscidea sabulosa* Correll. DUNE UNICORN-PLANT. Plant annual, sprawling and much-branched, to about 12 dm. across and 4 dm. high, the herbage viscid-pubescent throughout; leaves with thickened petioles to 1 dm. long or more, triangular-ovate to broadly subreniform, broadly cordate at base, rounded to obtuse at apex, the margins undulate-repand, to about 12 cm. long and broad; flowers several, borne in a congested raceme on an abbreviated peduncle, greatly exceeded by the foliage; pedicels slender and about 1 cm. long in flower, becoming stout and about 2 cm. long in fruit; pedicel bracts linear, about 5 mm. long; calyx bracts oblong-elliptic, 7-8 mm. long; calyx 1-1.3 cm. long, irregularly 5-lobed above the middle; corolla tubular-cylindric, only slightly ventricose; corolla tube cream-color and sparsely glandular without, about 2 cm. long and 1 cm. across the orifice, the glabrous throat cream-color with small reddish spots and a deep yellow line running the length of the tube on the lower side, paler blotches also present throughout the tube interior; corolla lobes ovate to somewhat quadrate, purplish-red, 4-5 mm. long, recurved, the lower lobe pleated; filaments glabrous or sparsely villous or tomentose below their point of attachment, glandular above; fruit body oblong-ellipsoid, somewhat laterally compressed, the endocarp coarsely sculptured, keeled on the dorsal surface, about 7 cm. long and 1.5-2 cm. thick, tapered into a slender recurved horn that is about twice as long as the body. Endemic in deep sand in the s.w. corner of the South Plains in w. Tex., July-Aug.

This is the smallest flowered species in this genus. The abbreviated inflorescences are concealed by the foliage, and it is necessary to search the plant in order to locate flowers.

5. *Proboscidea spicata* Correll. Annual, spreading, branched from base, to about 3 dm. high, the herbage viscid-pubescent throughout; leaves with slender petioles to about 1 dm. long, suborbicular-ovate to subreniform, to about 1 dm. long and wide, cordate at base, rounded at apex, entire to shallowly 3-lobed; flowers small, as many as 25 or more crowded in a spicate inflorescence to 17 cm. long; peduncle and rachis stout, rigid; pedicels weak, slender, mostly about 15 mm. long in flower; pedicel bracts oblanceolate, about 7 mm. long; calyx bracts oblanceolate-spatulate, obtuse, 5-8 mm. long; calyx campanulate, about 15 mm. long, very shallowly and irregularly 5-lobed; corolla funnelliform-campanulate; corolla tube pinkish, scarcely ventricose, strongly constricted near base, cylindrical portion about 7 mm. long, very sparsely glandular without, about 2 cm. long and 15 mm. wide across the orifice, the glandular throat provided with reddish spots and less conspicuous blotches; corolla lobes suborbicular, spreading, purple, about 1 cm. in diameter; filaments glabrous or sparsely villous or tomentose below their point of attachment, glandular on the arcuately curved portion; pistil 25 mm. long; fruits unknown. In

dry sandy soil along the Rio Grande in Presidio Co., May-June; undoubtedly also in adj. Mex.

6. *Proboscidea louisianica* (Mill.) Thell. UNICORN-PLANT, COMMON DEVIL'S CLAW, RAM'S HORN. Coarse viscid-pubescent annual with prostrate or ascending opposite branches to 1 m. long; leaves opposite or the upper ones subalternate, with densely short-pubescent petioles to 2 dm. long and 5 mm. thick, orbicular-reniform to broadly ovate, cordate at base, with entire or sinuate margins, to 3 dm. wide and slightly shorter; flowers 8 to 20 in an open raceme; pedicels 20-30 mm. long in anthesis, 45 mm. in fruit; pedicel bracts linear, 5-10 mm. long; calyx bracts oblong-falcate to ovate, 1 cm. long or less; calyx to 2 cm. long, the 5 lobes acutish to obtuse, one half the length of the calyx, thick and green or somewhat membranous and yellowish; corolla to 55 mm. long and nearly as wide, dull white or somewhat purplish or pinkish throughout, mottled or blotched with reddish-purple and yellow or occasionally nearly clear reddish-violet, conspicuous reddish-purple spots extending internally the entire tube length, the cylindrical portion of the tube short (5 mm. or less), the remainder broadly campanulate, 15-25 mm. long, 15-17.5 mm. wide at orifice, ventricose, the lobes 1.5-2 cm. long and 1.5-3 cm. wide; filaments glabrous or sparsely villous or tomentose below their point of attachment, glandular on the arcuately curved portion; fruit body stout, to 1 dm. long, 3 cm. thick, the horns one and one half to three times longer than the body. *P. Jussieui* Schmid., *Martynia louisianica* Mill. In meadows, playas, waste places and on stream banks, mostly in cen. and n.e. Tex., June-Sept.; nat. to s. U.S. but spontaneous northw.; sometimes cult. for its young pods which are made into pickles.

FAM. 163. OROBANCHACEAE VENT.*

BROOMRAPE FAMILY

Herbaceous fleshy plants parasitic on roots of various plants, appearing to be devoid of chlorophyll, provided mostly with alternate scales instead of green foliage and solitary or spicate usually luridly colored gamopetalous bisexual flowers; calyx persistent, 2- to 5-parted or spathe-like; corolla tubular, more or less bilabiate, ringent, persistent and withering, the upper lip entire or 2-lobed, the lower lip 3-lobed; stamens 4, didynamous, inserted on the tube of the corolla; anthers 2-celled, caudate, white, persistent; ovary free, ovoid, superior, with 2 carpels and 1-loculed, the placentation parietal, pointed with a long style; stigma discoid, peltate or 2-lobed; capsule 1-celled, 2-valved with each valve bearing on its face 1 or 2 placentae; seeds minute, numerous.

About 180 species in 14 genera mostly in the Northern Hemisphere of the Old World.

1. Plants confined to east Texas, parasitic on the roots of beech trees (*Fagus grandifolia*); stems slender, brittle and commonly branching; flowers scattered along the branches; corolla 4-toothed, the upper lip undivided; fruit laterally flattened (asymmetrical) 1. *Epifagus*, p. 1449.
1. Plants occurring west of the east Texas Timber Belt or (if in east Texas) with flowers on elongated pedicels or in a dense spike; stems stout, usually simple; corolla 5-toothed, the upper lip divided; fruit not asymmetrical (2)
- 2(1). Flowers in a thick scaly spike; calyx spathe-like, cleft abaxially, the upper lip large and 4-toothed; stamens exserted; style (and stigma) commonly persistent, arcuate; seeds smoothish, tan-color, vernicose; entire plant yellow, glabrous 2. *Conopholis*, p. 1450.
2. Flowers solitary and long-stalked or spicate; calyx regular or equally 2-lipped; stamens mostly included; seeds deeply pitted, brownish, dull; plants with some purplish color, viscid-pubescent (at least in part) . . 3. *Orobanche*, p. 1450.

1. EPIFAGUS NUTT.

BEECH-DROPS. CANCER-ROOT

A monotypic genus.

1. *Epifagus virginiana* (L.) Bart. Plants often forming large clumps; stems slender, to 45 cm. tall, pale-brown striped or suffused with purple or yellowish-brown, simple or

* Cf. another treatment by John W. Thieret in C. L. Lundell, *Flora of Texas* II: 331-337. 1969.

much-branched, with small scattered alternate triangular-ovate scales about 3 mm. long; flowers laterally white, with a broad dorsal band and a narrower lower band of brown-madder, about 1 cm. long, curved, 4-toothed, scattered along the stems; calyx 5-toothed; stigma capitate, somewhat bilobed; capsule 2-valved, with 2 approximate placentae on each valve, oblique, about 5 mm. wide; seeds minute, elliptic-fusiform, yellowish-white. Parasitic on the roots of beech trees in e. Tex., Feb.-June; from e. Can., s. to Fla. and along the Gulf Coast to e. Tex., inland to Wisc., Ill., Mo. and Ark.; also Tam. and Hgo.

All of the Texas plants examined have only cleistogamous, fertile flowers.

2. CONOPHOLIS WALLR. SQUAWROOT. CANCER-ROOT

A small American genus of several species.

1. *Conopholis mexicana* Gray. Low herb to about 25 cm. high, with thick short glabrous yellowish often clustered stems that are almost concealed by closely appressed erect bracts that are triangular-ovate and 1.5-2 cm. long; flowers perfect, in a dense scaly-bracted terminal spike; calyx subtended by two bractlets, spathe-like, split on the lower side; corolla about 2 cm. long, with a curved tube and strongly bilabiate limb, the upper lip notched and arching, the lower lip shorter and 3-lobed; capsule subglobose-ovoid, about 15 mm. long, 1-celled, with 4 placentae, terminated by the persistent arcuate style and capitate stigma. In leaf litter and parasitic on *Pinus*, *Juniperus*, *Quercus* and possibly *Acer* in the mts. of the Trans-Pecos, May-June; uncommon in w. Tex., N.M., Ariz. and Mex.

3. OROBANCHE L.¹⁸¹ BROOMRAPE

Plants more or less glandular-pubescent throughout, the bracteate stem purplish to brownish or sometimes yellowish-white; flowers solitary or in simple or branched terminal spikes; calyx nearly equally 5-lobed; corolla purplish to reddish or yellowish, the tube slightly curved, the limb bilabiate, the lips often nearly erect; capsule 1-celled, with 4 placentae.

About 140 species, mainly subtropical and warm temperate regions.

1. Flowers solitary on long naked scapose pedicels (to 15 mm. long) that greatly exceed the corolla in length, without bracts at base of calyx; corolla lobes orbicular, not tapered or rounded at apex (Sect. *Gymnocaulis*) (2)
1. Flowers densely spicate, sessile (at least some) or on pedicels shorter than the corolla, with 2 bracts at base of calyx; corolla lobes tapered to the pointed or rounded apex (Sect. *Myzorrhiza*) (3)
- 2(1). Caudex somewhat woody, with 5 to 10 firm bracts and several axillary pedicels that are rarely longer than the caudices; calyx lobes equal to or shorter than the calyx tube 1. *O. fasciculata*.
2. Caudex soft, herbaceous, with 1 to several greatly elongated pedicels from the axils of the few basal bracts; calyx lobes longer than the calyx tube 2. *O. uniflora*.
- 3(1). Corolla lobes rounded, obtuse, the upper erect, the lower extended or slightly reflexed, purple to yellow; corolla tube much lighter than lobes (in color); style persistent on fruit until dehiscence; inflorescence thyrsoid or a dense spike; calyx (8-) 10-17 (-20) mm. long, usually exceeding the fruit in length 3. *O. multiflora*.
3. Corolla lobes triangular, acute, the upper erect or reflexed, dark-purple or lighter, lower lobes reflexed and lighter in color than upper; style deciduous; inflorescence spicate, often branched; calyx (8-) 10-12 (-14) mm. long, equaling or shorter than the fruit (4)

¹⁸¹ Section *Myzorrhiza* (species 3 through 5) contributed by L. Turner Collins.

- 4(3). Stigma peltate, discoid and/or crateriform; upper corolla lobes erect, the lower only slightly reflexed, with one prominently purple vein in each; inflorescence a dense spike, rarely branched, the flowers sessile; lower stem cream to light-tan when fresh, drying rusty-brown 4. *O. ludoviciana*.
4. Stigma bilobed or 2-parted, crateriform (often confused with the above); upper and lower corolla lobes usually reflexed, the lower with 3 prominently purple veins in each lobe; inflorescence a loose spike, frequently branched, the flowers with pedicels 1-3 mm. (-15 mm. long); entire plant dark-purple, the lower stem purple-brown when dry 5. *O. Cooperi*.

1. *Orobanche fasciculata* Nutt. Caudex forked, it or its branches extended above ground for 5-10 cm.; branches with 5 to 10 firm scale leaves and to 10 erect crowded naked axillary pedicels that are to 12 cm. long; calyx lobes triangular, shorter than or equaling the tube; corolla purple, to about 2 cm. long, the tube curved and with 5 small semiorbicular spreading lobes at its apex. In brushland and forests of w. and n.w. Tex., Mar.-May; from Mich. to Yuk., s. to n. Ind., Ill., Neb., Tex., N.M., Ariz. and Baja Calif.

The var. *subulata* Goodman, characterized by having calyx lobes 6-8 mm. long, has been collected on a bare limestone prairie in Montague Co. in n.-cen. Tex.

2. *Orobanche uniflora* L. Stem subterranean or nearly so, very short and scaly, often branched with each branch supporting 1 to several 1-flowered pedicels to 15 cm. tall; calyx lobes narrowly triangular-lanceolate, about 1 cm. long; corolla about 25 mm. long, whitish, provided with 2 yellow bearded folds in throat and sometimes with lavender lines, the small lobes obovate to broadly elliptic. *Aphyllon uniflorum* (L.) Gray. In woods and on breaks in isolated localities in e. and w. Tex., Apr.-May; from N.B. and Que., w. to Mont., s. to n. Fla., Miss. and Tex.

3. *Orobanche multiflora* Nutt. Plants stout, seldom slender, 1-5 dm. tall, viscidly pubescent, often grayish, glabrous below ground, frequently branched above and below; base of stem often enlarged; cauline scales lance-ovate, obtuse, 5-12 mm. long; inflorescence dense, thyrsoid or spicate, often branched, the axes often purple; flowers sessile or the lowermost on short pedicels to 5 mm. long; bracteoles adnate or adjacent to calyx; calyx 8-17 mm. long, the lobes lance-linear to attenuate, about equal in length, deeply five-cleft, the inner surface often purple; corolla 15-35 mm. long; lips 5-12 mm. long, pale-purple to yellow, the upper lip erect; tube pale-purple to yellow or whitish with rounded obtuse lobes; anthers white woolly or glabrous, the filaments extending to the mouth of the corolla tube or less; style about as long as the filaments; stigma peltate, discoid-crateriform; capsule longitudinally dehiscent, about as long as the calyx or slightly shorter; style persistent on capsule until dehiscence. *Aphyllon multiflorum* (Nutt.) Gray. Parasitic on members of the Compositae (*Varilla texana*, *Artemisia filifolia*, *Heterotheca* spp., *H. canescens*, *Baccharis salicina*, *Hymenopappus flavescens*, *Haploesthes Greggii*, *Aphanostephus* sp., etc.) in, dunes, river sand deposits, beaches, sandy prairies and some gypsum soils, generally over the state except for the extreme eastern quarter, Mar.-Sept.; from Wyo. to Wash., s. to Tex., n. Mex. and s. Calif.

We have the following varieties in Texas.

Var. *multiflora*. Calyx 12-17 mm. long; corolla 25-35 mm. long, the upper lip purple and 9-12 mm. long; anthers often pubescent.

Var. *Pringlei* Munz. Calyx 8-10 mm. long; corolla 20-25 mm. long, the lips rose-purple or lighter and 5-7 mm. long.

4. *Orobanche ludoviciana* Nutt. Plants slender or somewhat stout, 1-2 dm. tall; stems simple or rarely branched, viscid-pubescent aboveground, creamy-white belowground when fresh, drying rusty-brown, light-purple aboveground; cauline scales 5-10 mm. long, lanceolate to lance-ovate; inflorescence a spike; flowers sessile or the lower ones short-pedicelled; bracteoles adnate or adjacent to calyx; calyx 10-12 mm. long, the lobes lance-linear, somewhat unequal in length; corolla 15-20 mm. long, upper lip erect and dark-purple, 6-8 mm. long, lower lip pale with one prominently purple vein in each triangular acute lobe; anthers white, pubescent or glabrous; filaments extending to mouth of corolla tube or almost exerted; style about as long as the filaments; stigma

peltate, discoid-crateriform; capsule longitudinally dehiscent, as long as or longer than calyx; style deciduous from fruit before dehiscence. *Aphyllon ludovicianum* (Nutt.) Gray. Parasitic on *Artemisia filifolia*, *Baccharis salicina*, *Xanthium* sp., etc. in dunes and river sand bars in Panhandle and South Plains, June-Sept.

A Great Plains species that is probably not as common as previously indicated due to confusion with *O. multiflora* and *O. Cooperi*.

5. *Orobanche Cooperi* (Gray) Heller. Plants slender or stout, 1-5 dm. tall, simple or branching from a somewhat enlarged base, brownish viscid-pubescent aboveground, entire plant dark-purple or purple-brown; cauline scales 5-10 mm. long, obtuse or rounded; inflorescence a loose simple spike or with several axillary branches; lower flowers with pedicels to 15 mm. long, upper flowers sessile or on pedicels 1-3 mm. long; calyx 5-12 (-14) mm. long, 5-cleft, the lobes lanceolate and narrowly acute at apex, several times longer than the cup, purple; bracteoles free from calyx, often 1-3 mm. below calyx; corolla 15-30 mm. long, purple, puberulent, upper lip dark-purple, shallowly cleft, erect or reflexed, 4-8 mm. long, broadly acute, the lower lip usually strongly reflexed, pale-lavender, narrowly acute, deeply cleft, each lobe with 3 prominently purple veins; anthers white, pubescent or glabrous; filaments usually not extending to mouth of corolla; style equaling or exceeding the stamen; stigma bilobed, oval or intermediate, usually crateriform, margin more or less crenulate; capsule longitudinally dehiscent, usually exceeding the calyx in length; style deciduous; seeds usually blackish-brown at maturity. Usually parasitic on the roots of *Viguiera stenoloba* but also reported on *Nicotiana glauca* and *Leucophyllum frutescens*, flowering at almost any time of the year when moisture conditions are favorable, in mts., on hillsides and stream banks mostly in the Trans-Pecos, w. through N.M., Ariz. and Son. to Baja Calif.

Stem cross sections of this species show two cycles of vascular bundles, the outer ring being typical of a dicot, whereas the inner ring has the phloem oriented toward the pith. This contrasts with other members of the family (*Myzorrhiza*) thus far investigated in that they have only one cycle of vascular bundles and medullary bundles in the pith. *O. Cooperi* has a normal dicot pith free from medullary bundles.

FAM. 164. LENTIBULARIACEAE RICH.

BLADDERWORT FAMILY

Aquatic, amphibious or terrestrial annual or perennial plants, commonly possessing traps and insectivorous or carnivorous; leaves alternate, cauline or in a basal rosette, simple or dissected; flowers 1 to several on an erect scape; calyx bilabiate, 2- or 5-lobed; corolla deeply bilabiate, the lower lip often 3-lobed, spurred at base in front and with a conspicuous palate; stamens 2; ovary free, 1-celled, the placentation free-central; capsule ovoid to globose, 2- or 4-valved, often bursting irregularly; seeds minute.

About 170 species in 4 genera that are world-wide in distribution.

1. Plants mostly aquatic, rarely amphibious or terrestrial; leaves filiform-dissected and usually bladder-bearing; flowers yellow or purplish in *U. purpurea*; calyx 2-lobed 1. *Utricularia*, p. 1452.
1. Plants terrestrial in moist soil; leaves entire, in a basal rosette, not bladder-bearing; flowers whitish or pale-violet; calyx 5-lobed 2. *Pinguicula*, p. 1455.

1. UTRICULARIA L.

BLADDERWORT

Perennial herbs, strictly aquatic, amphibious or in wet soil; stems slender; leaves capillary-dissected and usually bearing bladderlike traps with a few flagellae at their orifice and a valvelike action for trapping micro-organisms; flowers 1 to several on slender scapes; calyx bilobed; corolla bilabiate, the lower lip usually 3-lobed and with a conspicuous projecting usually bearded palate that often closes the throat, the erect upper lip usually entire, spurred at the base in front; stamens 2, the anthers convergent; capsule 2-valved.

About 120 species that are cosmopolitan in distribution.

1. Leaves minute and linear or none, always inconspicuous; vegetative branches subterranean or horizontal and submersed, only the erect filiform flowering scape aerial; bladders minute or none (2)
1. Leaves once to several times finely dichotomously branched, usually conspicuous on the submersed stems, the flowers arising above the surface of the water (4)
- 2(1). Bracts at base of pedicels peltate, not accompanied by bractlets; pedicels filiform, several times longer than the bracts 1. *U. subulata*.
2. Bracts at base of pedicels basally attached, accompanied each by a pair of minute bractlets; pedicels stout, at most scarcely exceeding the bracts (3)
- 3(2). Flowers approximate, the expanding lower ones overtopping the unexpanded buds above; pedicels mostly exerted beyond the basal bracts; corolla (from tip of spur to tip of upper lobe) 15 mm. high or more .. 2. *U. cornuta*.
3. Flowers not crowded, the expanding lower ones not reaching the unexpanded buds above; pedicels exceeded by the basal bracts; corolla 15 mm. high or less 3. *U. juncea*.
- 4(1). Leaves (at least the upper ones) in whorls of 4 to 9, the petioles often inflated (5)
4. Leaves all alternate, the petioles never inflated (7)
- 5(4). Flowers rose-purple; petioles not inflated 4. *U. purpurea*.
5. Flowers yellow; scape provided about or below the middle with a whorl of inflated petioles that act as floats (6)
- 6(5). Flowers usually 9 to 14; pedicels recurved in fruit; corolla spur notched at tip; racemose bracts longer than broad, never lobed; each lateral foliar unit with its primary basal division comprised of 2 unequal forks; bases of floats tapering gradually from the expanded central portion toward the scape axis, terete in cross section, the tips much-curved ventrally and submersed 5. *U. inflata*.
6. Flowers usually 3 or 4; pedicels rarely recurved in fruit, mostly stiffly erect-ascending; corolla spur never notched at tip, rounded or with a small terminal papilla; racemose bracts as broad as long or broader, variable with respect to lobing; each lateral foliar unit with primary basal division comprised of 2 equal forks; bases of floats uniform in breadth, tapering abruptly only at the scape axis, flattened in cross section, their tips scarcely curved ventrally, usually straight 6. *U. radiata*.
- 7(4). Floral bracts 3-6 mm. long; scape stout, usually bearing more than 8 flowers; leafy stems floating beneath surface of water 7. *U. vulgaris*.
7. Floral bracts 3 mm. or less long; scape slender-filiform, bearing fewer than 8 flowers; leafy stems creeping at the bottom of shallow water, commonly 2 or more of them radiating from the base of a flowering scape (8)
- 8(7). Lower corolla lip 5-7 mm. long, distinctly exceeding the thick very blunt spur; body of seed smooth 8. *U. gibba*.
8. Lower corolla lip 8-10 mm. long, about equaling or slightly shorter than the conic spur (9)
- 9(8). Leafy branches from the base of the flower stalk dimorphic, some bearing twice-dichotomous leaves and numerous bladders, others with thrice-dichotomous leaves that lack bladders; body of seed rough-tuberculate .. 9. *U. fibrosa*.
9. Leafy branches all alike, bearing small dichotomous leaves with numerous bladders 10. *U. biflora*.

1. *Utricularia subulata* L. Plants terrestrial, with filiform subterranean branches and slender undissected leaves, the minute traps borne on separate underground branchlets; scapes filiform, to 2 dm. tall, bearing as many as 12 flowers; floral axis usually flexuous when several flowers are developed; flowers with elongate filiform pedicels to about 15 mm. long; bracts at base of pedicels attached at or slightly below their middle, tapering

to base and apex, 1-2 mm. long; sepals elliptic to suborbicular, blunt, about 2 mm. long; corolla yellow, 3.5-12 mm. long, the rounded-ovate upper lip smaller than the 3-lobed lower lip, the prominent palate 2-lobed, the compressed spur appressed to and about as long as the lower lip. In wet peat, sands and on seepage slopes and pond shores in e. Tex., also Winkler Co. in w. Tex., Mar.-June; from Fla. to Tex. and Ark., n. to L.I., s.e. Mass. and w. N.S.

Sometimes plants with cleistogamous flowers are found. These are known as f. *cleistogama* (Gray) Fern.

2. *Utricularia cornuta* Michx. HORNED BLADDERWORT. Plants terrestrial or on floating mats; stem delicate, usually creeping underground and bearing linear-filiform simple leaves (seen only by collecting sods and gently washing away the soil); traps minute, borne along the leaf margins; scapes erect, wiry, slender, to 35 cm. tall, 1- to several- or rarely as many as 9-flowered; flowers subtended by an acute sessile bract to 2 mm. long and 2 smaller included bractlets, very fragrant, at first approximate, the freshly expanding lower ones over-topping the unexpanded buds above; pedicels mostly exerted somewhat beyond the bracts; longer sepal yellowish, acuminate; corolla yellow, 15-25 mm. high (from tip of long spur to tip of upturned upper lip), nearly as broad; the larger lower lip helmet-shaped, with a projecting convex center and recurved sides; spur subulate, turned downward and outward, 7-12 mm. long; capsule covered by the beaked calyx. In wet peaty, sandy or muddy shores or bogs, sometimes on edge of water, in the e. half of Tex., May-Sept.; from Nfld. to n. Ont. and Minn., s. to Fla. and Tex.

3. *Utricularia juncea* Vahl. Very similar to *U. cornuta* but smaller in all its parts, the more slender scapes to 4 dm. tall and bearing as many as 12 flowers; flowers not crowded, the expanding ones not reaching the unexpanded buds above; pedicels mostly overtopped by the bracts; corolla 1-1.5 cm. high, to 1 cm. broad; the lower lip obovate, consisting mostly of the high-arched palate, without broad recurving margin; spur 5-7 mm. long; fruiting calyx 5-7 mm. long. In wet sand and on margin of ponds and streams in s.e. Tex., May-Sept.; from Fla. to e. Tex., n. to L.I.; also W.I. and S.A.

4. *Utricularia purpurea* Walt. PURPLE BLADDERWORT. Stems submersed, to about 1 m. long; leaves numerous, in whorls of 5 to 7 separated by internodes to 5 cm. long, verticillately branched into filiform segments that often bear a terminal bladder; scape to 15 cm. long, 1- to 4-flowered; corolla about 1 cm. long, rose-purple to violet, the upper lip flat or concave, the lower lip adorned with a yellow spot at base, 3-lobed with the lateral lobes strongly and separately elevated at base into a palate; spur shorter than lower lip and appressed to it. *Vesiculina purpurea* (Walt.) Raf. In pools of quiet water, May-Sept., s.e. Tex. (Hardin Co.); from Que. and N.S. to Minn. and n. Ind., s. along the Coastal Plain to Fla., La. and Tex.; also W.I.

5. *Utricularia inflata* Walt.¹⁵² FLOATING BLADDERWORT. Plants free-floating, the elongated submersed stems with alternate leaves that are 4 to 6 times dichotomous into delicate capillary segments and bearing small ovoid bladders; scape supporting a whorl of 4 to 10 leaves that have inflated petioles which serve as floats, from the whorl of floats to the lowest pedicel 7-25 cm. long, supporting as many as 14 (usually about 8) flowers; floats 4-9 cm. long, the petiole 4-8 mm. thick, the basal divisions of their pinnately dissected blades 0.5 mm. or more in diameter; floral bracts 3-4 mm. long; calyx lobes 4-7 mm. long; corolla yellow, about 2 cm. broad, to 25 mm. high, the lower lip 3-lobed and twice as long as the appressed spur; fruiting pedicels to 35 mm. long, spreading or recurved. In ditches, swamps, slow streams, lakes and ponds in e. Tex., Mar.-July; from Fla. to Tex., n. to Del. and N.J.

6. *Utricularia radiata* Small. Very similar in habit to *U. inflata*; floats several, 2-5.5 cm. long, with inflated petioles 2-4 mm. thick; peduncle 1.5-5 cm. long, supporting usually 3 or 4 flowers; calyx lobes 3-4 mm. long; corolla about 15 mm. broad; fruiting pedicels 1-2 cm. long. *U. inflata* var. *minor* Chapm. In lakes, ditches, slow streams and ponds in e. Tex., Mar.-June; Fla. to Tex., n. to N.S., Tenn. and Ind.

7. *Utricularia vulgaris* L. COMMON BLADDERWORT. Plants rather coarse, with elongated stems to 2 m. long and 0.5 mm. or more thick that are free-floating just beneath the surface of the water, the plumose branches of foliage to 12 cm. in diameter; leaves

¹⁵² Ref.: G. W. Reinert and R. K. Godfrey in Am. Jour. Bot. 49:213-220. 1962.

elliptic to ovate-elliptic, up to 4 cm. long, much-dissected, the coarser capillary segments slightly less than 1 mm. thick, the numerous bladders large; scape erect, stoutish, to about 8 dm. high, supporting as many as 20 flowers, naked at the base or producing slender small-leaved stolonlike divergent offshoots; bracts 3-6 mm. long; corolla yellow, with brown or orange vertical stripes on the large conspicuous palate, 15-25 mm. high, the broad lower lip somewhat 3-lobed and slightly shorter than the curved obtuse or acutish conical spur; fruiting raceme elongate, the arched-recurved pedicels to about 2 cm. long; winter buds ellipsoid, 1-2 cm. long, their crowded leaves hairy; seeds brown, lustrous, striate-reticulate. Incl. var. *americana* Gray, *U. macrorhiza* Le Conte. In deep or shallow quiet water, rare in s.e. Tex., reported from the Panhandle, Apr.-Aug.; from s. Lab. to Alas., s. to Va., O., Ind., Mo., Tex. and Mex.

8. *Utricularia gibba* L. CONE-SPUR BLADDERWORT. Plant with delicate filiform creeping or floating stems and branches, the sparsely leafy often intricately entangled plumes of foliage to 2 cm. in diameter and 3 dm. long; leaves usually with 2 filiform segments and with few scattered bladders; scapes to 1 dm. high, 1- to 3-flowered; larger sepal sub-orbicular, 2-3 mm. long; corolla yellow, 6-12 mm. high, 6-8 mm. broad, the nearly equal lips projecting forward, the oblong-conic obtuse spur much shorter than the lower lip; fruiting pedicels ascending, to 1 cm. long; capsule 2-3 mm. thick, about as long as the sepals; seeds broadly winged, the body smooth. In mud of marshes, bogs and seepage areas and on floating debris in shallow water mostly in the e. half of Tex., s. to Cameron Co. and w. to Val Verde Co., June-Aug.; from Fla. to Tex. and Mex., n. to e. Can., Mich., Wisc., Minn. and Okla., w. to Calif.

9. *Utricularia fibrosa* Walt. Plant closely resembling *U. gibba*; stems creeping on the bottom in shallow water, radiating from the base of the scape, dimorphic, some without bladders that have rather crowded thrice-forked leaves to about 15 mm. long, the other with smaller twice-forked leaves bearing numerous bladders; peduncles to about 15 cm. high, with 2 to 6 long-pedicelled flowers; corolla yellow, the lower lip 8-10 mm. long and with a prominent palate; spur equaling or slightly exceeding the lower lip; capsule globose; seeds broadly winged, the body rough-tuberculate. Floating on mats of debris and rooted in shallow water of slow streams, ponds and lakes in e. Tex., June-July; from Mass. to Fla., w. to Tex., Ark. and Okla.

This is our only *Utricularia* with dimorphic stems and leaves. The bladders are borne mostly on stems and only occasionally on the leaves.

10. *Utricularia biflora* Lam. Plant closely resembling both *U. gibba* and *U. fibrosa*; stems all alike, with bladders throughout, floating on mats of debris or creeping on the bottom in shallow water; leaves very delicate, rarely more than 5 mm. long, usually with 3 or more segments; scapes erect, to about 15 cm. long, usually much shorter, with 1 to 4 flowers; pedicels filiform, about 15 mm. long; sepals 2.5-4 mm. long; corolla yellow, very similar to those of *U. fibrosa*, to 17 mm. high; lower lip 8-10 mm. long, with a prominent palate; spur about as long as or much shorter than the lower lip; fruiting pedicels to 25 mm. long; capsule 3.5-4 mm. thick, slightly exserted. *U. pumila* Walt. In shallow water in s.e. Tex., June-July; from e. Mass. to Fla., Tex. and Okla.

2. PINGUICULA L.

About 35 species, widely distributed.

1. *Pinguicula pumila* Michx. SMALL BUTTERWORT. Perennial terrestrial scapose herb with fibrous roots; leaves in a basal rosette, soft-fleshy, greasy to the touch, elliptic to elliptic-obovate, obtuse to rounded at apex, narrowed at base, 1-3 cm. long; scapes one or usually several, 1-flowered, naked, very slender, erect, glandular-puberulent, to 2 dm. tall, usually much smaller; calyx 5-lobed, more or less united and bilabiate; calyx lobes oblong, obtuse, 2-4 mm. long; corolla whitish or pale-violet, sometimes marked with purple and yellow, somewhat bilabiate with the 5 lobes subequal, 1-2 cm. broad; corolla spur subulate, about 3 mm. long, usually shorter than the saclike base of the corolla, the palate (in ours) subulate or clavate, included in the tube; capsule 2- to 4-valved. In seepage and wet soils of savannahs and low pinelands on the Coastal Plain in s.e. Tex., Mar.-June; from Fla. to Tex. and S.C.; also Bah. I.

FAM. 165. ACANTHACEAE JUSS.¹⁸³

ACANTHUS FAMILY

Herbs or small shrubs, usually with cystoliths appearing as minute short lines on the vegetative parts; leaves simple, usually entire, opposite or sometimes (as in *Elytraria*) alternate or subopposite; flowers irregular to nearly regular, perfect; calyx persistent, inferior, the segments 5 or occasionally fewer; corolla gamopetalous, the limb 5-lobed or 2-lipped (rarely 1-lipped); stamens 4, didynamous, or 2 only; staminodes often present in the 2-stamened flowers; anther sacs 2 or 1, longitudinally dehiscent; ovary 2-celled, the ovules 2 to 10 in each cavity; style filiform, simple; stigmas 1 or 2; fruit a capsule, 2-celled, 2-valved; seeds usually flat, borne on funicles which are papilliform in a few genera but usually hook-shaped, the testa smooth or roughened, often mucilaginous when moistened.

A large pantropical family of about 2,500 species in 250 genera.

1. Funicle papilliform or lacking; vines or herbs with densely bracteate peduncles (2)
1. Funicle hook-shaped (retinaculate) (3)
- 2(1). Plants herbaceous; ovules many 1. *Elytraria*, p. 1456.
2. Plants vines; ovules 4 2. *Thunbergia*, p. 1457.
- 3(1). Corolla lobes contorted (convolute) at aestivation; stamens 4 (4)
3. Corolla lobes imbricate (6)
- 4(3). Corolla deeply bilabiate; flowers in axillary fascicles; capsule terete and 2-celled to the very base 3. *Hygrophila*, p. 1457.
4. Corolla scarcely or not at all bilabiate, the 5 lobes broad and rounded, spreading (5)
- 5(4). Anther cells mucronate at base; corolla tube short, the throat campanulate
..... 4. *Dyschoriste*, p. 1458.
5. Anther cells rounded at base; corolla tube long, the throat usually not campanulate
..... 5. *Ruellia*, p. 1459.
- 6(3). Stamens 4; anthers 1-celled 6. *Stenandrium*, p. 1466.
6. Stamens 2; anthers 2-celled (7)
- 7(6). Anther cells equal, parallel and contiguous; corolla lobes similar or nearly so;
stamens more or less exserted; plants shrubby (8)
7. Anther cells unequally inserted (9)
- 8(7). Interrupted spikes few- to many-flowered; corolla very open, less than 15 mm.
long 7. *Carlwrightia*, p. 1467.
8. Unilateral spikes with numerous flowers; corolla tubular-funnelform, more than 20
mm. long 8. *Anisacanthus*, p. 1469.
- 9(7). Placenta separating from the capsule wall at maturity; corolla with narrow
tube; anther cells usually rounded at base (10)
9. Placenta not separating (11)
- 10(9). Corolla almost or quite equally 4-lobed; flowers each covered by a single large
primary bract 9. *Tetramerium*, p. 1470.
10. Corolla deeply 2-lipped; flowers each covered by 2 or 4 bracts
..... 10. *Dicliptera*, p. 1471.
- 11(9). Corolla tube long, slender, cylindric 11. *Siphonoglossa*, p. 1472.
11. Corolla tube short, not cylindric (12)
- 12(11). Corolla subequally 4-lobed 12. *Yeatesia*, p. 1472.
12. Corolla deeply 2-lipped; lower anther cell mucronate or calloused at base
..... 13. *Justicia*, p. 1473.

I. ELYTRARIA MICHX.

SCALY-STEM

Cauliscent or acaulescent herbs; leaves alternate or sometimes subopposite, basal or crowded at the ends of the branches; flowers borne in dense peduncled spikes, both

¹⁸³ Adapted from Dieter C. Wasshausen in C. L. Lundell, *Flora of Texas* I:223-282. 1966.

spikes and peduncles bearing imbricate coriaceous bracts; calyx scarious, the narrow segments entire or toothed at apex; corolla white or blue, the tube slender, the limb 2-lipped, the lower lip 3-lobed; stamens 2, barely exerted; anthers 2-celled, the equal sacs parallel and sometimes awn-tipped at base; staminodes usually wanting; ovary 2-celled; ovules 6 to 10 in each cavity; capsules narrow, contracted at base, acute at apex.

A genus of 7 species, all native of temperate or tropical America, except 1 species found chiefly in Africa.

1. Floral bracts entire; plants acaulescent 1. *E. bromoides*.

1. Floral bracts bearing a pair of thin triangular or rhombic teeth; plants usually caulescent 2. *E. imbricata*.

1. *Elytraria bromoides* Oerst. **WHEATSPIKE SCALY-STEM**. Stems ascending or spreading, to 6 cm. long, simple or sparingly branched above, clothed with appressed acuminate scalelike leaves; normal leaves basal, sessile or short-petioled, oblong to oblong-spatulate, 2-6 cm. long, obtuse or rounded at apex, spreading, pale-green, sparingly pubescent especially on the nerves beneath; spikes 1-2.5 cm. long; bracts rigid, about 1 cm. long, entire, woolly above within; bractlets ciliate along the back; calyx lobes about 7 mm. long, attenuate, barely pubescent at the tip; corolla 5-6 mm. long, the lower lip notched; capsules 4-5 mm. long, each with a conic tip. In sandy soil, coast of Tex., summer-fall; also e. Mex.

2. *Elytraria imbricata* (Vahl) Pers. **PURPLE SCALY-STEM**. Plant acaulescent or (if caulescent) the leaves crowded at the tip of a glabrous or sparingly pilosulous stem to 3 dm. long; leaves ovate to oblong or obovate, rarely linear-lanceolate, to 18 cm. long and 6 cm. wide, blunt or acutish at apex, narrowed at base to a slender winged petiole, both surfaces appressed-pilose or glabrate, the margins undulate; scapes numerous, axillary, to 24 cm. long, simple or branched (sometimes leafy at tip), covered by tightly appressed ovate to subulate scales; spikes one to several, to 6 cm. long; bracts oblong or elliptic, 3-6 mm. long, 1-2 mm. wide, firm, awn-tipped and bearing near apex a pair of triangular or rhombic hyaline teeth; bractlets 3 mm. long; calyx segments thin, the upper bidentate; corolla blue, 5-8 mm. long; capsule oblong, glabrous. Dry brushy slopes, canyons and ledges in the mts. of the Trans-Pecos, Mar.-Oct.; from Tex. to n. S.A.

2. THUNBERGIA RETZ. CLOCK-VINE

About 200 species chiefly African with a dozen or more species occurring in tropical or subtropical America, either under cultivation or as escapes.

1. *Thunbergia alata* Sims. **BLACK-EYED SUSAN**. A pubescent trailing or climbing vine usually about 1 m. long; leaves with a wing-margined petiole as long as the blades or shorter, ovate to triangular-ovate, 4-8 cm. long, acute at apex, cordate or hastate at base, entire or remotely few-toothed, pubescent; flowers large, axillary or borne in terminal racemes; peduncles mostly longer than the petioles; bracts 2, foliaceous, ovate-lanceolate, acute to acuminate, pubescent, about 15 mm. long; calyx short, cupuliform, truncate or many-toothed; corolla 2.5-4 cm. long, yellow or orange and usually with a dark-purple eye; corolla with a slender tube enlarged into a spreading 5-lobed limb; stamens 4, didynamous, borne near the base of the corolla tube, the anthers with an apiculate connective, the lobes mucronulate at base; disk fleshy; capsule depressed-globose, coriaceous, pubescent, 8-10 mm. in diameter, loculicidal, its stout beak about 1 cm. long. In fields, along trails, edges of thickets, gardens and open waste places in s. and e. Tex., Mar.-Apr.; a species of trop. Am. that is cult. and occurs as an escape.

A plant of the East Indian *T. grandiflora* Roxb. recently volunteered in a yard in League City, Harris County, where it makes a luxuriant growth. It may eventually become established in our flora. It differs from *T. alata* primarily in lacking winged petioles and in having light- or dark-blue, rarely white, flowers about twice the width of those of that species.

3. HYGROPHILA R. BR.

The genus is cosmopolitan. Of the numerous species described, only about 80 are now considered as valid.

1. *Hygrophila lacustris* (Schlecht. & Cham.) Nees. Herb to 8 dm. high, sparingly hirtellous to glabrate; stems obtusely quadrangular, branching; leaves lanceolate, 5-12 cm. long, 5-25 mm. wide, acute at apex, entire; flowers sessile, clustered in the axils; bracts linear; calyx segments 5, lanceolate, about 5 mm. long, white-margined, pilose; corolla yellow, puberulent, the cylindrical tube 5 mm. long, the bidentate upper lip 2.5 mm. long, the lower lip 3-lobed; stamens 4, didynamous or 2 perfect stamens with 2 staminodes, the filaments of each pair united at base by a membrane; anthers 2-celled, muticous or mucronulate; posterior stigma lobe abortive; capsules narrowly oblong, 8-12 mm. long, glabrous, 16- to 18-seeded. In marshy regions along streams or on shores of ponds in s.e. Tex. where its rhizomes form colonies, June-Sept.; from Fla. to Tex.

4. DYSCHORISTE NEES

Herbaceous caulescent perennials, prostrate to ascending or erect, glabrous or pubescent; leaves opposite, sessile or petioled, usually entire; inflorescence cymose, capitate or spicate, terminal or axillary; flowers subtended by foliaceous bracts and bracteoles; calyx deeply 5-parted, the lobes usually subulate-setaceous, ciliate, lineolate; corolla tube usually erect, occasionally slightly ampliate at the base, the spreading oblique limb obscurely or distinctly bilabiate and 5-lobed; stamens 4, didynamous; filaments both long and short, united at the base and adnate to the base of the corolla tube, pubescent; anthers 2-celled, the oblong cells sharply mucronate at the base and parallel or slightly divergent, glabrous or occasionally pubescent; ovary 2-celled, glabrous, ovules 2 or occasionally 1 in each cell; style filiform, pubescent; posterior lobe of stigma rudimentary, anterior lobe oblique and slightly flattened; capsule included in the persistent calyx, oblong-linear, glabrous, 2- to 4-seeded, separating with difficulty at maturity into 2 valves, 1 to 2 seeds to each valve held in position by a retinaculum; seeds flattened, suborbicular, mucilaginous when wet.

About 100 species, mostly tropical and subtropical.

1. Leaves mostly linear; stem erect and strict, hirsute with rigid hairs 1. *D. linearis*.
1. Leaves ovate, other than linear (2)
- 2(1). Leaf margins entire, not crenulate; stems spreading mostly along the ground ... 2. *D. decumbens*.
2. Leaf margins distinctly crenulate; stems erect or ascending 3. *D. crenulata*.

1. *Dyschoriste linearis* (T. & G.) O. Ktze. Stem 18-42 cm. high, erect and strict, branched and diffuse, hirsute with both rigid and short hairs, sometimes sparsely pubescent or merely glabrous, not cinereous; leaves linear-oblong to oblong-spatulate, 18-65 mm. long, entire, lineolate, rather rigid, pubescent on midrib and veins, the margin ciliate; bracts foliaceous, frequently in short-leaved specimens equaling the length of the leaf; calyx 5-cleft, densely lineolate, giving the appearance of appressed hairs; calyx lobes 9-13 mm. long, subulate-setaceous, more or less hispid, ciliate; calyx tube 4.5-6 mm. long, in most cases one half the length of the lobes; corolla somewhat bilabiate, about 27 mm. long, pubescent on external surface, the tube 5-7 mm. long and slightly shorter than the abruptly amplified limb; anther-cells oblong; capsule 4-seeded; seeds flat. Rather ubiquitous but mostly on rocky-grassy slopes, silty flats or about caprock in most of w. two thirds of Tex., Apr.-Aug.; from Tex. and N.M. to n. Mex.

2. *Dyschoriste decumbens* (Gray) O. Ktze. Plant cinereous-puberulent throughout; stems mostly spreading on the ground from a ligneous base, occasionally erect, branched; leaves spatulate to oblanceolate, 2-3 cm. long, 5-11 mm. broad, entire, usually obtuse or sometimes slightly mucronate at apex, attenuated and often having the appearance of a petiole at base; flowers few, in foliose bracteate clusters; calyx 1.5-2 cm. long, at maturity exceeding the capsule by as much as 1 cm., 5-cleft, the tube 5-7 mm. long, the subulate-setaceous lobes scarcely twice the length of the tube; corolla purple, 1.8-2 cm. long, the tube a little longer than the throat and slightly amplified at the base; anther cells oblong, the filaments united at the base of the corolla throat; seeds 4, suborbicular and flattened. On dry clayey soil, w. Tex., May-Aug.; also Ariz. and the plateau region of n. Mex.

3. *Dyschoriste crenulata* Kobuski. Stems several, 1-2 dm. high, erect or ascending from a perennial ligneous base, pubescent; leaves more or less spatulate to obovate, 2-3 cm. long, 6-10 mm. broad, acute to obtuse at the apex, attenuate at the base, densely cinereous-pubescent, the margin crenulate; calyx 5-parted, about 18 mm. long, nearly equaling the length of the corolla, the tube and lobes of nearly equal length; calyx lobes subulate-setaceous, cinereous, ciliate; corolla about 19 mm. long, pubescent on the external surface, the throat slightly longer than the tube; anthers occasionally unequally didynamous; style about 1.2 cm. long, the stigma oblique; mature capsule not seen. In chaparral and brushlands in s. Tex., Mar.-May; s. into Tam.

5. RUELLIA L.

Perennial herbs or shrubs; leaves petioled, entire to undulate or rarely dentate; flowers usually large and showy, solitary or clustered in the axils or borne in terminal cymose panicles; calyx usually 5-parted, the segments often narrow; corolla red, yellow, white or purple (usually mauve), funnelform or salverform, sometimes saccate, the tube usually narrow below, the upper portion more or less campanulate, the limb of 5 obtuse spreading lobes; stamens 4, didynamous, the anther sacs blunt at base; stigma lobes unequal; capsule oblong or clavate.

A large genus containing upward of 200 species, a majority of which are tropical or subtropical. The geographic center of distribution in the Western Hemisphere is somewhere in southern Mexico or Central America.

1. Plants bearing a terminal panicle of flowers and usually lateral few-flowered panicles of cleistogamous flowers produced early that often have completely disappeared before the normal flowers have expanded (2)
 1. Inflorescences in axillary sessile or more or less peduncled glomerules or cymes; bracts foliaceous (11)
 - 2(1). Corolla 5 cm. long or more (3)
 2. Corolla less than 5 cm. long (5)
 - 3(2). Leaf blades oblong-lanceolate to narrowly ovate-oblong; leaves and stems shortly and sparsely hirsute; corolla white 1. *R. Metzae*.
 3. Leaf blades ovate to broadly ovate; leaves and stems subvelvety-puberulent to velvety-pilose and often somewhat viscid; corolla bluish-lavender (4)
 - 4(3). Inflorescence an ample terminal panicle; leaf blades large, 4-10 cm. long, 20-80 mm. broad 2. *R. occidentalis*.
 4. Inflorescence a compact or spikelike terminal panicle; leaf blades small, 3-6 cm. long, 15-35 mm. broad 3. *R. Davisiorum*.
 - 5(2). Corolla more than 4 cm. long (6)
 5. Corolla 4 cm. long or less (8)
 - 6(5). Plants not conspicuously long-white-hirsute, usually 25 cm. or more tall; stems with several leaf-bearing nodes; lateral panicles rarely producing chasmogamous flowers 5. *R. nudiflora*.
 6. Plants conspicuously long-white-hirsute, exclusive of the inflorescence very low (not exceeding 20 cm.); elongated internodes 1 or 2 (rarely 3); lateral panicles often producing chasmogamous flowers (7)
 - 7(6). Leaf blades ovate-lanceolate, 2.5-5 cm. long, 10-15 mm. broad; chasmogamous fruits not exceeding 15 mm. in length 4. *R. Drushelii* var. *Drushelii*.
 7. Leaf blades ovate to ovate-lanceolate, 4-11 cm. long, 15-35 mm. broad; chasmogamous fruits about 20 mm. long 4. *R. Drushelii* var. *macrocarpa*.
 - 8(5). Leaves oblong-elliptic to spatulate, the basal ones prominent and mostly rounded at base; stems usually with few leaf-bearing nodes near the base; horizontal-ascending basal cleistogamous cymes 8. *R. yucatanana*.
 8. Leaves lanceolate to oblanceolate or narrowly ovate (9)

- 9(8). Leaves and stems conspicuously hirsute; leaf blades oblanceolate to narrowly ovate, rounded or rarely subacute at apex; corolla 3 cm. long 6. *R. Corzoi*.
9. Leaves and stems not conspicuously hirsute; leaf blades lanceolate to oblong-ovate, acute to subacute at apex; corolla 3-4 cm. long (10)
- 10(9). Stem and leaves very sparsely and obscurely hirsute; calyx glandular-pubescent 7. *R. Runyonii* var. *Runyonii*.
10. Stem and leaves densely pilosulous but not velvety; calyx eglandular to glandular-pilosulous 7. *R. Runyonii* var. *Berlandieri*.
- 11(1). Main axis terminating in a flowerless leafy tip; flowers one to few at leafy-bracted summits of branches or on peduncles from the median or lower axils, or the cymose inflorescences much-branched, if with sessile or short-pedicellate solitary flowers in the axils the flowers then less than 5 cm. long (12)
11. Main axis bearing flowers in sessile or short-peduncled gloimerules or (if flowers borne singly in axils) the corolla 5-11 cm. long (17)
- 12(11). Bracts of the loose cyme linear to linear-lanceolate (13)
12. Bracts dilated; leaves lanceolate to oblong or elliptic to ovate (14)
- 13(12). Leaf blades chiefly linear-elongate 9. *R. Brittoniana*.
13. Leaf blades chiefly lanceolate 10. *R. malacosperma*.
- 14(12). Stems from a lignescent base, to 10 cm. high, if taller then shrubby; plants of the Trans-Pecos 11. *R. Parryi*.
14. Stems taller than above, not fruticose; plants east of the Trans-Pecos (15)
- 15(14). Calyx lobes lanceolate to linear-lanceolate, flat to the tip, 2-4 mm. broad; ovary and capsule glabrous; leaves petioled 14. *R. strepens* var. *strepens*.
15. Calyx lobes narrowly linear, with prolonged linear-acicular tips, 1-1.2 mm. broad (16)
- 16(15). Ovary glabrous; calyx closely covered with appressed and partially immersed slender cystoliths; leaves subsessile 12. *R. pinetorum*.
16. Ovary pubescent with short spreading hairs; calyx pilose with slender pointed hairs; leaves short-petioled 13. *R. pedunculata*.
- 17(11). Calyx lobes linear-lanceolate, flat to the tips, 2-4 mm. wide; flowers chiefly or wholly cleistogamous 14. *R. strepens* var. *cleistantha*.
17. Calyx lobes narrowly linear, the prolonged tips very slender to almost bristle-form; flowers rarely cleistogamous (18)
- 18(17). Leaves essentially sessile, erect-ascending (19)
18. Leaves distinctly petioled, spreading (23)
- 19(18). Stems filiform, mostly less than 2 mm. thick at base; branches usually decumbent at base and strongly ascending, glabrescent to sparsely pilose; flowers 4.5-6 cm. long; leaves thin, oblanceolate to lanceolate, puberulent, sparsely pubescent to sparsely pilose, usually not crowded on the stems ... 15. *R. humilis* var. *depauperata*.
19. Stems stout; leaves lanceolate to suborbicular, mostly crowded on the stems; branches suberect to strongly divergent, typically villous-hirsute (20)
- 20(19). Corolla 3-4.5 cm. long, its slender tube 12-25 mm. long (21)
20. Corolla usually 4.5-7 cm. long, its slender tube 30-45 mm. long (22)
- 21(20). Larger leaves of the main axis lanceolate, rarely broadly lanceolate, 1-2.5 cm. broad, obtuse to subacute at apex; stems villous-hirsute, the hairs about 1 mm. long 15. *R. humilis* var. *humilis*.
21. Larger leaves of the main axis ovate to oval-oblong or broadly elliptic, 1-4 cm. broad, mostly rounded at apex; stems strongly spreading-villous, the hairs about 2 mm. long 15. *R. humilis* var. *frondosa*.

- 22(20). Larger leaves of the main axis lanceolate, 1-2.5 cm. wide, subacute to acute at apex 15. *R. humilis* var. *longiflora*.
22. Larger leaves of the main axis ovate-oblong to broadly oval, 2-4.5 cm. wide, rounded at apex 15. *R. humilis* var. *expansa*.
- 23(18). Glomerules few, restricted to the upper internodes; leaves lanceolate (24)
23. Glomerules several to many, extending well downward on the stem and branches (25)
- 24(23). Stem mostly strongly divergent, branched from the lower and median axils; corolla 25-50 mm. long 16. *R. caroliniensis* var. *semicalva*.
24. Stem mostly simple or with few ascending branches; corolla 25-45 mm. long 16. *R. caroliniensis* var. *salicina*.
- 25(23). Leaves relatively narrow, serrate-undulate to undulate, linear to lanceolate; internodes at least twice as long as the leaves 16. *R. caroliniensis* var. *serrulata*.
25. Leaves relatively broad, entire to undulate, ovate to broadly elliptic; internodes not much exceeding the leaves 17. *R. Drummondiana*.

1. *Ruellia Metzae* Tharp. Stems branched from a subligneous base, to 6 dm. high, the branches spreading-ascending; secondary branches numerous, erect-ascending, more or less densely glandular-puberulent and sparsely to moderately hirsute; leaves 3-12 cm. long, 1-4 cm. broad, oblong-lanceolate to narrowly ovate-oblong, basally narrowed into and decurrent upon petioles 1.5-6 cm. long, acute to rounded at apex, short appressed-pubescent and grayish-green above, paler beneath, the margins undulate-dentate to obscurely undulate; bracted cleistogamous-flowered branches arising from many of the lower nodes; terminal inflorescence a narrow or broad ample panicle with sharply ascending to spreading branches, very viscid-glandular throughout; calyx lobes 1.6-2 cm. long, linear-subulate; corolla white, sometimes pale-blue-purple, 55-65 mm. long, very slightly curved, the tube 3-3.5 cm. long; filaments sparsely retrorse-hispidulous; capsule 16-22 mm. long, 4-5 mm. thick, broadest at or slightly above center, densely puberulent, glandular-viscid (particularly on upper half), the cartilaginous stipelike base 1 mm. high, brown; seeds brown, 9 or fewer in each cavity, orbicular, the hilum indented, the hygroscopic viscid pubescence apparent only on the margins. Incl. var. *Marshii* Tharp & Barkl., *R. Muelleri* Tharp & Barkl. In mesquite thickets and open oak woods, in gravel washes of stream beds, and on open grassy limestone slopes in w.-cen. and s. Tex., May-Oct.; also N.M. and n.e. Mex.

2. *Ruellia occidentalis* (Gray) Tharp & Barkl. Perennial herb from a cluster of tough fibrous-fusiform roots; stems erect or ascending, subligneous at base, to 7 dm. tall, softly pale-glandular-pubescent, often bearing a leafy branch and a leafless (but bracted) early-deciduous cyme from one or more of the lower nodes (sometimes 2 leafy or 2 floriferous branches at a node); leaves with glandular-pubescent petioles to 5 cm. long, ovate, 4-10 cm. long, 2-8 cm. broad, rounded at apex, rounded to subcordate or subtruncate and decurrent at base, relatively thin to thickish, abundantly puberulent above and beneath, with long hairs on the margins and usually prominent veins, the margins crenate-undulate to subentire; cleistogamous flowers with linear-attenuate calyx lobes 9-11 mm. long at anthesis and pale glandular-pilose to the sharply pointed curved tips, the corolla 4-5 mm. long and slightly swollen just above base; expanding flowers in an ample inconspicuously bracted panicle of forking cymes with ascending to divaricate branches and with a sessile bractless flower frequently in some of the forks, softly short-glandular-pilose to viscid; calyx lobes 22-25 mm. long, linear-attenuate, pilose to the tips, united only at the very base; corolla bluish-purple, about 7 cm. long and 4 cm. broad, the tube about 27 mm. long; fruits from cleistogamous flowers 13-15 mm. long (about equaling the calyx lobes), 3.5 mm. thick, densely short-pilosulous, sparsely glandular on the upper portion, the seeds 5 or fewer in each cavity; fruits from expanded flowers 1.6-2 cm. long (slightly to considerably shorter than the calyx lobes), 3-3.5 mm. thick, densely short-pilosulous, the seeds 5 to 7 in each cavity. *R. strictopaniculata* Tharp & Barkl., *R. nudiflora* var. *occidentalis* (Gray) Leonard. In dry rocky woods and chaparral hills and flats on the Edwards Plateau and in the Rio Grande Plains, May-Oct.; also n. Mex.

3. *Ruellia Davisiorum* Tharp & Barkl. Roots clustered, tough, coarsely fibrous; stems erect and herbaceous except the subligneous base or becoming ligneous and greatly elongated during mild winters and under the protection of other vegetation; leaves with densely pubescent and glandular petioles 1-3 cm. long, ovate, 3-6 cm. long, 15-35 mm. broad, subacute to rounded at apex, abruptly short-decurrent at base, relatively thickish, subvelvety-puberulent and somewhat glandular, the margins obscurely crenate-undulate to subentire or occasionally somewhat crisped; terminal spikelike panicle usually an admixture of a few normal and many cleistogamous flowers, the branches, pedicels and calyces abundantly glandular-pilosulous; cleistogamous flowers with calyx lobes 1-1.5 cm. long, linear-attenuate, pale glandular-pilosulous to the sharply pointed tips; corolla 35-45 mm. long, more or less swollen just above the base; normal flowers with calyx lobes about 2 cm. long, linear-attenuate, pilose to the tips; corolla 5-6 cm. long, about 35 mm. broad, the tube about 2 cm. long; cleistogamous fruits 11-13 mm. long, 2.5 mm. broad, the pubescence retrorse below; normal fruits 1-1.2 cm. long, 3 mm. thick, densely short-pilosulous, becoming glandular below the apex; seeds 5 to 7 in each cavity. In the Rio Grande Plains and Valley, July-Nov.; also adj. Mex.

4. *Ruellia Drushelii* Tharp & Barkl. Roots perennial, clustered, fibrous; stems low, to 2 dm. high, branched, pubescent with coarse crooked jointed hairs toward base, these usually mixed with a dense puberulence that becomes increasingly apparent and glandular toward and in the inflorescence; leaves with white-pilose petioles to 3 cm. long, ovate to lanceolate-ovate, 2.5-11 cm. long, 1-3.5 cm. broad, obtuse to acute at apex, rounded and abruptly acuminate-decurrent to subcuneate at base, more or less densely pubescent above and below with coarse hairs similar to those on the stem, the margins crisped and more or less crenate-undulate; inflorescences terminal on main stem and branched; flowers subsessile, 2 or 3 in dichotomous cymes, the peduncles densely glandular-puberulent; cleistogamous flowers few; normal flowers showy, pale-blue-lavender; calyx lobes 1-2 cm. long, linear-filiform, softly white-hirsutulous, the erect hairs tipped with viscid brown glands; corolla 4-4.5 cm. long, the tube 1-1.2 cm. long; cleistogamous fruits 12-18 mm. long, 3.5-5 mm. thick, densely retrorsely puberulent toward base, increasingly glandular toward apex; fruits of the normal flowers 1.4-2 cm. long, 7 mm. thick, puberulent to retrorsely hispid, scarcely glandular; seeds orbicular, about 3 mm. long and 2 mm. wide, margins crenate. On limestone hills in w. Edwards Plateau, Apr.-Aug.; also n. Mex.

Two variants in our region are designated as follows:

Var. *Drushelii*. Stems low, 5-15 cm. high; leaves ovate-lanceolate, 2.5-5 cm. long, 1-1.5 cm. wide; calyx lobes 1-1.7 cm. long; normal fruits not exceeding 15 mm. in length, retrorsely hispid except at apex.

Var. *macrocarpa* Tharp & Barkl. Stem to 2 dm. high; leaves ovate to ovate-lanceolate, 4-11 cm. long, 15-35 mm. wide; calyx lobes 17-19 mm. long; normal fruits to 2 cm. long and 7 mm. thick, puberulent toward apex.

5. *Ruellia nudiflora* (Gray) Urban. Perennial from a suffruticose base; stems at first to about 25 cm. high and densely puberulent and sparsely hirsute, with age to 7 dm. tall and becoming essentially glabrous, erect or ascending; basal and lower leaves in spring aspect oblong to narrowly oblong-ovate, 6 cm. long or less, 3 cm. broad or less, gray-green, strongly reticulate beneath, moderately densely short pubescent, distinctly crisped, undulate-dentate, with a narrow ciliate cartilaginous margin and subglandular callosities on marginal vein-tips, decurrent on petioles to 25 mm. long; leaves in the summer aspect about 12 cm. long or much-reduced above; cleistogamous flowers produced in the spring; normal flowers produced in the summer, terminal, paniculate; sepals subulate-attenuate, 11-15 mm. long in flower, slightly longer in fruit, densely glandular-puberulent but not at all viscid; corolla purplish-blue, conspicuously curved, about 55 mm. long, 3.5-4 cm. broad, opening about sunrise, falling during early afternoon, the tube 1.5-2 cm. long; capsules from cleistogamous flowers about 15 mm. long, 3.5-4 mm. thick, clavate, densely retrorse-puberulent; seeds 4 or 5 in each cavity, brown, about 3.5 mm. long, 3 mm. broad; capsules from normal flowers 1.6-2 cm. long, 4-4.5 mm. thick, densely fine-puberulent; seeds 18 or usually fewer, dark brown, about 3 mm. long, scarcely as broad, rounded or apiculate at apex. Rather ubiquitous, mostly in the s. half of Tex., n. to n.-cen. Tex., flowering throughout the year in some parts of its range; also in n.e. Mex.

Plants in north-central Texas with sepals hispid-pubescent to slightly scabrous and

without gland-tipped hairs have been segregated as var. *hispidula* Shinnery in contrast to var. *nudiflora* that has gland-tipped hairs on its sepals.

6. *Ruellia Corzoi* Tharp & Barkl. Roots fibrous and fusiform-thickened; stems erect or nearly so from a subligneous base, to 35 cm. high, branched throughout; branches more or less sharply ascending, conspicuously hirsute from base to inflorescence with spreading hairs that become increasingly interspersed with glandular puberulence in the inflorescence, quadrangular with increasingly manifest grooves on the faces from base to tip; leaves with petioles 1-2 cm. long, oblanceolate to narrowly ovate, rounded to subacute at base and apex, 4-6 cm. long, 15-25 mm. broad, the lower surface moderately hirsute, upper surface more densely so the margins obscurely crenate to subentire, scarcely crisped; inflorescences of two kinds: (1) trichotomous simple or compound leafless but bracted cymes of pedicelled cleistogamous flowers usually from one member of each pair of lower branches (the other member elongated, leafy and following the branching pattern of the main stem), and (2) narrow terminal panicles 5-10 cm. long, of normal essentially sessile flowers, the larger branches being each subtended by a leaflike bract; normal flowers with calyx lobes 11-14 mm. long, densely glandular-pubescent without, eglandular-puberulent within; corolla bluish-purple, about 3 cm. long; cleistogamous fruits clavate, densely retrorse-puberulent and glandless below middle to spreading or ascending puberulent and increasingly glandular toward apex, 16-18 mm. long, 3.5 mm. thick, thickest above middle. In and along arroyos and draws, in depressions and on limestone hills in s.w. and s. Tex., Apr.-Nov.; also n.e. Mex.

7. *Ruellia Runyonii* Tharp & Barkl. Plant perennial by short rhizomes, herbaceous or often subligneous at the base, to 75 cm. high, the branches ascending; cleistogamous flowering branches often opposite leafy branches, glabrate to densely pilosulous; leaves with petioles to 3 cm. long, lanceolate to broadly lanceolate or narrowly oblong-ovate to spatulate, moderately thick, the margins more or less crisped and finely undulate-serrate, acute to obtuse at apex, cuneate and decurrent at base, 4-7 cm. long, 1.4-3 cm. broad, glabrate to densely pilosulous beneath, less so above, inflorescence (1) a narrow to ample terminal panicle, sometimes panicles in the axils of the uppermost leaves, branches erect-ascending, except uppermost branchlets, these sometimes divaricate, and (2) pedunculate lateral cymes of 1 to 3 cleistogamous flowers in the axils of most of the lower and middle leaves; cleistogamous flowers with calyx 9-13 mm. long, somewhat viscid, eglandular-pilosulous to sparsely glandular-pubescent, the lobes filiform; corolla less than 4 cm. long, 15 mm. thick, the lobes 1 cm. long and broad, broadly rounded; fruits about 12 mm. long and 4 mm. broad, oblanceolate in outline, eglandular-puberulent throughout; normal flowers deep bluish-purple; calyx lobes 9-18 mm. long, subulate-attenuate to filiform, rather densely short-stalked glandular-pubescent to pilosulous, viscid; corolla 3.5-4 cm. long, the tube about 1 cm. long, abruptly expanded into the throat; fruits of normal flowers 1.3-2 cm. long, 2.5-4.5 mm. broad, tapering at both ends, moderately to densely glandular-puberulent, sometimes slightly viscid, particularly on upper portion. In arroyos, canyons and woodlands, mesquite thickets, along streams and in moist grasslands on the Edwards Plateau and Rio Grande Plains and Valley, Feb.-July; also adj. Mex.

Those plants with stems and lower surface of leaves densely pilosulous, with calyx eglandular to glandular-pilosulous, and with fruits densely glandular-puberulent have been segregated as var. *Berlandieri* Tharp & Barkl.

8. *Ruellia yucatanica* (Leonard) Tharp & Barkl. Herbaceous perennial with clustered tough slender fibrous-fusiform roots; stems to 35 cm. tall, from a subligneous base, usually several, more or less densely glandular-pilosulous and viscid toward and especially in the inflorescence; basal leaves radially spreading, clustered from crowded nodes, with petioles rarely more than 25 mm. long, oblong-elliptic to spatulate, obtusely rounded to rarely acute at apex, to 13 cm. long and 8 cm. broad, cuneate at base, the margins finely crenate-serrate to subentire and somewhat crisped, more or less hirsutulous to glabrate; stem leaves similar to basal ones but usually smaller; cleistogamous cymes usually several-flowered; calyx lobes at anthesis 4-9 mm. long, filiform-subulate, moderately to densely white pilosulous-glandular with pale to yellowish-brown viscid glands; corolla 3-3.5 cm. long, about 12 mm. broad; normal flowers in open or somewhat congested terminal panicles, intermixed with a varying number of cleistogamous ones; calyx lobes 7-13 mm. long, linear-attenuate, densely pilosulous with spreading viscid gland-

tipped hairs; corolla lavender-blue, 3-4 cm. long, the tube 6-8 mm. long; capsules from cleistogamous flowers 1-1.4 cm. long, 3-3.5 mm. thick, moderately retrorse-puberulent except the apex which is spreading-glandular-pubescent; capsules from expanding flowers 15-17 mm. long, 3-3.5 mm. thick, rather densely retrorse-puberulent except at apex which has spreading sparsely glandular-pubescent; seeds light-yellowish-brown, orbicular, slightly plump, 2-2.5 mm. in diameter, pale to white-margined. In grasslands, caliche hills, chaparral and on the edge of dense woods in the Rio Grande Plains and Valley, Mar.-Oct.; also Mex.

9. *Ruellia Brittoniana* Leonard. Stems usually several, to 1 m. high, subligneous, angled to subterete, essentially glabrous, subcorymbosely branched at the summit; leaves with petioles 1-2 cm. long, linear to linear-lanceolate, to 27 cm. long and 2 cm. broad, lowermost leaves acute to subacute, the others acuminate, narrowly cuneate at the base, entire to undulate, glabrous except for cystoliths; flowering branches in the axils of the upper leaves, cymose, rarely equaling the subtending leaves and bearing 3 or more flowers; bracts linear; calyx lobes subrigid, narrowly lance-attenuate, glabrous or essentially so except for pale cystoliths, 5-10 mm. long; corolla lavender, 25-45 mm. long, the tube 8-12 mm. long, the limb 25-35 mm. broad; capsule glabrous, 2-2.5 cm. long, about 4 mm. wide; seed suborbicular, 2-2.5 mm. in diameter. Nat. in e. Mex., but widely cult. and naturalized in the s. U.S. from Fla. to Tex.

10. *Ruellia malacosperma* Greenm. Stems to 8 dm. high, subquadrangular, glabrous or sparingly pilose, cystoliths minute and numerous; leaves with sparingly long-pilose petioles to 2 cm. long, chiefly lanceolate, acute to acuminate at apex, narrowed at base and decurrent on the petiole, to 13 cm. long and 38 mm. wide, rather firm, entire or undulate, glabrous or the costa and basal margins bearing a few white spreading hairs; flowers borne on once- to twice-dichotomously branched peduncles to 8 cm. long, their branches 2-4 cm. long, all subquadrangular and glabrous, bearing conspicuous cystoliths, the ultimate forks flower-bearing; bracts linear, about 1 cm. long and 1.5 mm. wide at base or the uppermost smaller, all glabrous; calyx about 14 mm. long, divided nearly to the base, the segments subulate, gradually narrowed to tip and bearing minute scattered hairs on or near the margins, some of the hairs gland-tipped; corolla 4-5.5 cm. long, the tube 9-11 mm. long, minutely pubescent, mauve; capsule narrowly clavate, 2-2.5 cm. long, 8- to 20-seeded, glabrous or the apical calluses puberulous, brownish, the solid basal portion about 6 mm. long and 2 mm. broad, the seed-bearing portion 6 mm. broad; seed suborbicular, about 3 mm. in diameter, silky with white appressed hairs when dry but mucilaginous-pilose when moistened; retinacula 2 mm. long, slightly curved. In shady areas in s. Tex., May-Sept.; also n.e. Mex.

Probably introduced; perhaps a hybrid taxon involving *R. Brittoniana* and another species.

11. *Ruellia Parryi* Gray. Shrub to 4 dm. tall, usually profusely branched from root or from exposed rhizomes; stem often branched above, such branches more or less appressed; branches at first green, then white and in age gray, retrorsely hirsutulous, the internodes shorter than the leaves; leaves with petioles one fourth to one third as long as the blade, spatulate to obovate or lanceolate to oblanceolate, hirsutulous and ciliolate on the margin, rounded to acute at apex, cuneate at base, entire, 1-2 cm. long, to 13 mm. broad; peduncles solitary in the axils of the leaves, each bearing two leaflike bracts and a solitary flower; calyx lobes flat, lanceolate, abruptly acute, 7-10 mm. long, about 1 mm. wide, puberulent, the margins ciliolate; corolla pale-lavender, 3-3.5 cm. long, the slender tube about 15 mm. long, the limb 15-25 mm. broad; capsule brownish, glabrous, somewhat constricted at the base, about 1 cm. long and 3 mm. broad; seeds brownish, flat, ovate, about 3 mm. long and 1 mm. wide. On limestone hills and ledges along arroyos in the Trans-Pecos, Mar.-July; also s.e. N.M. and adj. Mex.

12. *Ruellia pinetorum* Fern. Stem slender, to 4 dm. high, minutely pilose in lines and puberulent with closely appressed hairs, simple or often with spreading branches, the internodes longer than the leaves; leaves sessile, ovate to oblong or elliptic-lanceolate, subcoriaceous, minutely puberulent in lines or glabrate, broadly cuneate at base, subacute at apex, the margins usually undulate, the basal leaves small, the principal leaves to 45 mm. long and 2 cm. wide; flowers solitary at the tips of 2-bracted peduncles or cymose with 2 to several flowers; peduncles usually straight, to 3 cm. long; bracts lanceolate, shorter than the calyx lobes; calyx lobes linear-filiform, 1.5-2 cm. long, less

than 1 mm. broad at base, tapering to very slender tips, glabrate except for closely appressed hairs or elongated cystoliths; corolla bluish-lavender, about 35 mm. long, the tube longer than the throat, the limb 2-3 cm. broad; capsule glabrous, to 16 mm. long; seeds orbicular, about 3 mm. in diameter. In low pine barrens and prairies in e. Tex., Feb.-July; from Fla. to Tex., n. to S.C.

13. *Ruellia pedunculata* Torr. Stem to 7 dm. high, slender, erect, more or less puberulent, the internodes usually long, simple but mostly with ascending to spreading branches; leaves short-petioled, ovate to ovate-oblong or lanceolate, acuminate or rarely subacute at apex, cuneate at the base and decurrent, entire to undulate, puberulent, the principal leaves to 11 cm. long and 45 mm. wide, the smaller lower leaves obtuse to subacute and soon deciduous; flowers solitary at the tips of simple 2-bracted peduncles or loosely cymose; peduncles straight to somewhat curved, to 7 cm. long; bracts smaller than (but similar in appearance to) the principal leaves; calyx lobes linear-filiform, 1-3 cm. long, less than 1 mm. broad at the base, tapering to very slender tips, pilose with very slender hairs; corolla violet to purple or sometimes paler, 35-55 mm. long, the tube about equal to the narrow throat in length, the limb 2-3 cm. broad; capsule brownish, hirsutulous, to 2 cm. long, about 5 mm. broad, constricted for about a third its length; seeds sub-orbicular, about 3 mm. in diameter. In open woods and along streams in e. Tex., Apr.-Aug.; from s. Ill., Mo. and Okla. to La. and Tex.

14. *Ruellia strepens* L. Stem to about 1 m. high, simple or with few ascending branches, minutely pilose to glabrous; principal leaves membranaceous, ovate, rounded or tapering to slender petioles at base, acuminate at apex, entire to barely undulate, to 18 cm. long and 9 cm. wide, short-strigillose to glabrous; peduncles borne from 1 to 3 median nodes, to 9 cm. long, terminated by 2 dilated leafy bracts that subtend 1 to 3 showy flowers; calyx segments lanceolate to linear-lanceolate, flat to tip, 2-4 mm. wide, villous-ciliate, villous to glabrate on back; corolla pale-blue-violet, broadly expanding, 3-6 cm. long, with broadly funnelform throat; capsule glabrous, 1-2 cm. long, usually overtopped by calyx segments. In rich woods, talus slopes and low woodlands, commonly in calcareous areas in e. and n.-cen. Tex., Apr.-May; from Tex. to S.C., n. to N.J., Pa., O., Ind., Ill., Mo. and Kan.

The var. *cleistantha* Gray has smaller cleistogamous flowers usually in cymose clusters and from several of the axils, and a peduncle lacking or shorter than that of var. *strepens*.

15. *Ruellia humilis* Nutt. Stem coarse to slender, usually erect or rarely decumbent at base, to 8 dm. high, in clusters from knotty shortened rhizomes, often strongly 4-angled, villous-hirsute with whitish hairs or glabrescent, usually with slender elongate arched-ascending to horizontally divergent or reclining branches; leaves of the main axis as many as 36, coriaceous, to 8 cm. long and 45 mm. wide; main leaves with petioles to 3 mm. long, ovate to lanceolate or broadly elliptic, subacute to acute or mostly obtuse or rounded at apex, truncate to broadly cuneate and decurrent at base, entire or slightly undulate, hirsute to villous or sometimes pilose-ciliate on margins; bracts lanceolate to linear-lanceolate or oblanceolate to elliptic; flowers usually few in the axils of the median and upper leaves, on very short peduncles; calyx lobes linear-attenuate, 15-25 mm. long, villous-hirsute and conspicuously ciliate; corolla lavender to light-blue, 3-7 cm. long, the tube to 45 mm. long, the limb mostly 2 to rarely 4 cm. broad, in cleistogamous flowers the reduced corolla is tubular and closed; capsule brownish, to 15 mm. long and 5 mm. broad, glabrous, constricted at base; seeds few, ovate to suborbicular, 3 mm. in diameter. *R. ciliosa* of auth. In open forests, savannahs and old fields, primarily in e. fourth of Tex., rare on Edwards Plateau and in the Panhandle, Apr.-Oct.; from Pa. and W.Va. to Mich., Ia. and Neb., s. to Fla. and Tex.

Those variations in this species that are considered to be distinctive and that have been named are segregated in the key. They are here given further consideration.

Var. *depauperata* Tharp & Barkl. is characterized by its weak filiform stems that are glabrescent to sparsely pilose, and its more or less oblanceolate sparsely pubescent to sparsely pilose leaves.

Var. *frondosa* Fern. has internodes strongly villous-hirsute, the large usually obtuse leaves of the primary axis ovate to oval-oblong or widely elliptic and 3.5-8 cm. and 2-4 cm. wide, the corolla 3-5 cm. long with the tube 1.2-3 cm. long.

Var. *longiflora* (Gray) Fern. with stems villous-hirsute; leaves copiously villous-hirsute

on veins and margins; larger leaves of the main axis elliptic-oblong to oblong-lanceolate, 3-6 cm. long, 1-2.5 cm. wide, obtuse to subacute at the apex; corolla 5-8 cm. long, its tube 3-5 cm. long.

Var. *expansa* Fern. with stems to 85 cm. high, the internodes strongly villous-hirsute; larger leaves of the principal axis ovate to oval-oblong or broadly elliptic, obtuse at apex, 3-7.5 cm. long, 2.5-4 cm. wide, ciliate-hirsute; corolla 5-8 cm. long, the tube 3-5 cm. long.

16. *Ruellia caroliniensis* (Walt.) Steud. Stem erect, simple to divergently or strictly branched, to 9 dm. high, canescent-pilose, villous, hirsute, puberulent or rarely glabrescent, the upper nodes greatly abbreviated and with crowded leaves and glomerules, the lower nodes elongate; lower leaves more or less obovate and rounded at apex; middle and upper leaves distinctly petioled, ovate to lanceolate, oval, elliptic or oblong, commonly strigose above, strigose, hispid, pilose or glabrescent beneath; glomerules very short-peduncled to sessile, mostly crowded at the 1 to 4 upper nodes; bracts linear to lanceolate or ovate to elliptic, narrow, nearly equaling or shorter than calyx; calyx lobes linear-setaceous, to 25 mm. long, usually strigose-ciliate; corolla lavender to lilac-blue, 2-5 cm. long, the slender tube to 27 mm. long, the limb 15-25 mm. broad; capsule brownish, glabrous to pilose or hirtellous, to 17 mm. long, constricted below; seeds orbicular to oval, about 3 mm. long. In pinelands, thickets and prairies in e. Tex., May-Oct.; from N.J. to O. and s. Ind., s. to Fla. and Tex.

Those variations in this species that are considered to be distinctive and that have been named are segregated in the key. They are here given further consideration.

Var. *semicalva* Fern. is similar to var. *caroliniensis* but the stems are scarcely villous-hirsute, the leaves are glabrescent to sparsely strigose beneath, and the capsules are frequently glabrous.

Var. *salicina* Fern. has simple to sparingly branched canescent-puberulent to subvillous stems to 7 dm. high; leaves of upper nodes narrowly lanceolate to linear-lanceolate, 2 cm. wide or less, glabrescent to sparsely strigose beneath; calyx segments canescent-pilose to glabrescent and ciliate; corolla 2-3 cm. long, with the throat above 5-10 mm. in diameter.

Var. *serrulata* Tharp & Barkl. has filiform stems with elongate internodes and narrow dentate leaves.

17. *Ruellia Drummondiana* (Nees) Gray. Plant perennial from a short subligneous rhizome, many-rooted from the nodes of the rhizome; stems to 75 cm. high, somewhat four-angled, puberulent and sparsely softly pilose, slender-branched, with petioles to 3 cm. long, ovate to ovate-elliptic, to 15 cm. long and 9 cm. wide, tapering to the obtuse to subacute apex, somewhat abruptly cuneate at base, undulate-margined, dark-green and sparsely appressed-pubescent above, pale-green and sparsely pilose beneath; glomerules lateral, usually short-peduncled, with two oval bracts whose blades are about 7 mm. long and 5 mm. broad; flowers 2 to 7; calyx lobes gradually tapering into subulate tips, 12-35 mm. long, those of some flowers much longer than in others, white-pilose-pubescent; corolla 32-42 mm. long, lavender; fruit short-pedicellate, about 1 cm. long and 4 mm. broad, minutely canescent, the style base tending to be persistent as a long point; seed with white appressed pilosity, 5 mm. in diameter. Among boulders on slopes along streams and in canyons in s.-cen. Tex., June-Oct.; endemic.

6. STENANDRIUM NEES

Small perennial caulescent or acaulescent herbs; leaves often radical; flowers borne in spikes that are sessile to subsessile or pedunculate or are borne on slender scapes; peduncles and scapes simple or branched; bracts ovate to lanceolate, herbaceous, entire or occasionally toothed; calyx segments 5, narrow, subequal, usually striate-nerved; corollas pink to white or purple, the slender tube cylindrical and more or less incurved and briefly ampliate at throat, the oblique limb spreading and 5-lobed, the obovate lobes rounded or retuse and imbricate; stamens 4, didynamous, affixed in the throat of the corolla tube, included, the free parts of filaments very short; anthers oblong, 1-celled, conniving or subcohering in pairs, sometimes barbellate at tip, mucous at base; style subclavate at apex, scarcely 2-lobed; ovules 2 in each cavity; capsules oblong to subfusiform, subterete; seeds 4 or fewer by abortion, plano-compressed, orbiculate, minutely hispid or muricate, subtended by rather long retinacula.

Approximately 30 species that are widely distributed throughout tropical and subtropical regions of America.

1. Stems well-developed; leaves sessile, oblanceolate to narrowly spatulate, decurrent at base, to 45 mm. long; plants conspicuously white-pilose 1. *S. barbatum*.
1. Stems none or (if present) short and inconspicuous; leaves petiolate, ovate, to 15 mm. long; lower surface of petioles green 2. *S. fascicularis*.

1. *Stenandrium barbatum* T.&G. Dwarf multicapital plants to 6 cm. high, with a stout woody underground stem; leaves oblanceolate to narrowly spatulate, to 45 mm. long and 7 mm. wide, obtuse to acute at apex, gradually narrowed to an indistinct petiole, entire, puberulent with straight stiff hairs and bearing additional segmented hairs to 2 mm. long; spike densely flowered, at first shorter than and later slightly exceeding the leaves, to 3 cm. long; bracts oblong-lanceolate, about 15 mm. long and 3 mm. wide or the uppermost narrower, acuminate, puberulent and pilose, the long hairs mostly near the margins; bractlets subulate, 2-3 mm. long, 1-nerved, tipped by a white hairlike point 1-1.5 mm. long, ciliolate; calyx 6 mm. long; calyx lobes lance-subulate, 3-5 mm. long, 3-nerved, ciliolate; corolla about 15 mm. long, purple, glabrous or bearing a few minute hairs near the base, the throat 5-6 mm. wide and bearded within, the tube 6 mm. long and 2.5 mm. broad at base (narrowed above to 1.5 mm.), the obovate lobes notched at apex; ovary and style glabrous, the style 5-6 mm. long, the stigma 2-lobed, funnelliform; capsule oblong, 12 mm. long, 4-5 mm. in diameter, blunt at tip, glabrous; seed brown, densely pilose. On limestone slopes and ridges, and in clay shales and rubble in the Trans-Pecos, Mar.-June; also in s.e. N.M. and n. Mex.

This species is well-marked by its multicapital habit, stout roots and shaggy white pubescence.

2. *Stenandrium fascicularis* (Benth.) Wasshausen. Rootstock to 3 cm. long, the roots thick-fibrous; stems very short or none; leaves with puberulent-pilose petioles to 15 mm. long, ovate, to 3 cm. long and 2 cm. wide, rounded or obtuse at apex, glabrous to puberulent or sparingly pilose on the lower surface; spikes ovate, 1-2 cm. long, 8-15 mm. broad; bracts lanceolate, 9-12 mm. long, 2.5-3 mm. wide, the tips of the lower ones acute to obtusish, the upper acuminate or cuspidate, all faintly 3-nerved, ciliate with spreading hairs to 1.5 mm. long; bractlets subulate, 4.5 mm. long, 0.5 mm. wide, sparingly ciliolate; pedicels to 4 cm. long but usually much shorter, puberulent; calyx segments lanceolate, about 1 cm. long, sparingly ciliolate at apex, papillose on margins near base; corolla purple, puberulent, 1-1.2 cm. long, the tube 5-6 mm. long and 2 mm. wide at base (narrowed to 1 mm. near throat), the limb 8-10 mm. broad; corolla lobes obovate, the posterior slightly smaller than the anterior, 3-5 mm. long, 2-4 mm. wide, rounded; ovary 1.5 mm. long, the style 6 mm. long, both glabrous; capsule about 9 mm. long, 2-3 mm. in diameter, somewhat blunt at tip, glabrous; seeds 3.5 mm. long, 2 mm. wide, appressed-pilose with whitish hairs. *S. floridanum* of auth., *S. dulce* of auth. Rare in moist soil, river bottoms, and beneath brush on clay dunes and deltas, Calhoun to Willacy Co., also Webb. Co. on the Rio Grande Plains, summer; in Fla., Tex. and cen. Mex.

7. CARLOWRIGHTIA GRAY

Plants suffrutescent or herbaceous, minutely cinereous-puberulent or glabrate, sometimes glandular; branchlets slender; leaves small, narrow and entire; flowers usually small, loosely spicate or racemose, often paniculate; calyx 5-parted or -cleft; corolla purple to cream-colored, the tube slender, the throat not dilated, the limb nearly equally 4-cleft; stamens 2, the anther cells equal, inserted at the same height; capsule stipitate, 4-seeded.

A genus of about 20 species, chiefly in Mexico and southwestern United States.

1. Leaves linear or nearly so; pubescence nonglandular ... 1. *C. linearifolia*.
1. Leaves lanceolate to broadly ovate (2)
- 2(1). Flowers chiefly in long naked spikes; leaves nearly sessile, 6 mm. wide or less ..
..... 5. *C. arizonica*.
2. Flowers axillary or in short spikes (3)

- 3(2). Leaf blades oblong to lanceolate, at least 4 times as long as wide
 2. *C. parviflora*.
 3. Leaf blades lance-oblong to broadly ovate, about 2 times as long as wide (4)
 4(3). Pubescence all or chiefly nonglandular 3. *C. Torreyana*.
 4. Pubescence chiefly of gland-tipped hairs 4. *C. serpyllifolia*.

1. *Carlowrightia linearifolia* (Torr.) Gray. Plants suffrutescent or herbaceous, to 12 dm. tall; stems slender, branching, ascending, minutely scaberulous; leaves attenuate to the sessile base, linear to filiform-linear, to 35 mm. long, short-acuminate, firm, scaberulous or minutely puberulous; flowers borne in axillary pairs and terminal panicles, the scaberulous peduncle to 24 cm. long; bracts 2, subulate, about 1 cm. long, scaberulous, the lower bracts foliaceous and intergrading with the leaves; bractlets 2, 1-1.5 mm. long, subulate; calyx deeply 5-parted, the lanceolate divisions similar to and equaling the bractlets, about 2 mm. long and 0.5 mm. wide, puberulous; corolla purple, to 14 mm. long, the oblong lobes twice the length of the tube; anthers sagittate, the cells at base very obtuse or retuse; filaments hirsute-puberulent; capsule 22 mm. long, glabrous or sparingly scaberulous, clavate, the stipe as long as the body of the capsule. In sandy-gravelly soils and among rocks and boulders on slopes, along arroyos and in canyons in the Trans-Pecos, May-Oct.; from Tex. to Ariz. and n. Mex.

2. *Carlowrightia parviflora* (Buckl.) Wasshausen. Plants suffrutescent, to 45 cm. tall; stems quadrangular, slender, branching, ascending, almost subglabrous, the young branches glandular-pubescent; leaves subsessile or with petioles to 5 mm. long, oblong to lanceolate, attenuate at apex, obtuse at base, to 1 dm. long and 11 mm. wide, the margins revolute, the upper leaf surface turning olive-green upon drying, cystoliths clearly visible on both surfaces; flowers borne in curved terminal opposite sessile short-interrupted spikes, glandular-pubescent; bracts 2, subulate, to 3 mm. long, glandular-puberulent; bractlets 2, about 1 mm. long, subulate; calyx deeply 5-parted, the long-subulate segments about 3 mm. long and 0.7 mm. wide, glandular-pubescent; corolla blue or white, to 8 mm. long, the subulate lobes acuminate, the tube narrow, twice as long as the calyx, puberulous; anthers sagittate, the cells at base very obtuse or retuse; filaments subglabrous to sparsely puberulent; capsule 5-11 mm. long, ovoid, acute, the stipe as long as the body, glabrous; seeds flat, roughened, 3 mm. broad, turning dark-brown upon drying. *Dianthera parviflora* (Buckl.) Gray. In gravelly or sandy-loamy soils in chaparral in the Rio Grande Plains, Feb.-June; also n. Mex.

3. *Carlowrightia Torreyana* Wasshausen. Plants perennial with a stout root, to 35 cm. tall; stems erect or diffuse, often numerous and tufted, simple or branched, glabrous to pilose; leaves ovate to oval or suborbicular, 1-3 cm. long and to 12 mm. wide, acute to short-acuminate at apex, more or less abruptly contracted into short petioles, undulate to repand, finely to densely pubescent; petioles slender, to 6 mm. long, glabrate to pilose, the hairs spreading; flowers sessile, borne in interrupted more or less curved spikes to 1 dm. long, the rachises glabrate to pubescent with the hairs appressed or curved; bracts 2, subulate, about 3 mm. long, puberulous; bractlets 2, subulate, about 2 mm. long; calyx deeply 5-parted, the linear-subulate lobes acuminate, 2.5-3 mm. long and 0.4 mm. wide, puberulous; corolla white to purple, about 8 mm. long, the lips about as long as the tube, the glabrous upper lip obtuse or retuse, the puberulous lobes of the lower lip oblong and obtuse; anthers sagittate, the cells at base very obtuse or retuse; filaments hirsute-puberulent; capsule 9-13 mm. long, ovoid, acute, the stipe shorter than the body; seeds flattish, 3 mm. broad, black, roughened, with crenate margin. *Croftia parvifolia* (Torr.) Small, *Dianthera parvifolia* (Torr.) Gray. On ledges and in gravelly-silty soils and among loose rocks on slopes, along creeks and in chaparral on the Edwards Plateau and in the Rio Grande Plains and Trans-Pecos, Apr.-July; also N.M. and Mex.

4. *Carlowrightia serpyllifolia* Gray. Plants suffrutescent, to 28 cm. tall, loosely branched, the branches whitish; stems erect, ascending, simple or branched, glabrous to sparsely pilose; leaves oblong-lanceolate to ovate, to 15 mm. long and 4 mm. wide, acute to short-acuminate at apex, attenuate at base and more or less contracted into a short petiole, glandular-puberulent; flowers borne axillary and in short curved spikes to 5 cm. long, the rachises densely glandular-puberulous with the hairs straight; bracts 2, subulate, about 2 mm. long, glandular-puberulous; bractlets 2, subulate, about 1.5 mm. long; calyx deeply 5-parted, the linear-subulate acuminate lobes 3-4 mm. long and 0.4 mm. wide,

glandular-puberulous; corolla purplish, deeply parted with the acute lobes to 7.5 mm. long and at least twice as long as the tube, sparingly and finely pubescent; anthers sagittate, about 1 mm. long; filaments glabrous, to 9 mm. long; capsule about 18 mm. long, the stipe equaling the body of the capsule; seeds dark, flattish, about 4 mm. broad, the margins dentate. On bluffs, cliffs and open rocky slopes among boulders in the Trans-Pecos, July-Sept.; also adj. Mex. and probably s.e. N.M.

5. *Carlowrightia arizonica* Gray. Low diffusely branched perennial with a woody base, 5 dm. high or less, the cinereous branches minutely puberulent; leaves short-petioled, oblong to linear-lanceolate, to 3 cm. long and 4 mm. wide, acuminate; flowers white to cream-colored or purple, sparsely spicate on filiform branchlets; bracts subulate, longer than the calyx, the bractlets minute or none; calyx deeply 5-cleft, the subulate lobes to 2 mm. long, puberulent; corolla to 15 mm. long, the narrowly oblong lobes twice the length of the narrow tube or the posterior lobe broader above with a yellow spot on the face, contracted below; stamens exerted; anthers sagittate, oblong, the cells at base very obtuse or retuse; filaments attached in throat of corolla tube, 6 mm. long, glabrous; capsule to 1 cm. long, ovoid, acute, the stipe usually slightly longer than the body of the capsule; seeds 4, with a cordate profile, about 2.5 mm. and 3 mm. wide, the tip acuminate, surface unevenly covered with sharp-pointed papillae. In rocky dry soil in the Trans-Pecos, Mar.-Sept.; from Tex. to Ariz. and n. Mex.

8. ANISACANTHUS NEES

Branched shrubs; stems stout or slender, with brown or gray bark exfoliating in thin strips; leaves opposite, petiolate or sessile, lanceolate to linear, punctate, with cystoliths common on the upper surface; inflorescence spicate to racemose or paniculate; flowers borne singly or several at a node, secund or opposite; bracts and bracteoles mostly triangular to linear, usually caducous, pubescent; calyx subequally 5-lobed, the lobes triangular to linear-acuminate, pubescent to glabrous; corolla usually red, mostly pilose, tubular to funnel-shaped, more or less arcuate, somewhat inflated at the base around the ovary, 2-lipped, usually recurved, the posterior lip entire or slightly emarginate, the anterior lip 3-lobed; stamens 2, epipetalous anteriorly, usually at the base of the central lobe and alternate with the corolla lobes; filaments more or less thick and fleshy, colored, glabrous; style filiform, glabrous, about as long as the corolla, the simple stigma 2-lobed; fruit a subpyriform capsule, slightly beaked, usually narrowed at the base to form a relatively distinct stipe, glabrous and shiny; seeds 2 to 4, discoid, more or less tuberculate, each supported by a curved retinaculum usually at about the same height in the body of the capsule.

A small genus of about 15 species in southwestern United States and Mexico.

1. Corolla 4-5 cm. long; calyx 6-10 mm. long, the lobes linear-ligulate, somewhat attenuate, separate almost to the base 1. *A. insignis*.
1. Corolla 3-4 cm. long; calyx mostly 5 mm. long, the lobes ovate to lanceolate, 2-3 mm. long, acute 2. *A. Wrightii*.

1. *Anisacanthus insignis* Gray. Slender vinelike shrub to 25 dm. high; stems pubescent in lines; lower leaves lanceolate to ovate, to 7 cm. long and 3 cm. broad, slightly acuminate; upper leaves and those of the flowering branches sessile, linear to linear-lanceolate, to 4 cm. long and 5 mm. broad, essentially glabrous; flowers borne in short racemose clusters in the axils of fallen leaves; bracts and bracteoles puberulent, sometimes glandular, obovate to elliptic or ovate, reduced from about 1 cm. to about 2 mm. in length; pedicels 3-8 mm. long, glandular; calyx 6-10 mm. long, stipitate-glandular, the linear-ligulate lobes separate almost to the base and somewhat attenuate; corolla mostly 5 cm. long, curved, slightly infundibuliform, the linear lobes recurved and longer than the tube; stamens alternate, inserted at the base of the central anterior lobe; anthers 4 mm. long, the parallel anther sacs slightly oblique; disk at base of ovary about 1 mm. high; capsule 2 cm. long, stipe as long as or longer than the body; seeds 4, sometimes 1 or 2 aborted, about 5 mm. in diameter, slightly obliquely discoid, brown, more or less tuberculate. In canyons and arroyos in the Trans-Pecos, June-Nov., also n. Mex.

2. *Anisacanthus Wrightii* (Torr.) Gray. Shrubs, to about 1 m. high, the young branches dull-green and pubescent in 2 lines; lower leaves with pilose petioles to 1 cm. long,

lanceolate, to 5 cm. long and 2 cm. broad, hispid to glabrate; flowers usually borne singly or in pairs in second terminal spicate inflorescences, subsessile to short-pedicellate; bracts and bracteoles lanceolate, acuminate, 2-5 mm. long, puberulent; calyx about 5 mm. long, puberulent, glandular; calyx lobes ovate to lanceolate, acute, 2-3 mm. long, with few scattered hairs along margin and at tip; corolla 3-4 cm. long, the lobes narrowly ovate and obtuse, posterior lobe slightly emarginate, the nearly straight slender tube scarcely dilated at the throat and longer than the lobes; stamens epipetalous, inserted near sinuses of the central anterior lobe, the filaments about 1 cm. long; anthers 3 mm. long, the anther sacs connected nearly half their length from the tips; ovary extending about 2 mm. above the disk; capsule about 15 mm. long, the body about 6 mm. thick and shorter than the stipe; seeds 2, rarely 4, about 5 mm. in diameter. On rocky banks and floodplains of streams on the Edwards Plateau, June-July; also n. Mex.

9. TETRIMERIUM NEES

Fruticose or suffruticose plants; stems usually much-branched, the pubescence often disposed in 2 opposite lateral lines; leaves sessile or petioled, linear to ovate, entire, glabrous or pubescent; flowers borne in terminal or axillary 4-angled spikes; bracts conspicuous, usually closely imbricate, opposite, ciliate, cuspidate at tip; calyx 4- or 5-parted, the segments ciliate; corolla infundibuliform to tubular, the tube straight or slightly curved, the upper lip entire or emarginate, the lower lip 3-lobed with the lobes nearly equal; stamens 2, included, the anther sacs slightly converging toward the apex with one a little longer than the other; capsule obovate, apiculate, contracted below into a solid base, usually hispid and 4-seeded (sometimes 2-seeded); seeds flattened, tuberculate or muriculate.

About 25 species from the southern United States to Colombia and Ecuador.

1. Bracts hirsute-pubescent, strongly 3- to 5-nerved, spinulose-pointed, hispid 1. *T. hispidum*.
1. Bracts scabrous-puberulent, not at all hirsute, lightly 3- to 5-nerved and veiny 2. *T. platystegium*.

1. *Tetramerium hispidum* Nees. Suffruticose plant, decumbent to ascending, to 1 m. high; stems several, freely branched, slender, at first evenly hispid (later pubescent in lines) to glabrate; leaves with pubescent to glabrate petioles to 1 cm. long, lanceolate to lanceolate-ovate, occasionally ovate, to 5 cm. long and 25 mm. broad, usually acuminate to acute at the apex, cuneate to rarely subcordate at the base, at first scattered-pubescent on both surfaces but more conspicuously so on the midrib and nerves, later glabrate; inflorescences more or less loosely spicate, the spikes 1-5 cm. long; bracts lanceolate to lanceolate-ovate or occasionally ovate, acuminate to acute or occasionally obtusish at the apex, contracted below the middle to a subpetiolate base, 3- to 5-nerved, scattered-hispid on the outer surface but more conspicuously so on the nerves, hispid-ciliate, usually conspicuously recurved near the apex with a mucro 0.5-0.8 mm. long; bracteoles 1 to 5, linear-lanceolate, 1-3 mm. long, hispidulous; calyx lobes 4, linear-lanceolate, hispidulous; corolla 9-11 mm. long; middle lobe of the anterior lip oblong-obovate, about 5 mm. long and 1.3 mm. broad, obtusish at the apex, concave; lateral lobes of the anterior lip ovate-oblong, about 5 mm. long and 2 mm. broad; posterior lip obovate, about 5 mm. long and 2 mm. broad, subemarginate; capsules 4-5 mm. long, about 2 mm. broad, pubescent near the apex, the constricted base about 1.5 mm. long; seeds 4, 1.3 × 1.2 mm. On rocky walls of canyons in the Trans-Pecos, May-Sept.; also s. Ariz. and Mex.

2. *Tetramerium platystegium* Torr. Stems freely branched, slender, at first evenly short-hispid-pubescent, later pubescent in lines or glabrous; leaves with hispid to glabrous petioles about 1.5 mm. long, elliptic-lanceolate to elliptic-linear, to 5 cm. long and 12 mm. broad, acutish to obtuse at apex, cuneate at the base, sparsely hispid to glabrous on both surfaces but more conspicuously so on the midrib and nerves; inflorescences more or less loosely imbricated, the spikes 1-4 cm. long, the internodes 3-5 mm. long; bracts erect, ovate, acute at apex, mucronate, cordate at base, 1-2 cm. long, 8-15 mm. broad, inconspicuously hispidulous sparingly intermixed with minute gland-tipped hairs; calyx lobes 5, lanceolate, 2-3 mm. long, hispidulous; corolla 18-25 mm. long, the tube 1.3-1.8

mm. long; middle lobe of the anterior lip elliptic-ovate, 6-7 mm. long, about 3 mm. broad; lateral lobes of the anterior lip elliptic-ovate, 6-7 mm. long, 3 mm. broad; posterior lip elliptic-ovate, 6-7 mm. long, 2-2.5 mm. broad, emarginate; stigma exserted; capsule about 8 mm. long and 4 mm. broad, the constricted base 2 mm. long; seeds 2, muriculate, 3.2 × 3 mm. In the Rio Grande Plains and Edwards Plateau, summer; ? endemic.

10. DICLIPTERA Juss.

Stems more or less hexagonal in cross section; leaves petioled, mostly ovate, entire or undulate; flowers 1 to several, borne in often contracted cymes that form spikes or panicles subtended by an involucre of 2 to 4 pairs of conspicuous bracts; calyx 5-parted, hyaline; corolla narrow, slightly ampliate, the limb 2-lipped; stamens 2, the anther sacs often unequal with the longer one sometimes calcarate at base; staminodes none; capsules ovoid or subglobose, the placentae separating elastically from their walls and rupturing on dehiscence; seeds 2 or 4.

About 150 species in tropical and temperate regions of the world. The species are easily recognized by their hexagonal stems and flattened bracted reduced cymes.

1. Outer bracts obovate, 2 or less times longer than wide
 1. *D. brachiata*.
 1. Outer bracts oblong-spatulate, 3 times longer than wide
 2. *D. Vahliana*.

1. *Dicliptera brachiata* (Pursh) Spreng. Herb to 7 dm. high; stems erect or ascending, rather slender, with numerous spreading branches, from almost glabrous to pilose-pubescent, rarely spreading-villous or hirsute; leaves oblong-ovate to ovate-lanceolate, to 1 dm. long and 5 cm. wide, membranaceous, mostly acuminate at apex, narrowed at base and decurrent on a slender petiole to 3 cm. long, glabrous to pilose-pubescent; flowers clustered in the axils and more or less paniculate, short-peduncled to sessile; branches of the panicle subtended by leaves similar to but smaller than those of the main stem; bracts varying from broadly obovate to spatulate-oblong, to 7 mm. long and 4 mm. wide near the middle, rounded at summit, narrowed at base; calyx subhyaline, 3-3.5 mm. long, campanulate, papular-puberulous or glabrous toward base; corolla purple or flesh-colored, finely pubescent, 1.5-2 cm. long; stamens partly enclosed by the upper lip of the corolla and reaching to its apex, the filaments glabrous to minutely pilose toward base; capsule ovoid, 5-6 mm. long, the solid stipitate basal portion 1 mm. long, the tip of the capsule emarginate and apiculate, the surface of capsule ciliate toward apex, sparsely pilose elsewhere; seeds brown, oval, flattened, about 2 mm. long and broad, essentially glabrous. Incl. var. *glandulosa* (Scheele) Fern. and var. *Ruthii* Fern., *Diapedium brachiatum* (Pursh) O. Ktze. In shady and moist places mostly in cen. and s. Tex., July-Oct.; from Fla. to Tex., n. to Va., Ind. and Mo.

2. *Dicliptera Vahliana* Nees. Herb to 1 m. high; stems erect or ascending, thinly puberulous, the papular hairs interspersed with scattered amber or whitish disk-tipped ones; leaves with petioles 1-1.5 cm. long, oblong-lanceolate, to 5 cm. long and 2 cm. wide or the lowermost larger, obtuse to short-acuminate at tip, apiculate, narrowed at base and decurrent on the petiole, essentially glabrous; flowers usually solitary, subtended by a pair of oblong-spatulate bracts 1.5 mm. long and 0.75 mm. wide at base, more or less secund in lax spikes, these forming large much-branched panicles, the branches of the panicle subtended by leaves similar to those of the main stem but smaller, innermost bracts lanceolate, 2.5-3 mm. long, acuminate, densely papular-puberulous; calyx subhyaline, 2.5 mm. long, campanulate, the triangular segments about 1 mm. and papular-puberulous or glabrous toward base; corolla red, finely pubescent, 28 mm. long; stamens partly enclosed by the upper lip of the corolla and reaching to its apex, the filaments minutely pilose toward base; anthers 2.5 mm. long and 1.5 mm. broad, bearing a few minute marginal hairs; capsules ovoid, 5-6 mm. at tip, the solid stipitate basal portion 2 mm. long, the tip of the capsule emarginate and apiculate, the entire surface except the basal portion rather densely retrorsely pubescent; seeds light-brown, oval, flattened, about 2 mm. long and broad, sparingly puberulous, the hairs papular and retrorsely barbed. Rare in the lower Rio Grande Valley; in s. U.S. to n. S.A. and the W.I.

11. SIPHONOGLOSSA OERST.

TUBE-TONGUE

Shrubs or suffrutescent herbs; bracts none; bractlets small; leaf blades entire; flowers sessile, solitary or few, borne in the axils of the uppermost leaves or occasionally on short peduncles; calyx segments 4, narrow, short-acuminate; corollas white, blue or purple, the slender elongated tube terete, the limb 2-lipped, the upper lip entire or 2-lobed, the lower lip 3-lobed and spreading; stamens 2, adnate to the mouth of the corolla tube, included or exerted but not reaching beyond the upper lip of the corolla; anthers 2-celled, the cells more or less superposed; staminodes none; stigmas slightly 2-lobed; capsules clavate, usually 4-seeded.

A small genus of tropical and subtropical plants consisting of about 15 species, ranging from the southern United States to northern South America; also tropical and South Africa.

1. Stems with spreading evenly scattered hairs 1. *S. pilosella*.

1. Stems with reflexed hairs disposed in decussating lines . 2. *S. Greggii*.

1. *Siphonoglossa pilosella* (Nees) Torr. Plants low, branching from a suffrutescent base, to 3 dm. high; stems hirsute with scattered spreading hairs; leaves subsessile, ovate to oval, to 4 cm. long and 2 cm. wide, subacute at apex, the upper surface glabrous or sparingly hirtellous below; flowers one to several, solitary in the axils of the uppermost leaves or terminating densely hirtellous axillary peduncles to 4 mm. long; bractlets subtending the calyx to 2.5 mm. long, hirtellous, the segments gradually narrowed to a slender tip; corollas lavender, to 28 mm. long, hirtellous; corolla tube cylindrical, 2 mm. in diameter at base, reduced to 1 mm. at 4 mm. above base, thence gradually enlarged to 2.5 mm. at mouth; upper corolla lip ovate, about 1 cm. long and 2.5 mm. wide near base; lower corolla lip 3-parted, the elliptic lobes about 8 mm. long and 3 mm. wide; stamens inserted near the mouth of the corolla tube; filaments 5 mm. long, glabrous; anthers 1.5 mm. long, their lobes more or less superposed; style about 15 mm. long, glabrous, the stigma linear-lanceolate; capsule clavate, 8-9 mm. long, 3 mm. broad, about 3 mm. thick, glabrous, narrowed to a blunt tip, the solid basal stipe about 3 mm. long; seeds 4, about 3 mm. in diameter, somewhat flattened, tuberculate. *S. dipteracantha* (Nees) Heller. In rocky and gravelly soils in chaparral on hills, banks and along streams in the s. two thirds of Tex., Apr.-Oct.; also adj. Mex.

2. *Siphonoglossa Greggii* Greenm. & Thomps. Plants with suffrutescent base, to 2 dm. high; stems erect or ascending, subcylindrical and often quadrangular, pubescence of reflexed hairs disposed in decussating lines; leaves opposite, short-petioled, lanceolate to obovate, to 25 mm. long and 7 mm. wide, acute to obtuse or rounded at apex, entire at base, gradually narrowing, glabrous above, somewhat paler when young, the nerves and veins appressed-puberulent; upper flowers axillary, solitary, sessile, the bracts subspatulate; calyx deeply 5-parted, 4 mm. long; calyx lobes linear to lanceolate, glabrous; corolla white, lavender, 1.5-2 cm. long, bilabiate; lower corolla lip horizontal, spreading, trilobate; upper corolla lip suberect, notched; corolla tube slender, 9-14 mm. long, exterior pubescent; ovary and style glabrous; capsule about 7 mm. long, smooth; seeds suborbicular and compressed, the surface warted, approximately 2 mm. in diameter. In chaparral, on the edge of thickets and along streams in the Rio Grande Plains and Valley of s. Tex., Mar.-Oct.; also adj. Mex.

12. YEATESIA SMALL

A monotypic genus.

1. *Yeatesia viridiflora* (Nees) Small. Perennial to 6 dm. high, puberulent to almost glabrous; stem erect, simple or branched, slightly glaucous, when dry with a contracted ring above each node as if articulated; leaves large, to 12.5 cm. long and 5 cm. wide, bright-green, membranaceous, ovate-lanceolate to oval, acuminate at apex, gradually tapering into a short petiole, glabrous on lower surface, slightly hairy above; flowers numerous, axillary and terminal, in oblong and somewhat strobilaceous usually short-peduncled cylindrical compact spikes; bracts oval to obovate, with a narrowed base, about 15 mm. long, mucronate, hirsute-ciliate; bractlets similar to bracts but smaller,

about half the length of the capsule; calyx sessile, somewhat glumaceous, deeply 5-parted; calyx lobes setaceous-subulate, sparingly hirsute-ciliate, the innermost smaller; corolla white to flesh-colored, 3- or 4-toothed, almost salverform, about 15 mm. long, the spreading lobes about 5 mm. long; stamens 2, with oblong contiguous and similar anther cells that are mucicous, with rarely one or both mucronate at base; filaments slender, inserted and included within the tube of the corolla; capsule clavate-oblong, firm-coriaceous, 4-seeded, the body longer than the stipelike base; seeds glabrous, minutely rugulose. *Gatesia laetevirens* (Buckl.) Gray. In pinewoods, gulf prairies and marshes of e. Tex., July-Oct.; from Fla. to Tex., n. to Ga. and Tenn.

13. JUSTICIA L.

Herbs or shrubs; leaves opposite, petiolate, entire; flowers solitary or in spikes or panicles; bracts various, small, linear to subulate, distant, conspicuous and imbricate; calyx segments 5 or (in some species) 4, usually narrow and nearly equal; corollas usually white, pink or purple, sometimes with purple or white markings in throat, the tube usually rather narrow, the limb 2-lipped, the upper lip 2-lobed, the lower lip 3-lobed; stamens 2, often slightly exerted but usually not exceeding the corolla lips; anther cells 2, more or less superposed, one or both cells apiculate or tailed, the connective narrow to broad, the lobes parallel or obliquely affixed; capsules clavate, 4-seeded.

About 300 species, mostly tropical.

1. Flowers borne on long sterile peduncles (2)
1. Flowers borne in the leaf axils (3)
- 2(1). Flowers capitate, the heads dense, at length oblong 1. *J. americana*.
2. Flowers in spikes, lax on one side 2. *J. lanceolata*.
- 3(1). Flowers clustered in upper leaf axils; corolla nearly or quite 25 mm. long; roots diffusely branched 3. *J. Runyonii*.
3. Flowers borne sessile and solitary; corolla less than 10 mm. long; rootstock thick, ligneous (4)
- 4(3). Leaves slender or acicular, 3-15 mm. long, 1 mm. or less wide 4. *J. Warnockii*.
4. Leaves obovate, the upper ones linear-lanceolate, less than 12 mm. long, more than 1 mm. wide 5. *J. Wrightii*.

1. *Justicia americana* (L.) Vahl. AMERICAN WATER-WILLOW. Perennial glabrous plant, colonial by rhizomes, to 1 m. high; stem erect, sulcate-angled, slender, usually simple, often rooting below; leaves linear to lanceolate or narrowly oblong, gradually acuminate, narrowed at base into short petioles or sessile, to 16 cm. long and 25 mm. wide; flowers borne in capitate spikes to 3 cm. long at ends of slender axillary stiffly ascending peduncles that are to 15 cm. long; calyx 5-parted, longer than the internodes above it; calyx lobes linear-subulate, about 7 mm. long; corolla violet or nearly white, 1-1.2 cm. long, its tube shorter than the lips, the base of the lower lip rough and palatellike, marked with purple dots; stamens 2, the glabrous filaments attached at tip of corolla tube and 6 mm. long; anther cells separating and somewhat unequal, the terminal anther sac transverse; capsule about 12 mm. long, exceeding the calyx, its stipe about the length of the slightly compressed body; seeds 4, densely verrucose, 3 mm. long, 2 mm. wide. *Dianthera americana* L. and var. *subcoriacea* (Fern.) Shinners. In shallow water and mud in e. and s.e. Tex., also on the Edwards Plateau and in n.-cen. Tex., Apr.-Sept.; from Ga. to Tex., n. to Que., Vt., N.Y., Ont., Wisc., Mo. and Kan.

2. *Justicia lanceolata* (Chapm.) Small. LANCE-LEAVED WATER-WILLOW. Perennial herb to 3 dm. high; stems erect or spreading, more or less branched; leaves sessile or nearly so, linear to linear-elliptic or elliptic-lanceolate, somewhat acuminate, minutely puberulent, to 1 dm. long and 3 cm. wide; peduncles often branching, longer than the leaves; spikes slender, 3-10 cm. long, the numerous flowers scattered singly and quite evenly along one side; calyx segments narrowly linear, 5-7 mm. long and less than 1 mm. wide; corolla about 1 cm. long, lips nearly as long as the tube which is saccate near the base,

the upper lip truncate or retuse, the lower lip 3-lobed with middle lobe truncate or retuse and the lateral lobe obtuse; stamens slightly exerted, the glabrous filaments attached about midway in the tube and 3-4 mm. long; anther cells unequal, the upper lobe 0.8 mm. long, the lower lobe 1 mm. long and apiculate, the connective broad; ovary 1.5 mm. long, 2-celled, glabrous, ovules 2 in each cell; style 1 cm. long, puberulent at base, the small stigma 2-cleft; capsule 1-1.5 cm. long, the body as long as the stipelike base or shorter; seeds 4, disklike, 2 cm. in diameter, with thickened margins and smooth surface. *Dianthera lanceolata* (Chapm.) Small. In wet and swampy grounds in s.e. Tex., Mar.-June; from Fla. to Tex., n. to Va.

3. *Justicia Runyonii* Small. Plant woody, often with two or more stems from the top of diffusely branched roots; stems lax, irregularly spreading or reclining and ultimately prostrate, sometimes rooting at the nodes, irregularly and sparingly branched, slightly enlarged at the nodes, the internodes bright-green, very minutely pubescent; leaves more or less reflexed, lanceolate to linear-lanceolate or almost linear at the ends of the branches, somewhat cuneately narrowed into petiolelike bases, to 11.5 cm. long, acuminate at apex, minutely pubescent near the edges and on veins, dark-green above, pale-green beneath, veins rather prominent on both sides; flowers clustered in upper leaf axils, subtended by narrow ciliate bracts and bractlets that are less than 13 mm. long; sepals acuminate, about 1 cm. long, green and finely pubescent on the back, with the white margins ciliate; corolla reddish-purple and striped, about 25 mm. long, narrowed upward to a notched and 2-lobed apex, with sheathlike fold (including the style) running from a hairy orifice near base of tube up to apex; upper corolla lip minutely glandular-pubescent without and with revolute margins; lower corolla lip with thin broad rounded lobes above saccate lower part of tube, the lateral lobes plain reddish-violet, the middle lobe with deep white fold, with white forking out into purple ground-color; stamens arched up into the upper corolla lip, the curved filaments somewhat flattened and slightly enlarged near middle; anther sacs unequally attached to filament connective; ovary conic-cylindric, seated in cuplike disk, green; style filiform, curved, white, the wide stigma obscurely two-lobed; capsule stout-clavate, about 17 mm. long, puberulent, whitish, the body green, acute at tip, the stipe stout; seeds globose-reniform, black-shining, about 4 mm. long. In the s. Rio Grande Plains, June-Aug.; also Tam.

4. *Justicia Warnockii* B. L. Turner. Low much-branched glabrous shrubby perennial to about 4 dm. high, the main stem to 6 mm. thick and covered with gray bark; ultimate branches yellow-green, very slender and crowded, broomlike; leaves very slender or acicular, to 15 mm. long and 1 mm. wide; flowers few, solitary and sessile in the leaf axils or terminating the slender branches; bracts 3-4 mm. long, linear to almost filiform, exceeding the calyx; calyx 2.5-3 mm. long, 5-parted, the subulate lobes 2-2.5 mm. long; corolla fugacious, 2-lipped, lavender with purplish blotches in two rows in the throat (these extending on the lobes), 7.5-9 mm. long, the tube about 5 mm. long, 4-lobed; upper corolla lobe broad and straight, 2.5-2.7 mm. long, 1.3-2 mm. wide, notched at apex; lateral lobes of lower lip elliptic, 2.3 mm. long by 1.2 mm. wide, the concave central lobe 2 mm. long by 3 mm. wide; stamens slightly exerted; filaments attached about midway in the tube, 1.5-2 mm. long, glabrous; anther cells unequal, the upper cell 0.6 mm. long, the lower cell 0.7 mm. long with a curved tail, both cells calcarate and joined by a broad connective; ovary 1 mm. long, 2-celled, glabrous; ovules 2 in each cell; style 5.3 mm. long; stigma small, 2-cleft, reflexed; capsule glabrous, 7.5-8 mm. long, with a stipe 3-3.2 mm. long; seeds 4, muriculate, oval to elliptic, 2.6 mm. long by 2.4 mm. wide. In mts. and canyons of the Trans-Pecos, May-Oct.; endemic.

5. *Justicia Wrightii* Gray. Low much-branched perennial, to 2 dm. high; stems erect, ascending from a suffrutescent base, cinereous-puberulent; leaves rigid, sessile, less than 12 mm. long and 3 mm. wide, the lowest obovate, the upper linear-lanceolate, mucronate-acute at apex; flowers solitary and sessile in the upper axils; bracts similar to the subtending leaves; calyx small, 5-parted, the puberulous lobes 3-4 mm. long; corolla purplish, 8 mm. long, somewhat campanulate, with a short tube and rather ampliate throat seldom longer than the limb, upper lip with a broad emargination and two short narrow lobes, lower lip larger with oval-obovate lobes; stamens slightly exerted; filaments attached at tip of tube, about 2 mm. long, glabrous; anther cells oblique and disjointed, lower anther cell abruptly short-spurred, upper cell smaller and mucronate at base; ovules 4; capsule glabrous, to 8 mm. long, with a stipe 2 mm. long; seeds 4, mucronate, oval to elliptic,

2.5 mm. long by 3 mm. wide, puberulent. On the w. edge of the Edwards Plateau, Apr.-May.; endemic.

FAM. 166. PHRYMACEAE SCHAUER¹⁸⁴ LOPSEED FAMILY

Perennial herbs with slender simple or rarely branching stems and coarsely crenate-serrate opposite leaves; flowers opposite in slender, elongate long-pedunculate terminal spikes, each subtended by 3 subulate bracts, strictly reflexed in fruit; calyx cylindrical, 2-lipped, the upper lip composed of 3 reddish-brown bristly-subulate teeth, the lower lip much-abbreviated and 2-toothed; corolla 2-lipped, the upper lip notched, the lower lip much larger and 3-lobed; stamens 4, included, didynamous; style slender, the stigma 2-lobed; fruit achenelike, dry, ellipsoid, 1-celled and 1-seeded; seeds orthotropous, filling the fruit.

Only one genus known.

1. PHRYMA L. LOPSEED

Characters of the family. Composed of our species and 2 others in eastern Asia.

1. *Phryma leptostachya* L. Plant with a cluster of fleshy roots, erect, to 9 dm. tall, usually much smaller, glabrous to sparsely cinereous-pilose, the internodes irregular in length; petioles varying from up to 5 cm. long for the lowermost leaves to essentially lacking for the upper leaves; leaf blades thin, bright green on upper surface, paler on lower surface, triangular-ovate to broadly elliptic-lanceolate, truncate to broadly cuneate at base, bluntly acute to long-acuminate at apex, to 15 cm. long and 8 cm. wide, the margins often doubly serrate; calyx 5-7 mm. long, strongly ribbed, closed in fruit, the teeth hooked at the tip; corolla purplish or rose-color, scarcely exceeding the calyx; seed brownish, about 4 mm. long. In open woodlands and thickets in e. Tex., May-June; from w. N.B., w. to Man., s. to Fla. and Tex.

FAM. 167. PLANTAGINACEAE JUSS.¹⁸⁵ PLANTAIN FAMILY

Annual or perennial scapose herbs without or with an abbreviated stem; leaves all basal or nearly so; flowers small, perfect or unisexual, hypogynous, regular or slightly irregular in the calyx, in long-peduncled bracted terminal spikes; calyx and corolla 4-divided or -lobed, persistent, usually scarious or scarious-margined; stamens 4 or 2, distinct, inserted on the corolla tube; style filiform, stigmatic for most of its length; ovary superior, 2- to 4-celled; fruit a capsule, 1 to few seeds per cell.

A family of 3 genera and about 270 species, cosmopolitan in distribution.

1. PLANTAGO L. PLANTAIN

Flowers in spikes or heads, each sessile or subsessile in the axil of a bract; sepals 4, the 2 next to the bract often somewhat different from the 2 next to the axis; corolla salverform, long-persistent after anthesis, its tube covering the summit of the capsule, its lobes reflexed and spreading or erect and connivent; capsule circumscissile at or below the middle.

More than 250 species, widely distributed.

1. Bracts scarious except at base and in center, ovate and abruptly narrowed into a long scarious tip 9. *P. lanceolata*.
1. Bracts scarious-margined or wholly herbaceous, without slender scarious tips (2)

¹⁸⁴ Contributed by Helen B. Correll.

¹⁸⁵ Contributed by Helen B. Correll; key to species adapted from Lloyd H. Shinnars in Field & Lab. 18:113-114. 1950.

- 2(1). Sepals and bracts glabrous; spikes 2-4 mm. thick in flower (3)
2. Sepals and bracts pubescent or villous; spikes 3.5-12 mm. thick in flower (4)
- 3(2). Leaf blades elliptic to ovate, more than 1.5 cm. wide; stamens 4 1. *P. major*.
3. Leaf blades linear to narrowly oblanceolate, less than 1.5 cm. wide; stamens 2 (13)
- 4(2). Hairs on upper part of scape spreading at right angles (5)
4. Hairs on upper part of scape usually closely ascending or appressed (8)
- 5(4). Bracts at base of spike keeled and clasping; corolla lobes erect and folded together after as well as before flowering (6)
5. Bracts at base of spike not keeled nor clasping; corolla lobes spreading or reflexed after flowering (7)
- 6(5). Bracts 1-2.5 mm. long; corolla lobes 0.8-2.3 mm. long; mature seeds oblong, 1.25-1.75 mm. long by 0.7-0.8 mm. wide, yellow-brown to black, deeply grooved ventrally, not transparent-margined; distribution mainly in east Texas 2. *P. virginica*.
6. Bracts 3-4.5 mm. long; corolla lobes 2-3 mm. long; mature seeds oval or oblong-oval, 2.4-2.8 mm. long by 1.3-1.8 mm. wide, bright-red to reddish-black, shallowly concave ventrally, with pronounced transparent margin; distribution mainly west of Blackland Prairies 3. *P. rhodosperma*.
- 7(5). Corolla lobes 1-2 mm. long; bracts rigid, scarious with green or purple midrib; spike 6-8 mm. thick 4. *P. insularis*.
7. Corolla lobes 3-4 mm. long; bracts linear-subulate; spike 8-12 mm. thick 10. *P. Helli*.
- 8(4). Bracts triangular-ovate, broadly scarious-margined except at apex (each margin one fourth to one third entire width of bract) (9)
8. Bracts narrowly triangular-lanceolate to lance-linear, narrowly scarious-margined near base, otherwise herbaceous (10)
- 9(8). Leaves woolly-pubescent on both surfaces; corolla lobes suborbicular, 2 by 2 mm. or 2.2 by 2 mm., measuring length in center of lobe 5. *P. Hookeriana*.
9. Leaves glabrous on the upper surface, thinly pubescent on the lower; corolla lobes cordate-ovate, about 0.5 mm. longer than wide, 2 by 2.5 mm. to 2.5 by 3 mm. 6. *P. Wrightiana*.
- 10(8). Leaves glabrous on the upper surface; bracts in middle of spike 3 to 6 times as long as the calyces 7. *P. aristata*.
10. Leaves rather densely pubescent on the upper surface; bracts in middle of spike shorter than or up to 4 times as long as the calyces (11)
- 11(10). Scapes 1.3-6.5 cm. long; spikes 2-10 cm. long when half or more of the flowers have opened; most of the scapes shorter than their spikes (a few may be as long or slightly longer) 8. *P. patagonica* var. *breviscapa*.
11. Scapes 6-26 cm. long; spikes 2-11 cm. long when half or more of the flowers have opened; most of the scapes longer than their spikes (a few may be as long or slightly shorter) (12)
- 12(11). Bracts in the lower part of spike shorter or slightly longer than the calyces 8. *P. patagonica* var. *gnaphalioides*.
12. Bracts in the lower part of spike 2 to 4 times as long as the calyces 8. *P. patagonica* var. *spinulosa*.
- 13(3). Corolla lobes erect in age; capsule about twice as long as the calyx; seeds 10 to 30, somewhat asymmetrical 11. *P. hybrida*.
13. Corolla lobes becoming reflexed in age; capsule slightly surpassing the calyx; seeds (2 to) 4 (to 8), symmetrical 12. *P. elongata*.

1. *Plantago major* L. COMMON PLANTAIN, LANTEN. Glabrous or more or less sparsely pubescent stout perennial; leaves thickish, strongly ribbed, spreading, ovate to broadly elliptic, rounded at apex, broadly cuneate to subcordate at base, to 3 dm. long (including the broad channeled petiole), undulate to sinuate-dentate or angular-toothed; scapes curved-ascending or sometimes decumbent, commonly shorter than the leaves; spike dense, to about 2 dm. long and 8 mm. thick; bracts ovate, acute, shorter than to rarely longer than calyx, brownish with a slender green keel; calyx lobes broadly ovate to elliptic, 1.5-2 mm. long; corolla lobes 1-1.5 mm. long, reflexed; capsules ovoid, broadly conic to rounded at summit, brown or purplish, about 3 mm. long, circumscissile below tips of sepals; seeds 6 to 16, angulate, reticulated, 1-1.5 mm. long. Introd. from Eur. to become a weed in many places in the U.S. and Can. as well as elsewhere.

2. *Plantago virginica* L. PALE-SEEDED PLANTAIN. Annual with a slender taproot, glabrate or usually villous with septate hairs; leaves spreading or ascending, oblanceolate to obovate, obtuse to subacute, entire to coarsely but remotely repand-dentate, hirsutulous, to 2 dm. long and 4 cm. wide, usually much smaller; scape to 3 dm. long, usually noticeably exceeding the leaves, short-hirsute; spikes dense or interrupted, to 2 dm. long and 8 mm. thick; bracts lanceolate to linear-lanceolate, about 2 mm. long, mostly shorter than the calyx, hirsutulous, essentially without a scarious margin; calyx lobes oblong-obovate, 2-2.5 mm. long, rounded at apex, the brownish keel hirsutulous, the whitish scarious margin broad and glabrous; pistillate corolla lobes sharply acute, erect and connivent after anthesis; capsules ovoid, about as long as the calyx lobes; seeds 2, dull pale-brown to nearly black, to 2 mm. long, less than half as wide, with no differentiated margin, cymbiform, the hilum nearly as long as the seed. Incl. var. *viridescens* Fern. In thin soil over rocks, along roadsides, in open thickets and flat woods, salt marshes and dunes along the coast and dry open slopes, rarely on caliche outcrops in e. third of Tex., Mar.-June; from Mass. and N.Y., w. to Wisc., Ia. and Kan., s. to Fla. and Tex.; introd. farther w.

3. *Plantago rhodosperma* Dcne. RED-SEEDED PLANTAIN. Annual with slender taproot; leaves oblanceolate, long-cuneate at base, obtuse to acute at apex, to 35 cm. long and 5 cm. wide, usually much smaller, grayish-green, pubescent, entire to coarsely pectinate- or salient-dentate; scapes one to several, hirsute, shorter than to much-exceeding the leaves, hirsute; spikes to 2 dm. long and 1 cm. thick; bracts and floral segments similar to *P. virginica* but the acute to acuminate keels of calyx lobes extended beyond the scarious margin; seeds 2, bright-red to reddish-black, 2-3 mm. long, more than half as wide, nearly flat on both sides, with a thin pale margin, the central hilum less than a third as long as the seed. Usually in rocky soils in brushlands and on slopes, occasionally in sandy soils and on gravel bars of washes and streams, almost entirely w. of the Blackland Prairies, Mar.-May; from Mo. and Tenn., w. to Kan., Tex. and Ariz.; adv. farther w.

4. *Plantago insularis* Eastw. Low annual with short erect stem and abbreviated ascending branches, villous and tomentose throughout; leaves linear-lanceolate, acute, entire or with minute callous teeth, to about 1 dm. long and 8 mm. wide, villous to lanate; scapes numerous, axillary, erect or ascending, to 18 cm. high, more or less pilose to tomentose; spikes many-flowered, erect, short-cylindric, to 2 cm. long and 8 mm. thick, villous to heavily tomentose; bracts oblong to ovate, scarious with green or brown rigid glabrous to villous midrib, as long as the calyces or slightly shorter; calyx lobes ovate to obovate, the midribs green or brown; corolla lobes ovate, apiculate, concave, about 2 mm. long and 1.5 mm. wide, reflexed-spreading, with a brown spot at base of each; capsule twice as long as the calyx, oval, rounded at apex, about 4 mm. long and 2 mm. thick; seeds 2, brown, narrowly oblong, very finely pitted, about 2.8 mm. long and 1.3 mm. wide, rim of face thickened. Incl. var. *fastigiata* (Morris) Jeps. On gravel bars in stream beds and on cobbly slopes of canyons in s. Trans-Pecos, Feb.-May; from s. Calif., Ut. and Nev. to w. Tex. and n. Mex.

5. *Plantago Hookeriana* Fisch. & Mey. TALLOW WEED. Short-stemmed annual with a slender taproot; leaves linear to narrowly oblanceolate, entire or with small scattered denticulations, callous-tipped at the acute to obtuse apex, to 3 dm. long and 2 cm. wide, usually much smaller, glabrous to lanate; scapes erect or ascending, shorter than to mostly noticeably exceeding the leaves, glabrate to pubescent; spikes capitate to long-cylindric, to 12 cm. long and 8 mm. thick, rarely reduced to only 2 flowers; bracts broad at base, scarious-margined for one third to the entire length of midrib, equal to or shorter

than calyces, glabrate to villous; calyx lobes oblong, about 3 mm. long; corolla lobes suborbicular-ovate, whitish with a brown spot at base of each or brown stripes the entire length of each, to 4 mm. long; capsules oval, about 4 mm. long; seeds 2, cymbiform, dull-brown, finely pitted, about 3 mm. long and 1.3 mm. wide. In sandy, gravelly or rocky soils in open woods, dunes and savannahs, also on clay flats from e. Tex., along the coast to the Rio Grande Valley and inland w. to the Trans-Pecos, Mar.-June; possibly endemic.

6. *Plantago Wrightiana* Dcne. Dark green annual with an elongate taproot and short erect stem; leaves numerous, erect, linear to linear-oblong, obtuse to acute and callous at the flat or sometimes involute apex, entire, to 2 dm. long and 1 cm. wide, usually much smaller, 3- to 5-nerved, glabrous or sparsely pubescent; scapes solitary to several or many, rather stout, surpassing the leaves at maturity, appressed-pubescent; spikes conspicuous because of the large corollas, long-cylindrical, to 9 cm. long and 8 mm. thick, villous; bracts rigid, herbaceous with scarious margins, equal to or shorter than the sepals, triangular-lanceolate to ovate, obtuse, about 3 mm. long and 1 mm. wide; villous or less hairy; calyx lobes thick and rigid, pilose, narrowly obovate, rounded at apex, about 3 mm. long, herbaceous and dark-green or brownish; corolla lobes ovate, obtuse, spreading and reflexed, the 2 laterals deflexed, about 3 mm. long and 2.5 mm. wide; capsules ovoid, rounded above, about 4 mm. long and 2 mm. thick; seeds 2, brown, slightly constricted below the middle, finely pitted. In sandy, gravelly or rocky soils mainly on the Edwards Plateau or adj. to it, Apr.-July; w. to Ariz.

7. *Plantago aristata* Michx. ВУКТИЮРН. Dark-green annual with thickened tapering root and short erect stem; leaves linear to narrowly oblanceolate, to 2 dm. long and 1 cm. wide, more or less villous below; scapes rigidly ascending, pubescent to villous, to about 25 cm. high; spikes (excluding bracts) cylindrical, to 15 cm. long and 8 mm. thick, usually much shorter; bracts aristate to linear and foliaceous, more or less hirsute, the scarious margins narrow and at very base, the lowest to 3 cm. long, progressively reduced upward; sepals narrowly oblong-obovate, rounded at apex; petals about 2 mm. long, suborbicular-ovate, spreading after anthesis; stamens 4; capsule about 3.5 mm. long and 1.5 mm. thick, about one third longer than calyx; seeds 2, brown, elliptic, about 2.5 mm. long and 1.3 mm. wide, very convex on the outer side, concave on the inner side, the cavity surrounded by a pale stripe, the minute hilum resembling the figure 8. In dry sterile or sandy soils mainly in the e. fourth of Tex., May-Nov.; from Me. to Mich., N.D., Mont. and Ore., s. to Fla., Tex. and n. Mex.

8. *Plantago patagonica* Jacq. Annual, more or less woolly-villous throughout; leaves linear to narrowly oblanceolate, acute to acuminate and commonly with a callous apiculate tip, to about 2 dm. long and 15 mm. wide, usually much smaller; scapes shorter than to noticeably longer than the leaves; spikes very dense, cylindrical, to about 1 dm. long and 8 mm. thick; bracts linear to linear-subulate, shorter than to conspicuously longer than the flowers; sepals, petals and seeds essentially as in *P. aristata*. In sandy, gravelly or rocky soils on prairies, plains, hillsides and mt. slopes throughout Tex. except in the extreme e. part, Mar.-June; represented by several variants throughout much of the U.S. and Can., s. to S.A.

Closely allied to *P. aristata* but the usually dense gray pubescence and mostly shorter bracts readily distinguish it. We have the following varieties.

Var. *gnaphalioides* (Nutt.) Gray. Distinguished by having its bracts in the lower part of the spike shorter than to only slightly longer than the calyces. *P. Purshii* R. & S.

Var. *spinulosa* (Dcne.) Gray. The most extreme form of var. *spinulosa* has yellowish-gray pubescence, that on the upper part of the scape is widely spreading, and the bracts markedly longer than the calyces, somewhat intermediate between var. *gnaphalioides* and var. *breviscapa*. *P. Purshii* var. *spinulosa* (Dcne.) Shinners.

Var. *breviscapa* (Shinners) Shinners. Bracts slightly to much longer than the calyces, as in var. *spinulosa*. The plant is distinctive in its dwarf habit, short scapes, long bracts, yellowish-gray pubescence and often somewhat falcate leaf blades. *P. Purshii* var. *breviscapa* Shinners.

9. *Plantago lanceolata* L. ENGLISH PLANTAIN, RIBWORT. Glabrous or more or less pubescent perennial or biennial; leaves narrowly lanceolate to oblanceolate, acute at apex, long-tapering at the petiolar base, strongly several-ribbed, to about 5 dm. long

and 35 mm. wide, entire or remotely toothed, essentially glabrous or pubescent beneath; scapes exceeding the leaves, channeled, commonly strigose above; spikes very dense, ovoid when young to long-cylindric and to 1 dm. long and 8 mm. thick when mature; bracts broadly ovate, scarious, with a narrow herbaceous center and abruptly long-acuminate hyaline tip, conspicuously surpassing the calyx; outer 2 sepals united into a broadly obovate truncate lamina with 2 midveins, the inner sepals ovate; corolla lobes ovate, acute, with a prominent brown midrib, 2-3 mm. long, usually spreading; capsule ellipsoid, obtuse, 3-4 mm. long, circumscissile near the base; seeds 2, black, semiellipsoid, 2-3 mm. long, cymbiform. A common weed of lawns, roadsides, fields and waste places throughout much of the U.S. and Can.; introd. from the Old World.

10. *Plantago Helleri* Small. Acaulescent or short-stemmed annual, often dwarf, more or less villous throughout; leaves deep-green, rather numerous, linear and somewhat broadened upward to linear-oblongate, to 2 dm. long and 1 cm. wide, acute, entire, glabrate in age (except near the base); scapes solitary or several to many together, erect or ascending, shorter than to much-exceeding the leaves; spikes oblong-cylindrical, to 4 cm. long and 12 mm. thick, conspicuous because of the corolla lobes; bracts linear-subulate, surpassing the calyces; calyx lobes about 4 mm. long, broadly oblong or oval, the scarious margins much broader than the green midrib; corolla lobes orbicular-ovate to suborbicular, about 3.5 mm. long, spreading; capsules oblong, 3-4 mm. long; seeds 1 or 2, brown, oblong, cymbiform, about 3 mm. long and 1.5 mm. wide. In sand-gravel beds of dry washes, on limestone slopes and in sandy soils of flats from n.-cen. Tex. and the Edwards Plateau, w. to the Rio Grande Plains and Trans-Pecos, Mar.-June; undoubtedly in adj. Mex.

11. *Plantago hybrida* Bart. Annual with numerous lateral fibrous roots as well as a taproot; leaves linear to linear-subulate, narrowly obtuse to acute at the rigid callous tip, entire, to 15 cm. long and less than 5 mm. wide, not woolly at base; scape slender, slightly pubescent, shorter than to conspicuously longer than the leaves; spikes slender and elongate, cylindrical, to 13 cm. long and 5 mm. thick, rather loose to expose the axis, the lower spikelets remote; bracts acute, equal to or about twice as long as calyx; calyx lobes ovate, with narrow green midribs; corolla lobes triangular-ovate, erect and somewhat connivent with age, less than 0.5 mm. long; stamens only 2; capsule about twice as long as the calyx; seeds 10 to 30, blackish, asymmetrically angular, less than 1 mm. long. (♀) *P. heterophylla* Nutt. In wet sands and shallow soils in rocky areas, fallow fields and flat woods, occasionally in salt marshes, in the e. third of Tex., Apr.-May; rather widespread, especially in s. U.S.

12. *Plantago elongata* Pursh. Annual with prominent taproot; leaves narrowly linear, 3-10 cm. long; scapes several to many, commonly surpassing the leaves; spikes mostly 2-10 cm. long, loosely flowered so as to expose the axis; bracts ovate to triangular-ovate, mostly shorter than the calyx but sometimes equal to or barely surpassing it, glabrous to slightly hispid, the central herbaceous portion about as wide as the scarious margins, becoming saccate at base; anterior sepals inequilateral and with narrow midvein and wide scarious margins, the posterior sepals similar but conduplicate and sharply keeled; corolla lobes 0.5-1 mm. long, reflexed with age; stamens only 2; capsules ovoid, rounded to the summit, 1.5-3.5 mm. long; seeds normally 4 or more, from 1.5 mm. in length (if many seeds) to 2.5 mm. long (if only 4 seeds). *P. pusilla* Nutt. In moist or dry sandy soil, commonly shallowly covering flat rocks, rare in e., s. and n.-cen. Tex., spring; from N.E. to the Lake States, s. to Fla. and Tex.

FAM. 168. RUBIACEAE JUSS.

MADDER FAMILY

Trees, shrubs or herbs, rarely climbing; leaves opposite or whorled, simple, entire; stipules often united to form a sheath, rarely leaflike; flowers perfect or unisexual, regular, usually in panicles or cymes, sometimes solitary or aggregated into heads; calyx tube more or less united with the inferior ovary, the segments 4 to 8, crowning the ovary and commonly persistent in the fruit; corolla funnelform, salverform or rotate, the 3 to 5 segments with valvate, imbricate or contorted aestivation; stamens 3 to 5, inserted on the corolla throat or at the throat, the filaments free, the anthers introrse; ovary crowned by

a more or less developed disk, inferior or rarely half-inferior, 1- to several-celled; style filiform, often divided above; fruit a capsule, berry, drupe or schizocarp (in *Galium*).

Probably more than 6,000 species in about 500 genera, world-wide in distribution. An important family that includes coffee (*Coffea* spp.) and quinine (*Cinchona* spp.).

1. Leaves verticillate, with foliaceous or indistinct stipules; herbs or rarely subshrubs (2)
1. Leaves opposite or (if verticillate) large shrubs, with distinctive stipules (4)
- 2(1). Corolla rotate; calyx teeth minute or none 1. *Galium*, p. 1480.
2. Corolla funnelform (3)
- 3(2). Flowers in involucrate heads 2. *Sherardia*, p. 1485.
3. Flowers in panicles 3. *Asperula*, p. 1486.
- 4(1). Ovules few to many in each cell of the ovary (5)
4. Ovules solitary in each cell of the ovary (8)
- 5(4). Fruit berrylike, hard, indehiscent; shrub to 2 m. high; leaves typically cuneate-obovate 4. *Randia*, p. 1486.
5. Fruit capsular; herbs or small shrubs; leaves typically linear-lanceolate (6)
- 6(5). Corolla bright-red, tubular, 15-32 mm. long; seeds winged 5. *Bouvardia*, p. 1486.
6. Corolla white or variously colored, funnelform or salverform, less than 15 mm. long; seeds wingless (7)
- 7(6). Flowers 4-merous; top of capsule nearly always extending beyond the hypanthium 6. *Hedyotis*, p. 1487.
7. Flowers 5-merous; top of capsule included in hypanthium 7. *Pentodon*, p. 1490.
- 8(4). Erect or scandent shrubs with definite woody stems and branches (9)
8. Annual or perennial herbs (11)
- 9(8). Flowers in naked dense globular heads about 15 mm. in diameter; usually in wet places 8. *Cephalanthus*, p. 1491.
9. Flowers not as above; in moist or dryish soils (10)
- 10(9). Shrub with scandent branches; leaves typically ovate; stipules broad, with a hard point; flowers in simple or compound racemes 9. *Chiococca*, p. 1492.
10. Shrub with erect-ascending branches; leaves typically linear or linear-lanceolate; stipular sheath bristly; flowers in axillary or terminal clusters 10. *Borreria*, p. 1492.
- 11(8). Trailing glabrous evergreen herbs in shady woods; fruit a soft berrylike scarlet drupe 11. *Mitchella*, p. 1492.
11. Erect to ascending or rarely prostrate nonevergreen herbs mostly in weedy or waste areas; fruit capsular, with 2 or more carpels (12)
- 12(11). Capsule thin-walled, circumscissile 12. *Mitracarpum*, p. 1492.
12. Capsule with thin or hard walls; dehiscing vertically or rarely remaining closed (13)
- 13(12). Calyx teeth gamosepalous at base, circumscissile-deciduous as a whole at or before the separation of the carpels 13. *Richardia*, p. 1493.
13. One or more calyx teeth persisting on each of the separated carpels (14)
- 14(13). Capsule splitting when ripe into 2 carpels; one carpel open on the inner face, the other one closed 14. *Spermacoce*, p. 1494.
14. Capsule splitting when ripe into 2 or 3 carpels, if tardily splitting then conspicuously 6-ribbed 15. *Diodia*, p. 1495.

1. GALIUM L.

BEDSTRAW. CLEAVERS

Slender annual or perennial herbs with 4-angled slender stems and whorled sessile or short-petioled leaves, the roots often containing a red coloring matter; stipules foliaceous; flowers perfect or in some species unisexual, mostly in axillary or terminal cymes or panicles, occasionally solitary or few on simple branchlets, the pedicels usually jointed

with the calyx; calyx tube ovoid or globose, the teeth obsolete; corolla rotate, 3- or 4-lobed, valvate in the bud; stamens 4, rarely 3, short; styles 2; fruit dry or fleshy, globular or ellipsoid, twin, separating when ripe into the 2 seedlike indehiscent 1-seeded carpels.

About 400 species of wide geographic distribution.

1. Distribution in Trans-Pecos Texas (2)
1. Distribution east of the Trans-Pecos region (11)
 - 2(1). Plants forming a compact intricate mosslike mat appressed to the walls of smooth perpendicular cliffs; corolla white or creamy, tinged with purple 1. *G. Correllii*.
 2. Plants with spreading to ascending or erect stems; corolla white to yellow or brownish-red (3)
 - 3(2). Fruit smooth or (at most) granulose (4)
 3. Fruits ornamented with hairs or occasionally verrucose or muricate (5)
 - 4(3). Plants glabrous; leaves firm, with callous margins; flowers sessile in a whorl of bracteal leaves 2. *G. microphyllum*.
 4. Plants somewhat scabrous on stem-angles and on lower midrib and margins of leaves; flowers on slender usually scabrellous naked pedicels 3. *G. trifidum*.
 - 5(3). Fruits with bristles or hairs that are hooked at apex, rarely merely tuberculate (6)
 5. Fruits with straight or only curved hairs (8)
 - 6(5). Flowers and fruits essentially sessile or short-pedicelled, not exceeding the 2 subtending bracteal leaves; fruits deflexed; plants annual 4. *G. proliferum*.
 6. At least some of the flowers and fruits prominently pedicelled to surpass the leaves and bracteal leaves; fruits not strongly deflexed; plants perennial (7)
 - 7(6). Angles of stem and margins of typically oblanceolate leaves retrorse-scabrous; fruit tuberculate or minutely hispidulous 5. *G. mexicanum* var. *asperulum*.
 7. Plant densely pilose; fruit with conspicuous bristles; leaves typically elliptic 6. *G. uncinulatum*.
 - 8(5). Plants glabrous or (at most) sparsely puberulent or slightly scabrous on leaf margins (9)
 8. Plants usually densely hirsute or hispid (10)
 - 9(8). Stems stout, 2 mm. thick or more; primary leaves 20 mm. long or more, bluntly obtuse; flowers bright-white 7. *G. boreale*.
 9. Stems slender, less than 2 mm. thick; primary leaves usually less than 15 mm. long, cuspidate; flowers reddish 8. *G. Rothrockii*.
 - 10(8). Plants hispid; flowers sessile or on short stiff pedicels to form a compact cylindrical strict inflorescence 9. *G. frankliniense*.
 10. Plants pilose; flowers produced on slender branchlets to form a lax open inflorescence 10. *G. Wrightii*.
 - 11(1). Fruits smooth, glabrous (12)
 11. Fruit adorned with hairs or bristles that are hooked at the apex (15)
 - 12(11). Peduncles axillary, much shorter than the leaves, usually 1-flowered (13)
 12. Peduncles terminal on the branchlets or sometimes appearing to be axillary, exceeding the leaves, usually several-flowered; fruit dry (14)
 - 13(12). Fruit dry, grayish, strongly deflexed, sessile or essentially so; leaves oblong, thin, less than 1 cm. long 12. *G. virgatum* var. *leiocarpum*.
 13. Fruit succulent, purple-black, divergent on a definite peduncle and pedicel; leaves linear, subcoriaceous, more than 1 cm. long 11. *G. uniflorum*.
 - 14(12). Corolla 2-3 mm. broad, 4-lobed 13. *G. obtusum*.
 14. Corolla less than 2 mm. broad, usually 3-lobed 14. *G. tinctorium*.

- 15(11). Flowers and fruits essentially sessile or short-pedicelled (16)
15. Flowers and fruits noticeably pedicelled (18)
- 16(15). Flowers solitary in axils of the usually simple main stem 12. *G. virgatum*.
16. Flowers produced on floral branchlets (17)
- 17(16). Leaves less than 10 mm. long; flowers produced solitarily or at less than 1 cm. apart on short stiff lateral branchlets rarely to 4 cm. long 4. *G. proliferum*.
17. Leaves more than 15 mm. long; flowers produced at 1 cm. or more apart on elongate fractiflex branches usually much more than 5 cm. long 15. *G. circaezans*.
- 18(15). Plants densely pilose throughout or (if glabrescent) the leaves elliptic; leaves in fours (19)
18. Plants essentially glabrous to merely sparsely scabrous or ciliate; leaves in sixes to eights (21)
- 19(18). Flowers in a distinct elongate terminal panicle; leaves almost invariably punctulate on lower surface; in the eastern fourth of Texas 16. *G. pilosum*.
19. Flowers produced in short lateral branchlets; leaves not punctulate; on the Edwards Plateau and southward (20)
- 20(19). Plants perennial, on the upper Rio Grande Plains and western Edwards Plateau to Brewster County; leaves on middle portion of stems broadly to narrowly oval-elliptic to obovate-elliptic, mostly rounded and somewhat mucronate at apex, averaging 1 cm. long or more; pedicels short, stout, rigid, more or less puberulent 6. *G. uncinulatum*.
20. Plants annual, in eastern Edwards Plateau and somewhat to the north and south; leaves of the middle portion of stems ovate to oval, usually distinctly acute or occasionally obtuse, less than 1 cm. long; pedicels elongate, slender-filiform, flexible, mostly glabrous 17. *G. texense*.
- 21(18). Leaves mostly oblanceolate, the margins retrorsely bristly; stems retrorsely bristly on the angles, usually pubescent above the nodes; annual 18. *G. Aparine*.
21. Leaves mostly elliptic-lanceolate, the margins with ascending cilia; stems smooth; perennial, stoloniferous 19. *G. triflorum*.

1. *Galium Correllii* Dempst. CLIFF BEDSTRAW. Small gray-green matted perennial, woody only at base; stems and leaves densely hispid with spreading hairs; nodes about as long as leaves or sometimes a little longer; leaves 4 to a node, the true leaves a little larger than the stipules, commonly 4-6 mm. long, sessile, broadly lanceolate, 1-nerved, drawn to a delicate point tipped with one or more long slender hairs, both surfaces with stomata; steroid cells absent; flowers perfect, very short-pedunculate above a pair of reduced leaves; corollas white or creamy, tinged with purple, campanulate, the tube about 1 mm. long, the lobes a little longer, papillose (especially at tips); ovaries oblong, minutely papillose; fruits slightly fleshy, ellipsoid, maroon, glabrous, about 2.5 mm. long, separating when ripe and dry into 2 slender nearly black carpels. In crevices of vertical walls of canyon in Val Verde Co., Apr.-June; endemic.

2. *Galium microphyllum* Gray. Diffusely spreading or ascending perennial, smooth and glabrous but not shining; branches to 3 dm. long; leaves firm, shorter than the internodes and narrowly linear, usually mucronate, with narrow midrib prominent beneath and callous naked margins, to 12 mm. long, usually smaller; flowers solitary on a very short or on a longer and pedunclelike axillary branchlet and sessile in its whorl of involucrifoliate leaves, or this proliferous and bearing a second whorl and flower; ovary and young fruit scabro-puberulous or at length granulose, at maturity fleshy-baccate. *Relbunium microphyllum* (Gray) Hemsl. In canyons and rocky ravines and on ledges and talus slopes in mts. of the Trans-Pecos, May-Oct.; from Tex. to Ariz. and adj. Mex.

3. *Galium trifidum* L. Weakly erect perennial from a slender rootstock, often freely branching to form dense mats, to about 3 dm. high, smooth and glabrous except for the

retorsely scabrous angles of the stems and usually more hispidulous and sparse roughness of the midrib beneath and margins of the thin leaves; leaves mostly in fours, occasionally in fives or sixes, linear to oblanceolate or oblong-lanceolate, obtuse, to 2 cm. long; peduncles slender, scattered; flowers solitary or (when terminal) in threes on capillary scabrous peduncles or pedicels to 3 cm. long; corolla whitish, about 0.5 mm. long, its 3 or 4 lobes obtuse; fruit smooth, annular in cross section. In wet ground in mts. of the Trans-Pecos, summer; from Nfld. and Lab. to Aleutian Is., s. to (?) Tex., Ariz. and Calif.; also Euras.

This species is included here based on various reports of its occurrence in the state. We have seen no material referable to it but it may occur in the mountains of west Texas.

4. *Galium proliferum* Gray. Annual with stem and branches often stiffly ascending, somewhat hispidulous or glabrate; leaves thin, oval to oblong, the alternate ones rather small; flowers borne on pedunculiform axillary branchlets with 1 to 3 internodes (these divergent at right angles to the main stem), a flower borne at each node between 2 bracteal leaves, never produced directly in axils of leaves of main stems or (if on a short peduncle) not deflexed; fruit uncinat-hispid, barely surpassed by its pair of bracts, or one or even two more by proliferation from the bracts. On open rocky brushy slopes and mesas on the Edwards Plateau and upper Rio Grande Plains, rare in the Trans-Pecos, Mar.-June; also N.M. and Mex.

Typical material of this species occurs only in the Trans-Pecos. The material of the Edwards Plateau and southward shows some evidence of introgression with the more eastern *G. virgatum*.

5. *Galium mexicanum* H.B.K. var. *asperulum* (Gray) Dempst. Stems erect or diffusely ascending but weak, 3-6 dm. high, from a slender perennial rootstock, minutely retrorse-hispidulous to scabrous or nearly glabrous on the angles; leaves 5 to 8, usually 6, lanceolate to oblanceolate, rounded-apiculate to acute at apex, 1-2.5 cm. long, vernicose on upper surface, the margins and midrib beneath antrorsely or retrorsely hispidulous-ciliate or more or less naked; cymes twice- or thrice-dichotomous, with filiform peduncles and pedicels; corolla white or turning purplish, to 4 mm. broad; fruit less than 2 mm. in diameter, tuberculate, sometimes minutely hispidulous with slender hooked hairs. *G. asperrimum* Gray. In shaded moist areas in mts. of the Trans-Pecos, May-Oct.; from w. Tex. to Calif., Wash., Mont. and Ida.

6. *Galium uncinatum* Gray. Perennial herb to 3 dm. high, with spreading branches that form a dense procumbent mass, rather densely pilose to hirsute throughout; leaves in fours, narrowly to broadly elliptic to obovate-elliptic, mostly rounded and somewhat mucronate at apex, averaging 1 cm. long or more; pedicels short, stout, rigid, rarely more than 8 mm. long, more or less puberulent; corolla yellow or yellowish-white, 2-3 mm. broad, the ovate lobes pilose; bristles of the fruit hooked. Incl. var. *obstipum* (Schlecht.) Wats. In gravelly soil along streams, on steep hillsides, ledges and canyons in Brewster Co., e. to the upper Rio Grande Plains and w. Edwards Plateau; also n. Mex.

In vegetative characteristics those plants of the western Edwards Plateau and Rio Grande Plains fall into this species. The flowers, however, are more the size of the closely allied *G. texense*.

7. *Galium boreale* L. Plant erect, to 9 dm. high, perennial, mostly smooth and glabrous, very leafy; leaves in fours, linear to broadly lanceolate, blunt at apex, rather rigid, distinctly 3-nerved, often with fascicles of smaller leaves in the axils, the uppermost leaves reduced to pairs of small oblong or oval bracts; flowers in numerous close cymules that are collected in a terminal and ample thyriform panicle; corolla bright-white, 3-4 mm. wide; fruits small, typically villous-hirsute with long straight or slightly curved hairs. In shaded areas in mts. of the Trans-Pecos, from Can., s. to Pa., (?) Tex., Ariz. and Calif.; also Euras.

This species is included, based solely on reports of its occurrence in Texas. It perhaps occurs in the mountains of west Texas.

8. *Galium Rothrockii* Gray. Perennial, polygamo-monoecious; stems more or less woody at base, slender and diffuse or shorter and substrictly erect, sometimes trailing or pendent, glabrous and smooth to slightly puberulent, to about 6 dm. high; leaves in fours, linear-lanceolate to linear, rigid, glabrous to slightly puberulent, the midrib stout and prominent on lower surface; flowers pedicelled; corolla small, usually red to dark brown-purple, 1-2 mm. wide, the lobes long-acuminate; style and style branches very slender;

fruit small, sparsely covered with soft straight hairs that are not longer than the body of the fruit. *G. Wrightii* Gray var. *Rothrockii* (Gray) Ehrend. In rock crevices and among boulders in the Chisos and Sierra Vieja mts. of Trans-Pecos, May-Aug.; from Tex. to Calif. and adj. Mex.

9. *Galium frankliniense* Correll. Plant densely hispidulous throughout; main stems from a heavy woody base and often with a prostrate woody stem with brownish bark; aerial stems prominently 4-angled, usually rigidly erect or ascending, to 3 dm. high; leaves in whorls of 4, sessile, elliptic to elliptic-oblong, obtuse to acute and cuspidate at apex, to 8 mm. long and 3 mm. wide, the margins somewhat revolute, the central vein somewhat keeled below the middle on the lower surface; flowers sessile or essentially so, perfect, rarely on a short naked peduncle, usually on very short branches to form an inflorescence of compact branches that stand rigidly above the leafy portion of stem; corolla mostly brownish-purple, about 1.5 mm. across; fruits densely covered with straight whitish hairs that are about as long as the diameter of the fruit. In limestone soils and crevices in the Franklin Mts. of extreme w. Tex., Apr.-Sept.; endemic.

10. *Galium Wrightii* Gray. Plant a rather diffusely branched perennial, erect and bushy, to about 3 dm. high, short-pilose throughout or occasionally becoming glabrate above; stems more or less woody at base; leaves in fours, linear to linear-elliptic or lanceolate to somewhat oblanceolate, somewhat flaccid, spreading or ascending, to about 12 mm. long; flowers usually dimorphic, on slender peduncles; corolla 2-3 mm. across, with lobes leathery and incurved or thin and spreading, purplish to dark purple-brown, rarely pinkish; hairs of the fruit straight, soft, white, about as long as the diameter of the fruit. Crevices on rocks, on ledges and cliffs in mts. of the Trans-Pecos, June-Nov.; from Tex. to Ariz. and adj. Mex.

11. *Galium uniflorum* Michx. Slender glabrous perennial with filiform yellow rhizomes; flowering stems simple or sparingly branched, to 35 cm. high; leaves in fours, linear to linear-lanceolate, 1-2.5 cm. long, subcoriaceous, often evergreen, the revolute margin scabridulous; peduncles axillary, divergent, much shorter than the leaves, leafy-bracted, with 1 to few white flowers; corolla lobes blunt; fruit succulent, purple-black, smooth, drooping, 2-4 mm. in diameter. Rich woods in e. Tex., Apr.-Oct.; from Fla. to Tex., n. to e. Va.

12. *Galium virgatum* Nutt. SOUTHWEST BEDSTRAW. Slender erect annual, simple or forking below, to 4 dm. high; stem wiry, smooth; leaves oblong, mostly in fours, 4-10 mm. long, bristly; flowers solitary, sessile or subsessile, reflexed, white, shorter than the subtending bracteal leaves; fruit uncinat-hispid. Dry barrens, glades and rocky woods mainly on the Edwards Plateau and northw. in Tex., Mar.-June; from La. and Tex., n. to Tenn. and Mo.

The rare var. *leiocarpum* T.&G. has fruit smooth and glabrous, and the herbage almost so.

13. *Galium obtusum* Bigel. BLUNTLEAF BEDSTRAW. Stems erect, from capillary rhizomes, simple (not intricately) branched, to about 8 dm. high, smooth, stiffish; leaves mostly in fours, rarely in fives or sixes, elliptic-oblong to lanceolate or broadly linear, obtuse, those of the primary axis to 3 cm. long and 6 mm. broad, loosely spreading, slightly scabrous on the margins; cymes terminating stems and branches, their several flowers grouped in two or threes; the straight peduncles and pedicels ascending in anthesis, often divergent in fruit; corolla white, 2-3 mm. broad, commonly with 4 acute lobes; fruits globose, smooth, 2.5-3.5 mm. in diameter. *G. trifidum* var. *latifolium* Torr. In low woods, swamps and wet shores in e. Tex., Mar.-July; from Fla. to Ariz., n. to s.w. N.S., s. and w. N.E., s. Ont., Mich., Wisc., Minn. and Neb.

14. *Galium tinctorium* L. DYE BEDSTRAW, STIFF MARSH BEDSTRAW. Perennial with stiff ascending or reclining stems, the younger internodes retrorse-scabrous on angles; leaves of main axis mostly in fives or sixes, sometimes in fours, broadly oblanceolate to oblong-spatulate, firm, to 2 cm. long; peduncles stiff, straight or straightish, the longest ones 1-1.7 cm. long with 3 (sometimes more) nearly uniform smooth short (to 8 mm. long) straight divergent pedicels; corolla white, usually 3-lobed, less than 2 mm. broad; mature pairs of fruit 2-3 mm. across. In swamps and damp places in the e. fourth of Tex., Mar.-Aug.; from Nfld. to Ont. and Neb., s. to S.C., Ky., Mo. and Tex.

15. *Galium circaezans* Michx. WOODS BEDSTRAW, WILD LICORICE, CROSS CLOVER. Perennial with a short crown; stems wiry, very slender, smooth to hairy on the angles, mostly simple, to 45 cm. high; leaves in fours, ovate-oblong to ovate-lanceolate or occasionally

oval, obtuse, thin, ciliate, the larger blades mostly 15-25 mm. long and to 14 mm. broad, sometimes to 5 cm. long and 25 mm. wide, glabrous to appressed-pilose on the nerves and margins; peduncles usually once-forked, supporting a broad flattish cymose panicle, the flowers and fruits mostly sessile or very short-pedicelled on the elongate and widely divergent somewhat fractiflex stiff branches; corolla greenish, its acute or acuminate lobes usually hairy outside; fruits bristly, at length deflexed. In dryish or rich woods, mostly on the e. Edwards Plateau and in n.-cen. Tex., Apr.-Oct.; from Fla. to Tex., n. to Va. and locally to s. N.E., N.Y., Ky. and Mich.

Those coarser plants that are more pubescent and with leaves to 5 cm. long and 25 mm. wide are referred to var. *hypomalacum* Fern.

16. *Galium pilosum* Ait. HAIRY BEDSTRAW. Stems tufted from a perennial crown, stiff, erect or ascending, simple or forking, to about 9 dm. high, densely to sparsely spreading-pilose at least on the lower angles, rarely completely glabrous; leaves in fours, oval to elliptic or oblong-elliptic, rarely suborbicular, mostly obtuse-apiculate at apex, firm, hairy, almost invariably punctulose on lower surface, 15-25 mm. long; inflorescence paniculate, elongate, the peduncles 2 or 3 forked; flowers greenish-white to purplish, on distinct pedicels; fruits bristly. Incl. var. *punctulosum* T.&G. Dry woods, flatwoods, prairies and copses in the e. third of Tex.; from s. N.H. to s. Ont. and Mich., s. to N.C., Tenn., Mo., Okla. and Tex.

Those plants with completely glabrous stems are referred to var. *laevicaule* Weath. & Blake.

17. *Galium texense* Gray. TEXAS BEDSTRAW. Plants annual; stem hispidulous-hirsute or the upper part essentially glabrous, weak and slender, 3 dm. or less high; leaves in fours, ovate to ovate-lanceolate or oval, thin, one-nerved, rarely more than 8 mm. long, pilose, the sides and margins equally beset with straight bristly hairs; peduncles terminal on lateral branchlets and 1-flowered, the primordial peduncles (pedicels) naked and filiform, 8-20 mm. long; single axils proliferous into a similar shoot which bears an unequally 4-leaved small whorl and a short peduncle or pedicel; carpels about 2 mm. long, bristles of the fruit much shorter than the carpels, barely uncinulate. *G. texanum* (T.&G.) Wieg. On rocky slopes and bluffs, and in sandy open woodlands on e. part of Edwards Plateau, s. to Live Oak and Gonzales cos. and n. to Palo Pinto Co., Mar.-May; also Okla. and Ark.

18. *Galium Aparine* L. CATCHWEED BEDSTRAW, GOOSE-GRASS, CLEAVERS. Weak or reclining annual with a slender taproot; stem retrorsely hispid on the angles, hairy above the joints, to 1 m. long; leaves mostly 6 to 8 in a whorl, linear-oblongate, tapering at the base, chiefly 2-7 cm. long, bristle-tipped, the margins and lower midrib retrorsely hispid; peduncles 1- to 3-flowered; corollas white; fruit bristly, 2-4 mm. in diameter. Incl. var. *Vaillantii* Koch. In rich woods, thickets, prairies, seashores and waste ground in e., cen. and s. Tex., Mar.-May; from Nfld. to Alas., s. to Fla., Tex. and Calif., both nat. and introd.; also Euras.

19. *Galium triflorum* Michx. FRAGRANT BEDSTRAW. Weak perennial from slender creeping rootstocks; stems simple or remotely forking, to 1 m. long or more, smooth; leaves mostly in sixes, thin, elliptic-lanceolate to narrowly oblong, cuspidate, the primary ones 2.8-5 cm. long, the upper ones only slightly reduced, with minute ascending cilia on or near the margin; peduncles axillary, rather short, terminally 3-flowered, the flowers all pedicelled; corolla whitish or greenish-white, 4-lobed, 2-4 mm. in diameter; fruit densely bristly. Woods and thickets in e. and n.-cen. Tex., May-Sept.; from Nfld. to Alas., s. through e. Can. and the n. states and more sparingly to Va., Tenn., La., Tex., Calif. and Mex.

The herbage is usually sweet-scented in drying.

2. SHERARDIA L. FIELD-MADDER

A monotypic genus, native of the Old World.

1. *Sherardia arvensis* L. SPURWORT, HERB SHERARD. Annual with slender reddish roots and numerous prostrate or decumbent spreading stems to 4 dm. long, simple or branched, more or less glabrous, with 4 rough angles; leaves 4 to 6 in a whorl, obovate-cuspidate to elliptic-acute, to 18 mm. long, glabrous except for prickles on the margins and midrib on lower surface; flowers 4 to 8 in terminal heads, subsessile; involucre of 8 to 10 lanceo-

late leaflike bracts longer than the flowers; sepals 4 to 6, triangular-lanceolate, persistent and usually accrescent in fruit; corolla 4-5 mm. across, pale-lilac, with a long slender tube about twice the length of the 4 or 5 free lobes; stamens 4 or 5; style bifid with capitate stigmas; fruit 4 mm. long, crowned by the sepals, composed of 2 obovoid mericarps with a solitary ovule in each, with short appressed bristles. In fields, on road shoulders and thickets in e. Tex., Mar.-May; introd. from the Old World.

3. ASPERULA L. WOODRUFF

About 90 species that are natives of the Old World, commonly included in *Galium*.

1. *Asperula arvensis* L. Annual herb, with nearly glabrous branching 4-angled stem to about 3 dm. high; leaves 6 to 9 in a whorl at the nodes, linear, obtuse at apex, minutely scabrous on the margins and midvein beneath, to 25 mm. long; flowers bright blue, about 4 mm. long, numerous in involute sessile terminal heads, 4-merous, about as long as the hispid bracts; calyx inconspicuous, not persistent in fruit; corolla funnelform, its tube equaling or exceeding the 3 or 4 lobes; styles more or less connate, the stigmas capitate; fruit brown, smooth, leathery, about 2 mm. in diameter, the 2 mericarps with one seed each. In clayey soil along streams and in waste places in the Blackland Prairies, Mar.-May; introd. from the Old World.

4. RANDIA L.

Several hundred species mostly in the Old World tropics, with few in America.

1. *Randia rhagocarpa* Standl. CRUCILLO. Shrub to 2 m. high, bearing numerous pairs of spines scattered along the branches, the divaricate spines 5-12 mm. long, the twigs short-hirsute with white incurved hairs; stipules broadly ovate, apiculate, about 2 mm. long; leaves opposite, borne on short lateral spurs, with slender short-hirsute petioles about 1 cm. long, cuneate-obovate to cuneate-orbicular, rounded to truncate or shallowly notched at apex, to 5 cm. long and 3 cm. broad, usually smaller, chartaceous, persistently short-hirsute on both surfaces, the lateral veins 3 or 4 on each side; flowers solitary or clustered in axils, sessile, 4- or 5-parted; calyx 1.5-2 mm. long, glabrous or with a few subappressed hairs, the hypanthium oblong-ovoid; calyx teeth ciliate, about 0.5 mm. long, subacuminate, spreading or reflexed; corolla pale-green, funnelform, glabrous outside, villous in throat, 6-7 mm. long, the slender tube 3.5-4 mm. long, the 4 or 5 lobes ovate-elliptic and to 2.7 mm. wide; stamens usually 5, inserted on the corolla, the dorsifixed anthers exerted two thirds from throat, about 1.7 mm. long, apiculate; style slender, glabrous; stigma clavate, laminated; fruit globose, 2-celled, to 1 cm. in diameter, drying with a rugose surface, the pericarp hard; seeds compressed, immersed in pulp. *R. texensis* Lundell, *R. mitis* of auth. In open brushlands and thickets in Cameron, Willacy and Hidalgo cos., Feb.-June; also Tam., N.L., S.L.P. and Ver.

5. BOUVARDIA SALISB.

About 50 species that are primarily in Latin America.

1. *Bouvardia ternifolia* (Cav.) Schlecht. SCARLET BOUVARDIA, TROMPETILLA, GLAVILLO. Shrub to about 1 m. high, rarely subherbaceous, the usually numerous branches erect; stipular sheath short, long-cuspidate or several-aristate; leaves sessile or short-petiolate, mostly in verticils of 3 or 4, ovate to lanceolate, acuminate to long-attenuate at apex, hirtellous to scabrous or glabrate; cymes terminal, usually few-flowered; calyx limb 4-lobate; corolla tube red, 15-32 mm. long, puberulent to short-villous outside with coarse thick hairs, with a short densely white-villous ring within at the base, the 4 ovate to ovate-oblong lobes 2-3 mm. long; anthers subsessile, included, 2.5-3 mm. long; capsule 5-7 mm. broad, didymous-globose, 2-celled, loculicidally bivalvate, rounded at apex; seeds numerous, dark-brown, compressed, winged, about 3 mm. broad. In dry soil, on rimrock or among boulders in mts. of the Trans-Pecos, May-Nov.; nearly throughout Mex. highlands n. to Ariz., N.M. and Tex.

6. HEDYOTIS L.¹⁸⁶ BLUETS

Erect or prostrate herbs or rarely low shrubs; leaves opposite to infrequently fasciculate, either sessile or petiolate, often linear; flowers large and colored or small and white, 4-merous, heterostylous, homostylous or short-stylous only; corolla salverform, funnellform or infrequently rotate; style slender, 1; stigmas 2; ovary 2-celled; capsule didymous or less commonly globular or turbinate, opening loculicidally across the summit. *Houstonia* L.; *Oldenlandia* L.

A diverse, largely pantropic genus of about 300 species best developed in the Old World; occasional in temperate regions of the Western Hemisphere and Asia.

1. Corolla 4 mm. long or more and colored, if somewhat shorter than white and flowering in winter or spring (to fall in *H. intricata*); capsules usually one-fourth to three-fourths inferior; seeds crateriform or concavo-convex, few to 20; in various parts of the state (2)
1. Corolla to 2 mm. long, white, flowering in summer or fall; capsules usually wholly inferior; seeds angulate, very numerous and small; in east (rarely central) Texas (13)
- 2(1). Shrubs with at least some leaves fasciculate 1. *H. intricata*.
2. Herbs (stems occasionally suffruticose) with leaves opposite or verticillate (3)
- 3(2). Perennials (doubtful cases should be keyed under both alternatives) (4)
3. Annuals (7)
- 4(3). Leaves acerose, often verticillate; free portion of capsules hirtellous 2. *H. acerosa*.
4. Leaves linear to ovate, opposite; free portion of capsules glabrous or minutely papillose (5)
- 5(4). Roots fibrous; leaves ovate to elliptic below; rare in east Texas 3. *H. purpurea*.
5. Stout taproot; leaves linear to lanceolate, infrequently elliptic; throughout Texas (6)
- 6(5). Stems few or numerous, not often tufted; corolla funnellform; capsules erect, usually longer than broad and obovoid-turbinate, one-half to three-fourths inferior; seeds concavo-convex 4. *H. nigricans*.
6. Stems cespitose; corolla salverform; capsules on recurved peduncles, broader than long, subdidymous, about one-fourth inferior; seeds crateriform with a hilar ridge 5. *H. pygmaea*.
- 7(3). Long thin taproot sparingly branched; flowers axillary; capsules often on recurved peduncles; common in south and west Texas (8)
7. Branched fibrous roots (if more or less unbranched then short and very delicate); flowers terminal; capsules upright; common in east Texas (11)
- 8(7). Corolla funnellform, 5-8 mm. long; flowers heterostylous; stipules to 2.5 mm. long, setiferous 6. *H. humifusa*.
8. Corolla salverform, to 3 mm. long; flowers homostylous or short-stylous only; stipules to 0.5 mm. long, without bristles (9)
- 9(8). Corolla longer than the calyx lobes; stems hirtellous; capsules on recurved or refracted peduncles, hirtellous, rounded at the base (10)
9. Corolla equal to or shorter than the calyx lobes; stems glabrous or sparingly hirtellous; capsules upright, glabrous, turbinate 7. *H. Greenmanii*.
- 10(9). Cauline leaves linear, widest to 1 mm.; peduncles 3-8 mm. long; flowers homostylous; capsule about three-fourths inferior 8. *H. subviscosa*.
10. Cauline leaves lanceolate, widest over 1 mm.; peduncles very short (to 2 mm.); flowers short-stylous only; capsule one-fourth to one-half inferior 9. *H. Croftiae*.

¹⁸⁶ Contributed by Walter H. Lewis.

- 11(7). Corolla white, the tube and lobes each 1.5-2 mm. long with the tube about equaling the length of the calyx lobes10. *H. australis*.
11. Corolla pink to violet, rarely white, the tube and lobes each 2.5-6 mm. long with the tube exceeding the length of the calyx lobes (12)
- 12(11). Stems 3-12 cm. long; corolla blue-violet to lilac, rarely white, the tube and lobes each (2.5-) 3-4 (-5) mm. long11. *H. crassifolia*.
12. Stems commonly to 3 cm. long; corolla pink, infrequently white or light-violet, the tube and lobes each about 6 mm. long12. *H. rosea*.
- 13(1). Annual; stems usually hirsute; leaves ovate to ovate-elliptic
.....13. *H. uniflora*.
13. Perennials or rarely annuals; stems usually glabrous; leaves linear to lanceolate (14)
- 14(13). Perennial; flowers solitary or in small clusters, subsessile; capsules short-ciliate or glabrous; frequent in east Texas14. *H. Boscii*.
14. Annual; flowers in 3-flowered cymes, occasionally solitary, the peduncles and pedicels (when present) each to 15 mm. long; very rare
.....15. *H. corymbosa*.

1. *Hedyotis intricata* Fosb. Erect to diffuse shrub, 2-6 dm. tall; stems fruticose, much-branched, the younger grayish; leaves opposite, usually 3- to 4-verticillate or fasciculate, sessile, linear, 4-10 mm. long, 1 mm. or less wide, bisulcate below, usually glabrous; flowers in few-flowered terminal cymes, heterostylous; corolla salverform, white, 2.5-5 mm. long, the lobes recurved, pubescent within, equal or slightly longer than the tube; capsule about 2.5 mm. broad, about one-half inferior, scabrous, the seeds concavo-convex. *Houstonia fasciculata* Gray. Higher elev. on rocky exposed ledges, slopes and creeks in s. Trans-Pecos, June-Nov.; from Tex. to s. N.M.; also n. Mex.

2. *Hedyotis acerosa* Gray. Low erect or ascending suffruticose perennial, 5-30 cm. tall; stems numerous and much-branched from a stout taproot, scaberulous or hirtellous; leaves opposite or mostly 3- or 4-verticillate, sessile, acerosa, 5-12 mm. long, 1 mm. or less wide, revolute, usually scaberulous; flowers axillary or terminal, solitary, sessile or pedunculate, heterostylous; corolla more or less salverform, white, pink or violet, 8-12 mm. long, the lobes one half to two thirds as long as the tube, villous within; capsule 2.5-3 mm. broad, about two-thirds inferior, the seeds crateriform. *Houstonia acerosa* Gray. Sandy and rocky limestone slopes, crevices and cliffs in w.-cen. and Trans-Pecos Tex., May-Sept.; from Tex. to s. N.M.; also Mex. (to S.L.P.)

Var. *Bigelovii* (Greenm.) W. H. Lewis. Stems suffruticose below; leaves opposite; flowers mostly pedunculate. *Houstonia polyplemoides* Gray. Infrequent throughout the range of the var. *acerosa*.

3. *Hedyotis purpurea* (L.) T.&G. Perennial herb with fibrous roots, 1-3 dm. tall; stems erect to ascending, one to several, usually sparsely pubescent; leaves ovate and sessile (3-5 cm. long, 1-2.5 cm. wide) to elliptic, subsessile and smaller basally, sparsely pubescent especially on midveins below; flowers in few-flowered terminal cymes, heterostylous; corolla funnelform, white to usually pale-purple, 5-7 mm. long, usually pubescent within, the lobes about one half the length of the tube; capsule 2-4 mm. broad, glabrous, about one-half inferior, the seeds subcrateriform. *Houstonia purpurea* L. In open woods, rare in s.e. Tex. (only Newton Co.), Apr.-June; from Ga. to Tex., n. to s. Me., s.e. Mich. and s.w. Mo.

4. *Hedyotis nigricans* (Lam.) Fosb. Erect, ascending or procumbent perennials from a stout taproot, 5-50 cm. tall; stems few or numerous, occasionally cespitose, glabrous; leaves more or less sessile, linear-filiform to lanceolate, infrequently elliptic, 1-4 cm. long, 0.5-4 mm. wide, usually scaberulous along the margins and nerves below, the margins often revolute; flowers usually in leafy cymes, heterostylous, sessile or pedunculate; corolla funnelform, white, pink or purplish, 5-8 mm. long, the lobes equaling or shorter than the tube, villous within; capsule 2.5-3 mm. long, usually longer than broad and obovoid-turbinate or rarely more or less equal and globose, one-half to three-fourths inferior, the seeds concavo-convex. *Houstonia angustifolia* Michx., *H. nigricans* (Lam.) Fern., *H. salina* Heller. Highly variable and common throughout Tex., Apr.-Nov.; from Fla. to Ariz., n. to Ga., O., s. Mich. and Neb.; also Mex.

Var. *filifolia* (Chapm.) Shinn. Leaves linear-filiform; capsule somewhat smaller

than typical. *Oldenlandia angustifolia* var. *filifolia* Chapm. Occasional in s.-cen. Tex.; also s. Fla., rarely Ala. and Mo.

Var. *parviflora* (Gray) W. H. Lewis. Stems reduced, 5-15 cm. tall, much-branched below; capsule more or less equal and globose, about one-half inferior, the short calyx lobes more or less equaling the capsule. *Hedyotis stenophylla* var. *parviflora* Gray, *H. angulata* Fosb., *Houstonia rupicola* Greenm. Infrequent in rocky crevices and hillsides in w. Tex.

Var. *rigidiuscula* (Gray) Shinnars. Stems reduced, 5-15 cm. tall, much-branched below; capsule longer than broad, obovoid-turbinate, about three-fourths inferior, the calyx lobes often exceeding the capsule. *Houstonia angustifolia* var. *rigidiuscula* Gray. Frequent on hillsides, canyons and rocky escarpments in w. and n.w. Tex.; from Fla. (?) and Tex. to Ariz.; also Mex.

5. *Hedyotis pygmaea* R. & S. Cespitose perennial, 5-10 cm. high; numerous stems erect or spreading, scaberulous or papillose; leaves linear, the lowest often spatulate, 5-25 mm. long, 0.5-3 mm. wide, usually scaberulous; flowers axillary or usually in terminal cymes, the short peduncles recurved after anthesis; calyx lobes 1.5-2 mm. long; corolla salverform, white to pale-purple, 4-7 mm. long, the lobes equal to or commonly shorter than the tube, papillose within; capsule to 3.5 mm. in diameter, subdidymous, broader than long, minutely papillose, about one-fourth inferior, the seeds crateriform. *Houstonia Wrightii* Gray, *Hedyotis Wrightii* (Gray) Fosb. Open hillsides, rocky canyon slopes and sandy mt. streams, infrequent in cen. Trans-Pecos, June-July; from Tex. to cen. Ariz.; also Mex. (to Pue. and Ver.).

6. *Hedyotis humifusa* Gray. Erect or spreading annual; stems 3-10 cm. long, much-branched from a single long slender root, scaberulous; leaves linear, 10-15 mm. long, 0.5-3 mm. wide, rosette leaves oblanceolate and larger, mucronate; stipules to 2.5 mm. long, white, copiously setiferous; flowers showy, axillary, heterostylous, the peduncle recurved after anthesis; calyx lobes very narrow, 3-4 mm. long; corolla funnelform, 5-8 mm. long, white to pink, infrequently pale-purple or lavender, the lobes somewhat shorter than the tube, papillose within; capsule to 2.5 mm. in diameter, papillose. *Houstonia humifusa* Gray. Grasslands, plains, dunes and pastures in sandy soils, w., n., cen. and s. Tex., Mar.-Sept.; from Tex. to s.e. Ariz., n. to w. Okla.

7. *Hedyotis Greenmanii* Fosb. Low winter annual, much-branched from a single slender root; stems ascending to 2 dm., glabrous or sparingly hirtellous; leaves linear to lanceolate, to 15 mm. long, 1-2 mm. wide, larger basally, glabrous; flowers very small, short-stylous, on erect peduncles 5-15 mm. long; corolla salverform, white (tips of lobes often pink), 1-2 mm. long, about equaling the length of the calyx lobes; capsule glabrous with prominent calyx lobes, 2.5 mm. broad, turbinate, about three-fourths inferior, the seeds crateriform. *Houstonia parviflora* Greenm. Infrequent in grassy pastures in cen. and s. Tex., Feb.-Apr.; endemic.

8. *Hedyotis subviscosa* (Gray) Shinnars. Erect to spreading winter and spring annual; stems 4-15 cm. tall, hirtellous; leaves linear, to 2 cm. long, about 1 mm. wide, basally oblanceolate and broader and longer, hirtellous to glabrate; flowers axillary, small, homostylous, the peduncles 3-8 mm. long, recurved or refracted after anthesis; corolla salverform, white or rarely light-pink, 2-3 mm. long, exceeding the short calyx lobes; capsule hirtellous, rounded at base, to 4 mm. broad, about three-fourths inferior, the seeds open crateriform. *Houstonia subviscosa* (Gray) Gray. Sandy soils in open pastures, creek margins and dunes in cen., s. and Gulf Coast Tex., Mar.-May; also n.e. Mex. (?).

9. *Hedyotis Croftiae* (Britt. & Rusby) Shinnars. Low spreading winter annual; stems much-branched, hirtellous or ciliate; leaves linear to lanceolate, about 1 cm. long and 2 mm. wide, basally larger, the margins ciliate; flowers small, short-stylous, on very short (to 2 mm.) recurved or refracted axillary peduncles; corolla salverform, white, 2-3 mm. long, exceeding the calyx lobes; capsule minutely hirtellous, rounded at base, about 3 mm. broad, one-fourth to one-half inferior, the seeds broadly crateriform. *Houstonia Croftiae* Britt. & Rusby. Infrequent in sandy soils of open pastures and waste fields in Rio Grande Plains, Feb.-Apr.; endemic.

10. *Hedyotis australis* Lewis & Moore. Low winter annual, often cespitose; stems upright to spreading, 3-10 cm. long; lower leaves broadly spatulate to ovate, about 1 cm. long and 2-3.5 mm. wide, the margins glabrous; flowers terminal, solitary, short-stylous;

corolla salverform, white, the tube and lobes each 1.5-2 mm. long with the tube equaling the length of the calyx lobes. Frequent in pastures, waste fields and along roadsides in e. and s.e. Tex., Feb.-Apr.; cen. Ga., from e. Miss. to Tex. and s. Ark.

11. *Hedyotis crassifolia* Raf. SMALL BLUETS, STAR-VIOLET. Low winter annual, often cespitose; stems 3-12 cm. long, spreading; lower leaves broadly spatulate to ovate, about 1 cm. long and 4-5 mm. wide, the margins often pubescent; flowers terminal, showy, short-stylous; corolla salverform, blue-violet to lilac, rarely white, the narrow tube 3-5 mm. long, the lobes 2.5-4 mm. long. *Houstonia minima* Beck, *H. patens* Ell., *H. pusilla* Schoepf. Common in pastures, prairies, waste fields and along roadsides in e. third of Tex., (Jan.-) Feb.-Apr.; from Fla. to Tex., n. to Va., Ill. and Kan.

12. *Hedyotis rosea* Raf. Low winter annual to 3 cm. tall (when stems upright), somewhat longer when spreading; lower leaves narrowly spatulate, to 1 cm. long, commonly 1-2 mm. wide; flowers showy, terminal, short-stylous; corolla salverform, pink or less frequently white or light-violet, the tube and lobes each about 6 mm. long. *Houstonia pygmaea* Muell. & Muell., *Hedyotis Taylorae* Fosb. Pastures, waste fields and roadsides, infrequent in e. third of Tex., Feb.-Apr.; from e. Miss. to Tex., n. to Ark. and e. Okla.

13. *Hedyotis uniflora* (L.) Lam. Erect to usually spreading summer annual; stems often branched, 1-6 dm. long, white-hirsutulous along the angles to less frequently glabrate; leaves ovate to ovate-elliptic, 1-2.5 cm. long, the midveins and margins commonly white-hirsutulous, the petioles 1-2.5 mm. long or rarely absent; flowers very small, homostylous, axillary in small or large clusters or rarely solitary, subsessile; corolla rotate, white, about 1 mm. long, shorter than the calyx lobes; capsule to 2 mm. broad, usually densely white-hirsutulous, more or less wholly inferior, the seeds angular, very numerous. On wet sandy-loam banks in e. Tex., June-Sept.; from Fla. to Tex., n. to s. N.Y. and s.e. Mo.

Var. *fasciculata* (Bert.) W. H. Lewis. Stems, leaves and usually capsules glabrous; leaves sessile. Infrequent on Gulf Coast, Fla. to Tex.

14. *Hedyotis Boscii* DC. Prostrate or spreading perennial; stems branched and often cespitose, 1-3 dm. long, glabrous to infrequently hirtellous; leaves mostly linear, 10-25 mm. long, 1-3 mm. wide, glabrous, sessile or subsessile; flowers very small, homostylous, axillary in small clusters or solitary, subsessile; corolla rotate, white (lobes often tipped pink), about 1 mm. long, shorter than the calyx lobes; capsule to 2.5 mm. broad, glabrous or short-ciliate, more or less wholly inferior, the seeds angular and very numerous. *Oldenlandia Boscii* (DC.) Chapm. Edges of ponds and rivers in lowlands and savannahs of e. Tex., rare in s.-cen. Tex., May-Aug.; from Fla. to Tex., n. to s.e. Va., Tenn. and s.e. Mo.

15. *Hedyotis corymbosa* (L.) Lam. Erect or spreading summer annual; stems branched, glabrous; leaves linear to lanceolate, 1-3.5 cm. long, 1-5 mm. wide, the margins scaberulous; flowers small, homostylous, axillary, usually in 3-flowered cymes or solitary, the peduncles to 15 mm. long, the pedicels often as long; corolla more or less salverform, white, about 2 mm. long, equaling or exceeding somewhat the calyx lobes; capsule to 2 mm. broad, glabrous, more or less wholly inferior, the seeds angular and very numerous. *Oldenlandia corymbosa* L. Introd. in lawns rarely in e. Tex. (also Gulf Coast?), July-Sept.; occasional from Fla. to Tex., a widespread pantropic weed.

Hedyotis rubra (Cav.) Gray. Cespitose perennial from a long slender taproot; leaves oblanceolate-linear below to linear above; corolla deep-rose to purple, rarely white, salverform, 1.5-3 cm. long. *Houstonia rubra* Cav. Not yet known from Texas, but occasional in neighboring New Mexico and Mexico. It should occur in the Trans-Pecos region.

7. PENTODON HOCHST.

Two species; represented in both hemispheres.

1. *Pentodon pentandrus* (Schum. & Thonn.) Vatke. Annual glabrous herb, the 4-angled stems often diffusely branched and partly creeping; leaves petioled, ovate to

elliptic or elliptic-lanceolate, obtuse to acute, 2-5 cm. long, entire; flowers in axillary or terminal cymes; hypanthium clavate; sepals 5, triangular-lanceolate to lanceolate, about 1 mm. long; pedicels thick, 3-4 mm. long; corolla white, funnelform, the tube 2-3 mm. long, the abbreviated lobes ovate to lanceolate; stamens 5, the filaments adnate to above the middle of the corolla tube; style columnar; capsule included in the hypanthium, 2-lobed, 2-4 mm. long. *P. Halei* (T.&G.) Gray. In swampy ground in s.e. Tex., Aug.-Sept.; from Tex. to Fla.

8. CEPHALANTHUS L. BUTTONBUSH

Shrubs or small trees; leaves opposite or with some verticillate, petiolate; flowers white or yellowish, densely aggregated into spherical peduncled heads; calyx tube obpyramidal, the limb 4- or 5-toothed; corolla tubular-funnelform, the 4 or 5 teeth imbricated in the bud; stamens 4, inserted on the corolla throat; anthers bicuspidate at base; ovary 2-celled, with one ovule in each cell; style filiform, much-exserted; stigma capitate; fruit small, at length splitting from the base upward into 2 to 4 closed 1-seeded segments.

About 17 species that are natives of America and Asia; sometimes placed in the segregate family Naucleaceae.

- 1. Calyx glabrous outside or the tube with a few long white hairs at the base 1. *C. occidentalis*.
- 1. Calyx densely pubescent outside with short appressed hairs 2. *C. salicifolius*.

1. *Cephalanthus occidentalis* L. COMMON BUTTONBUSH, HONEY-BALLS, GLOBE-FLOWERS. Shrub or small tree, sometimes to 15 m. high, with a trunk rarely 3 dm. in diameter, the branchlets slender, brown or grayish, glabrous or short-pilose; stipules 2-4 mm. long, deltoid, acute to acuminate, usually with glands along the margins; leaves opposite or ternate, sometimes 4-nate (but this varies on a single plant), the stout or slender petioles to 3 cm. long, glabrous or pilose, ovate to ovate-oblong or narrowly lanceolate, to 19 cm. long and 85 mm. wide, subcordate to cuneate at the base, abruptly or subabruptly long- or short-acuminate at the apex, bright-green above, glabrous or pilose beneath, with prominent lateral veins; peduncles terminal and axillary, simple or branched, stout, to 1 dm. long, glabrous; heads about 15 mm. in diameter; bractlets filiform-clavate, pilose above; hypanthium and calyx together 2-3 mm. long, glabrous or sparsely long-pilose at the base; calyx about 1 mm. long, shallowly 4- to 5-dentate, densely pubescent within, the lobes rounded, usually glandular; corolla 5-9 mm. long, glabrous outside, the 4 or 5 lobes ovate or oval, sparsely pubescent within, with a small black gland in each sinus; capsule 4-8 mm. long; seed solitary, brown, with a large white aril. In swamps, about ponds and margins of streams throughout the state, June-Sept.; from Fla. to Mex., n. to e. Can., N.Y. and w. to Calif.

Those plants with branchlets and at least the lower leaf surfaces soft-pubescent are segregated as var. *pubescens* Raf., while those with short-petioled narrower leaves arranged in whorls of three are segregated as var. *californicus* Benth.

2. *Cephalanthus salicifolius* H. & B. Shrub or small tree, the branches reddish-brown, glabrous; stipules 2-3 mm. long, deltoid, acute or acuminate, often with marginal glands, glabrous; leaves opposite and ternate, the stout petioles to 4 mm. long, glabrous, narrowly oblong to elliptic-oblong or lanceolate, to 12 cm. long and 23 mm. wide, acute to subcordate at the base, rounded and apiculate to long-attenuate at the apex, glabrous or sparsely pilose beneath along the veins, bright-green above, lustrous; peduncles mostly simple, 2-4 cm. long, glabrous, the heads 6-8 mm. in diameter, the receptacle very densely setose; calyx and hypanthium 2-2.5 mm. long, densely white-sericeous with short hairs; calyx 1 mm. long or shorter, shallowly 4- to 5-dentate, densely pilose within, the lobes minute, rounded, often glanduliferous; corolla 6-7 mm. long, glabrous outside, the lobes oblong or ovate, sparsely pilose within, often with black glands in the sinuses; capsule 4-5 mm. long, densely and minutely sericeous; seeds brown, with a large white aril. In wet soil in Hidalgo Co., extreme s. Tex., Mar.-July; from s. Tex. to s.-cen. Mex., also Hond.

9. CHIOCOCCA L.

About 20 species that are native to the Americas.

1. *Chiococca alba* (L.) Hitchc. DAVID'S MILKBERRY, SNOW-BERRY, PERLILLA, CANICA. Shrub, tall and sometimes climbing, glabrous; branchlets 4-angled or terete; leaves petiolate, opposite, papery, ovate to ovate-oblong or lanceolate, usually narrowed at base, abruptly short-acuminate at apex, to 9 cm. long and 3 cm. wide; stipules (including the hard point) 2-2.5 mm. long; racemes rather lax, about as long as the leaves, usually branched, many-flowered; bracts awl-shaped, about 1 mm. long; pedicels slender, to 5 mm. long; calyx tube subglobose, to 2 mm. long, longer than the 5-toothed limb that is persistent in the fruit; corolla greenish-white or yellow, funnellform, glabrous in throat, the tube to 6 mm. long, the ovate to ovate-lanceolate lobes to 4 mm. long; stamens 5, included, the anthers to 3 mm. long, disk prominent; drupe globose, compressed, white, leathery, 4-5 mm. in diameter; seeds brown, 4 mm. long. In palm groves and brushlands in Cameron and Hidalgo cos., flowering throughout the year; also, Fla. and throughout trop. and subtrop. Am.

The flowers of our plant average smaller than those of plants in tropical America. Various medicinal properties have been attributed to the plant.

10. BORRERIA MEY.

About 150 species that are natives of warm and tropical regions.

1. *Borreria verticillata* (L.) Mey. BOLON BLANCO. Small shrubby perennial, the branches angled and erect-ascending, essentially glabrous or sparsely scabrous, to about 1 m. high; leaves opposite, nearly sessile, linear to linear-lanceolate, acute at apex, 2-5 cm. long, with tufts of somewhat smaller leaves in their axils; teeth of the stipular sheaths setaceous; glomerules terminal or also at one or two of the nodes, dense, globose, 1-1.5 cm. in diameter, many-flowered; calyx tube turbinate; calyx lobes 2, narrow, persistent, about 1 mm. long; corolla white, funnellform, about 2 mm. long, its 4 spreading lobes ovate and acute; stamens 4, adnate to the corolla tube; disk obsolete or cushionlike; styles wholly or partially united; capsule subglobose, leathery, about 1 mm. in diameter, glabrous, the 2 carpels opening along their inner face, each 1-seeded. *B. podocephala* of auth. In sandy loam in open areas along the Tex. coast, Mar.-May; throughout the W.I. and cont. trop. Am.

11. MITCHELLA L.

PARTRIDGE-BERRY

Two species, the other Japanese.

1. *Mitchella repens* L. TWO-EYED BERRY, RUNNING BOX. Small glabrous trailing evergreen herbs forming appressed mats of indefinite size; leaves petioled, opposite, ovate to orbicular, rounded to cordate at base, obtuse at apex, shining, pinnately veined and sometimes variegated with whitish lines, 15-25 mm. long; stipules triangular-subulate; peduncle short, terminal, bearing 2 flowers at its summit; flowers fragrant, white, often tinged with purple, in pairs with their ovaries united, occasionally 3- to 6-merous, always dimorphous, all flowers of some individuals have exerted stamens and included stigmas, all flowers of other individuals with included stamens and exerted style; calyx 4-toothed; corolla tube about 13 mm. long, densely bearded inside, surpassing the oblong spreading lobes; style 1; stigmas 4, linear; drupes edible, 4-6 mm. in diameter, bright-red or rarely white (f. *leucocarpa* Bissell), overwintering, crowned with the calyx teeth of the 2 flowers, with 4 small seedlike bony nutlets to each flower. On dry or moist knolls in woods in e. Tex., May-July; from Fla. to Tex., n. to e. Can., Ont. and Minn.

12. MITRACARPUM ZUCC.

Annual or perennial herbs or low shrubs, the stems and branches mostly 4-angled; leaves opposite; stipular sheaths with several bristles; flowers small, white, densely

capitate; calyx teeth 4 or 5, the lateral ones nearly subulate, the others smaller; corolla salverform or funnelform, its 4 spreading lobes valvate; stamens 4, the anthers oblong or linear; ovary usually 2-celled; ovules one in each cavity; style branches narrow; capsule didymous, thin-walled, circumscissile; seeds globose or oblong.

About 40 species, mostly in the American tropics.

- 1. Plants nearly glabrous to somewhat minutely scabrous (especially the leaf margins); corolla tube 1.5-2 mm. long 1. *M. breviflorum*.
- 1. Plants (especially stem and branches) more or less hirtellous throughout; corolla tube 2.5-3 mm. long 2. *M. hirtum*.

1. *Mitracarpum breviflorum* Gray. WHITE GIRDLEPOD. Annual to 4 dm. or more high, mostly branched from the base, nearly glabrous and smooth or with the stems and leaves somewhat serrulate and scabrous; flowers small, in axillary verticillate-capitate clusters and a terminal one; leaves lanceolate to oblanceolate, obtuse to acute at apex, 2-5 cm. long; the petiolar base often pubescent on lower surface; stipules with few setiferous appendages; two larger calyx lobes lanceolate-subulate, longer than tube, equaling or surpassing the small (1.5-2 mm. long) glabrous white corolla, the intermediate small calyx lobes dentiform and hyaline; capsule about 1.5 mm. in diameter, circumscissile about the middle. On flats near Boca Chica, Cameron Co., June-Aug.; from Tex. to Ariz. and adj. Mex.

2. *Mitracarpum hirtum* (L.) DC. Annual to about 4 dm. high, more or less hirtellous throughout; stems branched, the branches 4-angled; leaves sessile or very short-petioled, oblong to elliptic, narrowed at base, obtuse to acute at apex, 2-6 cm. long; stipular sheath 2-3 mm. long, the bristles about as long; flower heads terminal and axillary, subglobose, many-flowered, 6-12 mm. in diameter; lateral sepals linear-lanceolate, acuminate, about 2 mm. long; corolla 2.5-3 mm. long; capsule shorter than the calyx, circumscissile near the middle. Exceedingly rare in grassy places in the Tex. coastal prairies, inland to Bexar and Wilson cos., May-July; also in W.I. and cont. trop. Am.

13. RICHARDIA L.

Various pubescent annuals or perennial herbs, mostly diffusely branched, prostrate to ascending, with broadish short-petioled to subsessile leaves and setiferous stipules; flowers whitish, mostly in a terminal capitate cluster, involucre by the one or two uppermost pairs of leaves; calyx teeth 4 to 8 (commonly 5 or 6), lanceolate, gamophyllous at base, circumscissile-deciduous as a whole at or before the separation of the 2 to 4 closed or barely opening rough coriaceous carpels; corolla funnelform, with 4 to 8 lobes; stigmas 2 to 4, linear or spatulate; fruit separating longitudinally at maturity into 2 to 4 1-seeded cocci.

About 10 species that are natives of tropical America.

- 1. Flowers and fruits 4-merous; fruit separating into 4 almost smooth obovoid cocci, the scar broad and flat or somewhat tumid; stems and leaves densely white hirsute; plants prostrate 1. *R. humistrata*.
- 1. Flowers and fruits 3-merous; fruit more or less muriculate, separating into 3 cocci; plants usually with some ascending branches (2)
- 2(1). Cocci obovoid; coccus scar broad, open, excavate, with a central keel; leaves thick but not coriaceous, gray-green when dry, appressed-hispid on both surfaces; stems hirsute 2. *R. brasiliensis*.
- 2. Cocci nearly cylindrical; coccus scar closed to a narrow groove or sulcate; leaves subcoriaceous, yellow-green when dry, essentially glabrous except for scabrous margins and midrib of lower surface; stems somewhat villous 3. *R. scabra*.

1. *Richardia humistrata* (Cham. & Schlecht.) Steud. Prostrate herb, densely white-hirsute; stems rooting at the nodes, the internodes short; stipular sheaths much-abbreviated, the elongate bristles conspicuous; leaves ovate to oblong-elliptic, to at least 3 cm. long and 15 mm. wide, narrowed to a short petiolar base, acute to acuminate at

apex; flowers and fruits in dense involucrate heads at summit of branches; calyx lobes triangular, acute, about 1.5 mm. long, densely pilose; corolla about 2 mm. long, inconspicuous; cocci in fours, glabrous, usually loosely held together, obovoid to ellipsoid, about 2 mm. long, tan-color. This Brazilian species has recently been introduced on the coast in the Gulf States. It should be looked for in dry sandy places.

2. *Richardia brasiliensis* Gomes. Annual, becoming perennial, with deep thickened root and villous or pilose diffusely branched or matted stems, to 3 dm. high; stipular bristles about as long as the sheath; leaves broadly ovate to elliptic, tapering at the base to a short petiole, acute to subacute at apex, 2-4 cm. long, to about 2 cm. wide, densely covered with appressed roughish hairs; involucre 4-leaved, the flower heads to 15 mm. in diameter; calyx tube barely 1.5 mm. long; calyx lobes about 3 mm. long, connate at base, narrowly triangular, acute, hairy with ciliate margins; corolla tube 4-5 mm. long; corolla lobes spreading, narrowly ovate, acute, shortly hairy at tip; fruit obovoid, about 2.5 mm. long, muriculate-hispidulous, dull-red, the cocci keeled on the ventral surface; seed barely 2 mm. long, broadly ovoid to subrotund, brown, smooth. On dunes, coastal prairies, in sandy scrub oak areas, roadsides and waste places on the Rio Grande Plains and in s. Tex., May-Oct.; from Fla. to Tex. and Mex., n. to s.e. Va.

3. *Richardia scabra* L. More or less loosely branching short-pubescent or hirsute annual to about 8.5 dm. high; leaves ovate to elliptic-lanceolate, obtuse to acute at apex, roughish, fleshy, 2-6 cm. long; stipules with rather few setiform appendages; glomerules depressed; calyx lobes united only at base, three to four times length of ovary; corolla hypocrateriform, 5-6 mm. long, its tube exerted from the calyx, the usually 6 lobes much-exceeding the stamens; mature fruit 3-3.5 mm. long, muriculate-tuberculate, the cocci ventrally sulcate. Roadsides, cult. fields and waste places in e. half of Tex., June-Oct.; from Fla. to Tex., n. to s.e. Va., s. Ind. and Ark.; naturalized from trop. Am.

Said to be relished by cattle. The root, in South America, is used as an emetic and as a substitute for Ipecac.

14. SPERMACOCE L. BUTTONWEED

Low spreading annual or perennial herbs; leaves opposite, their bases or petioles connected by a bristle-bearing stipular membrane; flowers small, whitish to purplish-blue, crowded into sessile axillary and terminal whorled clusters or heads; calyx tube short, obovoid, the limb parted into 4 teethlike lobes; corolla funnellform or salverform, 4-lobed, valvate in the bud; stamens 4, inserted on the corolla tube; ovary 2-celled; ovules one in each cavity; style slender, the stigma 2-cleft; fruit a dry capsule, sessile, coriaceous or somewhat crustaceous, sometimes didymous, splitting when ripe into 2 carpels, one of the carpels usually carrying with it the septum and therefore closed, the other carpel open on the inner face.

About 100 species in the warmer parts of America.

- 1. Flowers numerous in a dense conspicuous head; corolla 2-3 mm. long, densely white-bearded in the throat; fruit 2-4 mm. long, smooth, capped by sepals 1.5-2 mm. long1. *S. glabra*.
- 1. Flowers few in inconspicuous heads; corolla less than 2 mm. long; fruit typically less than 3 mm. long, capped by sepals 1 mm. long or less (2)
- 2(1). Corolla somewhat pubescent at and above the throat; fruit didymous-obovate, mostly puberulent, 2-2.5 mm. long2. *S. tenuior*.
- 2. Corolla glabrous within or with few hairs in the throat; fruit subglobose, smooth, 1-1.5 mm. long3. *S. floridana*.

1. *Spermacoce glabra* Michx. SMOOTH BUTTONWEED. Glabrous perennial herb; stems simple or unbranched, spreading, 6 dm. long or more; leaves elliptic to oblong-lanceolate or oblanceolate, acute to acuminate at apex, to 8 cm. long; stipular sheaths with several filiform segments 2-3 mm. long; axillary heads many-flowered; corolla 2-3 mm. long, slightly exceeding the calyx, conspicuously white-bearded in the throat, bearing the anthers at its base; filaments and styles short; fruit somewhat turbinate, smooth, 2-4 mm.

long, crowned by the conspicuous triangular-lanceolate spreading calyx teeth. Damp shores, low woodlands and in openings in the e. third of Tex., May-Oct.; from Fla. to Tex., n. to O., Ind., Ill., Mo. and Kan.

2. *Spermacoce tenuior* L. **SLENDER BUTTONWEED**. Annual, glabrous or nearly so; stems simple and erect or more or less diffusely branched from the base, to about 4 dm. long; leaves linear to oblong or oblong-lanceolate, narrowed into short petioles, acute to acuminate at apex, more or less scabrous, 2-5 cm. long; axillary heads with few flowers; calyx teeth subulate to subulate-lanceolate; corolla white, about 1.5 mm. long, funnelform, somewhat pubescent at and above the throat; fruit didymous-obovoid, mostly puberulent or short-pubescent, 2-2.5 mm. long, somewhat crustaceous and crowned with the 4 calyx teeth. In clay soils along creeks in s. Tex., Sept.-Jan.; also Fla. and La., the W.I. and cont. trop. Am.

3. *Spermacoce floridana* Urban. Annual, smooth, and glabrous; stems more or less diffusely branched from the base, ascending or spreading, the branches to about 5 dm. long, slender and somewhat wiry; leaves slender-petioled, broadly to narrowly elliptic to elliptic-lanceolate, tapering to somewhat rounded at the base, acute to acuminate at apex, to about 7 cm. long and 3 cm. wide, usually much smaller; axillary clusters of few flowers less than 1 cm. thick; sepals subulate-lanceolate, 1-1.5 mm. long; corolla white, about 1 mm. long, glabrous within, the tube campanulate, the lobes ovate-oblong; fruit subglobose, smooth, 1-1.5 mm. long. In palm groves in Cameron Co., Feb.-Apr.; also Fla. and W.I.

15. DIODIA L. BUTTONWEED

Spreading, decumbent, prostrate or ascending annual or perennial herbs; leaves opposite, entire, mostly sessile; stipules sheathing, long-setiferous; flowers mostly solitary or several and sessile in leaf-axils, rarely aggregated at summit of branches; calyx teeth 2 to 5, often unequal; corolla funnelform or salverform, the lobes 3 or 4; stamens and style usually exserted, the stamens usually 4 and inserted on the corolla tube, the style filiform and simple or cleft; fruit composed of 2 or 3 crustaceous or leathery indehiscent carpels that usually separate.

About 50 species, mostly American and African tropics and subtropics.

1. Fruits leathery, strongly 6-ribbed, glabrous or villous, crowned by 2 prominent calyx teeth, the 2 carpels rarely separated; corolla salverform, the tube 7-10 mm. long 1. *D. virginiana*.
1. Fruits crustaceous, not ribbed, strigose to bristly-hirsute or rarely glabrous, crowned by usually 4 calyx teeth, the carpels readily separated; corolla funnelform, 2-6 mm. long (2)
- 2(1). Stems spreading or ascending, the internodes usually more than 2 cm. long; leaves usually 3 cm. long or more; flowers 1 or several in leaf axils; corolla 4-6 mm. long; fruits 2-carpellate, about 4 mm. long 2. *D. teres*.
2. Stems prostrate, the internodes rarely to 2 cm. long; leaves usually 2 cm. or less long; flowers almost entirely aggregated at summit of branches; corolla 2-4 mm. long; fruits 3-carpellate, about 2 mm. long 3. *D. tricoeca*.

1. *Diodia virginiana* L. Plant diffusely spreading or procumbent from a perennial root, the forking branches to about 6 dm. long, nearly glabrous to villous-hirsute; leaves sessile or essentially so, elliptic-oblong to elliptic-oblong-lanceolate or linear-lanceolate, usually tapering to base, obtuse to acute or acuminate at apex, the margins slightly serrulate, mostly bright green, to 9 cm. long and 2 cm. wide, usually much smaller; stipular bristles few, strong and flat, sometimes sparingly hirsute; corolla white, 7-10 mm. long, the slender tube abruptly expanded into the large limb; style 2-parted; fruit ellipsoid, bicarpellate, 5-8 mm. long, to 5 mm. in diameter, glabrous to villous, crowned with 2 or sometimes 3 lanceolate more or less pubescent calyx teeth; carpels suberose-crustaceous, 3-ribbed on the back, held together by a thin epicarp that rarely ruptures. In swamps, meadows, coastal prairies and in mud along streams in e. third of Tex., May-Oct.; from Fla. to Tex., n. to N.J., Ill. and Mo.

Plants in extreme southeastern Texas with short elliptic to elliptic-obovate leaves that do not taper noticeably to the base, and with fruits about 5 mm. long are sometimes segregated as var. *latifolia* T.&G. (*D. tetragona* Walt.)

2. *Diodia teres* Walt. POOR JOE, ROUGH BUTTONWEED. Plant diffusely spreading or ascending from an annual but sometimes lignescent root, rigid, puberulent to hirsute; stems and branches to about 8 dm. long, terete, rather quadrangular above; leaves linear to lanceolate, rounded to somewhat clasping at the sessile base, acute to acuminate at the apex, rather rigid and often with revolute margins, more or less scabrous, to 5 cm. long and 1 cm. wide, usually much smaller; stipular bristles numerous, filiform, often reddish-brown, usually equaling the flowers and surpassing the fruit; corolla funnelform, whitish to pinkish-purple, 4-6 mm. long; style undivided; fruit obovate-turbinate, not ribbed, commonly hispid or hispidulous, about 4 mm. long, bicarpellate, crowned with usually 4 somewhat unequal ovate ciliate calyx lobes, when carpels separate often 3 lobes on one carpel and 1 on the other. In sandy soils in woodlands and open areas in the e. two thirds of Tex., rare on the Edwards Plateau, May-Nov.; from Fla. to Tex., n. to N.E., O., Ill. and Mo.

Those plants with a slender apical seta on each young leaf are segregated as var. *setifera* Fern. & Griseb.

3. *Diodia tricoeca* T.&G. PRAIRIE BUTTONWEED. Plant diffusely branched from a perennial root, low and much-spreading or depressed to form mats of 3 dm. across or more, the internodes rarely as much as 2 cm. long; leaves sessile, linear to lanceolate, acute to acuminate at apex, 25 mm. long or less; stipular bristles slender, whitish; flowers clustered at summit of branches and rarely in uppermost leaf axils; calyx teeth 3 to 5, usually 4 and equal, lanceolate, more or less pubescent, usually longer than the fruit; corolla white, funnelform, 2-4 mm. long, the limb 3- or 4-lobed; stigmas short and broad; fruit obovate-globose, about 2 mm. long, usually partially or wholly hispidulous, sometimes essentially glabrous, tricarpetate; carpels flattened on the ventral face, separating from a weak carpophore, either closed or torn open ventrally. *Crusea tricoeca* (T.&G.) Heller, *C. allococca* Gray, *Richardia tricoeca* (T.&G.) Standl. In sandy or sandy-clay soils in brushy or open-wooded areas, primarily in s. Tex., Mar.-Nov.; also adj. Mex.

FAM. 169. CAPRIFOLIACEAE Juss.

HONEYSUCKLE FAMILY

Shrubs, vines or rarely herbs with opposite usually exstipulate entire leaves; flowers perfect, gamopetalous, regular or irregular; corolla tubular to funnelform or rotate; calyx tube adherent to the 2- to 5-celled ovary; stamens as many as the corolla lobes and inserted on corolla tube; fruit a berry, drupe or capsule, 1- to several-seeded; seeds anatropous.

About 12 genera and 450 species mostly in North Temperate regions and tropical mountains.

1. Corolla rotate to open-campanulate, regular, deeply 5-lobed; style abbreviated, the 1 to 5 stigmas sessile or nearly so; inflorescences terminal and cymose (2)
1. Corolla elongate, funnelform to campanulate, often more or less irregular; style 1, elongate, with a usually capitate stigma; inflorescences lateral or terminal (3)
- 2(1). Leaves simple; fruit a 1-seeded drupe 1. *Viburnum*, p. 1497.
2. Leaves pinnately compound; fruit a 3-seeded berry ... 2. *Sambucus*, p. 1499.
- 3(1). Erect coarse herbs with large leaves and sessile flowers in their axils; fruit drupaceous, with 2 to 5 stones 5. *Triosteum*, p. 1503.
3. Erect or climbing shrubs (4)
- 4(3). Corolla funnelform to tubular; ovary 2- or 3-celled; fruit a berry, many-seeded ..
..... 3. *Lonicera*, p. 1500.
4. Corolla short-campanulate to salverform; ovary 4-celled; fruit a berrylike drupe, with only 2 stones maturing 4. *Symphoricarpos*, p. 1501.

1. VIBURNUM L. VIBURNUM. ARROW-WOOD

Shrubs or small trees with simple leaves and numerous white or rarely pink flowers in compound cymes; petioles sometimes bearing appendages that are apparently stipules; leaf buds naked or with pairs of scales; calyx 5-toothed; corolla spreading, rotate to broadly campanulate, deeply 5-lobed; stamens 5, exserted, the anthers oblong and introrse; style none, the 1 to 3 stigmas sessile on summit of ovary; fruit a 1-celled 1-seeded soft-pulpy drupe with a thin-crustaceous tumid or flattened stone.

About 200 species in the North Temperate Zone.

1. Leaves with margins entire to undulate or only finely serrulate or rarely denticulate (2)
 1. Leaves coarsely dentate to crenate-dentate and sometimes lobed (5)
 - 2(1). Cymes definitely peduncled; leaves entire to undulate or rarely irregularly denticulate (3)
 2. Cyme sessile or essentially so; leaves serrulate with sharp teeth (4)
 - 3(2). Leaves somewhat lustrous above, the veins raised below and strongly curved, gradually tapering or rounded to the apex, the margin revolute, sometimes somewhat denticulate; twigs, petioles and lower surface of leaves rusty-scurfy; anthers elevated 4-5 mm. above corolla; pulp of drupe bitter; stone globose-obovate, smooth in cross section 1. *V. nudum*.
 3. Leaves dull dark-green above, the veins not noticeably raised below, usually long-acuminate at apex, the margin only slightly revolute; twigs smooth and glabrous; lower surface of leaves rusty-scurfy when young, becoming light-green with scurfy dots in age; anthers elevated 1-3.5 mm. above corolla; pulp of drupe sweet; stone oblong-ellipsoid, ridged and grooved in cross section 2. *V. nitidum*.
 - 4(2). Petioles, midribs beneath and rays of cyme more or less rufescent-scurfy or -tomentulose; leaves lustrous above, coriaceous; rather frequent 3. *V. rufidulum*.
 4. Petioles, midrib beneath and rays of cyme without rufescent tomentum; leaves not lustrous, membranous to subcoriaceous; rare 4. *V. prunifolium*.
 - 5(1). Leaves palmately 3-ribbed from the rounded to subcordate base, mostly 3-lobed (maplelike), copiously dotted beneath; slender petiole often stipulate at base 5. *V. acerifolium*.
 5. Leaves pinnately veined, with unlobed margins, not evidently dotted beneath (6)
 - 6(5). Distribution in mountains of Trans-Pecos Texas ... 6. *V. australe*.
 6. Distribution in forests of east Texas (7)
 - 7(6). Leaves narrowly ovate to ovate-elliptic or occasionally ovate-lanceolate, mostly less than 35 mm. wide; corolla and fruit glabrous .. 7. *V. dentatum* var. *dentatum*.
 7. Leaves broadly ovate to suborbicular-ovate, mostly more than 35 mm. wide; corolla and fruit more or less setose or hirsute 7. *V. dentatum* var. *scabrellum*.

1. *Viburnum nudum* L. POSSUM-HAW. Shrub spreading or somewhat erect and arborescent, to 5 m. tall; buds brown or fuscous; leaves with a petiole to 1 cm. long, lustrous above, usually dotted beneath, coriaceous, elliptic to obovate or oblanceolate, rarely ovate, rounded to abruptly acute at apex, the more or less crenate margin revolute, to about 15 cm. long and 75 mm. wide; cyme to 1 dm. wide, on a peduncle 15 mm. or more long; corolla about 5 mm. wide; stamens long-exserted, the filaments 4-5 mm. long; drupe subglobose, bluish-black, glaucous, the flesh usually bitter; stone typically globose-obovoid. Along streams in swamp forests, bogs and in wet pinelands in e. Tex., Mar.-June; from Fla. to Tex., n. to N.E., Ky. and Ark.

2. *Viburnum nitidum* Ait. WHITE-ROD. Shrub or small tree very similar to *V. nudum*, if not referable to that species, from which it differs primarily in the narrower, long-

acuminate, less coriaceous leaves. *V. nudum* var. *angustifolium* T.&G., *V. cassinoides* var. *nitidum* (Ait.) McAtee. In swamps and wet woods in e. Tex., Apr.-June; from Nfld. to Man., s. to Fla. and Tex.

3. *Viburnum rufidulum* Raf. SOUTHERN BLACK-HAW. Shrub or small tree to 10 m. tall and trunk to 1 dm. in diameter, with checkered blackish bark; winter buds, branchlets, petioles, lower leaf surfaces irregularly densely scurfy with a rufescent tomentum; leaves with somewhat wing-margined petioles rarely to 2 cm. long, elliptic to obovate or oblanceolate, rounded to obtusely pointed at apex, to 9 cm. long and 55 mm. wide, lustrous, coriaceous, serrulate; the 3- or 4-rayed cymes sessile, to 1 dm. wide, more or less scurfy; corolla 8-10 mm. wide; stamens long-exserted, the filaments 3-5 mm. long; drupe ellipsoid to subglobose, blue-black, glaucous, 1-1.5 cm. long, the pulp sweet and quite edible; stone flattish. *V. rufotomentosum* Small, *V. rufidulum* [var.] *Margarettae* Ashe. Rather frequent on the edge of woods, along streams and in open woods and thickets in e. and cen. Tex., Mar.-May; from Fla. to Tex., n. to Va., s. O., s. Ind., s. Ill. and Mo.

4. *Viburnum prunifolium* L. BLACK-HAW. Shrub or small tree very similar to *V. rufidulum* from which it differs primarily in lacking the conspicuous rufescent tomentum found on vegetative parts of that species. Also, the upper surface of the leaves are dull, instead of being glossy, and are usually thick-membranous instead of being coriaceous. In woods, thickets and along roadsides, in moist or dry soil, in e. Tex., Mar.-May; from n. Fla. to Tex., n. to N.E., N.Y., O., Mich., Ill., Ia. and Kan.

5. *Viburnum acerifolium* L. ARROW-WOOD, MAPLE-LEAF VIBURNUM. Shrub to 25 dm. tall, the new stems, petioles, lower leaf surfaces and inflorescences usually finely pale stellate-pubescent; leaves thin, with slender petioles to 2 cm. long, dark-green above, pale beneath, suborbicular in outline, to 1 dm. long and 8 cm. wide, typically 3-lobed above middle with the lobes acute to shortly acuminate, coarsely toothed, rounded to subcordate at base; the usually 7-rayed cymes 3-6 cm. wide, on terminal peduncles 25-35 mm. long; corolla about 5 mm. wide; stamens long-exserted, the filaments 3-4 mm. long; drupe purple-black when ripe, ellipsoid to subglobose, about 8 mm. long, the flesh disagreeable to taste; stone lenticular, with 3 shallow grooves on one face and 2 grooves on the other. Moist or dry woods in e. Tex., Apr.-May; from Que. and N.B., w. to Minn., s. to Fla., La. and Tex.

Plants with some or all leaves 2-lobed or unlobed are segregated as var. *ovatum* Rehd. Those plants having the interspaces between the leaf veins glabrous or nearly so have been segregated as var. *glabrescens* Rehd.

6. *Viburnum australe* Morton. Straggling shrubs to about 15 dm. tall, with dull-colored glabrous or sparsely glandular branchlets; leaves subcoriaceous, with glandular-hispidulous petioles to 1 cm. long and linear persistent glandular-hispidulous stipules (5 mm. long) borne on the petiole 1.5-2 mm. above its base, broadly ovate to suborbicular, to 9 cm. long and 7 cm. wide, coarsely toothed and ciliate, abruptly acute to shortly acuminate at apex, truncate to somewhat cordate at base, more or less glandular and hispidulous on the prominent veins beneath; inflorescences conspicuously glandular and sparsely pubescent, the linear basal bracts to 15 mm. long and 2 mm. wide; cymes 6- to 8-rayed, twice-compound, to 55 mm. wide, on peduncles to 3 cm. long; calyx tube densely glandular-stipitate, the lobes distinct almost to base, about 1 mm. long, ciliate with long simple hairs; corolla about 5 mm. wide; stamens slightly exserted, the filaments 3-4 mm. long; drupe ellipsoid, compressed, about 1 cm. long, fleshy; stone with 3 grooves on one face and 2 grooves on the other. *V. affine* Bush var. *australe* (Morton) McAtee. On mt. slopes and at base of high bluffs, in igneous soil, in the Trans-Pecos, Apr.-May; also n. Mex.

7. *Viburnum dentatum* L. SOUTHERN ARROW-WOOD. Shrub or small tree rarely to 75 dm. tall, usually to about 5 m. tall, with close gray-brown or reddish bark, the twigs usually densely stellate-pubescent; leaves membranaceous, with glabrous to stellate-pubescent petioles to 15 mm. long, ovate to ovate-lanceolate or suborbicular, to 15 cm. long and 1 dm. wide, usually much smaller, broadly rounded to sharply acute or short-acuminate at apex, coarsely serrate with triangular teeth and often with salient points, broadly cuneate to rounded or rarely subcordate at base, glabrous or nearly so above, glabrous or with some stellate pubescence below; the 5- to 7-rayed cyme 5-7 cm. wide, on peduncles 3-6 cm. long; corolla 5-8 mm. wide, it and the hypanthium glabrous to

sparsely glandular and/or setose; style pubescent; drupe blue-black when ripe, subglobose to ovoid or obovoid, 5-10 mm. long; stone plump, ellipsoid, deeply grooved on one face. *V. pubescens* (Ait.) Pursh. Moist and dry woodlands and thickets in e. Tex., Apr.-June; from N.E., s. to Fla. and Tex. We have two varieties in Texas.

Var. *dentatum* has narrow leaves and a glabrous or only glandular hypanthium.

Var. *scabrellum* T.&G. has broader leaves and the corolla and hypanthium are more or less setose or hirsute. *V. scabrellum* (T.&G.) Chapm. and its var. *Ashei* (Bush) McAtee.

2. SAMBUCUS L. ELDER-BERRY

Shrubby to arborescent or rarely herbaceous plants with a rank smell when bruised; bark with lenticles clearly evident; leaves pinnate or rarely with some bipinnate, the leaflets serrate and acuminate; flowers small, numerous in terminal compound cymes; calyx lobes minute or obsolete; corolla rotate, with a broadly spreading 5-cleft limb; stamens 5, inserted at base of corolla, the filaments slender; stigmas 3; fruit a berrylike juicy drupe that contains 3 small seedlike stones, usually edible.

About 40 species mainly in temperate and subtropical regions.

1. Distribution mainly east and central Texas 1. *S. canadensis*.

1. Distribution in Trans-Pecos Texas (2)

2(1). In high mountains; a many-stemmed shrub; leaflets typically narrowly lanceolate, gradually acuminate and markedly asymmetrical at base; cymes mostly more than 15 cm. broad 2. *S. caerulea*.

2. At lower elevations; usually arborescent; leaves typically elliptic-lanceolate, abruptly acuminate and not conspicuously asymmetrical at base; cymes mostly less than 15 cm. broad 3. *S. mexicana*.

1. *Sambucus canadensis* L. COMMON ELDER-BERRY. Stems scarcely woody, to 4 m. tall, with large white pith; leaflets 5 to 11, ovate-elliptic to lanceolate, acuminate, to 18 cm. long and 7 cm. wide, sharply serrate, glabrous to hirtellous or rarely canescent beneath (especially along the veins); cymes flat, to 35 cm. broad, the branches and pedicels glabrous or rarely hispidulous; flowers white, about 5 mm. broad, fragrant; fruit purple-black, 4-5 mm. in diameter. In wet soil in low places, especially along streams and on edge of swamps, mainly in e. and cen. Tex., rare in Panhandle, May-July; from N.S. and Que., w. to Man. and S.D., s. to Fla. and Tex.

The edible fruits are used in the making of jellies and wine. Those plants with leaflets densely canescent beneath have been segregated as var *submollis* Rehd.

2. *Sambucus caerulea* Raf. BLUE ELDER-BERRY. Shrub of clustered erect stems to 7 m. tall, rarely taller, sprouting freely from the base, the main stems usually less than 15 cm. in diameter, the young stems and branches brown and sometimes glaucous; leaflets 5 to 9, often long-petiolulate, oblong-lanceolate to narrowly lanceolate, tapering at the acuminate apex, rounded at the strongly asymmetrical base, to 16 cm. long and 35 mm. wide, pale beneath, rather thick, serrulate to serrate, glabrous or sparingly to densely tomentose; cymes flat-topped, to 3 dm. broad; flowers pale-yellow or creamy-white, 5-6 mm. wide; fruit 5-6 mm. in diameter, dark-blue or blackish, when fully ripe covered with a dense white bloom. On talus slopes among boulders at base of high cliffs in Chisos Mts., Apr.-June; in mts. from w. Tex. to Alta., Mont., Calif. and n. Mex.

3. *Sambucus mexicana* Presl. MEXICAN ELDER, TAPIRO, SAÚCO. Trees or shrubs to 10 m. tall, usually much smaller, with the main trunks furrowed and to 3 dm. in diameter, the smaller branches glabrous or white-tomentulose; leaflets 3 or 5 or sometimes 7, subsessile to petiolulate, ovate to ovate-lanceolate or oval, abruptly acuminate or sometimes cuspidate at apex, rounded to cuneate at base, to 12 cm. long, coarsely or finely serrate except at base and apex, firm, green on both surfaces, glabrous to densely tomentulose; cyme essentially flat, to 15 cm. broad; flowers pale-yellow or creamy-white, 5-8 mm. broad; fruits 5-7 mm. in diameter, dark-blue or blackish, when fully ripe covered with a dense white bloom. *S. caerulea* var. *arizonica* Sarg. and var. *mexicana* (Presl) L. Benson, *S. Rehderana* Schwerin. Along streams and river banks and on slopes in the Trans-Pecos, summer; from Tex. to Calif. and Mex.

3. LONICERA L. HONEYSUCKLE

Erect or climbing and twining shrubs; leaves entire or rarely toothed or lobulate; flowers showy and fragrant; calyx tube subglobose to ovoid, the teeth very short; corolla tubular to funnelform or somewhat campanulate, often gibbous at the base, irregularly or nearly regularly 5-lobed; ovary 2- or 3-celled; fruit several-seeded.

About 200 species in the Northern Hemisphere, mainly in eastern Asia.

1. Leaves all distinct; peduncles axillary, single, 2-flowered at summit
..... 1. *L. japonica*.
1. One or two pairs of upper leaves connate to form a cup or disk that encircles the stem; flowers sessile in whorled, axillary or terminal clusters, forming heads or interrupted spikes (2)
- 2(1). Corolla more than 25 mm. long, mostly deep-red or orange-color on outer surface; berries red; lower leaves distinctly petiolate (3)
2. Corolla less than 20 mm. long, white or creamy-white; berries bluish-green; lower leaves sessile or very shortly petiolate; in central and west Texas (4)
- 3(2). Leaves glabrous or at most minutely pilose beneath; in eastern third of Texas ..
..... 2. *L. sempervirens*.
3. Leaves with conspicuous spreading cilia; in mountains of the Trans-Pecos
..... 3. *L. arizonica*.
- 4(2). Leaves glabrous; mostly on Edwards Plateau of central Texas
..... 4. *L. albiflora* var. *albiflora*.
4. Leaves pubescent; in the High Plains and Trans-Pecos regions
..... 4. *L. albiflora* var. *dumosa*.

1. *Lonicera japonica* Thunb. JAPANESE HONEYSUCKLE. Trailing or high-twining viny shrubs with pubescent younger stems; leaves ovate to oblong-elliptic, firm, to 8 cm. long and 4 cm. wide, rounded to broadly cuneate at base, obtuse to subacute and apiculate at apex, the early leaves sometimes toothed or lobed; bracts leaflike but much smaller; corolla 3-4 cm. long, lobed to about or somewhat above middle, white or white tinged with purple, becoming yellow with age, very fragrant, the tube pubescent; berries black, about 7 mm. in diameter. In thickets, open woods, border of woods and along roadsides in e. and cen. Tex., Mar.-July; a nat. of Asia that has escaped from cult. to become a rampant pernicious weed that has endangered nat. vegetation from Fla. to Tex., n. to Mass., N.Y., O., Ind., Mo. and Kan.

2. *Lonicera sempervirens* L. TRUMPET HONEYSUCKLE. Twining shrub with glabrous or essentially glabrous branchlets; leaves glabrous on both surfaces or sometimes minutely pilose beneath, green above, white beneath, linear-oblong to elliptic or obovate, rounded to cuneate at base, obtuse at apex, to 7 cm. long and 4 cm. wide, firm, the 1 or 2 upper pairs connate to form a disk; flowers 4 to 6 in mostly 2 to 4 sessile remote whorls, forming interrupted spikes; corolla slenderly trumpet-shaped, nearly regular, with subequal short rounded erect lobes, deep-red or rarely orange or yellow on outer surface, 40-55 mm. long; stamens and style little-exserted or included; berries red; seeds about 4.5 mm. long and 3.5 mm. broad. *Phenianthus sempervirens* (L.) Raf. Woods and thickets in e. Tex., Mar.-June; from Fla. to Tex., n. to s. Me., Mass., N.Y., O., Ia. and Neb.

3. *Lonicera arizonica* Rehd. Straggly or clambering woody viny shrubs; leaves ovate to oval, rounded to broadly cuneate at base, rounded and minutely apiculate at apex, 2-7 cm. long, with strong spreading cilia, pale and often pubescent beneath, deep-green and glabrous above, only the uppermost 1 or 2 pairs perfoliate; petiole of lower leaves 6-12 mm. long; inflorescence distinctly pedunculate, the whorl of flowers single or the whorls crowded together in a subcapitate spike; corolla with nearly regular limb, 35-45 mm. long, glabrous, tinged scarlet outside, orange within; stamens inserted deep in corolla tube; fruits red at maturity. Evergreen forests in Guadalupe Mts., May-July; also N.M., Ariz. and Ut.

4. *Lonicera albiflora* T.&G. var. *albiflora*. WHITE HONEYSUCKLE. Plant entirely glabrous or essentially so, bushy, the branches sometimes twining, to 25 dm. tall; leaves

rather rigid, suborbicular to oval or obovate, rounded to broadly cuneate at base, broadly rounded at apex, usually less than 3 cm. long, rarely as much as 65 mm. long, glaucescent on both surfaces, usually only the upper pair perfoliate to form a disk that subtends the simple sessile glomerules; corolla white or yellowish-white, less than 2 cm. long, lobed to about the middle, scarcely at all gibbous; style and filaments nearly naked. On rocky slopes, cliffs and in sandy soils, commonly in cedar brakes, in cen. and n.-cen. Tex., Mar.-May; also Okla.

Var. *dumosa* Gray. Those plants with leaves pubescent, at least on the margins and lower surface, and with the corolla sometimes pilose on the outer surface fall into this category. The leaves of this plant are also commonly larger than those of var. *albiflora*. In n.w. and w. Tex.; from Okla. and Tex., w. to Ariz. and n. Mex.

4. SYMPHORICARPOS BOEHM.¹⁸⁷ SNOW-BERRY

Shrubs, with the older bark exfoliating; leaves opposite, simple, exstipulate, usually entire but sometimes sinuately toothed or lobed; flowers in axillary or terminal clusters or solitary in axils of upper leaves, regular or nearly so; corolla campanulate to funnelliform or salverform, 4- or 5-lobed, pink or white, often pubescent within, with 1 to 5 nectaries at base; ovary 4-celled, with 2 of the cells containing 1 large fertile pendulous ovule, the other cells containing several small abortive ovules; fruit an ovoid to ellipsoid or subglobose drupe; stones normally 2, more or less compressed.

About 20 species, all except one (in China) found in North America.

1. Distribution east of the Pecos River; corolla broadly campanulate, 3-4 mm. long; fruit red 1. *S. orbiculatus*.
1. Distribution west of the Pecos River; corolla campanulate to salverform or funnelliform, 6 mm. or more long (except in *S. guadalupensis*); fruit typically white (2)
- 2(1). Corolla 2-3 mm. long, campanulate; plants glabrous, the twigs reddish; leaves oval to broadly elliptic 2. *S. guadalupensis*.
2. Corolla 6 mm. or more long, salverform or funnelliform; plants glabrous to pubescent, the twigs and leaves various (3)
- 3(2). Corolla salverform, 11-13 mm. long, with only one small basal nectary, glabrous within; style 4-7 mm. long, usually pilose above the middle; anthers sessile; leaves typically oblanceolate to obovate, glaucous, 6-15 mm. long, 2-5 mm. wide 3. *S. longiflorus*.
3. Corolla funnelliform, 6-13 mm. long, with 5 basal nectaries; style 3-5 mm. long, usually glabrous; anthers equaling or somewhat shorter than the free portion of the filaments (4)
- 4(3). Young twigs completely glabrous; corolla sparsely pilose to nearly glabrous within 4. *S. oreophilus*.
4. Young twigs puberulent to pubescent; corolla densely pilose within (5)
- 5(4). Pubescence of young twigs dense, of straight spreading hairs; corolla tubular-funnelform, 8-10 mm. long; anthers reaching only to base of corolla lobes; leaves suborbicular-oval, dark-green, obtuse or obtuse-rounded at apex, soft-pubescent on both surfaces, 1-3 cm. long, 6-18 mm. wide 5. *S. rotundifolius*.
5. Pubescence of the young twigs not dense or (if so) then the hairs short and curved; leaves typically ovate-elliptic, commonly apiculate .. 6. *S. Palmeri*.

1. *Symphoricarpos orbiculatus* Moench. CORAL-BERRY, INDIAN-CURRENT. Shrub erect, to about 2 m. tall; branches leafy, erect or ascending, slender, light-brown to purplish; bark on the older branches gray and shreddy; young twigs densely villosulous-tomentulose to puberulent; leaves with petioles 2-4 mm. long, oval to ovate or suborbicular, rounded to slightly cuneate at the base, obtuse to acute at the apex, rarely to 6 cm. long, dull-green and glabrous to sparsely pilosulous on the upper surface, somewhat glauces-

¹⁸⁷ Adapted partly from G. N. Jones in Jour. Arnold Arb. 21:201-252. 1940.

cent and soft-pubescent on lower surface; flowers in short many-flowered densely crowded axillary spikes on the branches of the season; corolla broadly campanulate, villous within, pinkish, 3-4 mm. long, turned obliquely upward, slightly ventricose on the lower side, the lobes about as long as the tube; anthers 1 mm. long, shorter than the filaments; calyx teeth 5, triangular, ciliate, persistent on the fruit; style 2 mm. long, pilose; fruit a delicate coral-red varying to pink or sometimes purple-tinged, glaucous, ellipsoid, 5-7 mm. long, 4-5 mm. thick, the beak about 1 mm. long; stones oval, flattened, 2.5-3.5 mm. long, about 2 mm. wide, obtuse at each end. *S. vulgaris* Michx., *S. spicatus* Engelm. In woods and thickets, especially along streams, in e. third of Tex., Apr.-July; from N.Y., s. to Fla. and w. to Tex., n. Mex., Colo. and e. S.D.

2. *Symphoricarpos guadalupensis* Correll. Shrub, entirely glabrous; stems slender, with the bark thinly fibrous-shredded, the twigs reddish-brown; leaves with petioles about 1.5 mm. long, oval to elliptic, to 15 mm. long and 9 mm. wide, rounded-apiculate at apex, the margins entire or with few coarse teeth or lobules above the middle; pedicels thick, about 1.5 mm. long; floral bracts ovate-concave, about 1.5 mm. long; calyx 1.8 mm. long, the short lobes broadly rounded; corolla campanulate, 3-4 mm. long, the broadly rounded lobes concave; fruit unknown. In limestone soil at head of South McKittrick Canyon, Guadalupe Mts., Aug.-Sept.; apparently endemic.

3. *Symphoricarpos longiflorus* Gray. Shrub low and spreading-diffuse, the branches somewhat declined and to 2 m. long; young twigs glaucous, glabrous to sparsely pilosulous; bark of the older branches thin, whitish, fibrous, shreddy; leaves with petioles 1-3 mm. long, lanceolate to oval or oblanceolate, narrowed at the base, obtuse to acute at apex, entire, 6-15 mm. long, 2-5 mm. wide, completely glabrous to rarely sparsely pilosulous, thick, pale-green and glaucous; flowers very fragrant, solitary or in pairs in the axils of the upper leaves, sometimes in small terminal few-flowered racemes; calyx 5-lobed, glabrous and glaucous or somewhat pubescent, the lobes deltoid and about 1 mm. long; corolla 11-13 mm. long, salverform, symmetrical, pink or reddish, the narrow tube 3 to 5 times as long as the widely spreading lobes, glabrous, with one small basal nectary; stamens about as long as the tube of the corolla; anthers versatile, sessile or nearly so, 1.5-3 mm. long, the filaments scarcely if at all free; style 5-7 mm. long, usually pilose above the middle, the stigma capitate or slightly bilobed; fruit white, ellipsoid, 8-10 mm. long; stones oval, glabrous, 4.5-5 mm. long, 2.5-3 mm. wide, acute at base. On slopes, ledges and along streams in canyons of mts. in the Trans-Pecos, June-Aug.; from s.e. Ore., s. to Colo., Tex. and s.e. Calif.

4. *Symphoricarpos oreophilus* Gray. Shrub erect, to 15 dm. tall, divaricately branched; branches slender, spreading, the bark becoming brown and shreddy; young branchlets completely glabrous; leaves oval, rather thin, glabrous on both surfaces or very rarely with a few short scattered trichomes, usually acute at apex, entire or dentate, scarcely paler on lower surface, those of the flowering branches 1-2.5 cm. long, 8-16 mm. wide, tapering to the very short petiole; petioles about 2 mm. long, broader at the base to enclose the pointed buds; flowers rose-color, mostly in axillary pairs or in few-flowered terminal spikes; bracts oval, acute, connate at base, glabrous, 1 mm. long; calyx glabrous, the deltoid lobes 0.5-1 mm. long; corolla tubular-funnelform, 11-13 mm. long, symmetrical, the slender tube sparsely pilose to nearly glabrous within, with 5 small basal nectaries, the slightly spreading lobes 2-3 mm. long; anthers 2 mm. long, about as long as the filaments; style glabrous, 3 mm. long, the stigma capitate; fruit white, ovoid to ellipsoid, 8-10 mm. long; stones narrowly ovoid, flattened, 5-6 mm. long, 2-2.5 mm. wide, tapering to the acute base, somewhat obtuse at the apex. In canyons of mts. in the Trans-Pecos, spring-summer; from Colo. and Ut. to Ariz., Nev., N.M., w. Tex. and n. Mex.

5. *Symphoricarpos rotundifolius* Gray. Low straggling shrub with slender arching branches, less than 1 m. tall; young branches softly and densely pubescent with short straight spreading hairs; leaves with a short-villous petiole to 3 mm. long, grayish-green, suborbicular to broadly oval or ovate, obtuse to rounded or rarely acutish at apex, to 3 cm. long and 18 mm. wide, usually entire or some of the larger leaves repand or sinuately dentate or lobed, usually puberulous above, pilosulous and grayish beneath; flowers almost sessile in the axils of the upper leaves; bracts shorter than the ovary; calyx campanulate, the lobes about 1 mm. long; corolla light-pink, tubular-funnelform, symmetrical, 9-10 mm. long, the tube pilose within on the lower part, with 5 small glandular nectaries

in the base, the slightly spreading lobes 2 mm. long; anthers 2-2.5 mm. long, reaching only to the base of the corolla lobes, equaling or somewhat shorter than the free portion of the filament; style glabrous, 3-4 mm. long, about one third the length of the corolla; fruit white, ovoid or ellipsoid, about 1 cm. long and 7 mm. wide; stones oval, flattened, striate, pointed at each end, about 5 mm. long and 3 mm. wide. In canyons and on wooded slopes of mts. in the Trans-Pecos, spring-summer; from w. Tex. to Ariz. and Colo.

6. *Symphoricarpos Palmeri* G. N. Jones. Trailing shrub to 3 m. long, the short branches erect or ascending; young twigs tomentulose-puberulent with short curved trichomes; bark gray and shreddy on the older branches; leaf buds puberulent, acute, 1-2 mm. long; leaves with pilosulous petioles to 3 mm. long, oval to ovate, to 2 cm. long and 18 mm. wide (leaves of the sterile branches larger), acute to apiculate at apex, cuneate at base, the margins somewhat ciliate and usually more or less sinuate to lobulate or crenate; upper surface of leaves finely reticulate, dark-green, pilosulous or glabrescent, the veins obscure; lower surface of leaves pale, prominently reticulate, grayish pilosulous on the veins; flowers short-pedicelled, in axillary pairs or solitary; bracts lanceolate, acute, puberulent; bractlets oval, acute, puberulent; calyx glaucous, glabrous or nearly so, nearly regularly and very shallowly 5-toothed, the teeth about 0.3 mm. long; corolla pinkish, tubular-funnelform, symmetrical, 9-12 mm. long, the lobes one fourth to one third the length of the tube that is pilose within on the lower part; anthers 2-2.5 mm. long, shorter than the filaments, reaching about to the middle of the corolla lobes; style glabrous, 2-4 mm. long; stigma capitate; fruit white, ellipsoid, 6-8 mm. long; stones 2, oval or ellipsoid, flattened, plano-convex, whitish, rounded at the apex, somewhat acutish at the base, 4-5 mm. long, 2-3 mm. wide. In canyons of mts. in the Trans-Pecos, spring-summer; from w. Tex. to Ariz. and Colo.

5. **TRIOSTEUM L. FEVERWORT. HORSE-GENTIAN**

A small genus of about 6 species in North America and Asia.

1. *Triosteum angustifolium* L. Perennial slender herb to 8 dm. tall, the stem retrorse-setose with glistening hairs to 3 mm. long; leaves narrowly obovate to oblanceolate, tapering to base, acuminate at apex, strigose above with hairs to about 1.5 mm. long, glabrous or merely hispid on nerves beneath, to 15 cm. long and 6 cm. wide; flowers mostly solitary in axils, subtended by a pair of bracts that are similar to calyx lobes; calyx lobes linear to linear-lanceolate, foliaceous, persistent, about 1 cm. long and 2 mm. wide, hispid-ciliate on margin; corolla tubular, subequally 5-lobed, scarcely longer than calyx, loosely villous, greenish or yellowish-white; ovary 3-celled; drupes dry, strigose-hirsute, containing a 3-ribbed 1-seeded long stone. In woods and thickets in e. Tex. (Smith and Cass cos.), Mar.-May; from Tex. to Ala., n. to Conn., Pa., Ind., Ill. and Mo.

FAM. 170. VALERIANACEAE BATSCH
VALERIAN FAMILY

Herbaceous annuals or perennials with opposite exstipulate leaves; flowers small, in cymes or capitate, perfect or unisexual; calyx annular or variously toothed, often inrolled in flower and forming a feathery pappus in fruit; corolla funnelform to rotate or almost salverform, 4- or 5-lobed, the base often saccate or spurred on one side; stamens 1 to 4, inserted near the base of the corolla tube; ovary inferior, mostly 3-celled, with 1 cell fertile and the other 2 cells sterile or essentially wanting; ovule 1, pendulous; fruit dry, indehiscent.

About 13 genera and 400 species mostly in the Northern Hemisphere.

- 1. Plants perennial; distribution in mountains of the Trans-Pecos 1. *Valeriana*, p. 1504.
- 1. Plants annual; distribution east of the mountains of the Trans-Pecos 2. *Valerianella*, p. 1504.

1. VALERIANA L.¹⁸⁸

VALERIAN. TOBACCO-ROOT

Perennial herbs with thickened strong-scented roots or rhizomes and with leafy or scapose stems; leaves entire to pinnate; inflorescence determinate, the cymes clustered or paniculate; calyx at first involute, later spreading, the limb sessile, hyaline, membranaceous, becoming setose distally, the setae plumose or the limb short-cupuliform and more or less toothed or lobed; corolla rotate to funnellform, the tube straight or gibbous, the throat more or less hairy, the 5 lobes subequal; stamens usually 3; anthers sessile or on filaments, 2- to 4-lobed; ovary 3-celled, maturing 1 fertile adaxial carpel with 1 pendulous ovule, the other 2 abaxial carpels vestigial; style 1, the stigma 3-lobed; fruit an achene.

About 200 species in temperate and cold regions of the Northern Hemisphere. Dried plants of the species in this genus are persistently malodorous.

1. Plants from rhizomes or thickened stolons, with adventitious roots; leaves commonly pinnate to pinnatifid, petiolate, the blades of the undivided leaves more or less abruptly expanded; corolla infundibuliform, the tube gibbous; achenes plane adaxially1. *V. arizonica*.
1. Plants from conical taproots; leaves mostly lingulate-spatulate, gradually decurrent to the subpetiolar and clasping base; corolla rotate; achenes with relatively prominent adaxial ribs2. *V. texana*.

1. *Valeriana arizonica* Gray. Plant to 3 dm. high, with a rather slender rhizome to 4 mm. thick; stems glabrous, with the nodes puberulent; leaves petiolate, predominantly basal, forming a loosely tufted rosette with the several adventitious roots, undivided or sometimes pinnate, ovate to suborbicular or rarely subcordate, to 17 cm. long, the blade to about 8 cm. long and 4 cm. wide; inflorescence dense in anthesis, to 3 cm. wide but later expanding to 5 cm. wide; bracts 5-7 mm. long, glabrous; calyx limb 10- to 12-fid; corolla infundibuliform, 5-15 mm. long, white or pinkish, glabrous on outside, the tube gibbous, the lobes 2-2.5 mm. long; stamens and style exerted; achenes ovate to oblong-lanceolate, 2-5 mm. long, glabrous, tawny or purpurescent. In moist limestone soil near summit of Guadalupe Mts. (8,000 ft. alt.) in the Trans-Pecos, spring; from s. Colo., N.M. and w. Tex. to Ariz. and n. Chih.

2. *Valeriana texana* Steyerem. Plant to 3 dm. high, with a stout multicapital caudex and forked rugose conical taproots to 2 cm. thick and much contorted in age; stems several, subcapose, glabrous or sometimes sparsely pilosulous at nodes; leaves predominantly basal, undivided, elliptic to obovate-spatulate, narrowly obtuse to acute, to 16 cm. long and 3 cm. wide, tapering to the subpetiolar base, firmly membranaceous, glabrous, usually somewhat marginate, the stem leaves similar to but smaller than the basal leaves; inflorescence 2-6 cm. long in anthesis, later diffuse and to 12 cm. long and 7 cm. wide, the internodes glabrous or sometimes thinly pilosulous; bracts 3-4 mm. long, reduced above, glabrous to spreading-ciliate; calyx limb 6- to 8-fid; corolla rotate, 2.5-3 mm. long, whitish, thinly pilosulous at the base on outside, the ovate lobes equal to or shorter than the tube; stamens and style exerted; achenes oblong to linear-oblong, 2-2.5 mm. long and less than 1 mm. wide, smooth, brownish, more or less keeled abaxially, the adaxial ribs evident. On boulders in creek and on moist shaded limestone cliffs in canyons of Guadalupe Mts. in the Trans-Pecos, Apr.-July; endemic.

2. VALERIANELLA MILL.¹⁸⁹

CORN SALAD

Annual or sometimes biennial often disgustingly malodorous (when dry) herbs with erect dichotomously branched stems; leaves more or less succulent, the basal leaves tufted and entire, the stem leaves sessile and often dentate; flowers small, cymose-clustered, bracted; calyx limb obsolete or short-toothed; corolla funnellform or salverform, white or pale-blue, equally or unequally 5-lobed; stamens 3 or rarely 2; fruit 2-celled or 3-celled with 2 of the cells empty and sometimes confluent and the other 1-seeded.

¹⁸⁸ Ref.: F. G. Meyer in Ann. Missouri Bot. Gard. 38:377-503. 1951.

¹⁸⁹ Adapted from Sarah C. Dyal in Rhodora 40:185-212. 1938.

About 80 species in the Northern Hemisphere. In northern Europe, *V. locusta* (L.) Betsche is commonly used as a potherb in fall and spring.

1. Fertile cell of fruit about one third less than (often to one half) the combined width of the sterile cells, when viewed dorsally it does not completely conceal the 2 sterile cells that extend outward 1. *V. Woodsiana*.
1. Fertile cell of fruit usually about equaling or wider than the combined width of the sterile cells, when viewed dorsally it usually completely conceals the 2 sterile cells (2)
 - 2(1). Plants glabrous or sometimes with tufts of hairs on each side of the leaf base near the nodes; fruit always pubescent (3)
 2. Plants pubescent, sometimes only on the leaves and the lower part of the stem, in addition to tufts on each side of leaf bases near the nodes; fruit glabrous or sometimes puberulent or pubescent (4)
 - 3(2). Fruit white-hirsute, 1.5-2 mm. long, the hairs uncinata; corymb compact, the glomerate cymes many 2. *V. amarella*.
 3. Fruit only sparsely short-pubescent, 1.7 mm. long; corymb open, with few glomerules 3. *V. florifera*.
 - 4(2). Fruits laterally compressed, strongly carinate, less than 1 mm. long 4. *V. texana*.
 4. Fruit dorsiventrally compressed, never strongly carinate, more than 1 mm. long (5)
 - 5(4). Fruits ellipsoid; fertile cell rounded on the dorsal side (6)
 5. Fruits ovoid; fertile cell flattened on the dorsal side (7)
 - 6(5). Corolla 2-3 mm. long, conspicuous above the bracts .5. *V. stenocarpa* var. *stenocarpa*.
 6. Corolla 1.5 mm. long, not conspicuous above the bracts .5. *V. stenocarpa* var. *parviflora*.
 - 7(5). Sterile cells of fruit more or less divergent with a prominent groove between them, their combined width slightly less than or wider than the fertile 6. *V. radiata* var. *radiata*.
 7. Sterile cells more approximate with only a slight groove between them, their combined width about half the width of the fertile 6. *V. radiata* var. *Fernaldii*.

1. *Valerianella Woodsiana* (T.&G.) Walp. Stem 1.5-5 dm. tall, rather stout, pubescent along the angles; leaves hairy on the margin and on the midrib on the lower surface; the lower spatulate, entire, slightly connate; the upper oblong-ovate with several coarse teeth near the base, not connate; bracts elliptic-lanceolate, acute to acuminate, glabrous, usually weakly glandularly fimbriate-serrulate toward the tip; inflorescence lax to somewhat compact, corymbosely cymose; corolla white, 1.5 mm. long, funnelform; tube much shorter than the limb, a saccate gibbosity at base of throat on the ventral side; stamens and style exerted; stigma lobes short; fruit yellowish, subglobose, about 2 mm. long, glabrous or finely pubescent; fertile cell often short-beaked, narrowly oblong to oblong-lanceolate, weakly one-nerved and flattened on the dorsal side, much narrower than the inflated widely divergent sterile cells which have a wide groove between them. In moist low sandy or clayey soils in woods and on prairies in e. Tex., Mar.-May; also e. Okla.

2. *Valerianella amarella* Krok. Stem 1.5-3 dm. tall, glabrous; leaves glabrous except for tufts of hairs on each side of the base near the nodes, the lower obovate-spatulate, entire, the upper oblong-obovate, sessile; bracts glabrous, ovate-lanceolate to elliptic-lanceolate, rounded to acute at the apex, usually hyaline-margined; inflorescence compact, corymbosely cymose; corolla white, funnelform, 1.5-3 mm. long; limb usually as long as the throat and tube combined, a saccate gibbosity at the base of the throat on the ventral side; stamens and style usually long-exserted, sometimes either stamens or style short and abortive; stigma lobes short; fruit 1.5-2 mm. long, subglobose, ovoid, brownish, hirsute with rather long uncinata white hairs; sterile cells much smaller than the large fertile cell, contiguous, groove between them narrow and very shallow or inconspicuous. On rocky calcareous open or wooded hills and in prairies, low grounds and barrens, mostly in cen. Tex., Mar.-May; also e. Kan. and Okla.

3. *Valerianella florifera* Shinnery. Stem 9-18 cm. tall, glabrous; leaves entire, glabrous or the lower slightly scabrous-ciliate, especially toward apex; lower leaves oblong to oblong-spatulate, sessile, upper oblong to oblong-lanceolate or narrowly deltoid-oblong, sessile; bracts lanceolate or elliptic-lanceolate, acute, glandular-denticulate or even lacerate, glabrous; inflorescence rather open, the glomerules few but many-flowered; corolla white, funnelform, the lobes 1.8-2 mm. long, throat 1.3-1.5 mm. long, with basal gibbosity, the tube (below gibbosity) 1.4-1.5 mm. long; stamens and style exerted; fruit narrowly ellipsoid, 1.7 mm. long, 0.6 mm. wide, rather sparsely pubescent with straight erect hairs; fertile cell somewhat flattened dorsally, with noticeable median line toward apex; sterile cells not diverging, their combined width barely equaling that of the fertile cell. In sandy moist soil in post oak woods in s.-cen. Tex., Mar.-May; endemic.

4. *Valerianella texana* Dyal. Stem 1-3 dm. tall, rather frail, pubescent on the angles; leaves hairy on the margin and upper surface, the lower spatulate, the upper oblong-ovate, sessile; bracts lanceolate, ciliate; inflorescence loosely and corymbosely cymose; corolla white, funnelform, 2-2.5 mm. long; tube slender, about as long as the limb; throat rather wide without a conspicuous gibbosity at its base; stamens and style exerted; stigma lobes short; fruit yellowish, laterally compressed, less than 1 mm. long, with four lines of short capitate hairs, 2 down the dorsal side of the fertile cell and one down the ventral side of each sterile cell; fertile cell narrowly oblong, produced at apex into a prominent tooth, much narrower than the combined width of the sterile cells which have a narrow deep groove between them with a prominent nerve down the middle of the groove. Moist stream banks in the vicinity of Kini Creek, Gillespie Co., spring; endemic.

5. *Valerianella stenocarpa* (Engelm.) Krok var. *stenocarpa*. Stem 1-5 dm. tall, pubescent on the angles; leaves ciliate, the lower spatulate with their bases connate, entire, the upper usually ovate with a few teeth on each side near the base; bracts lanceolate, glabrous or rarely weakly glandularly fimbriate-serrulate toward the tip; inflorescence loose, corymbosely cymose; corolla white, 2-3 mm. long, funnelform; tube short, less than one half the length of the limb, a saccate gibbosity at the base of the throat on the ventral side; stamens and style exerted; stigma lobes short; fruit yellowish, narrowly ellipsoid, 1.5-2.3 mm. long, more than twice as long as wide, glabrous or pubescent; fertile cell wider than the combined width of the sterile cells, rounded on the dorsal side, sometimes with a weak nerve down the middle; groove between the slender sterile cells narrow, rarely with a rather prominent nerve down the middle. Rocky ledges and low moist grounds, often along rivers, in cen. and e. Tex., Mar.-May, (?) endemic.

Var. *parviflora* Dyal. Corolla white, funnelform, 1.5 mm. long; fruit slightly smaller than in var. *stenocarpa*. Light soils, barrens, and prairies in e. and s.e. Tex., west to Calhoun, Bexar and Dallas cos., Mar.-May; also Mo. and Okla.

6. *Valerianella radiata* (L.) DuRoi. var. *radiata*. Stem 1.5-6 dm. tall, rather stout and pubescent along the angles; leaves hairy on the margins and on the midrib on the lower surface, the lower oblong-spatulate, connate, entire, the upper oblong-ovate, often coarsely toothed at the base, not connate; bracts lanceolate, the outer ones slightly ciliate, the inner glabrous; inflorescence loose, corymbosely cymose; corolla white, funnelform, 1.5-2 mm. long; tube shorter than the limb, a saccate gibbosity at the base of the throat on the ventral side; stamens and style exerted; stigma lobes short; fruit yellowish, ovoid, about 2 mm. long, glabrous or pubescent; fertile cells as broad as or broader than the combined width of the sterile cells; groove between the sterile cells narrow to rather wide and often rather deep, with a slight groove on each side between the fertile and sterile cells. Low moist grounds in cen. and e. Tex., spring; from Pa. to Kan., s. to Fla. and Tex.

Var. *Fernaldii* Dyal. Corolla slightly larger than in var. *radiata*; fruit more elongate, usually pubescent; fertile cell rounded on the dorsal side, much wider than the combined width of the slender sterile cells; groove between sterile cells slight or wanting. Low moist places in e. Tex.; from Conn. and Pa., s. to N.C., w. to Mo. and Tex.

FAM. 171. CUCURBITACEAE JUSS.

GOURD FAMILY

Plants herbaceous, annual or perennial; stems with tendrils, trailing or climbing; leaves alternate, petiolate, simple or compound; flowers mostly unisexual, with male and female

leaves ovate to ovate-reniform and cordate-based, 15-30 cm. wide, usually not lobed, the margins apiculate-dentate; flowers solitary, 5-10 cm. across, white, the staminate flowers on long peduncles and commonly surpassing the leaves, anthers only slightly coherent; fruit to 3 dm. long or more, varying from disk-shaped to nearly globular and bottle-shaped, dumbbell-shaped, club-shaped, crooknecked or coiled, with a hard usually greenish or tan but sometimes striped or mottled durable shell, occasionally knobby or ridged; seeds tan to brown, ridged on the margins and cornered, oblong to squarish. *L. vulgaris* Sér. Commonly cult. for ornament and for the use of its fruit as containers and decoration; probably Old World origin but cult. throughout the world, sometimes spontaneous in e. and s. Tex.

2. MOMORDICA L.

Annual or perennial vines with simple (in ours) or forked tendrils; leaves with entire, lobed or pedately dissected blades; male and female flowers on the same or separate vines; staminate flowers solitary or clustered, with a bracted peduncle, the calyx and corolla 5-lobed, usually with 3 stamens; pistillate flowers solitary, the staminodia gland-like or wanting; corolla rotate or bell-shaped; style slender, the stigmas 3; fruit ovoid to ellipsoid, warty or spiny-tuberculate.

About 45 species in the Old World tropics.

1. Bract entire, ovate, cordate at base, attached at the middle or base of peduncle; leaf blades with obtuse to subacute teeth 1. *M. Charantia*.
1. Bract serrate, attached at the apex of the peduncle . . . 2. *M. Balsamina*.

1. *Momordica Charantia* L. WILD BALSAM-APPLE. Plant annual; stem creeping or climbing, often greatly elongated, more or less pubescent; leaves with petioles 3-6 cm. long, thin, reniform to suborbicular in outline, to 12 cm. wide, 5- to 7-lobed, the lobes obtuse to abruptly acute, often somewhat serrulate, villous to glabrate; sepals oval to ovate-oval, to 4.5 mm. long; corolla yellow, the segments obtuse or emarginate, to 2 cm. long; fruit to 12 cm. long, golden-yellow, bursting at maturity; seeds elliptic, flat, 9-12 mm. long. Naturalized in thickets and waste places in s.e. Tex.; from Fla. to Tex., throughout trop. Am.

2. *Momordica Balsamina* L. BALSAM-APPLE. Glabrous monoecious annual; stems mostly high-climbig, much-branched; leaves with usually puberulent petiole, thin, broadly triangular-ovate to orbicular in outline, cordate at base, to 1 dm. wide, 3- to 5-lobed, with broad sinuses, the lobes with acuminate teeth; sepals elliptic, about 6 mm. long; corolla golden-yellow and dark or black at the center, about 25 mm. wide; fruit to 6 cm. long, orange-color; seeds oval to ovoid, 10-12 mm. long. Cult. and escaped to sandy soils in e. and s. Tex.; La. and Tex., throughout trop. Am.

3. LUFFA L. VEGETABLE-SPONGE

Several species in the Old World tropics.

1. *Luffa cylindrica* Roem. ESTROPAJO. Strong vine with slender angled stems, with branched tendrils; leaves deltoid to nearly orbicular in outline, pointed, 12-30 cm. long, 3- to 7-lobed, with the base closed or open, dentate, scabrous but not pubescent; male and female flowers on the same vine; flowers 5-10 cm. across, light-yellow; staminate flowers racemose; pistillate flowers solitary on a short or elongate peduncle; corolla deeply 5-lobed; anthers free, ovary with 3 placentae, the stigmas 3 and bilobed, ovules many; fruit nearly or quite cylindrical, 3-6 dm. long, straight or curved, usually with light furrows and stripes but not ribbed or angled, the smooth rind becoming dry and papery, the interior fibrous; seeds flat, smooth, margined, black or nearly so, about 12 mm. long. Commonly cult, but occasionally found as an escape in s. Tex.

The fibrous interior of the fruit has been and can be used as sponge.

4. CUCUMIS L.

Annuals or perennials trailing or climbing, mostly pubescent; tendrils simple; leaves entire or somewhat dissected; male and female flowers usually on the same vine; flowers

yellow, solitary or the staminate flowers sometimes 2 or more in an axil, usually short-stalked and hidden by foliage; corolla bell-shaped to rotate, deeply 5-parted; anthers free; ovary with 3 to 5 placentae and stigmas, many-ovuled, the styles short; fruit fleshy and usually indehiscent, globular to elongated, glabrous, pubescent or echinate.

About 25 species in warm temperate regions, mostly African.

1. Ovary and fruit smooth or at most roughened, not spiny or bristly 1. *C. Melo*.
1. Ovary and fruit provided with scattered short prickles or densely bristly (2)
- 2(1). Leaves deeply divided into 3 main lobes; fruit with scattered short prickles, on elongated crooked peduncles 2. *C. Anguria*.
2. Leaves unlobed; fruit burlike, on short straight peduncles 3. *C. dipsaceus*.

1. *Cucumis Melo* L. MUSKMELON. Trailing or somewhat climbing softly pubescent vine with striate or angled stems; leaves orbicular-ovate to subreniform, to 13 cm. wide, angled but usually not distinctly lobed, rounded at apex, the margins sinuate-dentate, pubescent and somewhat scabrous; flowers about 25 mm. across, the staminate flowers sometimes 2 or more in an axil, the corolla lobes obtuse; fruit various, mostly globular or ellipsoid, more or less furrowed, at first pubescent but soon smooth or only with slightly raised ribs, with musky fragrance, the flesh usually yellow or green; seeds numerous, white, slender, about 12 mm. long. Nat. of Asia; cult. for its edible flesh and sometimes spontaneous; May-Oct.

The Dudaim melon, var. *Dudaim* Naud., is sometimes found along fence-rows and invading cultivated fields where it becomes a pest. It is a small rampant vine with hairy-setose slender angled stems; leaves ovate-oblong and unlobed, to 15 cm. long but usually smaller; fruit broadly ellipsoid, golden-yellow, marbled with rich-brown, extremely odoriferous, to 8 cm. long and 6 cm. broad.

2. *Cucumis Anguria* L. BUR GHERKIN. Slender rough-hairy trailing vine, with angled stems and small tendrils; leaves to 9 cm. long, with 3 prominent main lobes, the sinuses rounded, the lateral lobes usually again somewhat lobed, sinuate-serrate, very scabrous; flowers about 13 mm. across, the staminate flowers sometimes larger, on slender peduncles; fruit oval or oblong, on crooked peduncles, about 5 cm. long, furrowed, prickly; seeds numerous, white, smooth, less than 5 mm. long. Rare in n.-cen. and s. Tex., Aug.-Sept.; also Fla. to S.A.; occasionally cult.

3. *Cucumis dipsaceus* Spach. HEDGEHOG-GOURD. Slender trailing vine with strongly setose angled stems; leaves broadly ovate to reniform-ovate, unlobed, cordate at base, to 12 cm. wide, sinuate-serrate, setose to scabrous; flowers small, the staminate flowers on long peduncles and to 2 cm. across; fruit a firm bristly ellipsoid bur to 65 mm. long; seeds numerous, flat, white, about 5 mm. long. A nat. of Arabia; escaped from cult. and well-established in open brushlands in s. Tex., May-Aug.

5. CITRULLUS SCHRAD.

Several species in Africa and Asia.

1. *Citrullus vulgaris* Schrad. WATERMELON, SANDÍA. Pubescent annual with long-running prostrate leafy stems; leaves ovate to ovate-oblong in outline, to 2 dm. long, cordate at base, pinnately deeply divided into 3 or 4 pairs of lobes and these again lobed and toothed, the segments broad at the apex; tendrils 2- or 3-forked; peduncles much shorter than the leaves; male and female flowers on the same vine; flowers small, solitary in the axils; corolla about 4 cm. across, rotate, the 5 lobes obovate and obtuse; fruit globular or oblong, sometimes to 6 dm. or more long, glabrous, with a green or variously striped hard but not durable rind and sweet juicy red, yellow or greenish flesh; seeds numerous, black, white or reddish, flat, smooth, to 15 mm. long. A nat. of trop. and warm temp. Afr.; cult. for its edible flesh and sometimes spontaneous; May-Oct.

The citron or preserving melon, var. *citroides* Bailey, characterized by having a usually mottled rind and hard, white flesh (inedible until cooked) and tan or greenish seeds, occurs locally abundant in sandy soils in several localities, especially in e. and s. Tex.

6. CUCURBITA L.

Annual or perennial, with long-running prostrate or climbing stems that bear branched tendrils and entire or lobed leaves, usually rather coarse and hairy, often scabrous; male and female flowers usually on same vine; flowers solitary in axils, rather large, the staminate flowers long-peduncled; corolla yellow, lobed to about or above the middle; anthers united; ovary 1-celled, with 3 to 5 placentae, the 3 to 5 stigmas bilobed; fruit smooth, indehiscent, fleshy, mostly with a hard rind; seeds usually numerous, ovate to oblong-ovate, flat, white to tawny or black.

About 15 species confined to America.

1. Leaves typically triangular in shape, longer than broad, entire or only slightly angled, thick, grayish, scabrous 1. *C. foetidissima*.
1. Leaves typically ovate to subreniform in shape, usually about as broad as long, at least some distinctly lobed, thin, green, not noticeably scabrous
..... 2. *C. texana*.

1. *Cucurbita foetidissima* H.B.K. BUFFALO-GOURD, CALABACILLA LOCA. Plant rank-growing and rampant, with a frequently huge fusiform perennial root producing numerous widely running stems to 6 m. or more long; leaves coarse and thick, triangular-ovate, at most shallowly angulate-lobed, broadly rounded to cordate at base, acute to acuminate at apex, to at least 3 dm. long, nauseously ill-smelling (especially when bruised), commonly grayish-green, rough to the touch; corolla to 1 dm. long, flaring above the middle; fruit mostly globose, green with lighter stripes, lemon-yellow when ripe, to 75 mm. in diameter. *C. perennis* (James) Gray. In sandy or gravelly soils in waste places, especially along roadsides, primarily in the w. half of Tex., Apr.-July; from Mo. and Neb., s. to Tex., Ariz., s. Calif. and Mex.

2. *Cucurbita texana* Gray. TEXAS GOURD. Plant annual, producing slender long-running and climbing leafy stems with abundant tendrils; leaves broadly ovate to subreniform in outline, angled to distinctly lobed, pubescent, the margins sharp-serrate, to about 15 cm. long, nearly as wide as long; calyx lobes short and slender; corolla yellow, usually with prominent somewhat greenish veins, to about 7 cm. long, flaring above, the lobes acute and cuspidate; fruit obovoid, hard-shelled, green and usually with light-green stripes, to 9 cm. long and 6 cm. broad, the flesh bitter and inedible. *C. Pepo* of auth. In debris and piles of driftwood, often climbing into trees, along several rivers, especially the Guadalupe, that drains the Edwards Plateau in cen. Tex., rare but abundant where found, July-Oct.; endemic.

7. APODANTHERA ARN.

About 15 species in warm temperate regions of America.

1. *Apodanthera undulata* Gray. MELON-LOCO. Plant with wide-spreading somewhat scarious leafy prostrate branches (to 3 m. long) from a thick perennial root to 2 dm. thick; leaves with petioles 3 cm. or more long, reniform, to 15 cm. wide, strigose, sparsely dentate and very shallowly lobed or only with undulate-cripsed margins, cinereous on lower surface; the short simple or sparsely branched tendrils in pairs; male and female flowers on the same vine; staminate flowers racemose or corymbose from the lower axils; pistillate flowers solitary in the upper axils; calyx tube subcylindric; corolla lobes almost distinct, yellow, elliptic-oblongate, to about 4 cm. long and equal to the calyx tube; stamens 3; anthers distinct, sessile, one anther 1-celled, two anthers 2-celled; fruit oval, longitudinally ridged, hard-shelled, 6-10 cm. long; seeds numerous, suborbicular, light-brown, about 1 cm. in diameter. On gravelly terraces and dunes and in sandy soil among shrubs in the Trans-Pecos, May-Sept.; from w. Tex. to s. Ariz. and Mex.

8. MELOTHRIA L. MELONETTE

About 10 species in the warmer regions of the New World.

1. *Melothria pendula* L. MELONCITO. Slender climbing vine from a perennial root; leaves more or less orbicular in outline, with a cordate base, subentire to 5-angled or -lobed, more or less scabrous; tendrils simple; male and female flowers on the same vine;

flowers small, yellow or somewhat greenish, the staminate flowers racemose or corymbose, the pistillate flowers solitary or clustered; corolla rotate to campanulate, deeply 5-parted; filaments free or barely coherent; ovary contracted beneath the corolla, with 3 placentae and many horizontal ovules, the style short and with 3 stigmas; fruit ovoid to subglobose or ellipsoid, green or yellowish, becoming blackish, 1-2 cm. long. Incl. var. *chlorocarpa* (Engelm.) Cogn., *M. chlorocarpa* Engelm. In sandy and moist rich soils, climbing on shrubs and small trees, near the coast and in s. Tex., Mar.-Oct.; from Fla., w. to Tex. and Mex., n. to Va., s. Ind., s. Mo. and Okla.

The seeds are reputed to be purgative.

9. IBERVILLEA GREENE GLOBE-BERRY

Climbing glabrous herbs from a thickened napiform perennial rootstock; leaves reniform to broadly ovate in outline, pedately 3- to 5-parted with the divisions mostly lobulate or coarsely toothed; male and female flowers on separate vines; flowers greenish-yellow, the pistillate flowers solitary, the staminate flowers racemose to fascicled or sometimes solitary, the narrowly campanulate or cylindrical calyx tube with 5 short lobes; petals 5, oblong or linear; stamens 3, inserted in tube; stigma 3-lobed; ovary with 2 or 3 placentae; fruit globose; seeds swollen.

A small perplexing American genus in need of a thorough study.

1. Distribution west Texas; fruits less than 2 cm. in diameter; leaf blades deeply and completely dissected into linear lobes or segments mostly less than 5 mm. wide 1. *I. tenuisecta*.
1. Distribution east of the Trans-Pecos; fruits 2 cm. or more in diameter; leaf blades scarcely lobed to variously dissected, the segments mostly 10 mm. or more wide (2)
- 2(1). Calyx tube of staminate flowers cylindric, 6-8 mm. long; lobes of the leaf blades broadly cuneate or rhombic-ovate 2. *I. Lindheimeri*.
2. Calyx tube of staminate flowers campanulate, about 4 mm. long; the leaf blades usually irregularly and often narrowly lobed 3. *I. tripartita*.

1. *Ibervillea tenuisecta* (Gray) Small. Stem slender and branched; leaves to 6 cm. wide, with petioles to 2 cm. long, deeply 5-parted with the linear to filiform divisions lobulate or coarsely toothed; staminate flowers tubular, to 8 mm. long; fruit bright-red when ripe, about 15 mm. in diameter; seeds 5-6 mm. long. *Sicydium Lindheimeri* var. *tenuisectum* Gray, *Maximowiczia tripartita* var. *tenuisecta* (Gray) Wats. On rocky hills and along draws, climbing on shrubs, in w. Tex., June-Aug.; from w. Tex. to s.e. Ariz. and n. Mex.

2. *Ibervillea Lindheimeri* (Gray) Greene. Stems slender, branched; leaves to 12 cm. wide, with petioles to 35 mm. long, rough to the touch, mostly deeply 3-lobed but sometimes 5-lobed or essentially unlobed, the divisions 1 cm. or more wide and cuneate to flabellate or rhombic-ovate, toothed to lobulate; staminate flowers tubular, 5 to 8 in a raceme, somewhat glandular-puberulent, 6-8 mm. long, about 2 mm. thick; fruit 25-35 mm. in diameter, orange-color to bright-red when ripe; seeds about 6 mm. long. *Sicydium Lindheimeri* Gray, *Maximowiczia Lindheimeri* (Gray) Cogn. Usually in open dry woodlands or thickets, among brush, in fence rows and sometimes in open rocky soil, centered in s.-cen. Tex., Apr.-July; also s. Okla.

This species, in the broadest interpretation, may include *I. tripartita*.

3. *Ibervillea tripartita* (Naud.) Greene. Similar to *I. Lindheimeri* but with more narrowly lobed leaves and shorter campanulate staminate flowers. *Sicydium tripartitum* Naud., *S. tenellum* Naud., *Maximowiczia tripartita* (Naud.) Cogn., *M. tripartita* var. *tenella* (Naud.) Cogn., *Ibervillea tenella* (Naud.) Small. Usually in sandy soil, mostly in s. Tex. but extending n. to the lower Plains Country, Apr.-Oct.; endemic.

10. CAYAPONIA S. MANSO

About 50 species mainly in tropical and subtropical America.

1. *Cayaponia quinqueloba* (Raf.) Shinners. Climbing herbaceous vine from a perennial rhizome; stem slender, finely pubescent; leaves long-petiolate, thickish, cordate at

base, 5-10 cm. long, less than 1 dm. wide, 3-angled or -lobed, sparingly pubescent beneath, the petioles bristly-villous; tendrils simple or branched; male and female flowers on same vine; flowers rather large, in racemes or panicles; calyx campanulate, 5-cleft; corolla rotate or subcampanulate, greenish-white, 5-parted; *staminate flowers* 5-6 mm. across, with 3 distinct stamens, the anther sacs flexuous, the rudimentary ovary 3-lobed; *pistillate flowers* often with 3 rudimentary stamens; ovary 3-celled, with 1 or 2 ascending ovules in each cell; style 3-cleft, the stigmas dilated; fruit reddish, ovoid to ellipsoid, somewhat fleshy, 12-14 mm. long; seeds 6-8 mm. long and 2 mm. thick. *C. Boykinii* (T. & G.) Cogn. In river bottomlands and along streams in e.-cen. Tex., June-Aug.; from Ga. to Tex.

11. ECHINOPEPON NAUD.

WILD BALSAM-APPLE

A small American genus.

1. *Echinopepon Wrightii* (Gray) Wats. Climbing annual with forked tendrils, more or less pubescent throughout; leaves reniform, broadly cordate at base, shallowly lobed or angular, scarcely denticulate, to about 15 cm. wide; male and female flowers on same vine; flowers 5-merous, the staminate flowers in long racemes or panicles, the pistillate flowers solitary; calyx absent on staminate flowers; corolla rotate, 6-8 mm. wide, the lobes triangular-ovate and glandular; fruit obovoid, rostrate, to 35 mm. long, less than 15 mm. in diameter, opening by apical pores, spiny with the prickles to 15 mm. long and hirsute, 3-celled. *Echinocystis Wrightii* (Gray) Cogn. Climbing on shrubs in extreme w. Trans-Pecos, June-Oct.; from w. Tex., s. N.M., Ariz. and n. Mex.

12. ECHINOCYSTIS T.&G.

WILD MOCK-CUCUMBER

A monotypic genus in North America, as interpreted here.

1. *Echinocystis lobata* (Michx.) T.&G. High-climbing annual, essentially glabrous throughout; tendrils forked; leaves suborbicular-ovate in outline, to 12 cm. long and wide, usually with 5 sharply triangular serrulate cuspidate lobes; flowers 5- or 6-merous, greenish or white, the staminate flowers in long racemes or panicles, the short-peduncled pistillate flowers solitary or in small clusters and from the same axils as the staminate flowers; corolla rotate, about 1 cm. wide, the lobes narrowly lanceolate and acuminate; stamens 3, united by their filaments into a column, the nearly straight anthers connivent; ovary 2-celled, with 2 erect ovules in each cell; style with a broad-lobed stigma; fruit ovoid, 3-5 cm. long, to 25 mm. in diameter, bladderly-inflated, somewhat beaked at summit and with weak glabrous prickles to about 6 mm. long, bursting somewhat irregularly at the summit; seeds flat, dark. In moist soil in thickets of the Trans-Pecos, Aug.-Sept.; N.B. to Sask., s. to Fla. and w. to Tex. and Ariz.; escaped from cult. and sporadic in w. U.S.

13. CYCLANTHERA SCHRAD.

About 15 species in warm temperate and tropical regions of America.

1. *Cyclanthera dissecta* (T.&G.) Arn. Annual, glabrous, with slender climbing stems to 3 m. long or more, climbing over trees and shrubs; tendrils simple to trifid; leaves 3- to 7-foliolate, the elliptic-lanceolate divisions somewhat lobed or toothed and to about 6 cm. long; leaves and leaflets stalked; flowers of both sexes from the same axils, to 7 mm. across, white; staminate flowers in racemes or panicles; pistillate flowers solitary; corolla rotate, deeply 5-parted; stamens united into a central column and with solitary annular anthers; ovary 1- to 3-celled, with few erect or ascending ovules; fruit dryish, 2-3 cm. long, on peduncles 1-2 cm. long, narrowly ovoid, somewhat asymmetric, rostrate, armed with long slender smooth spines, bursting irregularly; seeds ovoid. Among boulders and in rocky soil mainly in cen. and s. Tex., rare in w. and n.w. Tex., May-Oct.; from Kan. to La., Tex., s. Ariz. and Mex.

4. *Sicyos parviflorus* Willd. Plants with slender striate stems to 6 m. long; leaves with a villous petiole to 15 cm. long, broadly ovate in outline, cordate at base, palmately 5-angled or lightly 5-lobed, the margin nearly entire to remotely denticulate, to 12 cm. long and wide, scabrous; calyx tube campanulate, about 1 mm. wide; corolla lobes about 1 mm. long; fruit ovoid, 5-6 mm. long and 4-5 mm. thick, tuberculate, shortly and densely villous. In canyons of mts. in the Trans-Pecos, summer-fall; from Tex. to s. Ariz. and Mex.

5. *Sicyos glaber* Woot. Plants with slender striate stems to 6 m. long; leaves with petioles to 5 cm. long, triangular-ovate in outline, to 8 cm. long and about as broad, cordate at base, 5-lobed or -angled, the lobes triangular-ovate and with coarsely sinuate-denticulate margins, scabrous; calyx teeth very small or wanting; corolla broadly campanulate, 4-6 mm. wide, the lobes ovate; fruit ovoid, grayish-green, slightly compressed, about 6 mm. long and 3.5 mm. thick, entirely glabrous. In canyons of mts. in the Trans-Pecos, Aug.-Oct.; also N.M.

15. COCCINEA WIGHT & ARN.

About 30 species, natives of the Old World.

1. *Coccinea cordifolia* (L.) Cogn. Ivy' courd. Perennial vines; stem glabrous, climbing; tendrils simple; leaves with slender petioles about half the length of the blade, ovate to orbicular in outline, 3- to 5-lobed, to 1 dm. long, cordate at base, broadly obtuse-apiculate at apex; male and female flowers on separate vines; pistillate flowers solitary, with 3 staminodia; sepals thick, subulate or linear-subulate, 3-4 mm. long, reflexed; corolla white, campanulate, 3-4 cm. wide, strongly veined; berry ellipsoid to obovoid, smooth, scarlet, 4-5 cm. long; seeds numerous. Along the coast in extreme s. Tex., Oct.-Nov.; a nat. of Asia that has become established in various parts of trop. and warm-temp. Am.

FAM. 172. CAMPANULACEAE JUSS.¹⁹⁰ BLUEBELL FAMILY

Perennial, biennial or annual herbs, mostly terrestrial but occasionally aquatic or epiphytic; leaves exstipulate, simple or very rarely dissected, alternate and usually spirally arranged; flowers usually perfect and 5-merous except the gynoeceium that consists of 2 to 5 united carpels possessing a common style with usually distinct stigmatic tips; ovary inferior, 2- to 5-celled or rarely unicellular; placentation axile or parietal in species with unicellular ovaries; calyx usually 5-parted to the summit of the ovary or its tubular portion forming a rim above the ovary, the lobes alternate with the corolla lobes and opposite the stamens; corolla gamopetalous at least at base, usually 5-parted or -lobed, only exceptionally with apparently free segments; corolla and stamens inserted around the periphery of the calyx tube at the summit of the rim; stamens as many as the corolla lobes and alternate with them, epipetalous; seeds mostly small and numerous, with fleshy endosperm.

About 2,000 species in 65 genera of world-wide distribution.

1. Flowers minute, sessile in dense leafless terminal spikes less than 1 cm. in diameter; corolla white, about 2.5 mm. long; stamens inserted about the middle of the corolla tube, distinct; capsule circumscissile 1. *Sphenoclea*, p. 1515.
1. Flowers rather large, pedicellate or (if sessile or essentially so) in spikes with foliaceous bracts; corolla typically more than 5 mm. long, red or of various shades of blue and purple to dull-white (or clear-white in albino forms); stamens inserted at the base of the corolla and free from it, distinct or united; capsule loculicidally dehiscent (2)

¹⁹⁰ Adapted from Rogers McVaugh in C. L. Lundell, *Flora of Texas* III:331-366. 1951.

- 2(1). Flowers bilaterally symmetrical; corolla strongly irregular, two-lipped, the tube cleft nearly to the base on one side; stamens united into a tube; capsule opening by apical valves; inflorescence indeterminate, racemose or spicate 4. *Lobelia*, p. 1518.
2. Flowers radially symmetrical; corolla regular, rotate or campanulate; stamens distinct; capsule opening on the sides by outwardly curled elastic valves or by longitudinal slits; inflorescence determinate but mixed, the lower flowers on any branch opening before the upper ones except the terminal one (3)
- 3(2). Inflorescence loosely branched, at least the terminal flowers of the main axes solitary and long-peduncled at the ends of the branches; cleistogamous flowers none, all the campanulate corollas normally open and expanded; capsule obconic or turbinate to subglobose 2. *Campanula*, p. 1515.
3. Inflorescence narrowly spiciform in the upper part, at least the upper and terminal flowers sessile; lower flowers usually cleistogamous, with vestigial rotate corolla and stamens; capsule slender-cylindric or -prismatic 3. *Triodanis*, p. 1516.

1. SPHENOCLEA GAERTN.

A monotypic genus of the Old World tropics; segregated by some authors as a distinct family, Sphenocleaceae.

1. *Sphenoclea zeylanica* Gaertn. CHICKEN SPIKE. Coarse glabrous branched annual herb to 10 dm. high or more, with fistulose stems; leaves entire, with a petiole to 2 cm. long, elliptic, somewhat pale on lower surface, to 12 cm. long and 5 cm. wide; spikes erect, dense, cylindric, naked, tapering at tip, to 8 cm. long and 9 mm. in diameter, on peduncles to 1 dm. long; floral bracts spatulate, 2-3 mm. long, about 1 mm. wide; flowers small, sessile, 5-merous; calyx lobes imbricate in bud, triangular to suborbicular, arose at the rounded scarious apex, to 2 mm. wide at base, deciduous with capsule; corolla white, about 2.5 mm. long, the lobes triangular and obtuse, deciduous with stamens after anthesis; stamens alternating with the corolla lobes, inserted below middle of tube; anthers roundish, appearing peltate; ovary wholly inferior; capsule bilocular, circumscissile; seeds ellipsoid, about 0.5 mm. long. In wet places of lowlands and flats, especially rice fields, in e. and s. Tex., Aug.-Nov.; an Old World species that has been introd. in warm regions of the W. Hemis.

2. CAMPANULA L. BELLFLOWER

Perennial or sometimes biennial or annual herbs of various habit; radical leaves often larger and more obtusely pointed with longer petioles than the cauline ones; calyx 5-fid, the sinuses often with reflexed appendages; corolla usually blue or purplish-blue, varying to white in the same species, 5-lobed at apex or 5-parted but usually not parted below the middle, typically campanulate but varying to rotate; stamens 5, distinct; filaments expanded and membranaceous at base; anthers linear; ovary 3- to 5-celled, opening by as many valves as there are cells, the valves varying in position from very base to near apex of capsule.

About 300 species widely distributed in the Northern Hemisphere.

1. Perennial with upright mostly simple stems; flowers and fruits nodding; confined to the Guadalupe Mts. in the Trans-Pecos 1. *C. rotundifolia*.
1. Annual with divaricately branched stems; flowers and fruits erect; endemic in the granite region of the Edwards Plateau 2. *C. Reverchonii*.

1. *Campanula rotundifolia* L. BLUEBELL, HAREBELL. Plant perennial, to about 1 m. high, usually much smaller, the rootstocks slender and elongated; stems erect or decumbent, scabrous, simple to freely branched; leaves often in rosettelike clusters at or near base, long-petioled, round-cordate to elliptic or oblanceolate, to 5 cm. long and wide, mostly toothed, early-withering; cauline leaves numerous, linear to narrowly lanceolate,

smooth, to 1 dm. long and 3 mm. wide; flowers as many as 15 in a lax raceme; calyx lobes narrowly triangular to linear-subulate, usually entire, with sharp slender tips, erect to spreading or reflexed in fruit, to 1 cm. long and 2 mm. wide; corolla violet-blue, mostly 12-25 mm. long, the tube 7-15 mm. long; corolla lobes ovate-oblong, abruptly pointed at tips, 5-8 mm. wide; filaments 2.5-4.5 mm. long, abruptly dilated and ciliate on the basal portion; anthers 4-6 mm. long; capsule pendent, obovoid to ellipsoid or subglobose, prominently ribbed, 4-8 mm. long, 2-4 mm. in diameter. Rocky wooded areas in canyons of mts. in the Trans-Pecos, June-Oct.; across the n.-cen. portion of N.A., s. in the mts. to Tex., and n. Mex.

Throughout its wide area of distribution this species is highly variable, but with us it is rather constant.

2. *Campanula Reverchonii* Gray. BASIN BELLFLOWER. Plant annual, hirsutulous below, glabrous above, to about 3 dm. high; stem erect, slender, cymosely and effusively much-branched, angular, usually scabrous on the angles; leaves sparingly dentate, to about 15 mm. long and 5 mm. wide, the radical ones spatulate, the cauline leaves lanceolate, those of the upper branches almost filiform and entire; flowers and fruits erect on almost capillary elongate peduncles; calyx lobes narrowly triangular to linear-subulate, glabrous, 2-4.5 mm. long, blunt-pointed with the tips slightly thickened; corolla light-blue, narrowly funnellform, 9-13 mm. long, the tube 4-7 mm. long, the ovate-lanceolate lobes shorter than the tube and 6-8 mm. wide; filaments 1.3-1.5 mm. long, the proximal third dilated and ciliate; anthers 1.6-2.3 mm. long; capsule ellipsoid or obovoid, 3.5-6 mm. long, glabrous, crowned with the erect calyx lobes, opening above the middle. On granite rocks and soils in the Llano region on the Edwards Plateau, May-July; endemic.

3. TRIODANIS RAF. VENUS' LOOKING-GLASS

Low annuals with axillary blue or purplish flowers, the earlier flowers small and cleistogamous; calyx 3- to 5-lobed; corolla of perfect flowers rotate, 5-lobed; cleistogamous and greatly reduced flowers often in the lower axils; stamens 5, separate; the membranaceous hairy-based filaments shorter than the anthers; stigmas 3; capsule prismatic or slender-cylindric to subulate, 1- to 3-celled, at maturity capped by the calyx lobes; pores of the capsule equal in number to the cells, borne laterally, usually opening from base toward apex by the curling outward of an indurated cartilaginous process; seeds numerous, brownish.

About a dozen species native to Europe, the Mediterranean region and North America and South America. Many authors unite this genus with *Specularia* Fabr.

1. Foliage leaves usually strigose or hispidulous on the upper surface; calyx lobes 5, mostly more than 1 cm. long; capsule 3-celled in all flowers, linear-oblong to clavate, opening from apex toward base 1. *T. coloradoensis*.
1. Foliage leaves glabrous on the upper surface; calyx lobes 3 in cleistogamous flowers or (if 5) commonly not all uniform, usually much less than 1 cm. long; capsule mostly 2-celled in cleistogamous flowers and 3-celled in open ones, opening from base toward apex (2)
 - 2(1). Floral bracts lanceolate to linear, 5 to 8 times as long as wide; capsule of cleistogamous flowers terete, subulate, curved and with more or less spreading tips, 8 mm. or more long, dehiscent by 1 pore or longitudinal slit at apex 7. *T. leptocarpa*.
 2. Floral bracts ovate or broader, rarely as much as 3 times as long as wide; capsule of cleistogamous flowers terete or flattened, oblong to ellipsoid or ovoid, straight and more or less appressed, mostly less than 8 mm. long, dehiscent by 2 or 3 pores on the sides or at the summit (3)
 - 3(2). Openings of the capsule linear, 0.2-0.4 mm. wide, the elastic cartilage covering most of the pores, provided with very narrow scarious margins; pores located between base and apex of capsule 6. *T. Holzingeri*.
 3. Openings of the capsule broadly elliptic to oval or rounded, 0.5-1.5 mm. wide, the narrow cartilage with broad scarious margins; pores located about midway between base and apex or near apex of capsule (4)

- 4(3). Pores at or very near the apex of the capsule; seeds highly polished (5)
 4. Pores at about the middle of the capsule; seeds mostly roughened and dullish (6)
- 5(4). Floral bracts usually longer than broad, mostly less than 1 cm. wide; seeds 0.5-0.6 mm. long2. *T. biflora*.
 5. Floral bracts often broader than long, usually more than 1 cm. wide; seeds 0.8-1 mm. long4. *T. lamprosperma*.
- 6(4). Seeds plumply lenticular, muriculate or smooth and lustrous
3. *T. perfoliata*.
 6. Seeds more or less quadrangular, the surface roughened with low anastomosing longitudinal ridges5. *T. texana*.

1. *Triodanis coloradoensis* (Buckl.) McVaugh. Stem erect, to 1 m. high, usually much smaller, simple or with ascending branches, retrorsely scabrous or hispid on angles near base, glabrous above; leaves and bracts hispid or scabrous on veins beneath, ciliate; upper and middle leaves sessile, oblanceolate to elliptic, somewhat toothed, to 7 cm. long and 15 mm. wide, the lower leaves broader and with a short petiole; bracts sessile, lanceolate, attenuate to the callose-glandular tip, to 4 cm. long and 5 mm. wide; flowers in a loosely spiciform arrangement, sessile, 1 to several at the upper axils, the lowest sometimes cleistogamous; calyx lobes lanceolate, with slender subulate tips, loosely spreading in fruit, scabrous-ciliate on the margins, to 17 mm. long and 1.8 mm. wide; expanded corolla blue with a violet tinge, white in the tube, 9-18 mm. long, the tube 2-5 mm. long, the lobes 3.5-8 mm. wide; capsule linear-oblong to clavate, scabrous-papillose at least near base, to 23 mm. long, deeply sulcate between the cells; pores opening from apex toward the base, broadly elliptic or rounded; seeds smooth, lustrous, more or less flattened, 0.8-1 mm. long. *Specularia coloradoensis* (Buckl.) Small, *S. Lindheimeri* Vatke. On dry rocky hillsides and bluffs, among shrubs, limestone ledges, gravel bars and floodplains, and in rich woods on the Edwards Plateau, Apr.-June; endemic.

2. *Triodanis biflora* (R. & P.) Greene. Stems simple or branching chiefly from below, erect or reclining, to 8 dm. high, more or less hirsute below with pale flaccid hairs; leaves and bracts hispid to completely glabrous beneath; leaves ovate to oblong, not clasping, to 3 cm. long and 12 mm. wide; bracts ovate, broader than leaves, sharply acute at apex, sessile or slightly clasping; cleistogamous flowers at most nodes; expanded flower terminal or wanting, its anthers 1.5-2.5 mm. long; capsule ellipsoid to obovoid or ovoid, to 9 mm. long and 2 mm. in diameter, its oval or nearly circular pores apical or subapical; seeds smooth and lustrous, biconvex, 0.5-0.6 mm. long. *Specularia biflora* (R. & P.) Fisch. & Mey. In fields, forests and prairies, on dry hills, river banks and in canyons, in most of Tex., Apr.-June; from Va. to Kan., Ariz., Tex. and n. Mex., w. to Ore. and Baja Calif.

3. *Triodanis perfoliata* (L.) Nieuw. Stem pilose or hispid below, retrorse-hispidulous or scabrous above, simple to loosely ascending-branched, to 1 m. high; leaves and bracts roundish to ovate, clasping by the cordate base, to 25 mm. broad, hirsute or the bracts glabrous, toothed; flowers 1 to several at a node, those at lower nodes cleistogamous and rarely 5 mm. long, those at upper nodes expanded and about 1 cm. long, with anthers 2.5-3.5 mm. long; capsule ellipsoid to obovoid, 4-10 mm. long, the 2 or 3 broadly elliptic to roundish pores 0.5-1.5 mm. broad and borne about midway up the capsule; seeds plump-lenticular, ellipsoid, 0.5-0.6 mm. long, smooth or variously pebbled, somewhat shining. *Specularia perfoliata* (L.) DC. Rather ubiquitous but mostly as a weed in disturbed areas, common in the e. two thirds of Tex., Apr.-July; from Fla. to Tex. and n. Mex., n. to N.E., s. Que., w. to Mont. and B.C.

4. *Triodanis lamprosperma* McVaugh. Stem pilose to scabrous below, retrorsely scabrous to entirely glabrous above, to 85 cm. high; leaves and bracts firm, scabrous or hispid beneath, finely and densely ciliate; leaves sessile or short-petioled, oval or obovate, to 12 mm. wide; bracts sessile and clasping, ovate to reniform, to 25 mm. wide; cleistogamous flowers at the lower and median nodes, the expanded flowers rather large; capsule obovoid to oblong, 4-7 mm. long (in the cleistogamous flowers), 7-10 mm. long (in the expanded flowers), in the expanded flowers often sulcate and the pores somewhat sunken;

pores of capsule subapical; seeds highly lustrous, biconvex or slightly flattened on the sides, 0.8-1 mm. long. *Specularia lamprosperma* (McVaugh) Fern. In rocky openings, glades or thin woods in n.e. Tex., May-June; also Mo., Ark. and Okla.

5. *Triodanis texana* McVaugh. Stem slender, erect or reclining at base, to 75 cm. high, usually much less, hirsute below; leaves sessile or attenuate at base, ovate to elliptic or obovate, rounded to obtuse at apex, hirtellous to hirsute, ciliate, crenate, to 4 cm. long and 15 mm. wide; bracts broader than leaves, ovate, sessile or somewhat clasping, obtuse to sharply acute; flowers 1 to 3 at the axils; expanded corollas lavender-purple, glabrous, 7-14 mm. long, the tube 1.5-4 mm. long, the lobes 2-5 mm. wide; capsule ellipsoid to ovoid or truncate and clavate, 4-7 mm. long; pores oval, at about the middle of the capsule; seeds lustrous, 0.4-0.6 mm. long, more or less quadrangular with usually concave or flat sides and obtuse angles, the surface roughened with low narrow anastomosing ridges in longitudinal rows. *Specularia texana* (McVaugh) Fern. In woodlands and plains, on open banks and in depressions, mostly in sandy soils, in e. Tex., Apr.-May; endemic.

6. *Triodanis Holzingeri* McVaugh. Stem erect, slender, to 85 cm. high, simple or with few branches, hispid or hirsute at base, hispid or merely scabrous above; leaves and bracts scabrous beneath or the bracts essentially glabrous; leaves sessile or the lower with attenuate bases, ovate to elliptic or obovate, undulate-cripsed and crenate, to 3 cm. long and 13 mm. wide; bracts broader than leaves, ovate, sessile and somewhat clasping, acute; flowers 1 to 3 in the axils; expanded corolla lavender-purple, the tube 1-2.5 mm. long, the lobes 2-5 mm. wide; capsule ellipsoid or oblong to obovoid and truncate, often strongly angled, to 12 mm. long, often deeply sulcate between the cells; pores sunken, linear, about the middle of the capsule, 1.4-2.5 mm. long, 0.2-0.5 mm. wide, the cartilage essentially filling the entire width of the pore; seeds lustrous, lenticular, 0.4-0.7 mm. long, minutely low-tuberculate in longitudinal lines. *Specularia Holzingeri* (McVaugh) Fern. In open prairies and plains, roadsides, pastures, river bottoms and canyons, in sandy or gravelly soils, in cen., s. and s.w. Tex., Apr.-July; from Wyo. to Mo. and Tex., also Tenn. and Ariz.

7. *Triodanis leptocarpa* (Nutt.) Nieuw. Minutely hirsute to scabrous or glabrous plants, to 75 cm. high; leaves sessile, narrowly elliptic to oblanceolate, inconspicuously callose-toothed or shallowly crenate, to 35 mm. long and 8 mm. wide; bracts lanceolate to linear, to 25 mm. long and 6 mm. wide; upper nodes with expanded or cleistogamous flowers, lower nodes with cleistogamous flowers only; calyx lobes subulate, falcate or divergent; capsules very variable; capsules of the cleistogamous flowers terete, often subulate, outwardly arching and with straight or spiraling summits, or straight and appressed, 8-20 mm. long, opening by longitudinal slits or by a pore at apex; capsules from expanded flowers straighter, erect, to 25 mm. long; seeds smooth, lustrous, lenticular, 0.7-1 mm. long. *Specularia leptocarpa* (Nutt.) Gray. Prairies, barrens, glades, rocky open slopes and ridges in e.-cen. Tex., Apr.-Aug.; from Ind. and Minn. to Mont., s. to Ark., Okla., Tex. and Mo.

4. LOBELIA L. LOBELIA

Perennial, biennial or annual herbs; leaves mostly of a lanceolate type; flowers axillary or chiefly in bracted racemes, usually inverted before anthesis, the pedicel twisted; calyx 5-cleft, regular, parted to the summit of the ovary or the calyx tube extending a little above the ovary; corolla variously colored, with relatively narrow tube and spreading lobes, the tube usually cleft nearly to base between the 2 lobes of the upper lip, the 3 lobes of the lower lip often somewhat united, broad and conspicuous; stamens 5, usually free from the corolla; filaments free at base, united distally into a tube; anthers united into a tube, the orifice of the tube usually partly closed by the incurved tips of the 3 longer anthers, the shorter anthers usually stiff-bearded at apex; corolla, stamens and style withering-persistent on the fruit; capsule 2-celled, many-seeded, opening by apical loculicidal valves, splitting at apex and the 2 halves recurved laterally.

A genus of perhaps 300 species, represented in the floras of all the continents and on many oceanic islands; about 80 species in North America.

- 1. Flowers bright-red; corolla 35-40 mm. long or more; filaments 20 mm. long or more; pedicels with a pair of green or yellowish glandular bracteoles near base; seeds very rough (2)
- 1. Flowers blue, lavender, purple or white; corolla mostly not over 25 mm. long; filaments 15 mm. long or less; pedicels and seeds various (5)
- 2(1). Filament tube 24-33 (usually 28-30) mm. long; anther tube 4-5.5 mm. long; leaves usually coarsely and irregularly toothed, the blades 3 to 5 times as long as wide; eastern Texas 10. *L. Cardinalis* var.
Cardinalis.
- 2. Filament tube 19-25 (rarely 30) mm. long; anther tube mostly 3.5-4.5 mm. long; leaves entire to coarsely toothed, the blades often 6 to 12 times as long as wide; western Texas (3)
- 3(2). Inflorescence appearing pedunculate, usually short, of 20 flowers or fewer, not leafy-bracted; cauline leaves mostly 8 to 12 times as long as wide, linear to linear-lanceolate; plants nearly glabrous; in the Trans-Pecos 10. *L. Cardinalis* var.
pseudosplendens.
- 3. Plants leafy up to the inflorescence, the latter not appearing pedunculate, usually many-flowered, often leafy-bracted; cauline leaves mostly 6 to 8 times as long as wide, lanceolate to oblong or ovate (4)
- 4(3). Plants densely short-pubescent throughout; leaves subtire to somewhat toothed; in the Trans-Pecos 10. *L. Cardinalis* var.
multiflora.
- 4. Plants glabrous or sparsely pubescent; leaves usually prominently toothed; chiefly west of the 100th meridian and east of the Pecos River 10. *L. Cardinalis* var.
phyllostachya.
- 5(1). Filaments 12-15 mm. long; pedicels with a pair of gland-tipped bracteoles at or above the middle; calyx lobes often 5-6 mm. wide, with leafy auricles 2-5 mm. long at base; seeds very rough; northeastern Texas .. 9. *L. siphilitica.*
- 5. Filaments 9 (rarely to 11) mm. long or less; pedicels, calyx and seeds various (6)
- 6(5). Filaments more than 5 mm. long; corolla tube 7 (rarely 6.5) mm. long or more; seeds rough (7)
- 6. Filaments less than 5 mm. long; corolla tube 6 mm. long or less; seeds rough or smooth (10)
- 7(6). Corolla short-pilose within at base of lower lip, the tube not (or very rarely) fenestrate laterally; plants totally glabrous or puberulent in the inflorescence (8)
- 7. Corolla glabrous within at base of lower lip, the tube fenestrate laterally near base; plants rather densely and uniformly pubescent or (in exceptional forms) nearly glabrous in the inflorescence (9)
- 8(7). Leaves all basal or with a few small ones above the base; pedicels with minute inconspicuous bracteoles at base 5. *L. floridana.*
- 8. Leaves mostly cauline, well-distributed along the stem; pedicels bibracteolate well above base (usually about the middle or a little below), the bracteoles often 1 mm. long or more, often green and denticulate 6. *L. flaccidifolia.*
- 9(7). Filaments mostly 6-7 mm. long; plants puberulent to glabrate or short-hirsute; flowers numerous, usually about 1 cm. apart; calyx lobes narrowly triangular-lanceolate, not densely pilose at base 8. *L. puberula.*
- 9. Filaments 8-11 mm. long; plants long-hirsute (especially the hypanthium); flowers few and distant; calyx lobes broadly ovate-cordate at base and abruptly tapered above, with a dense tuft of hair at the base 7. *L. Reverchonii.*
- 10(6). Corolla tube evidently fenestrate laterally; seeds smooth, polished; annual or biennial with a stout taproot and coarsely serrate leaves; in the Trans-Pecos 2. *L. fenestralis.*
- 10. Corolla tube not fenestrate laterally; seeds rough or smooth; annuals with the leaves entire to irregularly dentate (11)

- 11(10). Seeds smooth, polished; calyx lobes without any auricles at base; southern and southwestern Texas (12)
11. Seeds rough, cellular-reticulate; calyx lobes usually with at least some vestige of triangular or foliaceous auricles at base; eastern Texas (13)
- 12(11). Calyx lobes ciliate; leaves mostly cauline; pedicels nearly upright, 4-10 mm. long in fruit 1. *L. Berlandieri* var. *brachypoda*.
12. Calyx lobes glabrous; leaves mostly in basal rosette; pedicels often incurved, at least 10-12 mm. long in fruit 1. *L. Berlandieri* var. *Berlandieri*.
- 13(11). Calyx lobes usually ciliate; auricles broad, flat, membranaceous, scarious-tipped, usually ciliate, usually drying blue or purplish, to 5 mm. long but sometimes almost wanting; corolla pubescent within at base of lower lip; stems glabrous or chaffy-hirtellous on the angles near base; middle cauline leaves sessile or clasping, ovate to oblong 3. *L. appendiculata*.
13. Calyx lobes glabrous or ciliate near tips; auricles short and triangular or filiform, glabrous, never flat and membranaceous; stems more or less generally short-puberulent near base; middle cauline leaves narrowed to base, lanceolate to oblong 4. *L. spicata*.

1. *Lobelia Berlandieri* A.DC. Annual to about 6 dm. high; stems erect to decumbent, simple or with as many as 20 ascending branches, glabrous to sparsely pubescent near base; leaves without or with a marginal petiole to 25 mm. long, often near the base or in a basal rosette but also cauline, thin, broadly ovate to elliptic or lanceolate, to 5 cm. long and 35 mm. wide, rounded to cuneate at base, rounded to obtuse at apex, glabrous to ciliate near base, the margins subentire to coarsely and irregularly toothed; inflorescence to about 25 cm. long; pedicels to 2 cm. long in fruit, glabrous or slightly bristly, nearly upright or usually incurved above the middle, with a pair of tiny bracteoles at base; bracts linear to linear-subulate, 3-9 mm. long, glabrous or ciliate; flowers 1-1.3 cm. long; calyx lobes linear-subulate, entire, glabrous to sparsely ciliate, 1.5-3.5 mm. long; corolla pale- or bright-purplish-blue with a white eye, glabrous or hairy within at the summit of the tube; filament tube 2.5-3.5 mm. long; anther tube 1-1.5 mm. long, light-bluish-gray; capsules ellipsoid, 3-6 mm. long. In sandy, rocky or clay soils in fields, moist areas and along streams, spring-summer.

The var. *Berlandieri* occurs in the Rio Grande Plains of south Texas and south into Mexico. The var. *brachypoda* (Gray) McVaugh, with leaves mostly cauline, occurs in the Edwards Plateau and Trans-Pecos.

2. *Lobelia fenestralis* Cav. LEAFY LOBELIA. Annual or biennial from a taproot, to 14 dm. high; stems erect, leafy, simple or with several ascending branches, glabrous or sparsely pubescent on the angles; leaves sessile or somewhat clasping at base, lanceolate to oblong or oblanceolate, acute at apex, coarsely and sharply serrate, glabrous or somewhat pubescent, to 7 cm. long and 12 mm. wide; inflorescence spicate, about 25 cm. long; pedicels to about 5 mm. long, mostly concealed by the lanceolate bracts; flowers 12-14 mm. long; calyx lobes lanceolate to linear-subulate, often toothed, ciliate or smooth, 2.5-6.5 mm. long; corolla blue with a white eye, the tube 5-6 mm. long and long-fenestrate; filament tube 1.5-2.3 mm. long; anther tube 1.5-2 mm. long, dark-bluish-gray or blackish; capsules 3-8 mm. long. Moist grassy or gravelly areas in mts. of the Trans-Pecos, July-Oct.; also mts. of Mex.

3. *Lobelia appendiculata* A.DC. Annual or biennial; stem erect, to 9 dm. high, simple or with few upright axillary branches, glabrous except for sparse chaffy basal hairs; cauline leaves very thin, sessile or with broad to clasping bases, oblong to ovate, obtuse to acute at apex, essentially glabrous, to 8 cm. long and 3 cm. wide; raceme 1-sided, to 3 dm. long; pedicels 4-8 mm. long, puberulent, with a pair of bracteoles near base; bracts linear to narrowly lanceolate, callous-denticulate, exceeding the pedicels; flowers 1-1.5 cm. long; calyx long-campanulate in fruit, subinflated, its linear-lanceolate lobes bristly-ciliate, its conspicuous flat lanceolate auricles 1-3 mm. long, the auricles drying blue or purplish; corolla lilac or violet, pubescent at base of lip inside, the tube 4-5 mm. long; filament tube 2-4 mm. long; anther tube 2-2.5 mm. long, bluish-gray; capsule partially exerted, horizontal or nodding. In sandy open ground, often in moist places,

in prairies, pinelands and old fields in e. Tex., Apr.-June; from Ala. to Tex., Ark., Okla., Mo. and Ill.

4. *Lobelia spicata* Lam. **BALESPIKE LOBELIA, HIGHBELIA.** Stem strict, erect, simple or with few branches, to about 11 dm. high, densely short-pubescent at base, smooth above; lower leaves oblanceolate to obovate or oblong, with short margined petioles, strigose; middle and upper leaves sessile, lanceolate; with narrow decurrent bases; raceme virgate, slender, dense, to 6 dm. long, with smooth bracts; pedicels to 8 mm. long in fruit, puberulent, inconspicuously bracted at base; flowers 9-12 mm. long; calyx lobes subulate to linear-lanceolate, 3-6 mm. long, usually with 2 shortly triangular or filiform basal auricles; corolla light-blue to white, the lower lip pubescent at base within, the tube 3-4.5 mm. long; filament tube 2-4 mm. long; anther tube 1.7-2 mm. long, pale-bluish-gray; capsules short-hemispherical, partly exserted. In prairies, pastures and open woodlands, often in rich soils among herbs and grasses, in s.e. Tex., May-Aug.; from e. Can. to Minn., s. to Ark., Okla. and Tex.

5. *Lobelia floridana* Chapm. Stem erect, to 15 dm. high, simple or with several stout upright or spreading branches, glabrous; basal leaves oblanceolate to lanceolate, acute to obtuse at apex, tapered into a margined petiole, to 4 dm. long and 25 mm. wide, usually much smaller, entire to crenate or dentate with callose teeth; cauline leaves much smaller and narrower; raceme to 5 dm. long, loosely or densely flowered; pedicels stout, 3-6 mm. long in fruit, rough, with a pair of minute bracteoles at base; bracts linear, glabrous, shorter than the pedicels; flowers 1.3-2 cm. long; calyx lobes broadly lanceolate to deltoid, 2-6 mm. long, acute, glabrous, the triangular auricles very small; corolla pale-purplish to nearly white, pubescent without, the lower lip densely hirsute at base within, the tube 8-9 mm. long; filament tube 6-11 mm. long, strongly deflexed; anther tube about 3 mm. long, light-bluish-gray; capsule 5-7 mm. long. In savannahs in s.e. Tex., Apr.-Aug.; from N.C. to Fla., w. to e. Tex.

6. *Lobelia flaccidifolia* Small. Annual to about 1 m. high; stems erect, simple or with few ascending branches; leaves essentially sessile or the lower ones short-petiolate, thin, lanceolate to oblong or oblanceolate, to 11 cm. long and 15 mm. wide, often rather abruptly narrowed at base, rounded to acute at apex, the margins subentire to inconspicuously crenate or serrate; inflorescence racemose, to 3 dm. long; pedicels rough, slender, curved, 4-11 mm. long in fruit, with a pair of bracteoles near or below the middle; bracts linear, denticulate, glabrous or puberulent, about equaling the pedicels; flowers 14-22 mm. long; calyx lobes narrowly sagittate, 3-7 mm. long, acute or attenuate at apex, glabrous or puberulent, often glandular-toothed, the reflexed auricles rounded and about 1.5 mm. long or less; corolla lavender or bluish-lavender to nearly white, with a white eye, pubescent or glabrous, the tube 6.5-8.5 mm. long; filament tube lavender, 5-8 mm. long; anther tube 2-3 mm. long, bluish-gray; capsule 4-6 mm. in diameter. In low moist pinelands, savannahs and prairies, wet places along streams and in river swamps in s.e. Tex., Apr.-Aug.; from Fla. and Ga. in the Coastal Plain to Tex.

7. *Lobelia Reverchonii* B. L. Turner. Stems to 1 m. high, conspicuously pilose with white spreading hairs to 1.5 mm. long; leaf blade typically linear to linear-oblanceolate, prominently toothed, to 14 cm. long and 15 mm. wide, mostly 7 to 10 times as long as wide; flowers 2-2.7 cm. long, usually 10 or fewer, rarely as many as 15, the lower ones 2.5-5 cm. apart; calyx lobes ovate to ovate-lanceolate, deeply cordate with rounded basal lobes, 3-5 mm. wide, with a tuft of hairs at base; hypanthium and pedicels densely pilose with long white or brownish hairs; corolla tube 9-15 mm. long; lower corolla lobes recurved, with 2 white lenslike markings following the venation between the lobes; filament tube 8-11 mm. long; anther tube 3-4 mm. long, grayish-blue. *Lobelia puberula* var. *pauciflora* Bush. In bogs in e. Tex., autumn; e. to Ala.

8. *Lobelia puberula* Michx. **DOWNY LOBELIA, PURPLE DEWDROP.** Plant densely short-hirsute or puberulent throughout, rarely glabrate, mostly to 16 (rarely to 27) dm. high; stem usually simple; leaves oblong to lanceolate or narrowly obovate, sessile or tapering to base, obtuse to acute at apex, with callous-tipped teeth or subentire, to 12 cm. long and 4 cm. wide, the upper ones passing gradually into the floral bracts; raceme dense or somewhat interrupted below, to 5 dm. long, commonly 1-sided, with as many as 75 flowers, the distance between the lower flowers at most 25 mm.; pedicels stout, 3-5 mm. long in fruit, the bracteoles basal or nearly so; bracts usually lanceolate, to 25 mm. long and 8 mm. wide; flower 15-24 mm. long; pedicels and base of calyx lobes glabrous to

thinly pubescent; calyx lobes lanceolate to narrowly deltoid-acuminate, with revolute margins, to 15 mm. long and 4 mm. wide, the auricles small; corolla blue to purple or rarely whitish, pubescent, the tube 5-8 mm. long, the lower lobes not recurved, with a white eye extending across the venation; filament tube 6-7 mm. long; anther tube 3-3.5 mm. long, light-bluish-gray; capsule 4-7 mm. long. In swamps, wet woods, bogs, prairies and open fields, usually in wet places, often in strongly acid soils in partial shade, in e. Tex., Aug.-Dec.; in s.e. U.S., w. to Okla. and Tex.

9. *Lobelia siphilitica* L. BIG BLUE LOBELIA, GREAT LOBELIA, BLUE CARDINAL FLOWER, LOUISIANA LOBELIA. Perennial by basal offshoots, to 13 dm. high; stem simple, coarse, smooth or sparsely hirsute on the angles; leaves thin, ovate to oblong or broadly lanceolate, irregularly serrate, acute at both ends, strigose above, to 18 cm. long and 6 cm. wide, the upper merging into the floral bracts; raceme dense, to 5 dm. long, scarcely secund; pedicels 5-10 mm. long, with median bracteoles; bracts lanceolate, 1-2 cm. long; flowers 23-33 mm. long; calyx hirsute, with broad foliaceous lobes to 14 mm. long and broad basal auricles 2-5 mm. long; corolla blue, white-striped in throat, the tube 11-15 mm. long, fenestrate, base of lower lip white and with 2 tubercles; filament tube 12-15 mm. long; anther tube 4-5.5 mm. long, bluish-gray; capsule 8-10 mm. long, partly exserted. In moist woods and swampy places, low places in prairies, sandy or gravelly margins of ponds and streams, and wet meadows in n.-cen. Tex., late summer; from Me. to Minn., Man. and Colo., s. to Tex.

Our plants are referred to the var. *ludoviciana* A.DC. They are characterized by being glabrous or nearly so, the leaves are mostly 15 mm. wide or less, and the flowers are often fewer than 20.

10. *Lobelia Cardinalis* L. CARDINAL FLOWER. Perennial by short basal offshoots, smoothish, to 2 m. high; stem simple, erect, coarse, glabrous or pubescent; leaves numerous, thin, glabrous or hirtellous, ovate to lanceolate, irregularly serrate; raceme terminal, simple, to 5 dm. long, somewhat 1-sided; pedicels bristly-puberulent, much shorter than the leafy bracts, bibracteolate near base; bracts linear or broader; flowers 3-5 cm. long; calyx lobes foliaceous, ovate to broadly lanceolate, to 14 mm. long and 6 mm. wide, undulate or crisped, ciliate and serrate; corolla vermilion or deep-red, the fenestrate tube 1.5-2 cm. long; filament tube 24-33 mm. long, long-exserted; anther tube 4-5.5 mm. long, bluish-gray; capsule 8-10 mm. long. In wet or moist soil, open places along streams, in meadows and along roadsides, about springs and ponds, in swamps where shade is not too dense, throughout Tex., except the s. tip, May-Dec.; from Fla., n. to n.e. N.B., s. Que., S. Ont., Mich., Wisc. and Minn., w. to Nev., Calif. and Mex.

The subsp. *graminea* (Lam.) McVaugh is represented in Texas by three varieties of which two, var. *multiflora* (Paxt.) McVaugh and var. *pseudosplendens* McVaugh, occur in the Trans-Pecos region only. The remaining one, var. *phyllostachya* (Engelm.) McVaugh, is the prevailing cardinal flower across the central part of the state. Although the distinguishing characteristics of each are given in the key, many intermediate forms occur, and it is often not possible to assign individual plants definitely to any one variety; often only the extreme forms are recognizable.

FAM. 173. GOODENIACEAE R. BR.

GOODENIA FAMILY

Herbaceous or woody plants; leaves alternate or rarely opposite, simple, exstipulate; flowers perfect, irregular; calyx tubular, adnate to the ovary, with 5 partially united lobes or rarely obsolete; corolla of 5 equally or unequally united petals; stamens 5, alternate with corolla lobes, free or rarely slightly adnate to base of corolla; anthers 2-celled, opening longitudinally; ovary mostly inferior, 1- to 4-celled; style 1; stigma surrounded by an indusium; fruit drupaceous, baccate or capsular; seeds small, flat.

Several hundred species in about 14 genera, mainly Australian.

1. SCAEVOLA L.

Characters of the family. About 60 species, mainly Australian.

1. *Scaevola Plumieri* (L.) Vahl. Succulent shrub to 15 dm. tall, usually much smaller; stem spreading under sand to form large colonies; leaves obovate to oblanceolate or

broadly spatulate, subpetiolate, rounded at apex, glabrous, to 1 dm. long and 45 mm. wide above the middle; flowers few in pedunculate cymes that arise in axils of leaves; calyx lobes short, broadly rounded; corolla white or pinkish, 2-3 cm. long, woolly within, the lobes linear to lanceolate and subacute; corolla tube open to the base on one side, the lobes winged, with few slender processes on inner surface; style to 15 mm. long, somewhat twisted-sinuous; stigma with a ciliate cup-shaped indusium; fruit broadly oval to globular, 1-1.5 cm. long, black, juicy. Very rare if not extinct, coastal dunes of Padre Island, fall; Fla., Tex., Mex., W.I. and trop. Am.

FAM. 174. COMPOSITAE GISEKE SUNFLOWER FAMILY

Herbs, vines or shrubs; leaves alternate or opposite, exstipulate; flowers borne in dense involucrate heads (the number of flowers in the head occasionally as few as 1 or 2); axis and/or receptacle of the head usually thicker than its stem (peduncle), globose, cylindrical, conical, convex, flat or concave, near its base usually invested with 1 or more series of persistent or deciduous bracts ("phyllaries") which partly enclose the head as it develops (when 2 or more series of phyllaries are present, only the innermost subtend flowers; any similar bracteal structures subtending the inner flowers of the head are called pales), the receptacle either smooth or usually rough or pitted and in many genera chaffy, i.e. with persistent or deciduous pales subtending some or all of the flowers (note that bracteal structures subtending the most peripheral flowers are called phyllaries); flowers small, epigynous, protandrous, uni- or bisexual, fertile (producing a viable fruit) or infertile; calyx absent or represented by a pappus (a series of scales and/or bristles) at the tip of the achene near the base of the corolla if a corolla is present; corolla sympetalous (composed of 4 or 5 coalescent petals), rarely absent, quite diverse but usually taking one of the following forms or types: (a) more or less radially symmetrical with a basal tube and a more or less well-differentiated thicker (4- or) 5-toothed or -lobed limb; flowers with such corollas are usually bisexual and are called disk flowers because they form the central part ("disk") of the heads of the vast majority of the Compositae; (b) bilaterally symmetrical, with a short basal tube and a flat beltlike or straplike usually 3-toothed or -lobed ray-portion ("ray" is often used to mean the entire corolla); flowers with this kind of corolla are pistillate, lack stamens, and are called ray flowers because when present they are peripheral in the head, the rays projecting outward as extensions of the radiuses of the head, similar to spokes of a wheel; (c) bilaterally symmetrical and more or less 2-lipped, with 2 teeth and lobes on the ventral lip (the lip toward the center of the head) and 3 lobes or teeth on the dorsal; such flowers are usually bisexual and are found exclusively in the tribe Mutisieae (genera 136-139), which displays no other sort; (d) bilaterally symmetrical, with a basal tube or funnel and a flat beltlike or straplike 5-toothed ray-portion ("ray" is often used to mean the entire corolla); flowers of this kind are usually bisexual and are found exclusively in the tribe Cichorieae (genera 140-159), to the exclusion of other sorts of flowers; androecium of (4 or) 5 stamens, alternate with the corolla lobes or teeth; filaments separate, adnate to the lower part of the corolla limb and tube but free for part of the length above (lightly coalescent to each other in *Ambrosia*, *Xanthium*, *Iva* and *Hymenoclea*); anthers flat, elongate, 2-celled, coalescent to form a short tube around the style (loosely coherent or nearly free in *Ambrosia*, *Xanthium*, *Iva*, *Hymenoclea* and *Kuhnia*); pistil solitary, composed of 2 carpels (1 being abortive), the ovary inferior, uniloculate; style columnar and usually exerted late in anthesis, usually 2-branched, the branches often arcuate-diverging, usually each slightly dorsiventrally flattened and often with linear stigmatic areas (stigmatic lines) along proximal parts of the 2 thinner edges, and near the stigmatic lines often with a variously rough or hairy portion and occasionally distally from this an appendage (meaning that portion of the style branch, if any, distal to the stigmatic line); fruit an achene, either columnar or prismatic or conical or often flattened or compressed (the flattening or compression said to be "lateral" when the plane of the achene is radial and includes the axis of the head; "dorsiventral" when the plane of the achene is perpendicular to a plane passing through the axis of the head, and in a dorsiventrally compressed achene the side toward the center of the head is said to be "ventral", that toward the periphery of the head "dorsal"); ovule solitary, basally attached, anatropous; integument solitary.

This is the largest family of vascular plants and is the largest one in Texas, also. Not

only does it include the largest number of Texas taxa of any Texas family, but it probably competes with Gramineae for the highest number of individuals growing in the state each season.

KEY TO TEXAS TRIBES OF THE COMPOSITAE

1. Corollas all of type "d" described above XI. *Cichorieae*, p. 1534.
1. Corollas not of type "d" (2)
 - 2(1). Corollas all of type "c" described above (nearly regular in *Gochnatia*) X. *Mutisieae*, p. 1534.
 2. Corollas not of type "c" (3)
 - 3(2). Anthers with elongated cartilaginous mostly connate appendages at the tip and caudate-appendaged basally; receptacle hairy-bristly or naked IX. *Cynareae*, p. 1533.
 3. Plants not with combination of characters given above, occasionally with caudate anthers or with hairy receptacle but not both (4)
 - 4(3). Anthers caudate-appendaged basally (i.e., with slender tail-like appendages hanging from the thecae between the filaments); ray flowers (type "b" corollas) absent IV. *Inuleae*, p. 1528.
 4. Anthers not caudate-appendaged basally (in some genera such as in Tribe Vernonieae the anthers narrowly sagittate basally and simulating caudation); rays often present (5)
 - 5(4). Corollas all of type "a" described above, usually white, red or purple or blue, never yellow (see also *Marshallia*); stigmatic lines obscure, present (if at all) only below the middle of the style branch (6)
 5. Corollas either of type "a" or some of type "b", often yellow; stigmatic lines otherwise than above (7)
 - 6(5). Style branches long, slender, terete, threadlike, minutely hairy all over; leaves alternate, scattered or basal I. *Vernonieae*, p. 1525.
 6. Style branches thickened upward or clavate, obtuse, very minutely and uniformly pubescent or nearly glabrous; leaves opposite, whorled or alternate II. *Eupatorieae*, p. 1525.
 - 7(5). Style branches of the perfect flowers flattened and smooth, extended into lanceolate or elongate-deltoid hairy appendages; those flowers with type "a" corollas mostly yellow; receptacle essentially naked (except in *Xanthisma*) III. *Astereae*, p. 1525.
 7. Style branches of the flowers with type "a" corollas not appendaged or with a very short or slender appendage, or else the type "a" corolla not yellow (8)
 - 8(7). Pappus of soft very fine (capillary) bristles; involucre herbaceous, little or not at all imbricated (i.e., phyllaries equal in length); receptacle naked (except in *Bartlettia*); stem leaves when present mostly alternate VIII. *Senecioneae*, p. 1533.
 8. Pappus absent or of scales and/or awns and/or bristles (but when of bristles these not extremely fine and soft); involucre diverse; receptacle naked or not; lowermost stem leaves often opposite (9)
 - 9(8). Phyllaries mostly scarious or papery; pappus absent; style branch tips truncate; leaves alternate VII. *Anthemideae*, p. 1533.
 9. Phyllaries or at least some of them mostly herbaceous or membranous (occasionally with hyaline marginal zones) (10)
 - 10(9). Receptacle chaffy (merely with awns or bristles in *Eclipta*) V. *Heliantheae*, p. 1528.
 10. Receptacle naked or merely with persistent awns VI. *Helenieae*, p. 1531.

I. KEY TO TEXAS GENERA OF VERNONIEAE

1. Pappus of numerous coarse bristles 1. *Vernonia*, p. 1535.
 1. Pappus of 5 or 10 stiff awns which are basally dilated and indurated
 2. *Elephantopus*, p. 1538.

II. KEY TO TEXAS GENERA OF EUPATORIEAE

1. Achenes with 10 to 20 (rarely 6 to 9) ribs; phyllaries indefinite in number (2)
 1. Achenes normally with 5 (rarely 4 or 6) ribs or angles, prismatic or subprismatic,
 rarely compressed; phyllaries definite or indefinite in number (5)
 2(1). Pappus of scales, dilated basally; small shrubs with opposite leaves; young plants
 without rosettes; corolla rose-colored or white 3. *Carpochaete*, p. 1538.
 2. Pappus of bristles (3)
 3(2). Phyllaries not conspicuously striate; leaves alternate; corolla rose-colored to
 purple, rarely white; barbules of pappus indefinitely arranged along the axis
 4. *Liatris*, p. 1539.
 3. Phyllaries thin, striate, scarcely herbaceous; leaves alternate or opposite; corolla
 ochroleucous to yellow, rarely rose-colored; barbules of pappus bristles tending to
 be aligned vertically (4)
 4(3). Phyllaries imbricate in several series; shrubs and perennial herbs
 5. *Brickellia*, p. 1544.
 4. Phyllaries 2- to 3-striate; perennial herbs from long conical roots
 6. *Kuhnia*, p. 1547.
 5(1). Pappus a low irregular crown of connate scales 0.3 mm. long or less, or essentially
 absent (6)
 5. Pappus much longer than 0.3 mm., usually of awns or bristles (7)
 6(5). Pappus a low irregular crown of connate scales 0.3 mm. long
 7. *Ageratum*, p. 1549.
 6. Pappus essentially absent or of a very few minute fimbriate scales
 8. *Trichocoronis*, p. 1549.
 7(5). Pappus of a basal ring to which are attached 10 plumose bristles, the whole pappus
 deciduous as a unit 9. *Carminatia*, p. 1549.
 7. Pappus usually persistent, at least in part of separate nonplumose units (8)
 8(7). Pappus of 1 to 3 stiff awns (these absent in some flowers on the head in some
 species) 10. *Stevia*, p. 1550.
 8. Pappus of slender bristles (9)
 9(8). Phyllaries uniformly 4 per head 11. *Mikania*, p. 1551.
 9. Phyllaries more than 4 per head 12. *Eupatorium*, p. 1551.

III. KEY TO TEXAS GENERA OF ASTEREAEE

1. Heads unisexual; male and female heads on separate plants
 13. *Baccharis*, p. 1558.
 1. Flowers (at least disk flowers) perfect (2)
 2(1). Rays white, pink, violet or purplish, never yellow (see also *Ericameria austro-*
texana with pale-yellow rays) (3)
 2. Rays yellow, sometimes pale-yellow, or absent (25)
 3(2). Pappus of disk flowers absent or reduced to a mere vestige or paleaceous crown
 less than 0.5 mm. long (4)
 3. Disk flowers with a manifest nonvestigial pappus (8)

- 4(3). Receptacle flat or slightly convex 35. *Chaetopappa*, p. 1601.
4. Receptacle hemispherical, conical or beehive-shaped (5)
- 5(4). Achenes with true ribs extending from base to summit (6)
5. Achenes lacking true ribs, at most with incomplete superficial ridges (7)
- 6(5). Phyllaries 0.8-1.6 mm. broad; upper herbage densely viscid-pubescent with glandular-capitate hairs 42. *Egletes*, p. 1611.
6. Phyllaries 0.4-1.1 mm. broad; upper herbage pubescence not viscid nor glandular ..
..... 36. *Erigeron*, p. 1603.
- 7(5). Achenes columnar to quadrate or terete, truncate or cupped apically
..... 43. *Aphanostephus*, p. 1612.
7. Achenes slightly laterally compressed, shortly narrowed apically
..... 40. *Astranthium*, p. 1610.
- 8(3). Receptacle conical or hemispherical to beehive-shaped (9)
8. Receptacle flat to slightly convex (11)
- 9(8). Achenes with true ribs extending from base to summit, not winged
..... 36. *Erigeron*, p. 1603.
9. Achenes lacking true ribs but winged (10)
- 10(9). Perennial herbs 20-100 cm. tall; phyllaries in about 3 series, slightly imbricated
..... 38. *Boltonia*, p. 1609.
10. Taprooted annual 4-24 cm. tall; phyllaries in 2 series, equal
..... 41. *Dichaetophora*, p. 1611.
- 11(8). Pappus of disk flowers of numerous capillary bristles (12)
11. Pappus of disk flowers at least partly of scalelike members, if bristlelike then these
not capillary but relatively coarse and basally dorsiventrally flattened (23)
- 12(11). Pappus bristles manifestly in 2 series (13)
12. Pappus bristles in a single series or nearly so (15)
- 13(12). Leaves linear or slightly oblance-linear, about 3 cm. long, crowded over most of
the stem but in the lowest part of the stem reduced to mere scales
..... 33. *Ionactis*, p. 1600.
13. Foliage not as above (14)
- 14(13). Achenes with 2 definite ribs 36. *Erigeron*, p. 1603.
14. Achenes either unribbed or with several very weak ribs
..... 32. *Doellingeria*, p. 1600.
- 15(12). Phyllaries in 1 or 2 series (16)
15. Phyllaries in 3 to many series (17)
- 16(15). Tubular portion of ray corolla shorter than the remainder
..... 36. *Erigeron*, p. 1603.
16. Tubular portion of ray corolla longer than the remainder
..... 37. *Conyza*, p. 1607.
- 17(15). Pappus of ray flowers absent 28. *Machaeranthera*,
p. 1579.
17. Pappus present in ray flowers (18)
- 18(17). Base of plant distinctly woody 28. *Machaeranthera*,
p. 1579.
18. Base of plant not woody (19)
- 19(18). Taprooted annuals (20)
19. Rhizomatous or stoloniferous perennials (21)
- 20(19). Leaves deeply serrate or pinnatifid 28. *Machaeranthera*,
p. 1579.
20. Leaves or most of them entire 30. *Aster*, p. 1593.

- 21(19). Ericoid depressed plants about 10-15 cm. tall, the rhizomes placed well below ground level; pappus bristles definite in number (usually 25) 34. *Leucelene*, p. 1600.
21. Plants usually taller, the rhizomes nearer the ground surface; pappus bristles indefinite in number, numerous (22)
- 22(21). Rays more than 1 cm. long; involucre 1-2 cm. broad, about 1 cm. high; head-bearing portion of plant spiciform or subracemiform . 31. *Heleastrum*, p. 1599.
22. Rays usually shorter; involucre usually smaller; head-bearing portion of plant more diffuse and irregular 30. *Aster*, p. 1593.
- 23(11). Pappus of a single series of subulate broad (dorsiventrally flattened) basally scalelike unequal bristles 39. *Townsendia*, p. 1609.
23. Pappus double, the outer of scales, the inner of capillary bristles (or the latter rarely absent) (24)
- 24(23). Achene with 2 definite true ribs; pappus of about 10 bristles and 10 minute scales 36. *Erigeron*, p. 1603.
24. Achene not having 2 true ribs; pappus of fewer members 35. *Chaetopappa*, p. 1601.
- 25(2). Receptacle with a chaff of long subulate persistent scales 17. *Xanthisma*, p. 1569.
25. Receptacle not chaffy (26)
- 26(25). Pappus in both ray and disk flowers reduced to a microscopic ring or essentially absent; tube of ray corolla longer than the flat portion, the whole corolla usually not equaling the disk corollas; straggly shrubs 20. *Gymnosperma*, p. 1573.
26. Pappus either not reduced or if reduced in one kind of flower then plant not as above (27)
- 27(26). Pappus (at least that of disk flowers) caducous (28)
27. Pappus not caducous (or occasionally so in some ray flowers) (29)
- 28(27). Pappus of 2 to 10 awns which vary from slender to stout or even sometimes are scalelike 18. *Grindelia*, p. 1570.
28. Pappus of large number of coarse somewhat unequal bristles 19. *Prionopsis*, p. 1572.
- 29(27). Ray flowers absent (except in some populations of *Chrysothamnus*) (30)
29. Ray flowers present (34)
- 30(29). Pappus of 10 scales 21. *Thurovia*, p. 1573.
30. Pappus of bristles (31)
- 31(30). Perennial herbs with rigidly erect wiry almost naked stems; leaves crowded near the base 24. *Bigelowia*, p. 1576.
31. Shrubs with leafy twigs (32)
- 32(31). Corolla with a short basal tube which is sharply demarked from the abruptly flaring throat of the limb 27. *Isocoma*, p. 1578.
32. Corolla gradually ampliate, the tube and limb rather poorly delimited (33)
- 33(32). Phyllaries in well-marked vertical files; the 5 lobes of the disk corolla subequal 25. *Chrysothamnus*, p. 1576.
33. Phyllaries not in vertical files; the 5 lobes of the disk corolla unequal 26. *Ericameria*, p. 1577.
- 34(29). Pappus solely of short or elongate scales, with no bristlelike members either in ray or disk 22. *Xanthocephalum*, p. 1573.
34. Pappus with at least some bristlelike members (35)

- 35(34). Disk flowers infertile, with a pappus of 1 or 2 slender bristles or awns, quite different from the pappus of the fertile ray flowers .. 15. *Bradburia*, p. 1563.
35. Disk flowers fertile, with pappus often more similar to that of the ray flowers (36)
- 36(35). Leaf blades bristly-serrate, pinnatifid or pinnately parted 28. *Machaeranthera*,
p. 1579.
36. Leaf blades entire or merely toothed (37)
- 37(36). Pappus double in the disk flowers, the outer series much shorter than the inner 16. *Heterotheca*, p. 1563.
37. Disk pappus not differentiated into 2 distinct series (38)
- 38(37). Taprooted annuals with bristly stiff pubescence .. 14. *Croptilon*, p. 1562.
38. Perennials, not bristly (39)
- 39(38). Taprooted shrubs (some plants of *Chrysothamnus* may key down here also) ... 26. *Ericameria*, p. 1577.
39. Rhizomatous perennial herbs (40)
- 40(39). Stems strictly erect, topped by flat or roughly corymbiform aggregations of stems and heads, the heads 4-6 mm. high including the flowers 23. *Euthamia*, p. 1575.
40. Plants not corymbiform or if somewhat corymbiform the heads larger 29. *Solidago*, p. 1585.

IV. KEY TO TEXAS GENERA OF INULEAE

1. Heads unisexual; male and female heads on separate plants 48. *Antennaria*, p. 1617.
1. Heads bisexual (2)
- 2(1). Receptacle chaffy either nearly throughout or in a peripheral zone (3)
2. Receptacle not chaffy (occasionally with a few hairlike emergencies) (4)
- 3(2). Flowers nearly all fertile, the most peripheral achenes somewhat enfolded by the subtending pales and falling with them 45. *Stylocline*, p. 1614.
3. Central flowers usually infertile; peripheral achenes falling naked 44. *Evax*, p. 1613.
- 4(2). Phyllaries mostly scarious (5)
4. Phyllaries not mostly scarious (6)
- 5(4). Pappus bristles plumose 47. *Facelis*, p. 1617.
5. Pappus bristles not plumose 46. *Gnaphalium*, p. 1615.
- 6(4). Perennial herbs from woody crowns, growing in dry sandy uplands; leaves strikingly bicolored, dark above, white below, linear; heads borne in glomerules which are borne in a spiciform arrangement 49. *Pterocaulon*, p. 1617.
6. Herbs or weak shrubs usually growing in low poorly drained or even wet areas; foliage not so strikingly bicolored; heads borne otherwise (7)
- 7(6). Pappus members of the staminate (central) flowers of the head flattened, whitish, bristlelike, near the tip discolored brownish and about twice as broad as in the lower part 51. *Tessaria*, p. 1619.
7. Pappus members not broadened upward 50. *Pluchea*, p. 1618.

V. KEY TO TEXAS GENERA OF HELIANTHEAE

1. Ray flowers fertile but with corollas reduced to a vestige or a minute tube with oblique orifice, or fertile heads burlike and lacking staminate flowers (2)
1. Ray flowers when present with better developed corollas or else infertile (5)

- 2(1). Heads with both fertile ray flowers and staminate disk flowers, never burlike ...
..... 60. *Iva*, p. 1627.
2. Heads unisexual (3)
- 3(2). Phyllaries of staminate heads free from each other; pistillate heads burlike
..... 63. *Xanthium*, p. 1633.
3. Phyllaries of staminate heads coalescent partially (4)
- 4(3). Leaves linear or filiform 61. *Hymenoclea*, p. 1630.
4. Leaves otherwise 62. *Ambrosia*, p. 1630.
- 5(1). Disk flowers seemingly perfect but infertile (6)
5. Disk flowers fertile (14)
- 6(5). Achenes short and thick, not flattened (7)
6. Achenes markedly flattened (9)
- 7(6). Inner phyllaries merely subtending the achenes ... 52. *Polymnia*, p. 1620.
7. Inner phyllaries embracing the achenes (8)
- 8(7). Phyllaries persistent; fruit unarmed 53. *Melampodium*, p. 1620.
8. Phyllaries persistent; fruit armed with hooked prickles . 54. *Acanthospermum*,
p. 1622.
- 9(6). Ray flowers in 2 or 3 series 55. *Silphium*, p. 1622.
9. Ray flowers in 1 series (10)
- 10(9). Achenes not adnate to phyllaries or pales, some of them exceeding the involucre
..... 90. *Dicranocarpus*, p. 1665.
10. Achenes adnate to and falling away with 1 or more phyllaries and/or pales (11)
- 11(10). Rays very inconspicuous (0.5-1.5 mm. long), often whitish
..... 59. *Parthenium*, p. 1625.
11. Rays longer, often yellowish (12)
- 12(11). Ray flowers (4 or) 5; annual herbs 57. *Lindheimera*, p. 1625.
12. Ray flowers usually more numerous; perennial herbs (13)
- 13(12). Outer phyllaries linear 58. *Engelmannia*, p. 1625.
13. Outer phyllaries broader 56. *Berlandiera*, p. 1623.
- 14(5). Rays persistent on the achenes (15)
14. Rays falling from the achenes, or absent (17)
- 15(14). Achenes not flattened; leaf blades toothed 66. *Heliopsis*, p. 1636.
15. Achenes flattened or 3- or 4-angled; leaf margins entire or nearly so (16)
- 16(15). Receptacle conic 64. *Zinnia*, p. 1634.
16. Receptacle nearly flat 65. *Sanvitalia*, p. 1635.
- 17(14). Pappus a single series of 15 or 20 plumose bristles
..... 94. *Bebbia*, p. 1671.
17. Pappus not of plumose bristles (18)
- 18(17). Ray flowers absent; disk corolla white, cream or pale-lavender or pale-purplish,
deeply parted into 5 long linear obtuse lobes 92. *Marshallia*, p. 1670.
18. Plants not having the same combination of characters (19)
- 19(18). Disk pappus of 15 or 20 narrow minutely fimbriate persistent scales
..... 93. *Galinsoga*, p. 1671.
19. Disk pappus a mere crown or cap or of a few teeth, awns or bristles or absent, or
(if of scales) these fewer than 15 (20)
- 20(19). Achenes markedly dorsiventrally flattened (21)
20. Achenes (at least those of the disk) flattened laterally or not flattened at all (26)
- 21(20). Involucre uniseriate, green; depressed or sprawling yellow-headed perennial
herbs 85. *Calyptocarpus*, p. 1658.
21. Involucre at least seemingly double; usually erect herbs (22)

- 22(21). Principal (inner) phyllaries partially united 91. *Thelesperma*, p. 1665.
22. Principal phyllaries essentially separate (23)
- 23(22). Pappus of 2 barbless teeth, a mere crown or absent 86. *Coreopsis*, p. 1658.
23. Pappus mostly of retrorsely or antrorsely barbed or hispid awns or teeth (essentially absent in *Bidens aristosa* and *B. polylepis*) (24)
- 24(23). Achenes of ray and outer disk flowers narrowly wing-margined, apically blunt; achenes of central disk flowers not winged but subulate-beaked 89. *Heterosperma*, p. 1664.
24. Achenes not dimorphic in this manner (dimorphic in another form in *Bidens Bigelovii*) (25)
- 25(24). Achenes beaked 88. *Cosmos*, p. 1664.
25. Achenes not beaked 87. *Bidens*, p. 1661.
- 26(20). Outer involucre of 4 leaflike partially united phyllaries; inner involucre of several small phyllaries 67. *Tetragonotheca*, p. 1637.
26. Involucre otherwise (27)
- 27(26). Chaff of the receptacle merely awns or bristles 69. *Eclipta*, p. 1638.
27. Chaff of concavo-convex or folded pales (28)
- 28(27). Each achene closely invested by the pale which appears as an outer coat 68. *Sclerocarpus*, p. 1638.
28. Each achene merely subtended by a pale or loosely enfolded by it (29)
- 29(28). Ray flowers uniformly absent (30)
29. Ray flowers uniformly present (32)
- 30(29). Aromatic shrubs with resinous-verniceous herbage; west Texas deserts 80. *Flourensia*, p. 1653.
30. Herbs or low shrubs, not aromatic, not verniceous; southern Texas (31)
- 31(30). Spreading low shrubs with fleshy, alternate leaves 70. *Varilla*, p. 1638.
31. Erect, opposite-leaved annual herbs 71. *Isocarpha*, p. 1639.
- 32(29). Receptacle conic, subulate or columnar (33)
32. Receptacle flat or convex (38)
- 33(32). Ray flowers fertile and styliferous; style branches truncate or penicillate; leaves opposite 72. *Spilanthes*, p. 1639.
33. Ray flowers infertile and styleless; style branches of disk flowers with acute or obtuse appendages; leaves mostly alternate (34)
- 34(33). Receptacle conical (35)
34. Receptacle columnar, cylindrical or conic-cylindrical at maturity (36)
- 35(34). Corolla expanded into a bulblike base, contracted above into the cylindrical corolla tube; receptacular pales with stout subuliferous apices 73. *Echinacea*, p. 1639.
35. Corolla tubular; pales acute 74. *Rudbeckia*, p. 1641.
- 36(34). Receptacle cylindrical or conic-cylindrical; phyllaries 2- or 3-seriate, subequal 74. *Rudbeckia*, p. 1641.
36. Receptacle columnar; phyllaries 2-seriate, the inner ones half or less than half as long as the outer (37)
- 37(36). Mature achenes terete, transversely wrinkled; leaf blades entire 75. *Dracopis*, p. 1643.
37. Mature achenes compressed-rhomboidal or laterally flattened, smooth; at least some of the leaves pinnate 76. *Ratibida*, p. 1643.
- 38(32). Disk achenes often somewhat flattened but the two thin edges not sharp nor winged (39)
38. Disk achenes thin-edged, knife-edged or winged (41)

- 39(38). Ray flowers fertile; maritime rhizomatous subshrubs of saline habitats 77. *Borrchia*, p. 1644.
 77. *Borrchia*, p. 1644.
39. Ray flowers sterile (40)
- 40(39). Pappus always occurring but quickly deciduous, of 2 usually paleaceous awns (1 over each shoulder of the achene and rarely short intermediate scales present) ... 79. *Helianthus*, p. 1647.
 79. *Helianthus*, p. 1647.
40. Pappus persistent or absent, when persistent rather like that of *Helianthus* in form 78. *Viguiera*, p. 1645.
 78. *Viguiera*, p. 1645.
- 41(38). Subscapose desert perennial herbs; sharp edges of the achenes very pubescent 81. *Encelia*, p. 1654.
 81. *Encelia*, p. 1654.
41. Habitally otherwise (42)
- 42(41). Shrubs (sometimes small) with broad somewhat foliaceous phyllaries 83. *Zexmenia*, p. 1655.
 83. *Zexmenia*, p. 1655.
42. Herbs with usually narrower phyllaries (43)
- 43(42). Achenes winged; ray flowers fertile or infertile ... 84. *Verbesina*, p. 1656.
43. Achenes wingless; ray flowers uniformly infertile 82. *Simsia*, p. 1654.

VI. KEY TO TEXAS GENERA OF HELENIEAE

1. Leaves and/or involucre with translucent oil glands (2)
1. Leaves and involucre not having oil glands (often with resin-droplets visible under high magnification) (7)
 - 2(1). Style branches of the perfect flowers short, oblong; leaves simple, bristly-ciliate near the base 102. *Pectis*, p. 1684.
 2. Style branches of the perfect flowers elongate, appendiculate or truncate; leaves (if simple) not bristly-ciliate near the base (3)
 - 3(2). Pappus at least partly of scales (4)
 3. Pappus wholly of distinct bristles (6)
 - 4(3). Pappus of 2 awns and 2 scales 104. *Tagetes*, p. 1687.
 4. Pappus of more numerous members (5)
 - 5(4). Pappus double, the inner series of 5 awned scales, the outer of numerous bristles 101. *Nicolletia*, p. 1683.
 5. Pappus otherwise 99. *Dyssodia*, p. 1680.
 - 6(3). Ray flowers absent 103. *Porophyllum*, p. 1685.
 6. Ray flowers present 100. *Chrysactinia*, p. 1683.
 - 7(1). Phyllaries in 3 to 5 series, imbricated, the outer ones shorter than the inner; receptacle bristly around the sockets (8)
 7. Phyllaries in 1 or 2 series, nearly equal in length, rarely with 1 to 3 small outer calyculate ones (9)
 - 8(7). Phyllaries in about 3 series; rays 2 to 4 per head; weak shrubs or strong subshrubs 106. *Pseudoclappia*, p. 1687.
 8. Phyllaries in 4 or 5 series; rays about 12 per head; subshrubs 105. *Clappia*, p. 1687.
 - 9(7). Ray corollas persistent on the achenes and falling off with them, marcescent (10)
 9. Ray corollas deciduous from the achenes or absent (11)
 - 10(9). Pappus of 4 to 6 scales 117. *Psilostrophe*, p. 1700.
 10. Pappus absent 118. *Baileya*, p. 1701.
 - 11(9). Achenes laterally flattened and with only marginal ribs or veins (12)
 11. Achenes either distinctly 3- to 5-angled or if less distinctly so then obconic or 10-ribbed (13)

- 12(11). Phyllaries uniseriate; leaf blades caudately long-acuminate 109. *Pericome*, p. 1689.
12. Phyllaries biseriate; leaf blades but caudately long-acuminate 110. *Perityle*, p. 1689.
- 13(11). Achenes columnar, 10-ribbed, rarely slightly flattened (14)
13. Achenes distinctly 3- to 5-angled or if less distinctly so then obconic (15)
- 14(13). Ray flower solitary or absent 108. *Flaveria*, p. 1688.
14. Ray flowers 3 to 5 per head 107. *Sartwellia*, p. 1688.
- 15(13). Style branches long and filiform, stigmatic to near the apex, hispidulous down to the fork or below; both disk and ray corollas rose-purple or rose-pink; involucre from elongate-turbinate to almost cylindrical 111. *Palafoxia*, p. 1695.
15. Style branches either short or with a distinct appendage, not hispidulous to or below the fork; either disk or ray corolla or both yellow or if purple then the involucre not narrow (16)
- 16(15). Phyllaries with thin more or less scarious and colored margins (17)
16. Phyllaries wholly herbaceous or in some species somewhat chartaceous basally, without scarious margins (20)
- 17(16). Principal phyllaries 4 to 9, rarely with 1 or 2 smaller ones at the base; leaves impressed-punctate 114. *Schkuhria*, p. 1697.
17. Principal phyllaries 6 to 12; leaves (if at all) not conspicuously impressed-punctate (18)
- 18(17). Disk corollas deeply cleft into linear-oblong lobes at least 3 times as long as the funnellform throat 113. *Florestina*, p. 1697.
18. Disk corollas with ovate to oblong lobes which are not twice as long as the campanulate or cylindro-campanulate throat (19)
- 19(18). Disk corollas with cylindro-campanulate throat and erect lobes; phyllaries oblong; pappus scales narrowly linear-lanceolate with the midrib excurrent into a barbelate awn; ray flowers present 112. *Hymenothrix*, p. 1696.
19. Disk corollas with campanulate throat and spreading lobes; phyllaries obovate; pappus scales obovate or ovate, rarely with excurrent midrib; ray flowers absent 119. *Hymenopappus*, p. 1701.
- 20(16). Achenes narrowly obpyramidal, several times as long as broad; throat of disk corollas mostly campanulate or funnellform; phyllaries usually rather broad and appressed (21)
20. Achenes obpyramidal, only 2 or 3 times as long as broad; throat of disk corollas elongate-funnelform, trumpet-shaped or cylindrical, many times as long as the tube (22)
- 21(20). Involucre campanulate; outer phyllaries keeled; foliage conspicuously impressed-punctate 116. *Picradeniopsis*, p. 1699.
21. Involucre hemispheric or broadly turbinate; phyllaries flattish; foliage less conspicuously impressed-punctate 115. *Bahia*, p. 1698.
- 22(20). Involucre campanulate to hemispheric; phyllaries erect or ascending, not reflexed 98. *Hymenoxys*, p. 1676.
22. Involucre rotate; phyllaries spreading, wholly or at least the tips reflexed in age (23)
- 23(22). Receptacle with long setiform or small dentiform projections 95. *Gaillardia*, p. 1671.
23. Receptacle not with bristles or teeth (24)
- 24(23). Inner phyllaries scarious, resembling the pappus scales 96. *Amblyolepis*, p. 1674.
24. Inner phyllaries not scarious 97. *Helenium*, p. 1674.

VII. KEY TO TEXAS GENERA OF ANTHEMIDEAE*

1. Receptacle chaffy at least near the center (2)
1. Receptacle naked or hairy around the sockets (3)
- 2(1). Receptacle high-conic; disk corolla greenish-yellow; heads solitary 120. *Anthemis*, p. 1704.
2. Receptacle not high-conic; disk corolla whitish; heads in corymbiform aggregations 121. *Achillea*, p. 1704.
- 3(1). Heads spiny by the persistence and induration of the style; achenes winged; plants usually less than 1 dm. tall 123. *Soliva*, p. 1707.
3. Heads not spiny; achenes not winged; plants commonly taller 122. *Artemisia*, p. 1705.

VIII. KEY TO TEXAS GENERA OF SENECIONEAE

1. Most of the leaves opposite 129. *Haploesthes*, p. 1713.
1. Most of the leaves alternate (2)
- 2(1). Receptacle convex or conic; each achene with a persistent linear pale appressed to one side and attached at the base 124. *Bartlettia*, p. 1708.
2. Receptacle flat or merely slightly convex or with a small cone in the center; achenes not with persistent basal paleae (3)
- 3(2). Rays present 126. *Senecio*, p. 1708.
3. Rays in the usual sense absent (4)
- 4(3). Involucre hemispheric 125. *Psathyrotes*, p. 1708.
4. Involucre cylindric, campanulate or urceolate (5)
- 5(4). Marginal pistillate flowers present, their corollas filiform with a slight funnellform throat and 3- to 5-lobed summit; annuals 128. *Erechtites*, p. 1712.
5. Marginal pistillate flowers absent; perennials 127. *Cacalia*, p. 1712.

IX. KEY TO TEXAS GENERA OF CYNAREAE

1. Achenes usually oblique at the base where attached; peripheral flowers as compared to central ones enlarged and slightly raylike 130. *Centaurea*, p. 1713.
1. Achenes (at least the central ones) not oblique basally; peripheral flowers not enlarged or raylike (2)
- 2(1). Filaments united into a short tube slightly above the level of their insertion on the corolla tube and free only just below the bases of the anthers; leaves white-mottled along the veins; pappus several-seriate, not plumose 133. *Silybum*, p. 1719.
2. Filaments separate; leaves not or rarely white-mottled (3)
- 3(2). Pappus of several short scales in several series; outer phyllaries leaflike or ending in leaflike appendages; flowers yellow; receptacle with scaly chaff 134. *Carthamus*, p. 1719.
3. Pappus of elongate slender bristles, these in most of our species united at the base; outer phyllaries not leaflike; flowers yellow in only one or two species; receptacle either with hairlike bristles or essentially naked (4)
- 4(3). Receptacle bristles absent, the receptacle fleshy and deeply alveolate 135. *Onopordum*, p. 1720.
4. Receptacle with numerous bristles, not markedly fleshy or alveolate (5)

* See *Cotula* in Appendix.

- 5(4). Pappus bristles plumose, at least in the lower part 132. *Cirsium*, p. 1715.

 5. Pappus bristles not plumose, sometimes barbellate in the lower part 131. *Carduus*, p. 1715.

X. KEY TO TEXAS GENERA OF MUTISIEAE

1. Shrubs (2)
 1. Herbs (3)
 2(1). Leaves white-tomentose beneath, strongly contrasting with the dark-green upper surface 136. *Gochnatia*, p. 1720.
 2. Leaves nearly concolorous 137. *Trixis*, p. 1720.
 3(1). Leaves white-tomentose beneath 139. *Chaptalia*, p. 1721.
 3. Leaves nearly concolorous 138. *Perezia*, p. 1721.

XI. KEY TO TEXAS GENERA OF CICHORIEAE*

1. Pappus at least in part of plumose members (2)
 1. Pappus not plumose (5)
 2(1). Leaves lance-linear, entire, coarse, long-tapered to a fine point; stems basally (3-) 5-9 mm. thick 150. *Tragopogon*, p. 1729.
 2. Leaves pinnatifid or if entire then not long-tapered to a fine point; stems usually more slender basally (3)
 3(2). Achene not at all beaked; stems wiry; most of the leaves greatly reduced to mere subulate bracts 146. *Lygodesmia*, p. 1727.
 3. Achene beaked; some leaves well-developed (4)
 4(3). Perennials from stout underground parts; calyculum absent; midribs of phyllaries whitish; pappus bristles about 20, plumose to the tip 151. *Hypochoeris*, p. 1730.
 4. Winter annuals from taproots; calyculum present; pappus members about 10, plumose for most of the length but not at the extreme tip 147. *Rafinesquia*, p. 1728.
 5(1). At least some of the flowers subtended by chaffy scales on the receptacle (6)
 5. Receptacle naked (or with a few scattered hairs in some genera) (7)
 6(5). Flowers rosy-white or lavender-white; achenes 5-ribbed; pappus of bristles 140. *Pinaropappus*, p. 1722.
 6. Flowers blue; achenes not ribbed but obscurely striate; pappus a low crown of minute scales 142. *Cichorium*, p. 1724.
 7(5). Most of the pappus deciduous as a unit leaving a solitary persistent bristle on the achene 148. *Malacothrix*, p. 1728.
 7. Pappus otherwise (8)
 8(7). Entire pappus of a number of whitish slender bristles, deciduous as a unit 149. *Calycoseris*, p. 1729.
 8. Pappus otherwise (9)
 9(8). Pappus entirely of persistent scales each prolonged into a number of long awn-like bristles of unequal length 143. *Nothocalais*, p. 1725.
 9. Pappus otherwise (10)
 10(9). Pappus at least partly of scales or absent (11)
 10. Pappus wholly of bristles (13)

* See Appendix.

- 11(10). Pappus dimorphic, that of the peripheral achenes a scaly-fringed crown about 1 mm. high, that of the central achenes of several more elongate scales 152. *Hedypnois*, p. 1730.
11. Pappus otherwise (12)
- 12(11). Pappus of 5 nearly linear scales a little longer than the achene 144. *Microseris*, p. 1725.
12. Pappus otherwise 141. *Krigia*, p. 1723.
- 13(10). Achene beaked, i.e., rather abruptly attenuate upward into a slender apical portion which is of slightly different texture and/or color from the swollen body (14)
13. Achene not beaked, sometimes slightly attenuate upward but of nearly uniform color and texture through the full length (16)
- 14(13). Caulescent herbs (3-) 5-25 dm. tall; glandular spot near apex of phyllary rarely proliferating; achenes rather clearly flattened 154. *Lactuca*, p. 1731.
14. Herbs usually 1-5 (-8) dm. tall, the glandular spot near apex of phyllary proliferating after anthesis into a low crest or minute horn; achenes not or only obscurely flattened (15)
- 15(14). Pappus tawny-white or buffy-white; basal leaves not runcinate 145. *Pyrhopappus*, p. 1725.
15. Pappus white or yellowish-white; basal leaves runcinate 159. *Taraxacum*, p. 1736.
- 16(13). Pappus members dimorphic on each flower (of 50 to 100 extremely fine capillaries plus 6 to 10 dorsiventrally flattened caducous bristles) 153. *Sonchus*, p. 1730.
16. Pappus members alike in form though sometimes unequal in length (17)
- 17(16). Corollas white, rosy-white, pink, lavender or purplish, never yellow (18)
17. Corollas yellow or orange (19)
- 18(17). Leaves of stem well-developed, mostly obovate ... 156. *Prenanthes*, p. 1734.
18. Leaves of stem much-reduced to mere subulate bracts .. 146. *Lygodesmia*, p. 1727.
- 19(17). Achenes tri- or quadrangular in transection 157. *Youngia*, p. 1735.
19. Achenes subterete in transection (20)
- 20(19). Heads often nodding; lower stems with long spreading tawny hairs 155. *Hieracium*, p. 1733.
20. Heads usually not nodding; lower stems either glabrous or if pubescent then not with long spreading tawny hairs 158. *Crepis*, p. 1735.

I. VERNONIA SCHREB. IRONWEED

Perennial herbs; leaves alternate, pinnately veined, mostly narrow and willowlike; heads in terminal corymbiform aggregations, usually 5-14 mm. broad; receptacle flat or convex, essentially naked; involucre usually campanulate-cylindric; phyllaries in several series, strongly imbricated; ray flowers absent; disk flowers numerous, perfect, fertile, the corolla mauve or purple or rose-colored, rarely white but never yellow; anthers not caudate; style branches elongate, filiform-subulate (not thickened upward), hispidulous throughout, with stigmatic lines only near the base; achenes 6- to 10-ribbed commonly resin-dotted between the ribs; pappus fuscous-white or rusty-white, persistent, double, of numerous coarse bristles.

About 1,000 species in America, Africa, Asia and Australia. Our species show considerable evidence of genetic intercontamination; the determination of some specimens is thus difficult if not impossible.

1. Phyllaries whitish- or grayish-tomentose 7. *V. Lindheimeri*.
1. Phyllaries glabrous to variously pubescent or even tomentose but not whitish- or grayish-tomentose (2)

- 2(1). Outer pappus of bristles, irregular in length and not evidently differentiated from the inner bristles; leaves lance-linear or linear, nearly glabrous 3. *V. marginata*.
2. Outer pappus of scales (or if these very narrow the leaves pubescent beneath), nearly uniform in length and differentiated from the bristles of the inner series (3)
- 3(2). Pubescence of the lower leaf surface wholly or in part of crooked slender hairs, more or less tomentose at least along the veins (4)
3. Pubescence of the lower leaf surface absent or at most in part of short straight conical hairs, with or without longer hairs on the veins (5)
- 4(3). Scales of the outer pappus 1.5 to 2 times as broad as the inner pappus members; midvein of the principal phyllaries not prominent and the lateral areas not copiously covered by resin globules about 0.5 mm. thick, the apices blunt and appressed; flowers about 34 to 55 per head; achenes averaging about 4 mm. long 2. *V. missurica*.
4. Scales of the outer pappus 1 to 1.5 times as broad as the inner pappus members; inner phyllaries near the apex with slightly prominent narrow usually dark midvein and on each side of it a patch of yellowish shiny resin-globules about 0.5 mm. thick, the apices often acutish and very slightly spreading; flowers averaging fewer per head; achenes averaging only about 3 mm. long 1. *V. Baldwinii*.
- 5(3). Lower leaf surface essentially glabrous 4. *V. vulturina*.
5. Lower leaf surface with short straight conical projections and occasionally along the veins some narrow patches of longer curly hairs (6)
- 6(5). Leaves lanceolate to elliptic-lanceolate 5. *V. altissima*.
6. Leaves linear to lance-linear 6. *V. texana*.

1. *Vernonia Baldwinii* Torr. WESTERN IRONWEED. Erect, 6-15 (-20) dm. tall, nearly simple except in the uppermost head-bearing region, pubescent to tomentose; leaf blades firm-membranous, elliptic or elliptic-lanceolate to ovate-lanceolate, 8-15 (-20) cm. long, 2-6 cm. broad, acuminate, sharply serrate, narrowed to the base, glabrous or scabrellate to puberulent above, with variable pubescence below from almost glabrous to tomentose with multicellular curled hairs and under the tomentum (if any) dotted with resin-globules, sessile or nearly so; involucre narrowly campanulate to thick-cylindric; phyllaries regularly and closely imbricate, often purplish-green and darker along the margin and midvein, the apices of the inner phyllaries acutish and very slightly spreading, marginally pubescent, with a slightly prominent narrow midvein and on either side of it a broad patch of resinous globules that are yellowish when fresh, shiny and about 0.5 mm. thick; flowers usually 18 to 34 per head; achenes about 3 mm. long, with resin-globules in the furrows between the ribs. *V. interior* Small. Frequent in n.-cen. Tex., Edwards Plateau and the Plains Country, infrequent or rare in e. Tex., summer; Ill. to Minn., s. to La. and Tex.

Hybridizing extensively; the hybrids and backcross types of this species and *V. Lindheimeri* have been called *V. guadalupensis* Heller. Many specimens from east and south-east Texas show combinations of characters of *V. Baldwinii* and *V. missurica*; a strong case could be made for considering those two taxa to be conspecific. *V. Baldwinii* and *V. altissima* also show evidence of genetic intercontamination.

2. *Vernonia missurica* Raf. Erect, 10-15 dm. tall, branched in the upper parts, pubescent; leaves numerous, the blades spreading, firm-membranous, sessile to short-petioled, lanceolate to ovate-lanceolate, 6-15 cm. long, 15-50 mm. broad, long-acuminate, sharply and coarsely serrate to nearly entire, acute or rounded at base, dark-green and scabrellate above, tomentose beneath at least along the veins; involucre broadly campanulate, short-cylindric or hemispheric, 6-8 mm. high; phyllaries appressed, closely and regularly imbricate, purplish or greenish, broadly rounded-keeled (the midnerve not narrowly prominent) or flat, glabrous or pubescent (in genetically contaminated plants with some resin-globules), arachnoid-ciliate at the margins, rounded, obtuse usually; flowers about 34 to 55 per head; achenes about 4 mm. long, resinous in the furrows. *V. Drummondii* Shuttlew. Local or locally abundant in s.e. Tex., infrequent to rare in e.

Tex., summer; Ont. to Ia. and s.w. to Miss., La., Tex. and N.M.

See discussion under *V. Baldwinii*; hybridizes with *V. Baldwinii* and *V. altissima*.

3. *Vernonia marginata* (Torr.) Raf. PLAINS IRONWEED. Stems erect, simple or rarely branched below the head-bearing region, 4-10 dm. tall, glabrous or minutely puberulent; leaf blades firm-membranous, linear to linear-lanceolate, 5-10 cm. long, 3-8 mm. broad, acute or acuminate, entire or remotely denticulate, essentially glabrous, punctate underneath; involucre broadly campanulate to thick-cylindric, about 8 mm. broad, 7-10 mm. high; phyllaries appressed, closely and regularly imbricate, mostly acute, glabrous or nearly so except in some specimens on the margins; flowers about 18 to 21 per head; achenes 4-5 mm. long, glabrous, with resin-globules in the furrows. *V. tenuifolia* Small. Frequent in the Trans-Pecos and Plains Country, summer; Kan., Okla., Tex. and N.M.

Exceedingly closely related to *V. fasciculata* Michx. (with blunter phyllaries) which has been reported to occur in Texas; no doubt the two taxa should be considered conspecific.

4. *Vernonia vulturina* Shinn. Nearly glabrous perennial herb; stems virgately ascending, probably about 1 m. tall or less, nearly simple, internodes in the upper few dm. of the length about 1 cm. long; leaves not much reduced upward, dark-green, narrowly lanceolate, 12-15 cm. long, 12-17 mm. broad, ascending, on each side with 30 to 40 mucrolike teeth about 0.4 mm. long, beneath microscopically black-punctulate, above especially near the margins with minutely antrorse-appressed scabrous projections; heads borne fairly crowded in an irregular terminal aggregation about 1 dm. high and broad, the individual peduncles 1-9 mm. long; heads about 13 mm. high; involucre about 7 mm. high, hemispheric-campanulate; phyllaries herbaceous, in 4 (or 5) series, very strongly graduated, the inner ones oblong and rounded apically, about 2 mm. broad, dark-purplish-brown and glabrous except for the pale minutely fimbriate margins, outer ones more acute and about 1 mm. broad and long; receptacle strongly convex, rough; flowers perfect, fertile, about 25 in number; corollas purplish-red, about 8.5 mm. long, only slightly ampliate upward, the 5 narrowly deltoid lobes 2 mm. long, the undivided portion thus about 6.5 mm. long; style branch appendages short, subulate; anthers not caudate basally; achenes 1.7-2 mm. long, brown, 6- or 7-ribbed, glabrous; pappus double, of about 50 pale-purplish-brown dorsiventrally flattened marginally minutely serrulate bristlelike members about 6 mm. long, plus a smaller number of subulate, serrulate paleae 0.6-0.7 mm. long and 0.1 mm. broad. Moist sandy soil, near Buzzard's Spring in Dallas, Dallas Co., Aug.; endemic.

Exceedingly rare or perhaps now extinct, collected once about 80 years ago.

5. *Vernonia altissima* Nutt. Stems erect, 1-3 m. tall, branched above, glabrous or nearly so; leaf blades thin, narrowly elliptic to lanceolate or lance-ovate, 15-25 cm. long, 3-7 cm. broad, long-acuminate, gradually attenuate basally, sharply and irregularly serrate to nearly entire, essentially glabrous above, beneath with short straight conic projections or (in genetically contaminated plants) with some curly hairs along the veins; involucre campanulate, 4-5 mm. high or rarely larger; phyllaries appressed, regularly imbricate, ovate to oblong-ovate, glabrous or puberulent, sparsely ciliate or entire, obtuse or rounded to acute or short-cuspidate; flowers (13 to) 21 to 29 per head; achenes usually lacking resin-globules. Reported to occur in e. and s.e. Tex., but we have seen no specimens, summer; N.Y. to O. and Mo., s. to S.C., Ga. and La.

6. *Vernonia texana* (Gray) Small. Stems erect, simple except in the uppermost parts, 4-8 dm. tall, glabrous or minutely puberulent; leaves firm-membranous, ascending, linear-lanceolate, 6-12 cm. long, 1-2 cm. broad, acute, sharply dentate with low salient teeth to nearly entire, attenuate to a sessile base, scabrous above, puberulent especially along the veins and usually pitted beneath, the upper blades strongly reduced and narrowed compared to the lower ones, linear to subulate; involucre broadly campanulate, 5-6 mm. high; phyllaries irregularly imbricate, appressed or the upper slightly spreading, tinged with purple, puberulent or glabrate, acute, the outer ones ovate, the inner oblong; flowers 18 to 21 per head; achenes pubescent on the ribs, with resin-globules in the furrows, about 2.5 mm. long. Infrequent in e. Tex., rare in s.e. and n.-cen. Tex., summer; Ark., La. and Tex.

Rather closely related to *V. altissima*; some specimens may be intermediate to that species.

7. *Vernonia Lindheimeri* Gray & Engelm. WOOLLY IRONWEED. Stems erect, simple except in the uppermost parts, 2-8 dm. tall, tomentose or canescent; leaves numerous and crowded, the blades narrowly linear, 5-8 cm. long, entire, revolute, 1-nerved, either glabrous or whitish-tomentose above, densely white-woolly beneath; involucre campanulate, 7-9 mm. high; phyllaries loosely and irregularly imbricate, purple, densely gray-tomentose dorsally, the outer ones ovate-lanceolate and acute, inner ones narrowly oblong and obtuse to rounded or mucronulate; flowers 20 to 60 per head; achenes glabrous, 4 mm. long, in the furrows with or without resin-globules. Incl. var. *leucophylla* Larsen. Locally abundant in Edwards Plateau, rare in n.-cen. Tex., summer; also Coah. (has been reported in Ark.)

In the eastern part of the Edwards Plateau occur the populations with nearly glabrous upper leaf surfaces and fewer flowers per head; these hybridize extensively with *V. Baldwinii*; some of the intermediates have been called *V. guadalupensis* Heller.

2. ELEPHANTOPUS L. ELEPHANT'S-FOOT

Perennial herbs usually 2-5 (-9) dm. tall, usually coarsely pubescent, branched in the upper half; leaves alternate, mostly ovate or obovate or elliptic, the larger ones 7-15 cm. long, unlobed, serrate, sessile but often narrowed to subpetiolar bases, acute or blunt; heads sessile, about 1 cm. high, subcylindric, in very tight few-headed glomerules at the ends of the branches, each glomerule simulating a head 1-2 cm. thick by virtue of being closely subtended by about 3 reduced deltoid leaves about 1 cm. long; involucre about 1 cm. high, subcylindric; phyllaries in several series, very strongly graduated, stramineous, appressed; ray flowers absent; disk flowers 3 or 4 per head, perfect, fertile, the corollas 5-lobed apically, pinkish-white to lavender; achenes columnar, antrorsely pubescent, several-nerved near the base; pappus persistent, of 5 or 10 stiff awns which are basally dilated and indurated.

A genus of a dozen or so species in America. Ours may hybridize to a limited extent.

1. Leaves basal except for bracteal leaves in the upper branch system, about as broad as long 3. *E. tomentosus*.
1. Leaves cauline as well as basal; the bracteal leaves subtending the glomerules of heads manifestly longer than broad (2)
- 2(1). Basal leaves usually persistent until flowering time; cauline leaves only 2-3 cm. long at most 2. *E. nudatus*.
2. Basal leaves (if any) withered and absent by flowering time; cauline leaves mostly larger 1. *E. carolinianus*.

1. *Elephantopus carolinianus* Raeusch. Perennial herb 3-9 dm. tall, leafy; leaves oblanceolate-elliptic, mostly (3-) 5-15 cm. long, only gradually reduced upward; deltoid bracteoles subtending the heads often discolored-indurate basally and manifestly longer than broad. Frequent or infrequent in sandy forested areas, e. and s.e. Tex., rare w. to n.-cen. Tex., late summer-fall; s.e. U.S.

The author of the botanical name is sometimes given incorrectly as "Willd."

2. *Elephantopus nudatus* Gray. Perennial herb 2-4 dm. tall, with a persistent basal rosette of oblanceolate to narrowly obovate leaves 3-15 cm. long; stem leaves few and much-reduced, usually 2-3 mm. long and sometimes oblong; deltoid bracteoles subtending the heads longer than broad. Infrequent in open woods on sandy flats, s.e. Tex. (Chambers, Hardin and Jefferson cos.), Aug.-Oct., rarely in May also; s.e. U.S., mostly near the coast.

3. *Elephantopus tomentosus* L. TOBACCO-WEED, DEVIL'S-GRANDMOTHER. Perennial herb 2-6 dm. tall with a persistent basal rosette of narrowly obovate leaves 8-22 cm. long; cauline leaves essentially absent; bracteal leaves subtending the heads about as broad as long. Infrequent in wooded sandy lands, e. and s.e. Tex., Aug.-Sept.; s.e. U.S.

3. CARPOCHAETE GRAY BRISTLEHEAD

A genus of about 3 species in Mexico and southwestern United States.

1. *Carpochaete Bigelovii* Gray. Subshrub (1-) 2-5 dm. tall; leaves opposite (or often fascicled so that the true phyllotaxy is obscure), linear to linear-oblanceolate, firm, 1-2

(-3) cm. long, densely resin-dotted, entire, essentially sessile; heads solitary, sessile and terminal on the short branches, 2-3 cm. long (including pappus); involucre nearly cylindrical, 13-19 mm. high; phyllaries linear, firm and resin-dotted like the leaves, very strongly graduated, (the shortest (outer) ones about 3-4 mm. long, and all intermediate lengths represented), acutish, the inner ones nerved and scarious-margined; receptacle 0.5 mm. broad, flat, naked; ray flowers absent; disk flowers 4 to 6, perfect, fertile, at anthesis about equaling the involucre, later much-exserted, the corolla whitish or purple-white, 5-lobed apically; achene about 1 cm. long, columnar, 10-ribbed, minutely pubescent; pappus persistent, about 15 mm. long, of about 10 subulate stiff bristlelike scales which are scarious-margined for most of their length and a few much shorter scarious outer paleae. Infrequent in the Chisos, Davis and Franklin mts. in the Trans-Pecos, Mar.-May (-June); Tex., N.M., Ariz. and Chih.

4. LIATRIS SCHREB.¹⁹¹

GAY-FEATHER. BUTTON-SNAKEROOT.

BLAZING-STAR

Perennial herbs from underground corms; leaves elongate, linear to ovate-lanceolate, sessile, more or less conspicuously punctate with impressed and resinous dots or not so punctate, the radical leaves usually much longer than the stem leaves that diminish in length upward; heads disposed in various ways, usually in spiciform or racemiform arrangements, each head with few to many flowers; ray flowers absent; disk flowers usually numerous, rarely as few as 4; receptacle naked, essentially flat; involucre of several series of imbricated phyllaries; phyllaries variously shaped, usually firm throughout, often marginally ciliate or erose; corolla typically purple, rarely white, never yellow, radially symmetrical, the cylindrical tube usually exceeding the pappus or twice as long as the pappus, the throat scarcely or slightly perceptible as opposed to the tube; corolla lobes 5, equal, ovate, acute, erect or more or less spreading; stamens 5; filaments uniform, equally inserted in the middle of the corolla tube, glabrous or with tiny outgrowths; anthers short, oblong, about half as long as the filaments; style stiff, bifid, exserted late in anthesis, the style branches club-shaped; achenes somewhat cylindrical but pointed basally, about 10-ribbed, pubescent on the ribs and more finely between the ribs; pappus of 12 to 40 bristles, sessile, in one or more series, plumose or barbellate.

About 40 species confined to North America.

1. Pappus units barbellate, the length of the lateral hairs only 3 to 6 times as great as the thickness of the central axis (hairs scarcely visible without a lens) (2)
1. Pappus units plumose, the length of the lateral hairs 15 times or more as great as the thickness of the central axis (7)
- 2(1). Heads 15- to 40-flowered, subglobose to campanulate, the numerous broad phyllaries appressed or erect or bullate or partly recurved (3)
2. Heads 3- to 20-flowered, oblong or cylindrical, the phyllaries mostly erect with their erect tips spreading or recurved (4)
- 3(2). Heads subglobose, 25- to 40-flowered; inner phyllaries usually strongly bullate ..
.....1. *L. aspera*.
3. Heads campanulate, 15- to 25-flowered; inner phyllaries not bullate
.....2. *L. squarrosula*.
- 4(2). Phyllaries obtuse to acuminate, appressed and never recurved (5)
4. Phyllaries acuminate and recurved at the tips (6)
- 5(4). Each head with about 12 flowers3. *L. lancifolia*.
5. Each head with 3 to 5 flowers4. *L. acidota*.
- 6(4). Stems 3-5.5 dm. tall; leaves above midstem becoming abruptly smaller than those below5. *L. tenuis*.
6. Stems 6-15 dm. tall; leaves gradually decreasing in length upwards
.....6. *L. pycnostachya*.

¹⁹¹ Adapted largely from L. O. Gaiser in Rhodora, Vol. 48. 1946.

- 7(1). Heads 4- to 14-flowered, slender-cylindrical; head-bearing region spiciform (8)
 7. Heads 15- to 60-flowered, more nearly globose or thick-cylindrical; head-bearing region like a loose cyme or cylindrical-racemose (11)
 8(7). Phyllaries with prolonged petaloid tips; corolla not at all pilose within
 7. *L. elegans*.
 8. Phyllaries herbaceous and appressed or with only the tips free; corolla quite pilose within the tube (9)
 9(8). Plants with a long underground rootstock 8. *L. punctata*.
 9. Plants with a somewhat globular corm (10)
 10(9). Heads 4- to 6-flowered 9. *L. mucronata*.
 10. Heads 10- to 14-flowered, few and distant on few-branched stems; leaves narrow, rather channeled and bractlike 10. *L. bracteata*.
 11(7). Phyllaries appressed 11. *L. cymosa*.
 11. Phyllaries recurved or loosely spreading 12. *L. squarrosa*.

1. *Liatris aspera* Michx. Corm rounded, irregular, subglobose, 2-5 cm. thick; stems often solitary, sometimes several, 4-11 (-15) dm. high, glabrous below and with scattered hairs above on the axis of the flower region or rough over the entire stem length; leaves mostly linear-lanceolate though frequently almost linear, the basal ones 10-15 cm. long, 1-2 cm. broad, rhombic-lanceolate, narrowed into subpetiolar bases in the lower half, glabrous on both surfaces and lacking any roughness on the margins or rough on one or both surfaces; upper leaves sessile, reduced to less than the length of the heads they subtend; head-bearing regions spiciform; heads sessile to pedunculate, somewhat globose, each with 25 to 40 flowers, 15-25 mm. thick; phyllaries all glabrous with exposed tips rounded and with broad scarious margins and slightly bullate, the middle and inner ones oblong-spatulate to rounded and strongly bullate (giving the globose head a puckered appearance); corolla usually purple, pilose within the tube at the base of the stamens, the tube 8-10 mm. long; pappus 7-8 mm. long, the barbellate units 4-6 mm. long. Frequent in sandy soils of e. and s.e. Tex., infrequent w. to Grayson, Henderson, Bastrop and Gonzales cos., July-Oct.; e. N.A., n. to Ont. and w. to N.D., Neb., Kan., Okla. and Tex.

Two superficial varieties are distinguished in Texas by some authors, the var. *aspera* [var. *intermedia* (Lunell) Gaiser] with heads obliquely ascending to horizontal, and var. *salutans* (Lunell) Shinnars, with heads horizontal to reflexed.

2. *Liatris squarrosa* Michx. Corm small, subglobose, about 2 cm. thick; stem usually solitary, 4-9 dm. high, often somewhat virgate, softly and densely pubescent or rough with short white hairs, or even almost glabrous; leaves glabrous, softly pubescent and rough on the margins only or more rarely scabrous, the basal ones sharply lanceolate, 1-2 dm. long, 5-15 mm. broad, narrowing to a short or winged subpetiolar base from one half to one third the length of the blade; upper leaves rigid, sharp-pointed, narrowly lanceolate or linear, reduced from 6-8 cm. long to narrow bracts less than 1 cm. long that subtend the heads; head-bearing region narrowly racemose, of 20 to 50 subsessile heads on erect or depressed peduncles about as long as the heads, or more rarely becoming branched and paniculate by the elongation of the peduncles into slender branches bearing several heads each; heads with 15 to 25 flowers, somewhat turbinate or campanulate, 10-15 mm. long, about 1 cm. thick at anthesis; phyllaries appressed or sometimes recurved, herbaceous, green and softly pubescent; outer phyllaries subulate, middle and inner ones oblong-spatulate, 7-8 mm. long, 2-3 mm. broad, herbaceous and usually finely pubescent, sometimes purplish with ciliolate margins; corolla tube 7-9 mm. long, scantily to moderately pilose at the base of the tube; mature achenes 3-4 mm. long; pappus about 6 mm. long, barbellate. Infrequent or rare in n.e. and e. Tex. in sandy soils, Sept.-Oct.; s.e. U.S. n. to N.C., Tenn. and Ind., w. to Tex.

Many authors use the name *L. Earlei* (Greene) K. Schum. for this species.

3. *Liatris lancifolia* (Greene) Kittell. GAY-FEATHER. Glabrous perennial to 6 dm. tall or more; leaves numerous, broadly linear, the basal ones 2-3 dm. long, 10-15 mm. broad near the center (tapering to base and to apex), upper ones shorter and bluntly lanceolate; heads in dense or loose spiciform arrangement 15-30 cm. long, 2-3 cm. thick, each head with about 12 flowers; phyllaries erect, glabrous, the outer deltoid-ovate, the inner oblong and acute, mostly herbaceous, with narrow purplish ciliolate margins; corolla purple, 6

mm. long, glabrous within; achene 3 mm. long or more; pappus barbellate, about 5 mm. long. Rare in meadowlands and on open slopes in the Panhandle (Hemphill and Oldham cos.), June-Aug.; S.D., Neb., Kan., Wyo., Colo., N.M. and Tex.

Exceedingly closely related to *L. spicata* (L.) Willd. which has more narrowly linear leaves and occurs over most of the eastern United States but has not yet been found in Texas.

4. *Liatris acidota* Engelm. & Gray. Corm globose, slightly elongated, usually not more than 3 cm. thick, bearing the remnants of previous basal leaves; stems slender, stiffly erect, 5-8 dm. tall, glabrous or puberulent, solitary or in 3's or 4's; basal leaves very long, glabrous, linear-lanceolate, 2-4 dm. long, 3-5 mm. broad; leaves of the slender spikes narrowly linear, becoming abruptly shortened, erect and bractlike; heads numerous, loosely covering 1-2 dm. of the erect spikelike head-bearing region, with 3 to 5 flowers, cylindrical but narrowed acutely to the tip when in bud, about 1 cm. long; phyllaries few, glabrous, appressed, the outer ovate, the inner oblong-lanceolate, sometimes becoming purplish; corolla about 8-10 mm. long, purple, lacking any pilosity within the tube; achene 4-5 mm. long; pappus about 7 mm. long, barbellate. Frequent in often wet areas, e. and s.e. Tex., w. to Austin Co. and s. to Calhoun Co., July-Dec.; also La.

5. *Liatris tenuis* Shinners. Corm 1-2 cm. thick, round or somewhat like an inverted carrot; stems 1 to few, 30-55 cm. tall, toward the base with spreading or ascending hairs, strigillose upward; leaves rather crowded, linear, punctulate, more or less pilosulous along the margin and the single nerve, acute, the stem leaves to 15 cm. long and 4.2 mm. broad, those of midstem becoming abruptly much smaller than those below, the uppermost leaves reduced to bracts 1-3 cm. long and 1-1.5 mm. broad; head-bearing region 15-25 cm. long, slender, spiciform or racemiform, interrupted, the internodes 7-15 mm. long; head usually solitary in the axils of the bracteiform upper leaves; peduncles to 3 mm. long; involucre cylindrical-campanulate, 10-13 mm. long; phyllaries in 4 or 5 series, narrowly ovate, acuminate, apically attenuate and spreading or subrecurved, ciliate, dorsally glabrous or at the very base pilosulous; flowers 10 or 11 per head; corolla about 7 mm. long, glabrous within the tube; pappus bristles barbellate, 4-7 mm. long; achenes 4.2-4.5 mm. long, prominently pilosulous along the ribs. Infrequent or rare in open pine woods on sandy soil, e. Tex. (Angelina, Jasper, Sabine and Tyler cos.), June-Aug.; endemic.

6. *Liatris pycnostachya* Michx. Corm globose or more elongate and resembling a rhizome, often 1 dm. thick in mature plants; stems 1 to many, 6-15 dm. tall, stiff, striate, generally hirsute, sometimes glabrous; leaves numerous, linear, punctate, the lower ones 1 dm. long and 4-5 mm. wide, hirsute or glabrous, gradually decreasing in length upward and passing into bracts subtending the heads; heads with 5 to 12 flowers, cylindrical, about 1 cm. long, sessile, crowded in a very dense spiciform arrangement that is 15-30 cm. long and 2-3 cm. thick with a generally hirsute axis; phyllaries herbaceous or purplish, lanceolate-acuminate or oblong, with more or less acute tips markedly squarrose and scarcely reflexed or merely lax and spreading, the margin mostly ciliate when herbaceous but frequently merely crisped and sometimes petaloid; corolla phlox-purple, occasionally white, 7-9 mm. long, the tube nonpilose or with very few hairs within; achenes 4-7 mm. long; pappus 6-7 mm. long, barbellate. Frequent in open sandy areas, often in or around moist bogs, e. and s.e. Tex., June-Oct.; Ind. to S.D., s. to La. and Tex.

A local race in the east Texas piney woods with extremely hairy leaves and flowering, on the average, later than the var. *pycnostachya* is called var. *lasiophylla* Shinners.

7. *Liatris elegans* (Walt.) Michx. Corm globose, 1-3 cm. thick or sometimes elongate to 15 cm. long; stems 1 or 2, 3-12 dm. tall, finely pubescent and leafy; leaves sessile, glabrous, punctate, linear to linear-lanceolate, reduced upward from the basal ones which are not more than 1 dm. long and 5 mm. broad, the uppermost bracteate leaves subtending the long heads and commonly soon deflexed; head-bearing region cylindrical to pyramidal, 15-50 cm. long, basally usually with short peduncles or with subsessile heads or (in some plants) with longer branches each bearing a number of peduncles; heads usually 5-flowered, 25-30 mm. long; outer phyllaries short, lanceolate, herbaceous; inner phyllaries prolonged into dilated lanceolate and reflexed or truncate and rounded petaloid serrulate tips, phlox-pink or white and surpassing the corolla and pappus; corolla 9-11 mm. long, as frequently white as purple, nonpilose within; achenes 4-6 mm. long; pappus long-plumose, 9-11 mm. long. Frequent in deep fine pure sandy soil in e., s.e. and n.-cen. Tex.

and the Rio Grande Plains, Aug.-Oct.; Coastal States, S.C. to Tex., inland to Ark. and Okla.

The plants of Bexar, Medina and Wilson counties are reported to be relatively robust with elongate corms as opposed to the globose corms of the var. *elegans*, and they have been given the name var. *carizzana* Gaiser; this variety is also reported to grow in deep sandy soils near Sierra Blanca, Hudspeth County, in the Trans-Pecos.

8. *Liatris punctata* Hook. Corm elongate, somewhat like a rhizome, often extensive; stems numerous, glabrous, striate, 15-80 cm. tall; leaves numerous, glabrous, rigid, linear, conspicuously punctate; basal leaves 8-15 cm. long, 1.5-6 mm. broad with a cutinous margin bearing prominent cilia or only scantily so provided, gradually diminishing; arrangement of heads generally densely (sometimes loosely) spiciform, 6-30 cm. long, 2-3 cm. thick when the flowers are open, the usually crowded heads 15-20 mm. long and 8-10 mm. thick with 4 to 8 flowers; phyllaries herbaceous, thick, punctate and closely appressed except for the free tips, the short outer ones rigidly ovate and acuminate or cuspidate, the inner ones oblong with acute or mucronate to lanceolate-acuminate tips, 10-14 mm. long, 1.5-2 mm. broad, prominently ciliate-margined in individuals having cilia on the margin of the leaves and correspondingly less ciliate to merely membranous in others; corolla purple (rarely white), 9-12 mm. long, the tube quite pilose inside; pappus distinctly plumose, 9-11 mm. long, usually slightly exceeded in length by the corolla; achenes 6-7 mm. long, ribbed and hairy.

We have the following two varieties.

Var. *punctata*. Stems 15-30 cm. long, stiff; basal leaves 8-10 cm. long, 3-5 mm. broad, with prominent cilia along the cutinized margin; inflorescence shortly spiciform, 6-20 cm. long; heads crowded, about 2 cm. long, containing 5 to 8 flowers each; phyllaries prominently margined by long white cilia, inner ones lanceolate-acuminate or oblong with acute or mucronate tips. Very likely rare on calcareous uplands of the n. part of the higher elev. in the Plains Country and possibly also in the Guadalupe Mts. in the Trans-Pecos, late summer; from Man. to Sask. and s. to Ia. and Kan., and from Alta. s. along the e. Rocky Mts. into N.M.

Var. *mexicana* Gaiser. Plants 50-85 cm. tall with few stems; corm thick, ovate or subelongate; leaves few, commonly completely glabrescent, shining, remote, 125-150 mm. long, 4-6 mm. broad; head-bearing region lax, with internodes 1-2 cm. long; heads 15-20 cm. long, with 5 or 6 flowers; phyllaries from ovate-acuminate to mucronate, marginally ciliate or not. Infrequent to locally abundant on calcareous uplands in the w. part of the Edwards Plateau and in the mts. of the Trans-Pecos, generally at about 4,000 ft. elev., Aug.-Sept.; also S.L.P., Tam. and Coah.

Some of the plants from the Panhandle and the Guadalupe Mts. seem to be intermediate between var. *punctata* and var. *nebraskana* Gaiser, of central United States. The latter variety is distinguished by its narrower leaves, 2-3 mm. broad, proportionally longer, and the leaves and phyllaries being without prominent ciliate margins.

9. *Liatris mucronata* DC. Corm globose, 2-4 cm. thick; stems few to numerous, 3-8 dm. tall, often reddish in color; leaves narrowly linear, punctate or not, the basal ones 5-10 cm. long and 1-5 mm. broad, progressively diminishing upward to become short bracts in the head-bearing region; head-bearing region spiciform, dense, 8-60 cm. long; heads cylindrical, 8-18 mm. long, usually sessile, each with 3 to 6 flowers; phyllaries herbaceous, the short outermost ones ovate-lanceolate with mucronate tips becoming longer, the innermost ones lanceolate and acuminate, thin-papery, glabrous with merely membranous or slightly ciliolate margins in exceptional cases, somewhat glutinous or the phyllaries merely acute or rounded and mucronate; corolla purple, 9-10 mm. long, slightly pilose to moderately pilose at the base of the tube; pappus 6-7 mm. long, plumose, the lateral cilia more than 15 times as long as the thickness of the central axis; achenes 5-7 mm. long, ribbed and hairy. Incl. var. *interrupta* Gaiser, *L. angustifolia* (Bush) Gaiser. Abundant in well-drained calcareous uplands, n.-cen. Tex., Edwards Plateau and Plains Country, less abundant on caliche cuerdas in the Rio Grande Plains and rather rare in e. Tex., Aug.-Dec.; Mo., Kan., Okla., Neb., Coah. and Tam.

The species is rather closely related to *L. punctata* and possible intermediates between the two have been found in Missouri and Oklahoma and are to be expected in Texas.

10. *Liatris bracteata* Gaiser. Corm subglobose, about 4 cm. thick; stems glabrous, few

to several; leaves linear, glabrous, punctate, rigid, slightly channeled, the basal ones 7-12 cm. long and 2-3 mm. broad, somewhat rigid, diminished above until in the head-bearing region they are mere bracts; head-bearing region spiciform, extremely lax; internodes of the spiciform head-bearing region 1-3 cm. long; heads few, subturbinate, 2 cm. long (including the pappus), 15 mm. thick, each with 8 to 10 flowers; lower phyllaries ovate, acuminate, the interior ones broader, lanceolate, commonly cuspidate, 10-12 mm. long, 3-4 mm. broad, commonly purplish, long-ciliate on the margins; corolla purple, 9-11 mm. long, sparsely pilose within the tube; pappus 10-15 mm. long, plumose; achenes 8-12 mm. long. Frequent in prairies of s.e. Tex. (Harris, Galveston and Matagorda cos.), Oct.; endemic.

This species is distinguished from *L. mucronata* on the basis that some of the upper heads are commonly 10- to 14-flowered, all the heads are few and very distant on few-branched stems, the narrow leaves rather channeled and bractlike.

11. *Liatris cymosa* (H. Ness) K. Schum. Corm rounded, to 3 cm. thick; stems stiff, upright, 25-60 cm. tall, dichotomously cymosely branched above; leaves mostly glabrous, punctate, linear-lanceolate, the radical leaves 15-20 cm. long and 5-15 mm. broad, tapering to a clasping subpetiolar base, the stem leaves linear and gradually reduced upward; head-bearing region a simple or compound cymose aggregation; heads 20-25 mm. long, 7-10 mm. thick, each with about 20 flowers; phyllaries appressed, closely imbricated, in about 6 series, slightly hirsute, ciliate-margined, the outer phyllaries almost orbicular with rounded or truncate apices, the inner ones oblong with mucronate tips, often colored; flowers purple; corolla 15 mm. long, the inner surface of the lobe of the corolla and the tube smooth; pappus about 8-10 mm. long, plumose; achenes 8-15 mm. long, hispid on the ribs. Infrequent or rare in tight clay-loam soil, e. Tex. (Brazos, Walker and Washington cos.), Aug.-Nov.; endemic.

12. *Liatris squarrosa* (L.) Michx. Corm rounded, to 4 cm. thick; stems several to numerous, 3-6 dm. tall, variously pubescent; leaves linear and rigid, punctate, glabrous or hirsute, the radical ones 15-25 cm. long and 4-7 mm. broad, the cauline leaves 10-15 cm. long; head-bearing region with 1 to few heads and racemelike or with many heads, branched and paniculate; heads elongate or almost isodiametric, sessile or on short pedicels, 15-30 mm. long, each with 25 to 40 flowers, the terminal heads often greatly exceeding the rest (up to 60 flowers), the heads varying in their thickness according to the spread of the phyllaries; phyllaries foliaceous, glabrous or hirsute, ciliate-membranous or callous-margined; inner phyllaries in all varieties narrowly linear with acute tips, 15-20 mm. long, 1-2 mm. broad; outer phyllaries elongate, triangular or lanceolate, often like reduced leaves, ciliate-margined, linear; middle phyllaries similar, acuminate and spreading or broader, more closely appressed basally, mucronate and squarrose at the tip; corolla phlox-purple, 9-15 mm. long, inner surface of corolla lobes conspicuously hairy, outer flowers of the head tending to be bent outward (approximately at mid-corolla) to give to the head a broad flat top; stigmas sometimes white; achenes 5-6 mm. long; pappus 7-12 cm. long. From Del. to Ill. and S.D., s. to the Gulf States.

Our material is represented by the following three varieties.

Var. *alabamensis* (Alex.) Gaiser. Stems, leaves and outer phyllaries glabrous or softly pubescent; outer phyllaries spreading or slightly squarrose, triangular-lanceolate, acuminate, 5-8 mm. long, 3-5 mm. broad, ciliate-margined; middle phyllaries glabrous, more sharply pointed and cellular-margined, 10-15 mm. long, 5 mm. broad; heads 15-20 mm. long and 10-15 mm. broad, of about 30 flowers; corolla 10-12 mm. long; pappus about 1 cm. long. *L. glabrata* Rydb. var. *alabamensis* (Alex.) Shinnery. Frequent in sandy uplands in e. and s.e. Tex. and n. extreme of Rio Grande Plains, s.w. to Bastrop and DeWitt cos., July-Sept.; also Ala., Miss. and La.

Var. *hirsuta* (Rydb.) Gaiser. Plants with hirsute stems and hirsute narrow 1- to 3-veined leaves and long ciliate-margined phyllaries; few outermost phyllaries may be narrowly lanceolate but most are broadly oblong, narrowing abruptly into long tusklike tips that alone are strongly reflexed to give the head of about 20 flowers a more compact narrow cylindrical appearance (averaging 13 mm. long by 1 cm. thick); outer phyllaries 7-10 mm. long, 4-5 mm. broad; middle phyllaries 10-13 mm. long, 3-4 mm. broad; corolla about 1 cm. long; pappus 8 mm. long. Infrequent in open sandy areas, e. and s.e. Tex., late summer-early fall; also Ky., Miss., Mo., Ark., La., Neb., Kan. and Okla.

This variety is often considered to be a separate species, *L. hirsuta* Rydb.

Var. *glabrata* (Rydb.) Gaiser. Plants entirely glabrous with rigid narrow 1- to 3-veined leaves; phyllaries narrower than in var. *hirsuta*, short-acuminate or cuspidate, callous-margined and recurved after flowers are opened though they may be quite erect before that time; outer phyllaries triangular-lanceolate and 7-10 mm. long; middle phyllaries 10-15 mm. long and 4 mm. broad; heads trim, without the long foliaceous outermost bracts of var. *compacta* and var. *squarrosa* (averaging 13 mm. long and 1 cm. thick), each with 20 to 30 flowers; corolla about 1 cm. long; pappus 7-8 mm. long. Frequent in open sandy lands, n.-cen. Tex., rare e. into e. Tex., late summer-fall, rarely in May; also Mo., Ark., S.D., Neb., Kan., Okla. and Colo.

This is sometimes considered along with var. *alabamensis* to constitute a separate species, *L. glabrata* Rydb.

5. BRICKELLIA ELL.¹⁹²

Perennial herbs, subshrubs or shrubs; leaves opposite or alternate; inflorescence various but basically paniculate; heads discoid, white, greenish-yellow or orange; involucre of numerous graduated bracts with longitudinal striations; florets slender, somewhat contracted above with 5 inconspicuous erect teeth at the summit; achenes 10-ribbed (5-ribbed in *B. Fendleri* and *B. Shineri*), cylindrical, usually densely pubescent; pappus of numerous scabrous (rarely smooth or plumose) bristles. Flowering mostly in late summer and fall.

A New World genus of about 100 species, mostly in western North America.

1. Petioles less than a fifth as long as the blade (2)
1. Petioles more than a fifth as long as the blade (9)
- 2(1). Achenes glabrous or glabrate 7. *B. dentata*.
2. Achenes variously and usually densely pubescent (3)
- 3(2). Leaf bases narrowly cuneate; stems densely leafy .. 8. *B. laciniata*.
3. Leaf bases obtuse or truncate; stems not densely leafy (4)
- 4(3). Leaf blades mostly 10-15 mm. long 2. *B. parvula*.
4. Leaf blades mostly more than 15 mm. long (5)
- 5(4). Leaves lance-oblong, margins somewhat revolute .. 6. *B. venosa*.
5. Leaves lanceolate to ovate, margins not revolute (6)
- 6(5). Leaf blades more than 6 cm. long, the bases oblique 5. *B. viejensis*.
6. Leaf blades less than 6 cm. long, bases not oblique (7)
- 7(6). Pappus bristles plumose (if merely scabrous, then plants glandular-pubescent); leaf blades thin, not reticulate-veined 1. *B. brachyphylla*.
7. Pappus bristles scabrous or smooth; leaf blades subcoriaceous, usually reticulate-veined beneath (8)
- 8(7). Leaves lanceolate to lance-ovate; inflorescence usually somewhat congested 3. *B. cylindracea*.
8. Leaves ovate, usually broadly so; inflorescence usually open, of fewer heads 4. *B. conduplicata*.
- 9(1). Larger leaf blades less than 15 mm. long; heads on very short peduncles 10. *B. veronicaefolia* var. *petrophila*.
9. Larger leaf blades more than 15 mm. long (if shorter, then heads on peduncles about 1 cm. long) (10)
- 10(9). Stems with deciduous papery outer bark; alternately branched (11)
10. Stems without papery outer bark (bark occasionally membranaceous in *B. Coulteri*, which is oppositely branched) (12)

¹⁹² Contributed by Lowell David Flyr.

- 11(10). Leaf bases cuneate; blade outline somewhat rhomboid
 11. *B. baccharidea*.
11. Leaf bases truncate or cordate; blade outline not rhomboid
 9. *B. californica*.
- 12(10). Stems brittle, oppositely branched; heads not in terminal clusters
 12. *B. Coulteri*.
12. Stems simple or variously branched, usually from near the base, not brittle; heads in
 terminal clusters (13)
- 13(12). Achenes 10-ribbed; outer involucre bracts with caudate-acuminate tips
 15. *B. grandiflora*.
12. Stems simple or variously branched, usually from near the base, not brittle; heads in
 bracts acute to acuminate (14)
- 14(13). Involucres about as broad as high; shrubs without glandular-viscid stems
 14. *B. Fendleri*.
14. Involucres 0.5 to 0.7 times as broad as high; herbs with glandular-viscid stems
 13. *B. Shineri*.

1. *Brickellia brachyphylla* (Gray) Gray. Perennial herb, usually much-branched from a woody base; leaves opposite or alternate, short-petioled, lanceolate, the margins serrate or entire, apices acute to acuminate; inflorescence an elongate raceme or panicle or the heads rarely solitary; involucre of 15 to 20 acuminate bracts; achenes densely pubescent; pappus bristles plumose in the typical variety, otherwise scabrous or barbellate. The species ranges through much of w. Tex. (July-Oct.) and is represented with us by 3 varieties as follows:

Var. *brachyphylla*. Stems with stipitate glands; heads about 8 mm. across. Higher elev. in the Trans-Pecos and along caprock in the Plains Country; also the Okla. Panhandle, N.M., s. Colo. and e. Ariz.

Var. *terlinguensis* Flyr. Stems without stipitate glands; heads about 5 mm. across; leaves narrowly lanceolate; plants densely glandular. Lower, more arid places from s. Brewster Co. to Hudspeth Co.; endemic.

Var. *Hinckleyi* (Standl.) Flyr. Stems without stipitate glands; heads about 5 mm. across; leaves broadly lanceolate; plants sparsely glandular. *B. Hinckleyi* Standl. Known only from the n. slope of Mt. Livermore, Jeff Davis Co.

2. *Brickellia parvula* Gray. Much-branched perennial herb from an elongate woody base, usually less than 3 dm. tall; leaves opposite below, short-petioled, about 15 mm. long, ovate, thin, acute at the apices, margins serrate; inflorescence a loose corymbose panicle, the heads long-pedunculate; involucre 8-9 mm. high, of about 15 bracts; achenes densely pubescent; pappus of about 30 somewhat barbellate bristles. Franklin Mts., El Paso Co. and Guadalupe Mts., Culberson Co., Sept.-Oct.; also s. Ariz.

3. *Brickellia cylindracea* Gray & Engelm. Perennial herb or subshrub to 1 m. tall, from a compact woody base, stems usually several; leaves opposite or alternate, sessile or with a petiole 1-3 (-5) mm. long, lanceolate to narrowly ovate, usually coriaceous and reticulate-veined beneath (less often thin with veins obscure), margins crenate to serrate, apices obtuse or acute; inflorescence racemose to paniculate, often very dense, with leafy bracts intermixed; involucre usually reddish-tinged, of about 20 bracts, the outer bracts much shorter than the inner; pappus of about 30 to 35 scabrous bristles; achenes sparsely to densely pubescent. Various habitats from Bell and Travis cos. w. to Jeff Davis and Presidio cos., Aug.-Nov.; also n. Mex.

An extremely variable species in leaf size, shape and texture as well as inflorescence; not easily distinguished from the next species.

4. *Brickellia conduplicata* (Robins.) Robins. Perennial herb with few mostly simple stems arising from a compact woody rootstock; leaves mostly opposite, with a distinct petiole about 3 mm. long, ovate (often broadly so), flat or conduplicate, often reticulate veined below, margins crenate to somewhat serrate, apices acute or obtuse; inflorescence usually a panicle or sometimes a raceme but heads not densely crowded; involucre occasionally reddish-tinged, bracts acute to acuminate; achenes usually densely pubescent. Higher elev. in s. Brewster and Presidio cos., Aug.-Nov.; also n. Mex.

Many of the plants referred here may be only extreme variants of the preceding species.

5. *Brickellia viejensis* Flyr. Coarse perennial herb about 6 dm. tall; stems longitudinally furrowed, pubescent and somewhat glandular; internodes about 5 cm. long; leaves subopposite, 6-8 cm. long with a petiole to 1 cm. long, the leaf bases oblique, margins coarsely serrate, apices acute, the blades pubescent and glandular-punctate; inflorescence an open panicle; involucre about 14 mm. high, of about 18 linear bracts acute at the apices; achenes with dense fine pubescence; pappus of about 35 scabrous bristles. Sierra Tierra Vieja, Presidio Co.; endemic.

6. *Brickellia venosa* (Woot. & Standl.) Robins. Perennial herb or subshrub, much-branched from near the base; stems slender, brittle, pubescent; leaves opposite, sessile or with a short petiole, narrowly lance-oblong, margins entire or crenulate and somewhat revolute, reticulate-veined, apices obtuse; inflorescence a loose panicle; heads about 7 mm. across; involucre bracts about 25, reddish-tinged, the outer mucronate; achenes sericeous, the ribs obscure; pappus of about 30 to 40 shining bristles. *Coleosanthus venosus* Woot. & Standl. Rocky slopes and arroyos, in Tex. only from the Franklin Mts., El Paso Co., Aug.-Oct.; also s. N.M., s. Ariz., n. Mex. (Son., Chih.).

7. *Brickellia dentata* (DC.) Sch. Bip. Shrubs about 1 m. tall, much-branched from near the base; stems ascending, with pale bark; leaves alternate, short-petioled, densely crowded, lanceolate, margins dentate or sometimes nearly entire above, apices acute; inflorescence an elongate leafy panicle with heads less than twice as high as broad; involucre bracts minutely pubescent near the obtuse to acute apices; achenes glabrous or very slightly puberulent; pappus of 30 to 35 barbellate bristles. *B. Riddellii* (T.&G.) Gray. Limestone streambeds, s.e. Edwards Plateau, Aug.-Nov.; endemic.

8. *Brickellia laciniata* Gray. Shrub, usually 1-2 m. tall, with bright-green foliage and very numerous closely-ascending branches; young stems glandular-pubescent with papery white outer bark that soon peels away to reveal tan smooth inner bark; older stems usually leafless; leaves alternate, crowded, oblong or ovate but irregularly toothed or cleft, narrowly cuneate at the base to a slender petiole, vernicose and punctate; inflorescence an elongate leafy panicle with heads about twice as high as broad; involucre bracts about 20, acutish, somewhat glutinous; achenes sparsely pubescent; pappus of about 25 minutely-scabrous bristles; reflexed involucre bracts often persisting long after achenes have fallen. Dry streambeds and rocky places from Kimble and Val Verde cos. westw. through the Trans-Pecos, Aug.-Nov.; also s. N.M. and n. Mex. to S.L.P., Zac. and Dgo.

A very common weedy shrub through much of its range. This species almost certainly hybridizes with *B. californica* in the Davis Mts.

9. *Brickellia californica* (T.&G.) Gray. Shrub, usually more than 1 m. tall, divaricately branched; stems somewhat tortuous, with glandular-puberulent deciduous papery outer bark; leaves alternate, with a petiole equaling a third to half the punctate somewhat scabrous blade which is broadly ovate to deltoid and truncate or cordate at the base, margins dentate, crenate, somewhat lobed or rarely nearly entire, apices acute or obtuse; inflorescence a leafy panicle or a series of terminal ascending branches, each of these a raceme; involucre bracts about 3 mm. across, 9 mm. high, of about 20 acute to acuminate bracts, often reddish-tinged; achenes tawny-pubescent; pappus of about 30 scabrous bristles. *B. Wrightii* Gray [including var. *reniformis* (Gray) Robins.]. Rocky places from about 4,000 to 7,500 ft. alt. in the Trans-Pecos, and in the Panhandle near the caprock, Aug.-Nov.; also the Okla. Panhandle, Colo., Ut., Ida., s. to n.w. Mex. (incl. Baja Calif.).—Cf. note under *B. laciniata*.

10. *Brickellia veronicaefolia* (H.B.K.) Gray var. *petrophila* (Robins.) Robins. Shrub usually less than 5 dm. tall, much-branched from near the base; stems reddish, glandular-pubescent; leaves subopposite, with a petiole about 3-4 mm. long, broadly ovate to reniform, usually less than 15 mm. long, margins crenate, minutely pubescent and punctate, obtuse at the apex; inflorescence a leafy panicle; involucre bracts about 7 mm. across, reddish-tinged, the bracts 35 to 40, acute to acuminate; achenes 10-ribbed, glabrate; pappus of about 25 scabrous bristles. Known in Tex. (and the U.S.) only from higher elev. of the Chisos Mts.; this and other varieties of the species common over much of the Mex. Plateau.

11. *Brickellia baccharidea* Gray. Shrub with slender mostly ascending branches; leaves alternate, disposed mostly at the ends of the branches, with a petiole about 5-7 mm. long, rhomboid-ovate with a cuneate base, rather thick, reticulate-veined, punctate,

margins coarsely toothed, acute at the apices; inflorescence a loose leafy panicle, the heads mostly crowded on the terminal 1 dm. of each branch; involucre about 3 mm. broad, 7 mm. high, of about 25 mostly obtuse bracts, the outermost bracts very short; achenes appressed-pubescent; pappus of about 20 minutely scabrous bristles. Known in Tex. only from the Franklin Mts., El Paso Co.; also s. Ariz.

12. *Brickellia Coulteri* Gray. Diffuse sprawling shrub to about 1 m. tall, oppositely branched; stems very brittle, with crisped-glandular pubescence; leaves opposite, with petioles about a third the length of the broadly ovate-deltoid blade, minutely pubescent, margins coarsely toothed or rarely entire, attenuate at the apices; inflorescence a diffuse panicle; involucre about 20, acute to acuminate; florets about 17; achenes sparsely glandular-pubescent, the ribs obscure; pappus of 35 to 40 minutely scabrous bristles. In sand and among rocks at lower elev. in the Trans-Pecos near the Rio Grande, late spring-fall; also s. Ariz., n.w. Mex. (incl. Baja Calif.).

13. *Brickellia Shineri* Flyr. Viscid perennial herb to 6 dm. tall from a compact woody rootstock; stems striate, glandular-pilose; leaves opposite below, subopposite to alternate above, with a petiole about equaling the ovate to deltoid thin blade, margins coarsely crenate-dentate, apices acute to slightly acuminate, thin; inflorescences corymbose or with smaller clusters of heads disposed along the stems in addition; involucre about 4 mm. across, the bracts several-seriate, 15 to 20, acuminate; achenes 5-ribbed (or with a few additional indistinct ribs), sparsely pubescent; pappus of about 30 scabrous bristles. *Eupatorium Parryi* Gray. Higher elev. in the Chisos Mts. and in canyons in Val Verde Co., late spring-fall; also n. Mex., but rare.

14. *Brickellia Fendleri* Gray. Shrub usually less than 1 m. tall, much-branched from near the base; stems with crisped hairs; leaves alternate, with a petiole a third to one half as long as the broadly ovate to deltoid blade, margins crenate-dentate, attenuate at the apices; inflorescence a panicle but the heads usually densely clustered, somewhat nodding; involucre nearly as broad as high, bracts about 20 to 25, conspicuously unequal, minutely pubescent especially near the margins, obtuse to acute at the apices; achenes 5-ribbed (or occasionally with a few intervening between these), coarsely puberulent; pappus of about 25 scabrous bristles. *Eupatorium Fendleri* (Gray) Gray. Moist places at higher elev. in the Guadalupe, Davis and Chisos mts., July-Oct.; also N.M. and Ariz.

15. *Brickellia grandiflora* (Hook.) Nutt. Perennial herb, usually much less than 1 m. tall, from a fusiform rootstock; stems few, erect, crisped-puberulent; leaves opposite below to alternate above, triangular or somewhat hastate, with a petiole more than half as long as the crenate-dentate blade, apices long-attenuate; inflorescence more or less paniculate but heads crowded at the tips of the branches; involucre about 7-8 mm. broad, the outer bracts with caudate-acuminate tips, the inner acute; florets with slightly enlarged throats; achenes somewhat constricted near the apex, 10-ribbed (obscurely), minutely puberulent; pappus bristles about 25 to 30, scabrous, somewhat caducous. In high forests in the Guadalupe, Davis and Chisos mts., July-Oct.; also Mo., Ark., Neb. and Colo. w. and n. to Calif. and B.C., and in n. Mex. (incl. Baja Calif.)

6. KUHNIA L. FALSE BONESET

Perennial herbs from vertical obconical woody taproots, the crowns usually several; stems 1 to several, simple or branched, erect to decumbent; leaves alternate (in young plants or young stems the lowermost leaves sometimes opposite); heads solitary or few and long-peduncled or in subcorymbose or paniculate aggregations; involucre subcylindric to turbinate or campanulate; phyllaries firm (often chartaceous in age), in 4 to 7 series (but only the outer 2 to 4 series distinctly graduated in size), the outer ones lanceolate to deltoid, acute or acuminate, the inner ones linear or narrowly oblong or oblanceolate; receptacle flat or slightly convex, naked; ray flowers absent; disk flowers perfect, fertile; corollas regularly 5-lobed at summit, whitish to yellowish or reddish; style tips flattened, clavate, long; achenes columnar or slightly clavate, 10-ribbed (or also in some specimens with extra intermediate weaker ribs); pappus of 10, 15 or 20 equal uniseriate plumose bristles slightly shorter to slightly longer than the corollas.

A North American genus of about half a dozen species.

1. Stem leaves all narrowly linear and entire, not more than 3 mm. broad (2)
1. Stem leaves linear-lanceolate to broadly rhombic, at least the middle and lower ones more than 3 mm. broad (3)
- 2(1). Leaves narrowly linear, 0.5-1 mm. broad, very numerous and crowded, the upper ones little reduced; stems simple up to the narrow part of the plant where the heads are borne on ascending branches 1. *K. leptophylla*.
2. Leaves linear to lanceolate, the larger ones 1-3 (-8.5) mm. broad, scattered, the upper considerably smaller; branching usually profuse and spreading 2. *K. chlorolepis*.
- 3(1). Leaves sessile or subsessile, entire or rarely with a single pair of prominent teeth near the base, the larger blades 1.5-8.5 mm. broad; heads solitary or in loose clusters of 2 to 5, on peduncles or branchlets 5-30 (-120) mm. long 2. *K. chlorolepis*.
3. Leaves subsessile or short-petioled, the petioles to 1 cm. long, the blades entire or coarsely and deeply toothed with the larger ones 5-45 mm. broad; heads mostly in rather dense clusters of 3 to 8, on peduncles 3-20 mm. long, or a few solitary or in pairs on peduncles as much as 40 mm. long 3. *K. eupatorioides*.

1. *Kuhnia leptophylla* Scheele. Stems 2-7 dm. tall; leaves very numerous, often with axillary fascicles, sessile, the upper ones little-reduced, the narrowly linear blades to 5 cm. long and 1 mm. broad, entire and with revolute margins, scabrous above, punctate beneath, falcate or twisted; branches in the head-bearing region closely ascending so that the stem with heads is rather narrowly cylindrical; involucre 7.8-9 mm. high; flowers 17 to 25; phyllaries linear; corollas about 6.3 mm. long; achenes 10-ribbed, 5-6 mm. long; pappus conspicuously plumose, brown, 4.5-5.5 mm. long. Local on limestone slopes and in stream beds, s. part of Edwards Plateau, Sept.-Nov.; endemic.

2. *Kuhnia chlorolepis* Woot. & Standl. Stems 30-75 cm. tall, usually bushy-branched in the upper third or nearly from the base, minutely pubescent; stem leaves sessile or subsessile, linear or narrowly oblong to lanceolate, entire or very rarely with a basal pair of salient teeth, green and scabrous above, paler, punctate and glabrous beneath, 1- or the larger 3-nerved; middle and lower leaf blades 25-55 (-75) mm. long, 1.5-8.5 mm. broad; heads solitary and terminal on the branchlets or in small loose clusters of 2 to 5; peduncles 5-30 mm. long; involucre 8-12 mm. high; flowers 15 to 34; phyllaries linear to oblong or oblong-lanceolate, obtuse and apiculate; corollas 6.3-7.5 mm. long; achenes 4.8-5.2 mm. long, blackish-brown; pappus bristles 5-6.3 mm. long. Infrequent in the Trans-Pecos and w. part of Edwards Plateau, late summer-fall; Chih., Coah., Dgo., N.L., Son., Zac., Ariz., Colo., N.M., Tex., (Ut.?).

3. *Kuhnia eupatorioides* L. Stems solitary or few, 4-13 dm. tall, erect, simple below the head-bearing region; stem leaves narrowly lanceolate to broadly rhombic-lanceolate, the largest ones 25-100 mm. long and 5-40 mm. broad, minutely scabrous and resin-dotted above, paler and reticulate-veiny and resin-dotted beneath, marginally entire to sparingly and shallowly dentate; petioles of largest leaves to 1 cm. long; branching in the head-bearing region rather spreading and loose; heads corymbosely clustered; involucre 7-14 mm. high; flowers 7 to 33; phyllaries in about 4 series, striate, hirsutulous, more or less resin-dotted, the outer subulate-deltoid to lanceolate with acute to very narrowly linear tips, 0.6-1.1 mm. broad; corollas creamy or yellowish, 4.5-5.8 mm. long; achenes 10-ribbed, 4.5-5.2 mm. long; pappus bristles 20, white to brownish, 4.5-5.5 mm. long. Widespread e. of Trans-Pecos, flowering in very late summer and fall, with 3 varieties in Tex. as follows:

Var. *eupatorioides*. Middle and outer phyllaries acute or acuminate, usually all considerably less than three fourths as long as the inner and erect and appressed; flowers 7 to 14 per head; involucre 7-10.5 mm. high. In deep sandy soils of e. Tex., s.w. to Bexar and Wilson cos.; widespread in e. U.S., n. to Ind., Pa. and N.J.

Var. *texana* Shinn. Middle and outer phyllaries with conspicuous elongate falcate or twisted filiform tips, usually at least some of them from three fourths to fully as long as the inner. Calcareous soils of n.-cen. Tex. and e. part of Edwards Plateau and rare in the Plains Country; also known in Okla.

Var. *corymbulosa* T.&G. Outer phyllaries much as in var. *eupatorioides* but involucre

8.7-14 mm. high and heads with 14 to 33 flowers. Plains Country; also midwest. U.S. from O. to N.M. and Mont. Another variety, var. *ozarkana* Shinnars, is known from Ark., Ill. and Mo.

7. AGERATUM L.

An American genus of about 3 dozen species.

1. *Ageratum corymbosum* Zuccag. Subshrubs or perennial herbs 3-7 dm. tall, the culms often partly decumbent, often rather freely branched; leaves opposite (or those bracteals in the upper head-bearing extremity not), firm-membranous; blades ovate to rhomboid-lanceolate, 3-6 cm. long, 14-35 mm. broad, acute, basally rotund or cuneate, marginally crenate to dentate, rarely serrate, from the base 3- (to 5-) nerved, pubescent, more densely so below; petioles 4-8 mm. long; heads about 7 mm. thick, in tight corymbiform aggregation at the ends of the branches; involucre campanulate to hemispheric; phyllaries linear-lanceolate, attenuate, hispidulous, 2-ribbed, in 2 or 3 series, well-imbricated and graduated; receptacle essentially flat, naked; ray flowers absent; disk flowers perfect, fertile, the corolla blue and 5-toothed terminally; achenes 2.2 mm. long, black-brown to black, glabrous, 5-ribbed; pappus a low irregular crown of connate scales 0.3 mm. long, persistent. Reported to occur in the Trans-Pecos, apparently through the mistaken assumption that Wright's collection locality "Guadalupe Pass" is in Tex.; actually it is in s.w. N.M. near the Ariz. border; widespread in Mex. highlands.

8. TRICHOCORONIS GRAY

Annual (?) glabrous herbs 5-30 cm. tall, freely branching from the base and rooting at the lower nodes; most of the leaves opposite, only a few upper ones becoming alternate, sessile, 1-3 (-6) cm. long, often shallowly to deeply incised into 3 lobes nearly to the tip but otherwise entire and oblong to cuneate; heads singly terminating the branches; involucre hemispheric, 2-6 mm. high; phyllaries linear or oblong, in roughly 2 subequal series, weak and thin and each obscurely 3-nerved; receptacle slightly convex, naked; ray flowers absent; disk flowers perfect, fertile, numerous, the corollas whitish or purplish-white, sharply divided into a minute glandular-pubescent tube and an abruptly flaring 5-toothed limb; achenes 1-2 mm. long, slightly flattened, 5-ribbed at maturity, glabrous, linear, dark; pappus essentially absent or of a few very minute fimbriate scales.

A genus of 2 species, both occurring in Texas.

1. Achenes about 1 mm. long and involucre about 2 mm. high 1. *T. Wrightii*.
 1. Achenes about 2 mm. long and involucre about 5 mm. high 2. *T. rivularis*.

1. *Trichocoronis Wrightii* Gray. Depressed annuals (?) with fibrous roots, usually spreading so that the diameter of the clump is greater than the height of the plant; leaves usually oblong, only obscurely toothed near the apex; involucre about 2 mm. high; corolla about 1 mm. long; achenes about 1 mm. long. Local in moist swales, calcareous clay soil, Rio Grande Plains and s. part of s.e. Tex. (also Gonzales Co.), spring; also Tam.; adv. in Calif.

2. *Trichocoronis rivularis* Gray. Much-branched and rooting at the nodes, spreading or sprawling; leaves often flaring and slightly lobed apically; involucre usually 5-6 mm. long; corolla 2-3 mm. long; achenes about 2 mm. long. *Shinnarsia rivularis* (Gray) King & Rob. Very rare and local in moist spring-fed swales and rooted and submersed in streams in n.e. part of Rio Grande Plains and s. part of Edwards Plateau, spring; also Coah.

9. CARMINATIA DC.

PLUME-WEED

A monotypic genus.

1. *Carminatia tenuiflora* DC. Taprooted annual; stems usually subsimple or few-branched, (1-) 2-5 dm. tall; most of the leaves opposite or the uppermost few alternate;

blades thin, deltoid to ovate-deltoid, 2-5 cm. long, coarsely serrate, acutish, petioles about as long as the blades; heads often in interrupted-spiciform arrangement in the upper parts of the stem (or branch); involucre 10-15 mm. high, nearly cylindrical when young or at fruiting time narrowly obconic; phyllaries in about 4 rough series and strongly unequal or often extremely strongly graduated and no two of the same length, subulate or lanceolate, few-nerved, glabrous, the outermost only 2 mm. long; receptacle about 1 mm. broad, essentially flat, naked; *ray flowers* absent; *disk flowers* few, perfect, fertile, the corolla white or greenish-white, extremely shallowly 5-toothed terminally; achenes columnar, 5-ribbed; pappus deciduous as a unit, composed of a basal ring to which are attached about 10 dorsiventrally flattened plumose bristles. Rare in moist canyons, Davis, Chisos and Chinati mts. in the Trans-Pecos, Aug.-Oct.; C.A. n.w. to Ariz. and Tex.

10. STEVIA CAV.

Perennial herbs, subshrubs or shrubs, or much-branched above the base, usually 5-10 dm. tall; leaves opposite (or subopposite, scattered or alternate in *S. serrata*), usually elongate, unlobed, often serrate, usually short-petiolate, minutely resin-dotted; heads in tight corymbiform aggregations at the top; involucre nearly cylindrical; phyllaries 5 (or 6), usually nearly linear or oblanceolate-linear, occasionally 1 or 2 narrow shorter leaflike bracts also present near the base; receptacle flat, naked; ray flowers absent; disk flowers 5 (or 6), perfect, fertile, the corolla white or purplish-white and 5-toothed terminally; achenes columnar, 5-ribbed, black; pappus usually of 1 to 3 stiff awns (these absent in some flowers of the head in some species) and minute intermediate scales.

A genus of perhaps 100 species of the Americas from Argentina and Chile to southwestern United States.

1. Distinctly shrubby plants of branched habit or ligneous only near the base (2)

1. Herbaceous or nearly so (3)

2(1). Leaves pubescent on both surfaces 3. *S. rhombifolia*.

2. Leaves entirely glabrous or at most obscurely hirtellous
..... 1. *S. salicifolia*.

3(1). Leaves alternate or scattered 2. *S. serrata*.

3. Leaves (at least the main cauline) opposite 3. *S. rhombifolia*.

1. *Stevia salicifolia* Cav. **HIERBA DEL AIRE**. Slender-stemmed viscid vernicose shrubs 2-8 dm. tall; leaves opposite, narrowly lanceolate to usually linear, alternate on the upper and lower part of stem, sharply serrate to nearly entire, penninerved; heads about 1 cm. long; phyllaries acute; most of the achenes awned. *S. foliosa* Small. Reported to occur in Tex. but we have not seen any Tex. collections, fall (?); widespread in the highlands of Mex. s.e. to Ver. and Pue.

2. *Stevia serrata* Cav. Erect perennial 4-8 dm. high; stem usually virgate, very leafy; leaves alternate or scattered or merely subopposite, often oblanceolate to spatulate-linear but variable, usually strongly serrate in the distal half, 3-5 cm. long, usually 2-8 mm. broad, attenuate and sessile basally, green and resin-dotted above and below; heads 8-10 mm. long; phyllaries resin-dotted; pappus a corona of short scales, some of the flowers also with 2 or 3 long awns. Incl. var. *ivaefolia* (Willd.) Robins. Rare in Trans-Pecos mts., Aug.-Oct.; Tex., N.M. and Ariz. s.e. to Ecu. and Venez.

3. *Stevia rhombifolia* H.B.K. Erect herbaceous perennial or subshrub, or even at times distinctly fruticose, 6-12 dm. tall, single-stemmed at base, sometimes virgate but usually having several pairs of opposite branches above the middle; leaves opposite (or in the upper few cm. of the head-bearing portion alternate), acutish to acuminate, crenate-serrate from below the middle, entire toward the gradually narrowed sessile or short-petioled base, hirtellous to rather copiously pubescent on both surfaces at least near the veins, 2-6 (-9) cm. long, 15-25 (40) mm. broad; heads 6-9 mm. long; phyllaries minutely resin-dotted, 4-5.7 mm. long; pappus of a crown of short erose scales and most of the achenes also with 1 (or 2) long awns. Rare in the Trans-Pecos (Chisos Mts.), late summer; highlands of Mex. and C.A.

11. MIKANIA WILLD.

An American genus of about 175 species.

1. *Mikania scandens* (L.) Willd. CLIMBING HEMP-WEED. Perennial twining vine; leaves opposite; blades elongate-deltoid, acute, (2-) 3-10 cm. long, marginally undulate or shallowly lobed, basally often slightly cordate; petioles about half as long as blades; heads in corymbiform aggregations at the ends of the branches; phyllaries 4, lanceolate, a few mm. long, equal, often with a fifth one attached in an outer "series;" receptacle less than 1 mm. broad, essentially flat, naked; ray flowers absent; disk flowers uniformly 4 per head, perfect, fertile, the corolla whitish and 5-toothed terminally; achenes short-columnar or slightly obconical, 5-ribbed; pappus persistent, of about 30 rather stiff bristles. Incl. var. *pubescens* T.&G. Infrequent in river bottoms and other moist woods, e. and s.e. Tex., rare in Rio Grande Plains and n.-cen. Tex., late summer-fall; warmer parts of Am., n. to Sin., and to N.E. and s. Ont.

12. EUPATORIUM L.

BONESET. THOROUGHWORT

Usually perennial herbs, also fairly commonly scandent elongate perennial herbs, or a few species of shrubs; leaves opposite; heads often in roughly corymbiform aggregations either at the top of the plant or terminal on the branches; involucre hemispheric or campanulate to essentially cylindrical; phyllaries more than 4, in 2 to 6 series, either subequal (when few-seriate) or strongly imbricated, usually with 1 or more vertical nerves, usually herbaceous (rarely papery) in texture, occasionally somewhat indurate basally; receptacle flat to conic, naked; ray flowers absent; disk flowers few to numerous, perfect, fertile, the corolla equally 5-toothed terminally, whitish, bluish, purplish or roseate; style branches long and clavate; achenes usually blackish, subcolumnar or gently narrowed to the base, 5-ribbed (occasionally fainter intermediate stripes visible); pappus of slender bristles, persistent. *Osmia* Sch. Bip.; *Conoclinium* (L.) DC.

Primarily an American genus of about 1,000 species, a few in Europe, Asia and Africa. *Eupatorium* is exceedingly closely related to *Brickellia*, and the two genera could easily be united with no violence to their taxonomy. *Mikania* could even more easily be submerged in *Eupatorium*.

1. Leaf blades dissected into linear or filiform segments less than 2 mm. broad or if entire then linear or filiform, not more than 2 mm. broad (2)
1. Leaf blades simple and broader than 2 mm. or dissected but the divisions broader than 2 mm. (3)
- 2(1). Leaves or their segments filiform, 0.5 mm. broad or narrower 1. *E. capillifolium*.
2. Leaves or their segments 1-2 mm. broad 2. *E. compositifolium*.
- 3(1). Leaves connate-perfoliate 8. *E. perfoliatum*.
3. Leaves not connate-perfoliate (4)
- 4(3). Most of the leaves deeply palmately 3-lobed and the 3 lobes again pinnately dissected 15. *E. Greggii*.
4. Most of the leaves unlobed (5)
- 5(4). Involucres cylindric and the phyllaries in a number of series and very strongly imbricate (6)
5. Involucres usually obconic to hemispheric and the phyllaries in 2 to 4 series and weakly if at all imbricate (8)
- 6(5). Leaves whorled 11. *E. fistulosum*.
6. Leaves opposite (7)
- 7(6). Leaves lance-linear; achene about 2-2.4 mm. long .. 13. *E. ivaeifolium*.
7. Leaves deltoid-ovate to rhombic-ovate; achene about 4 mm. long 14. *E. odoratum*.

- 8(5). Petioles less than 2 mm. long, or absent (9)
8. Petioles 2 mm. long or more (14)
- 9(8). Leaves deltoid-ovate 7. *E. rotundifolium*.
9. Leaves elliptic or oblong to linear (10)
- 10(9). Inner phyllaries with acute white tips; involucre about 7 mm. high 6. *E. leucolepis*.
10. Inner phyllaries blunt or if acutish then not white except in a very thin marginal zone (11)
- 11(10). Principal leaves prominently 3-nerved at the base, narrowed to a narrowly marginal subpetiolar base 1-2 mm. long; inner phyllaries narrowly obovate, broadly rounded apically; north-central Texas 9. *E. altissimum*.
11. Principal leaves only faintly if at all 3-nerved; inner phyllaries mostly narrowly oblong to lanceolate or linear; east and southeast Texas (12)
- 12(11). Involucre 3-4 mm. high 3. *E. glaucescens*.
12. Involucre 4-7 mm. high (13)
- 13(12). Principal leaves 3-11 cm. long, usually 1-3 mm. broad 4. *E. hyssopifolium*.
13. Principal leaves 2-5 cm. long, usually 3-8 mm. broad .. 5. *E. linearifolium*.
- 14(8). Whitish flowered shrubs (15)
14. Herbs, subshrubs or lianes or if approaching a shrubby habit then flowers not whitish (16)
- 15(14). Leaf blades 1-2 cm. long; petioles (2-) 3-5 mm. long; Trans-Pecos Texas 24. *E. Wrightii*.
15. Leaf blades (2-) 3-5 (-7) cm. long; petioles 3-10 (-15) mm. long; east of Trans-Pecos Texas 23. *E. havanense*.
- 16(14). Receptacle markedly convex to usually beehive-shaped; corollas bluish or purplish, rarely whitish (17)
16. Receptacle essentially flat; corolla whitish varying to pink or lilac-white, rarely or never blue or purple (19)
- 17(16). Scandent shrubs or woody nontwining vines of extreme south Texas woodlands 18. *E. azureum*.
17. Stems always herbaceous (18)
- 18(17). Blades deltoid; stems scandent-climbing to 2 m. tall 17. *E. coelestinum*.
18. Blades oblong, usually 2 to 3 times as long as broad, the lower corners often prolonged parallel to the petioles (subcordately); stem not scandent, not more than 1 m. tall, much of it reclining and node-rooting 16. *E. betonicifolium*.
- 19(16). Involucre densely and softly pubescent and resin-dotted 10. *E. serotinum*.
19. Involucre glabrous to granular-puberulent, rarely resin-dotted (20)
- 20(19). East of Trans-Pecos Texas (21)
20. Trans-Pecos Texas (22)
- 21(20). Corolla glabrous 19. *E. incarnatum*.
21. Tips of corolla lobes dorsally pubescent 20. *E. rugosum*.
- 22(20). Blades broadly lanceolate; phyllaries very acute .. 12. *E. solidaginifolium*.
22. Blades proportionately broader, ovate or deltoid-ovate (23)
- 23(22). Rhizomes slender, rarely woody; leaf blades rarely cordate; whole plant never yellow-green; tips of corolla lobes dorsally pubescent; involucre essentially glabrous 21. *E. Rothrockii*.
23. Rhizomes woody, with thicker woody crowns at intervals; leaf blades usually slightly cordate; whole plant usually grayish-yellow-green; tips of corolla lobes glabrous; involucre usually granular-puberulent 22. *E. herbaceum*.

1. *Eupatorium capillifolium* (Lam.) Small. DOG-FENNEL. Coarse rhizomatous perennial (reported to be annual elsewhere) erect herb to 3 m. tall; stems scabrous-hirsute; leaves crowded, mostly alternate, 1- or 2-pinnately divided into many segments, the divisions 0.5 mm. broad or narrower, on the upper leaves entire; heads in an elongate leafy much-branched wandlike or thyriform or paniclelike arrangement, very numerous, green to bronze, 3- to 5-flowered, 2-3 mm. long; involucre obconic, about 3 mm. high, nearly glabrous; phyllaries roughly biseriate, the principal ones subequal, few, oblong, about 3 mm. long, mostly green with whitish margins, often with 4 green veins visible under high magnification; outer phyllaries very few, much shorter; corolla white; achenes about 1 mm. long. Infrequent or rare in sandy soil, e. and s.e. Tex., Oct.; s.e. U.S.

Intergrading completely with *E. compositifolium* and scarcely deserving separate recognition. Possibly our plants are not true *E. capillifolium* of the eastern coast (Va. to Fla.) which is described in some manuals as an annual.

2. *Eupatorium compositifolium* Walt. YANKEE WEED. Identical to *E. capillifolium* but with coarser, harsher pubescence; leaf segments or leaves 1-2 mm. broad; involucre 3, 3-4.5 (-5) mm. high; achenes about 1.5 (-2) mm. long; the other parts correspondingly averaging larger. Exceedingly abundant in overgrazed pastures and disturbed areas of sandy soil, e. and s.e. Tex. and coastal parts of Rio Grande Plains, Sept.-Oct. (rarely as late as Jan.); s.e. U.S.

Apparently hybridizing occasionally with *E. perfoliatum*, the hybrids having been called *E. pinnatifidum* Ell.

3. *Eupatorium glaucescens* Ell. Perennial herb from short ligneous rhizomes; stems few, mostly simple from the base, (3-) 5-8 dm. tall; leaves opposite, narrowly oblong to oblong-lanceolate or oblong-oblongate, 3-5 (-8) cm. long or essentially absent; heads in a roughly corymbiform cluster at the top; involucre 3-4 mm. long, obconic; phyllaries in 2 distinct size-classes (the outer extremely short), softly and usually copiously pubescent, often resin-dotted, with a very narrow white border all around; flowers whitish or brownish-white. *E. cuneifolium* Willd., *E. semiserratum* DC., *E. semiserratum* DC. var. *lancifolium* T.&G. Frequent in sandy soil, e. and s.e. Tex. (s. to Aransas Co.), Aug.-Sept.; s.e. U.S.

4. *Eupatorium hyssopifolium* L. Perennial herb from short rhizomes; stems few, ascending (2-) 3-5 (-7) dm. tall; leaves opposite, often with fascicles of smaller leaves in the axils, the principal ones 3-11 cm. long, usually subentire or with obscure appressed teeth in the distal half, linear or lance-linear, 1-3 (-10) mm. broad; heads 3- to 7-flowered; involucre 4.5-5.5 mm. high, subcylindric, canescent-pilose; inner phyllaries narrowly oblong, round-tipped or blunt, the narrow margins thinner, whitish; flowers white, exserted. Incl. var. *calcaratum* Fern. & Schub. Said to occur in e. Tex., but we have seen no specimens, late summer and early fall; s.e. U.S. and Coastal States n. to Mass.

The complex including *E. glaucescens*, *E. linearifolium* and *E. hyssopifolium* needs much further taxonomic evaluation.

5. *Eupatorium linearifolium* Walt. Perennial herb, the stem loosely bushy-branched from near the base, 4-10 dm. tall, pilose above; leaves narrowly oblanceolate to linear-spatulate, entire, tapering to a slender base, obtuse, minutely pilose, the larger ones 2-5 cm. long and 3-8 mm. broad, usually with shorter leaves fascicled in the axils; involucre 4-7 mm. high; phyllaries in 2 (or 3) series, pilose, the inner ones subequal, acutish, outer ones much shorter than the inner ones. *E. tortifolium* Chapm. Reported to be present in e. Tex., but we have seen no specimens, late summer-fall (?); coastal states, Va. to Tex.

6. *Eupatorium leucolepis* (DC.) T.&G. JUSTICE-WEED. Perennial herb from a short knotty fibrous-rooted stock; stems erect, 8-12 dm. tall, minutely gray-puberulent; leaves opposite, firm and fairly thick, nearly sessile, those of midstem 3-8 cm. long and 5-9 mm. broad, broadly linear or narrowly oblong, dull-gray, bluntish, on each side in the upper two thirds to five sixths the length with 7 to 12 appressed teeth; heads dirty-white, in a roughly corymbiform arrangement at the tip; involucre inverted-conical, about 7 mm. high; phyllaries in 2 or 3 series, sharply differentiated with a minute outer series and the longer inner series, the longer ones subulate, acute, mostly herbaceous, with a narrow white margin and white tip-portion (often as much as a third the total length). Rare in e. and s.e. Tex. (Hardin, Jasper, Orange and Tyler cos.) in sandy or boggy woods, Oct.; near the coast, N.Y. to Tex.

Apparently intergrading or introgressing in Texas with *E. glaucescens* which is extremely closely related.

7. *Eupatorium rotundifolium* L. Perennial herb from short rhizomes with thick masses of fibrous roots; stems one or few, nearly simple, erect, (3-) 5-12 dm. tall, hispid, often scaberulous; leaves deltoid-ovate to ovate-deltoid, serrate, blunt or rarely acutish, basally truncate or less commonly shortly narrowed (very broadly cuneate), 3-nerved basally; heads few-flowered; involucre softly pubescent, obconic, 4.5-5.5 mm. long, often resin-dotted; phyllaries in roughly 2 size-classes (the outer ones much less than half as long as the inner), linear, nerveless, grayish, with narrow whitish margins all around, blunt or rarely acutish with whitish tips; receptacle essentially flat; corollas whitish. *E. scabridum* Ell. Frequent in (often moist) sandy loam, forested areas, e. and s.e. Tex., rare inland to n.-cen. Tex., (July-) Aug.-Sept.; s.e. U.S. and near the coast n. to N.Y.

8. *Eupatorium perfoliatum* L. ТНОРОУСНВОРТ. Rhizomatous perennial forming colonies; aerial stems (3-) 5-15 dm. tall, simple below, branched in the upper part; leaves opposite, lanceolate, sessile, perfoliate, (3-) 5-15 cm. long, serrate, softly pubescent especially on the underside; heads numerous and crowded, 10- to 20-flowered; involucre obconic, 3-5 mm. high, softly grayish-pubescent; phyllaries in 2 or 3 size-classes, the outer much shorter than the inner, oblong-linear, blunt (outer) to acutish (inner), the margins and tips thin and whitish; flowers whitish. Infrequent in moist sand, e. Tex., late summer-fall; most of e. U.S.

9. *Eupatorium altissimum* L. Rhizomatous perennial, 5-20 (-27) dm. tall, aerial stems nearly simple except in the uppermost head-bearing region; leaves mostly opposite, those of midstem narrowly elliptic, 4-10 cm. long, 6-12 (-30) mm. broad, antrorsely appressed serrate in the upper third to half with 7 to 15 teeth on each side, definitely 3-nerved; fascicles of smaller leaves often present in the axils; petioles absent or only 1-2 mm. long; heads dirty-white, subcorymbosely arranged, about 5- to 7-flowered; involucre obconic, 3.8-4.3 mm. high; phyllaries graduated, narrowly obovate, mostly herbaceous but with narrow hyaline margins, quite blunt; flowers whitish. Infrequent in open plains, n.-cen. Tex. (Collin, Denton, Fannin, Grayson, Lamar and Tarrant cos.), Aug.-Oct.; most of e. U.S. (but not near the coast.)

10. *Eupatorium serotinum* Michx. Rhizomatous perennial forming colonies; stems scattered, (3-) 5-12 (-15) dm. tall, simple below, branched above; leaves opposite for most of the length, approximate; blades narrowly ovate to lance-ovate or ovate-lanceolate, (3-) 5-10 (-15) cm. long, serrate most of the length, 3-nerved basally, softly and minutely pubescent at least beneath, acute, basally rounded or cuneate (rarely somewhat truncate); petioles 1-3 cm. long; heads densely crowded in rather flat-topped terminal arrangements, with 12 to 15 flowers; involucre obconic, softly pubescent and resin-dotted, 3.5-5 mm. high; phyllaries in roughly 2 (or 3) size-classes (the outer ones about a third as long as the inner), linear, blunt, the margins and tips whitish; receptacle slightly convex; flowers whitish. Frequent in open places, e., s.e. and n.-cen. Tex., s. to Kleberg Co. and w. to Llano region, also Val Verde Co., (Aug.-) Sept.-Nov.; s.e. U.S. n. to N.J., O., Ind., Wisc. and w. to Kan., Okla., Tex.; also n.e. Mex.

11. *Eupatorium fistulosum* Barr. JOE-PYE-WEED, TRUMPET-WEED. Coarse subrhizomatous perennial herb 1-3 m. tall; stems mostly simple, virgately ascending, often purplish-green, some of the internodes hollow; leaves whorled, lance-ovate to ovate-elliptic, 1-2 dm. long, coarsely crenate-serrate, about 2 to 3 times as long as broad, penninerved, acute or very slightly acuminate; petioles (1-) 2-3 cm. long, blackish; heads in a usually round-topped or domed mass at the top; involucre cylindrical, about 1 cm. high; exterior phyllaries closely imbricated in about 4 series, the outermost extremely short, all usually purplish-striate but mostly pale or whitish and not herbaceous (except the shorter outer ones); receptacle flat; flowers 5 to 8 per head; corollas purple to lilac-pink to rosy-brownish-lavender, 3.5-4.8 mm. long, scarcely exerted. Infrequent to rare in sandy forested areas, e. Tex. (Houston, Newton and San Augustine cos.), July-Aug.; e. U.S. w. to Ia., Okla. and Tex.

At times confused with *E. purpureum* L. which has not been found in Tex. but is to be expected; *E. purpureum* has creamy-white to pale-purple corollas 5.5-7.5 mm. long that are strongly exerted.

12. *Eupatorium solidaginifolium* Gray. Subshrub with a number of rigidly ascending stems (or branches) (3-) 4-6 (-10) dm. tall; leaves opposite; blades broadly lanceolate, 25-60 (-90) mm. long, basally shortly rounded to truncate, apically long-attenuate and

slightly acuminate, subentire or the larger ones often with 3 to 5 obscure appressed teeth on each side, essentially glabrous, 3-nerved; petioles 2-4 (-6) mm. long; upper leaves suppressed; the short bracteate upper branches bearing rounded masses of heads, the entire end of the stem with its several "corymb"-bearing short branchlets forming a sort of elongate thyse; heads usually with only 3 to 5 flowers; involucre obconic, about 5 mm. long; phyllaries essentially uniseriate (occasionally the bracteal leaves of the peduncles so close to the involucre as to resemble outer phyllaries), lanceolate, very acute, mostly thin and stramineous except for the three darker nerves; corollas apparently lilac-white or pinkish-white, scarcely exerted from the involucre. Frequent in mts. of the Trans-Pecos, usually in mesic canyons, (Aug.-) Sept.-Nov.; Chih., Coah., Dgo., Ariz. and Tex.

13. *Eupatorium ivaefolium* L. Perennial (rarely suffruticose) from fibrous root system; stems to 2 m. high, weak and semiscandent usually; leaves opposite, lance-linear, 3-nerved, essentially entire or obscurely serrate, acute, pubescent, 3-7 cm. long, 5-22 mm. broad; petioles about 1 mm. long; heads numerous, in subcorymbiform clusters at the ends of the ascending branches, subcylindric, about 8 mm. high and 3-4 mm. thick; involucre 5-8 mm. high, half as thick; phyllaries strongly graduated in about 5 series, appressed, blunt, firm, stramineous, with several strong purplish nerves near the tip, the outer ones with purplish-pubescent tip-splotches; receptacle low-convex, naked; ray flowers absent; disk flowers about 20 to 25, perfect, fertile, the corolla pale-blue or pink and terminally 5-toothed; achene about 2-2.4 mm. long, black, columnar, 5-ribbed; pappus persistent, of about 30 slender stiffish bristles. *Osmia ivaefolia* (L.) Small. Rare in s.e. Tex., fall; warmer parts of Am. n. to Miss., La., Tex. and Cuba.

14. *Eupatorium odoratum* L. CRUCIFERA. Subshrub at our latitude (shrubs in the tropics), 1-2 m. tall, suberect or scandent; stems spreading-villous; internodes often 1 dm. or more long; branches opposite, divaricate, often curved upward; leaves deltoid- or rhombic-ovate, 3-10 cm. long, 1-3 cm. broad, long-acuminate, subentire to few-toothed, basally narrowed and often acutish, sparingly villous above, moderately pubescent to velvety beneath, 3-nerved from the base; petioles 3-12 mm. long; heads in numerous showy corymbiform aggregations; involucre subcylindric, 8-10 mm. high, about half as thick; phyllaries in about 5 series, strongly graduated, the blunt discolored apexes appressed; receptacle convex, naked; ray flowers absent, disk flowers 20 to 35, the corollas lilac to bright-purplish-blue, usually fragrant; achenes columnar, black, 5-ribbed, about 4 mm. long; pappus of stiffish bristles, persistent. *Osmia odorata* (L.) Sch. Bip., *O. conyzoides* Vahl. Infrequent in s.e. Tex. and Rio Grande Plains, (late summer-) fall; warmer parts of Am., n. to the Gulf States.

15. *Eupatorium Greggii* Gray. Perennial herb, the bases fibrous-rooted and occasionally subrhizomatous; aerial stems weak, 3-8 (-12) dm. tall, often tortuous, sometimes semiscandent, the uppermost 1-2 dm. of the branches few-noded; leaves opposite, nearly sessile, ovate or deltoid in over-all outline but deeply palmately 3-lobed with the 3 main lobes again pinnately dissected, pubescent and minutely resin-dotted; heads in tight subcorymbiform clusters terminating the branches; involucre hemispheric, 4-6 mm. high; phyllaries in about 3 subequal series, linear-subulate, pubescent, obscurely 3-nerved; receptacle conical, naked; flowers numerous, the corollas blue or purplish-blue; achenes black, columnar, 5-ribbed; pappus persistent, of a number of stiffish bristles. *Conoclinium Greggii* (Gray) Small. Frequent along stream beds and in overflow areas in the Trans-Pecos, infrequent e. to Edwards Plateau and Rio Grande Plains, spring-fall; Tex., N.M., Ariz. and n. Mex.

16. *Eupatorium betonicifolium* Mill. Rather similar to *E. coelestinum* but plants usually not scandent, not more than 1 m. tall, much of the stem reclining (and node-rooting), only the last 2-3 dm. of the flowering branch ascending and it having very few scattered nodes; blades slightly fleshy, not deltoid but oblong, usually 2 or 3 times as long as broad and rather blunt, the lower corners often prolonged parallel to the petiole. *Conoclinium betonicum* DC. and var. *integrifolium* Gray, *C. betonicifolium* (Mill.) King & Rob. Subsaline marshes and poorly drained areas, s.e. Tex. (n. to Refugio Co.), and Rio Grande Plains, n.w. to Val Verde Co.

The plants farther inland (Val Verde Co., etc.) have less distinctly serrate leaves, and perhaps deserve varietal recognition.

17. *Eupatorium coelestinum* L. MIST-FLOWER. Rhizomatous perennial; stems weak, scandent, to 2 m. tall; leaves opposite; blades pubescent, minutely resin-dotted, deltoid,

2-7 cm. long, serrate; petioles 3-20 mm. long; heads in roughly corymbiform aggregations at the ends of the branches; involucre hemispheric, 3-5 mm. high; phyllaries in roughly 3 series (the 2 inner series about equal, the outer a little shorter), linear-subulate, pubescent, obscurely 3-nerved; receptacle conical, naked; flowers numerous, the corollas blue or purplish-blue. *Conoclinium coelestinum* (L.) DC. Frequent in moist sandy wooded areas, e. and s.e. Tex. (s. to Kleberg Co.), less frequent w. to n.-cen. Tex., summer-fall; N.J. to Kan. s. to Gulf States.

18. *Eupatorium azureum* DC. BLUE BONESET. Scandent shrub or woody nontwining vine, much-branched, to 2-3 m. tall with long, nearly glabrous internodes, basally with a thick fibrous root system; leaves opposite; blades deltoid, (15-) 20-50 (-60) mm. long, (10-) 15-40 (-45) mm. broad, truncate or narrowed basally, coarsely crenate or crenate-serrate in the distal two thirds or less commonly nearly entire, acute or often acuminate, apically thin, puberulent to thinly velutinous beneath, 3-nerved near the base; petioles 5-20 (-30) mm. long; heads in small rounded clusters at the ends of the branches; involucre campanulate-obconic, 6-8 mm. high; phyllaries numerous, membranous, in about 3 or 4 series (the outer about half as long as the inner), lance-subulate, obscurely nerved, puberulent, green or purple-green; receptacle convex to beehive-shaped; flowers about 30 to 50 per head; corollas bluish or blue-lavender (a white-flowered form also exists), exerted from the involucre. *E. ageratiforme* var. *acuminatum* Coult. Local in dense thickets, Brownsville region (Cameron Co.; collected once also in Willacy Co.), Feb.-May (-July); S.L.P., N.L., Tam. and Tex.

19. *Eupatorium incarnatum* Walt. Perennial from fibrous-rooted crowns; stems sprawling or scandent through shrubbery, to 2 m. long or more; branches numerous, often minutely pubescent with curled hairs; leaves opposite; blades deltoid, 1-5 cm. long, acute, coarsely serrate or crenate-serrate on the 2 distal sides, usually 3-nerved, basally usually truncate, less commonly or rarely narrowed, beneath more or less densely pubescent with minute curled hairs, apically usually acute, rarely acuminate; heads in small rounded clusters at the ends of the branches; involucre obconic, 5-6 mm. long; phyllaries in roughly 2 size-classes (the outer about half as long as the inner), lance-subulate, glabrous or with some pubescence of minute curled hairs, with 2 (or 3) thickish whitish or stramineous longitudinal nerves, the green internerve portions and narrow whitish marginal areas being thinner; receptacle flat or slightly convex; flowers about 20 to 25 per head; corollas mostly whitish but the distal portion pink or rarely lilac. *Fleischmannia incarnata* (Walt.) King & Rob. Frequent in thickets on loamy soil, Rio Grande Plains and s.e. Tex., rare inland to n.-cen. Tex., Oct.-Dec. (rarely to Feb. in extreme s.) or at other times following injury; Mex. n. to W.Va., O., Ind., Ill., Mo., Okla. and Ariz.

Related to *E. coelestinum* and *E. azureum*.

20. *Eupatorium rugosum* Houtt. WHITE SNAKEROOT. Perennial herb from a small fibrous-rooted crown, occasionally with short rhizomes; stems few, ascending, often branched, occasionally semi-scandent, (3-) 5-8 (-12) dm. tall, often with a pubescence of minute crisped hairs on the younger parts, especially dense on the peduncles; leaves opposite; blades deltoid-ovate or ovate or less commonly lance-ovate, usually acuminate, rounded basally, rather coarsely and somewhat doubly-incised-serrate with (on each side) 10 to 20 (counting the smaller ones, too) salient usually sharp teeth, 3-nerved basally; petioles about a third as long as the blades; heads mostly in small rounded clusters at the ends of the branches, with about 15 to 20 flowers each; involucre obconic, 4-5 mm. long; phyllaries in roughly 2 size-classes (but the outer nearly as long as the inner), linear, mostly green with narrow paler margins and tips apically blunt; corolla white, tips of corolla lobes often with a few hairs as seen with the lens. *E. urticaefolium* Reich., "*E. ageratoides* L.f." of old manuals and *E. ageratoides* var. *angustatum* Gray. Local in e., s.e. and n.-cen. Tex. and Edwards Plateau, Sept.-Nov.; most of e. N.A.

When only short branches are collected, the specimens are exceedingly similar to poor specimens of *E. havanense*, but the number of teeth on the leaves affords a confident determination, usually.

21. *Eupatorium Rothrockii* Gray. Perennial herb; rhizomes only slightly if at all ligneous, only a few mm. thick, heavily fibrous-rooted; stems several, ascending, often arcuate, (2-) 4-7 (-12) dm. tall, branched in the upper half, the branches also ascending and arcuate; leaves opposite; blades thin, ovate or deltoid-ovate, those of midstem and

lower parts of the branches (4-) 5-7 (-11) cm. long, usually bright- or dark- (nearly olive-) green, less commonly slightly yellowish-green, nearly glabrous, basally 3-nerved and rounded or rarely truncate, never cordate, apically acute and commonly very slightly acuminate, on each side with 10 to 15 (to 20) teeth (including even the minutest intermediates and basals), these teeth slightly antrorse, usually sharp and each with a minute gland visible under a strong lens; petioles (6-) 10-40 (-50) mm. long; the loose irregularly corymbiform aggregations of heads (2-) 4-10 cm. across, the individual peduncles usually (4-) 6-12 mm. long, densely puberulent with minute curved hairs; involucre broadly obconic, 5-6.6 mm. high, glabrous, never resin-dotted; phyllaries in roughly 2 size-classes (the outer ones blunt and only slightly shorter than the inner), linear or oblance-linear, very thin and faintly greenish except for the 2 (rarely 3) prominent paler stramineous nerves, the inner ones acutish and the margins near the tip sometimes microscopically ciliate; receptacle essentially flat; flowers about 20 to 25 per head; corollas rather pure-white, the extreme tip of each of the 5 short lobes dorsally with about a dozen whitish hairlike projections 0.1-0.2 mm. long; achenes gradually narrowed basally, maturing black, about 2.5 mm. long, antrorsely hispid on the 5 ribs and also in median strips between the ribs, each of the 5 inter-rib areas distally with a weak median nerve (visible under 25 \times magnification), apically the achene abruptly constricted and above the constriction supporting a whitish subcartilaginous cup with a diameter slightly less than the maximum thickness of the achene itself, this cup being the pedestal for the pappus members which are attached at its rim. *Ageratina Rothrockii* (Gray) King & Rob. Locally abundant in the higher parts of Trans-Pecos mts. (Chisos, Guadalupe and Davis), (Aug.-) Sept.-Oct.; Ariz., N.M., Tex. and Chih.

The species is closely related to and perhaps conspecific with, *E. rugosum*. The latter has been reported to occur in Trans-Pecos Texas also but the specimens so determined are closer to *E. Rothrockii*.

22. *Eupatorium herbaceum* (Gray) Greene. Perennial herb or subshrub; crowns quite woody, sometimes irregular in shape and often 2-3 cm. thick at the nodes, with woody horizontal rhizomelike organs as much as 3 dm. long and 5 mm. thick; stems several from the crown or from the nodes (crowns) of the underground organs, (2-) 3-6 (-8) dm. tall, usually 2-3 mm. thick, pale-grayish-yellow-green, rather stiffly erect, usually freely branched, minutely granular-puberulent (glabrate on the oldest parts), the internodes (2-) 3-5 (-6) cm. long, the branches spreading and then ascending toward the ends; leaves opposite, deltoid to ovate-deltoid, firm-membranous, those of midstem and the lower parts of the branches (25-) 30-50 (-60) mm. long, definitely yellow-green or grayish-yellow-green, on the veins and margins minutely scabrous-hispid, basally truncate or often slightly cordate, apically acute, on each side with 9 to 13 teeth (including the intermediate as well as the principal teeth), these being slightly antrorse, usually sharpish, each with a microscopic gland; petioles (4-) 6-15 mm. long; the tight crowded rounded masses of heads (1-) 2-4 cm. across, the individual peduncles (2-) 3-5 (-8) mm. long, densely granular-puberulent; involucre hemispheric-obconic, 3.5-4.5 (-5) mm. high, densely (rarely sparsely) granular-puberulent, often resin-dotted, gray-green to yellow-green; phyllaries in roughly 2 size-classes; outer phyllaries oblong or linear-oblong, blunt, half to two thirds as long as the inner; inner phyllaries lanceolate, acute, often nearly 1 mm. broad in the lower half, with 2 (or 3) obscure nerves, the margins very narrow, thin, whitish; receptacle essentially flat; flowers about 12 to 20 per head; corollas whitish or usually off-white, glabrous, often with a few microscopic bumps or resin-globules on the lobes; achenes gradually narrowed basally, maturing black, about 3 mm. long, antrorsely setulose-hispid on the 5 ribs and also in a median strip between the ribs, each of the 5 intercostal areas with a weak median nerve, apically the achene scarcely or very slightly constricted and above the constriction supporting an extremely minute stramineous cup about 0.4 mm. long with a diameter as great as the greatest thickness of the achene below the constriction, this cup being the pedestal for the pappus members which are attached at its rim. *Ageratina herbacea* (Gray) King & Rob. Locally abundant in Trans-Pecos mts. (Chisos, Guadalupe, Franklin, Cornudas and Davis), Sept.-Oct.; Ariz., Ut., Colo., N.M., Tex. and Chih.

Superficially resembling both *E. Rothrockii* and *E. havanense*.

23. *Eupatorium havanense* H.B.K. Rounded shrub (3-) 6-15 (-20) dm. tall, much-branched, the younger parts (especially peduncles) usually rather densely pubescent

with minute curved hairs; leaves opposite; blades deltoid, (2-) 3-5 (-7) cm. long, 3-nerved, basally truncate or extremely broadly cuneate, on each of the 2 distal sides with 6 to 8 (to 9, rarely 10) rounded and subappressed teeth, apically acute to less commonly very slightly acuminate; petioles 3-10 (-15) cm. long; heads in rounded masses at the ends of the branches, usually with 15 to 20 flowers each; involucre obconic to hemispheric-obconic, 4-6 mm. long; phyllaries roughly in 2 size-classes (but the outer fully two thirds as long as the inner), linear, green but with paler margins and tips, usually blunt; corolla pinkish-white to nearly pure-white. *E. ageratifolium* DC., *E. ageratifolium* var. *texense* T.&G., *Ageratina havanensis* (H.B.K.) King & Rob. Frequent in limestone hills, Edwards Plateau, (Sept.-) Oct.-Nov.; Tam., N.L., Coah., Tex., Ver., S.L.P.; Cuba, Bah. I.

24. *Eupatorium Wrightii* Gray. Rounded shrub (2-) 3-5 (-10) dm. tall, intricately branched; leafy branches usually only 5-10 cm. long, usually minutely granular-puberulent or glandular-puberulent; leaves opposite or subopposite; blades usually ovate-deltoid, 1-2 cm. long, usually almost as broad as long, granular-puberulent, entire or with 3 to 7 small teeth on each side, often truncate basally, 3-nerved, blunt apically; petioles (2-) 3-5 mm. long, often in its upper part bordered by a very narrowly decurrent strip of blade tissue; heads in small rounded masses at the ends of the twigs, each usually about 10- to 12-flowered; involucre obconic, about 3.5-4 mm. high, granular-puberulent; phyllaries lance-oblong, in roughly 2 (or 3) series (the outer about half as long as the inner), acutish, the inner with 2 or 3 nerves; corollas whitish. *Ageratina Wrightii* (Gray) King & Rob. Frequent in the Trans-Pecos at moderate elev., in dry places, Oct.- Nov.; Chih., Coah., S.L.P. and Tex.

13. BACCHARIS L.¹⁹³

GROUNDSEL-TREE

Unisexual shrubs or subshrubs, glabrous or hispid; branchlets usually striate-angled or slightly striate and terete, smooth to glandular-scabrous; leaves subulate to obovate, alternate, crowded to sparse, entire to serrate or dentate, 1- to 3-nerved, sessile or petioled, usually reduced within the inflorescence (sometimes to bractlike leaves); male and female heads on separate plants; heads in somewhat paniclelike, corymbiform or racemose aggregations; *pistillate involucre* hemispheric to narrowly cylindrical with outer phyllaries ovate to lanceolate; inner phyllaries lanceolate to narrowly linear and obtuse to acuminate, usually scarious-margined, the midrib evident or obscure; receptacle pitted to nearly smooth, naked or fimbriate, flat; ray flowers absent; corolla filiform with 5 minute distinct lobes or teeth, yellowish-white to brown in color; style bifurcate, style branches usually glabrous; achene 5- to 10-ribbed, yellow to reddish, glabrous or hispid, smooth or glandular; pappus of 1 to several series of numerous bristles, flaccid or rigid, equaling or greatly exceeding the style; *staminate involucre* hemispheric to cylindrical with outer phyllaries ovate to lanceolate; inner phyllaries lanceolate to linear and obtuse to acuminate, usually scarious-margined, the midrib dilated and smooth or absent; receptacle pitted to nearly smooth, naked or fimbriate and flat; ray flowers absent; corolla filiform basally and either abruptly or gradually enlarged and funnellform, white to yellowish-brown, its 5 lobes lanceolate; style clavellate or bifurcate, its branches hispid; pappus not exceeding style, usually one series of numerous bristles, rigid, more or less plumose-tipped, the bristles more or less barbed, usually crisped; ovary abortive.

Plants of this large genus (about 400 species, all American) unfortunately often superficially resemble plants of other asterean genera, and their determination is enigmatic until the unisexuality of the plants and flowers is discovered.

1. Plants hispid 1. *B. brachyphylla*.
1. Plants glabrous or essentially so (2)
- 2(1). Branches terete, slightly striate, glandular-scabrous; heads appearing racemosely arranged on short lateral branchlets 2. *B. pteronioides*.
2. Branches striate-angled, essentially not glandular-scabrous (3)
- 3(2). Pappus of pistillate flowers many-seriate, rufous-tinged; achenes 3-5 mm. long, slightly to prominently glandular-scabrous (4)
3. Pappus of pistillate flowers in 1 or 2 series, white to sordid; achenes usually less than 3 mm. long, glabrous (5)

¹⁹³ Adapted from W. F. Mahler and U. T. Waterfall in Southwest. Nat. 9:189-202. 1964.

- 4(3). Pistillate involucre usually 9 mm. long or less; phyllaries keeled, their midribs dilated; most leaves more than 1 cm. long, their margins undulate 3. *B. texana*.
4. Pistillate involucre (9-) 10-12 mm. long; phyllaries flat to partially keeled; most leaves less than 1 cm. long, marginally not undulate 4. *B. Wrightii*.
- 5(3). Achenes 8- to 10-ribbed; pappus exceeding the corolla by 5 mm. or more (6)
5. Achenes 4- or 5-ribbed; pappus exceeding the corolla by 4 mm. or less (8)
- 6(5). Leaves elliptic to rhomboid; involucre 4-6 mm. long 6. *B. halimifolia*.
6. Leaves narrowly elliptic to linear or oblanceolate; involucre 4-8 mm. long (7)
- 7(6). Pistillate involucre 5 mm. or less long; leaves narrowly linear to very narrowly elliptic 7. *B. neglecta*.
7. Pistillate involucre 6 mm. or more long; leaves oblanceolate 8. *B. salicina*.
- 8(5). Leaves oblong, irregularly incised to serrate 9. *B. Bigelovii*.
8. Leaves lanceolate to narrowly elliptic or linear to spatulate, not irregularly incised to serrate (9)
- 9(8). Leaves linear or spatulate, saliently incised to entire 10. *B. Havardii*.
9. Leaves lanceolate or narrowly elliptic, remotely serrate to nearly entire (10)
- 10(9). Heads in a terminal large corymbiform aggregation; leaves 3-8 (-11) cm. long, 10 (-20) mm. broad, not crowded 5. *B. glutinosa*
10. Heads in several smaller corymbiform aggregations terminating lateral branches, leaves 3-5 cm. long, 5 mm. broad, usually crowded .. 11. *B. viminea*.

1. *Baccharis brachyphylla* Gray. Subshrub about 6 dm. tall, erect, slender; branches striate-angled, hispid; leaves sparse, sessile, linear, acute, less than 1 cm. long and 2 mm. broad, 1-nerved, gradually reduced upward to subulate bracts in the head-bearing region, the latter an elongated paniclelike aggregation or appearing racemose but with several heads to each lateral branch; heads with 10 to 15 flowers; *pistillate involucre* campanulate, about 5 mm. high; phyllaries lanceolate, acute to acuminate, scarious-margined with hispid dark-brownish-green midrib; receptacle flat, nearly smooth, naked; corolla filiform, 1.5-2 mm. long, its 5 teeth truncate or triangular; style exerted, as long as pappus; bristles in several series, rigid, slightly barbellate, about 4 mm. long; achene 4- or 5-ribbed, about 1 mm. long, pubescent; *staminate involucre* campanulate, about 5 mm. long; phyllaries lanceolate, acuminate, scarious-margined, with hispid dark-greenish-brown midrib; receptacle flat, nearly smooth, naked; corolla filiform, the upper half dilated and funnelliform, its 5 lobes lanceolate; pappus bristles rigid, uniseriate, plumosely tipped, about 4 mm. long; ovary abortive. Locally frequent in sandy deserts, El Paso region, July-Aug.; Calif., Son., Ariz., N.M. and Tex.

2. *Baccharis pteronioides* DC. YERBA DE PASMO. Shrub; branches terete, only slightly striate, glandular-scarious; leaves fascicled, crowded, sessile, linear or spatulate with attenuate bases, entire to 5-toothed, larger leaves about 10 mm. long (rarely to 20); heads racemosely arranged, 2-4 (-8) mm. thick, terminating very short leafy branches; *pistillate heads* 15- to 20-flowered; involucre campanulate, 5-6 (-7) mm. long; phyllaries lanceolate-oblong, acute to obtuse, stramineous, with scarious wings; receptacle slightly alveolate, flat; corolla filiform, 3.6-5.3 mm. long, 5-lobed; pappus 8-10 mm. long, rigid, not exceeding styles by more than 3-4 (-5) mm.; achenes 1.8-2.6 mm. long, 4- to 8-ribbed, sparsely glandular, the hairs few; *staminate heads* 15- to 20-flowered; involucre hemispheric, 4-5 mm. long; phyllaries loosely imbricated, lanceolate-oblong, acute to obtuse, scarious-margined; receptacle slightly alveolate, flat; corolla with lower half of tube filiform, upper half enlarged and funnelliform, about 4 mm. long, the 5 lanceolate lobes 1-3 mm. long; pappus about 4 mm. long, not greatly surpassing the style, plumosely tipped, crisped; ovary abortive. *Baccharis ramulosa* (DC.) Gray. Local in dry mt. areas, 4,500-6,000 ft. elev., in the Trans-Pecos, Apr.-June; Tex., N.M., Ariz., s.e. to Pue.

This plant is known to be toxic to cattle and sheep.

3. *Baccharis texana* (T.&G.) Gray. Shrub or subshrub from rhizomes, branched at base, 25-60 cm. tall; stems striate-angled; lower leaves punctate, sessile, linear to narrowly lanceolate, minutely undulate, 2-4 (-5) cm. long, 2-4 mm. broad, 1-nerved; upper leaves alternate, sessile, linear, acute, undulate, about 10 mm. long, 1 mm. broad, 1-nerved, usually punctate, sometimes crowded; bractlike leaves in the head-bearing region slightly scarious-margined, ciliate; heads corymbosely arranged, each terminating a peduncle; *pistillate head* with about 20 to 30 flowers; involucre campanulate, 7-9 (-10) mm. long; phyllaries lanceolate, acute to acuminate, keeled, the midrib dilated, margins narrowly scarious, usually ciliate; receptacle flat, naked, pitted; corolla filiform, 3.5-4 mm. long, truncate, the 5 teeth obscure and erose, about 0.2 mm. long; pappus 11-13 mm. long, copious, in several series, antrorsely barbellate; achene 3-4.5 mm. long, subglandular, 5- or 6-ribbed; *staminate involucre* campanulate, 6-7 mm. long; phyllaries lanceolate, acute or obtuse, keeled, the midrib dilated, margins narrowly scarious and usually ciliate; receptacle flat, naked, pitted; corolla tube filiform, abruptly enlarged at about the middle, about 5 mm. long, the 5 lanceolate lobes 1.6-2 mm. long; pappus equal to the corolla in length, usually plumose-tipped and crisped; ovary abortive. Local, Edwards Plateau, Rio Grande Plains, Plains Country, Trans-Pecos, n.-cen. and s.e. Tex., late Aug.-Nov.; Okla., Tex., Tam., N.L. and Coah.

4. *Baccharis Wrightii* Gray. Subshrub 10-75 cm. tall, glabrous, slender and erect or short and freely branched; branchlets striate-angled; leaves sparse, sessile, punctate, linear to lanceolate; lower leaves oblanceolate to oblong, 10 mm. long or less (rarely to 25 mm.), 1-2 (-7) mm. broad; upper leaves usually subulate with apexes recurved, entire or with colorless serrations from a narrow colorless margin, 1-nerved; *pistillate involucre* hemispheric, 9-12 mm. long; phyllaries lanceolate, acute or acuminate, green- or brown-veined, the margins scarious and erose; receptacle flat, naked and smooth; corolla filiform, 3.7-4.7 mm. long, its 5 linear lobes 0.3 mm. long or shorter, erose; style exerted beyond corolla lobes; pappus copious, multiseriate, antrorsely barbellate, to 15 mm. long, rufous; achene 3-5 mm. long, glandular, 5- to 10-ribbed, transversely ridged; *staminate involucre* hemispheric, 8-9 mm. long; phyllaries linear to lanceolate, with acute apexes, margins slightly serrate to entire, scarious; receptacle flat, naked, smooth; corolla filiform, 4.6-5 mm. long, with upper half gradually to abruptly funnellform, the 5 lanceolate lobes 1-1.6 mm. long; pappus about as long as corolla, plumose-tipped, crisped; ovary abortive. Local, Plains Country and Trans-Pecos, May-June; Kan., N.M., Okla., Tex., Ariz., Chih. and Dgo.

5. *Baccharis glutinosa* (R. & P.) Pers. JARA, SEEPWILLOW, WATER-WALLY. Shrub 10-35 dm. tall; branchlets striate-angled, glabrous, glutinous; leaves punctate, sessile to indistinctly petioled, lanceolate to narrowly elliptic, tapering from middle to apex and to base, nearly entire to prominently serrate (teeth of larger leaves usually 3-5 mm. apart), 3-8 (-10) cm. long, 1 (-2) cm. broad, distinctly 3-nerved; heads in a terminal corymbiform aggregation, often on several branches; *pistillate heads* with about 50 flowers or more; involucre hemispheric, about 4 (-4.5) mm. high; phyllaries ovate or lanceolate, obtuse (inner may be acute), stramineous, brown-purplish-tipped, the midrib distinct with its margins scarious and erose; receptacle flat, nearly smooth, naked; corolla filiform, 2-2.3 mm. long, with 5 narrow linear lobes 0.2 mm. or less in length; style exerted, bifurcate; pappus uniseriate, flaccid, 4-5 mm. long; achenes about 1 mm. long, glabrous, 5-ribbed; *staminate heads* 10- to 20-flowered; involucre campanulate, about 4 mm. high; phyllaries ovate-lanceolate, obtuse to acute, marginally scarious and erose; receptacle flat, slightly pitted, naked; corolla 3-4 mm. long, filiform, upper half funnellform, its 5 lobes lanceolate and about 1.2 mm. long; pappus 3-4 mm. long, plumose-tipped, crisped, not exceeding corolla; ovary abortive. Along sandy watercourses in dry areas, especially along the Rio Grande, in the Trans-Pecos, Edwards Plateau and Rio Grande Plains, local, summer-fall; widespread in Am., n. to Calif., Colo. and Tex.

6. *Baccharis halimifolia* L. SEA-MYRTLE, CONSUMPTION-WEED. Shrub 1-2 (-6) m. tall; branchlets striate-angled, glabrous; leaves punctate, distinctly petioled or sessile, elliptic to rhomboid or obovate, with acute to obtuse or rounded apexes, cuneate to attenuate-based, lower half of blade entire, upper half entire or with few to several teeth, the upper leaves gradually reduced and becoming entire; larger leaves 3-5 (-7) cm. long, 22-30 mm. broad, prominently 1-nerved with 2 lateral nerves extending from midrib

above leaf-base; inflorescence widely paniculate; head about 20-flowered; *pistillate involucre* campanulate, 4-6 mm. high; phyllaries ovate-lanceolate, obtuse to acute, greenish-brown-tipped, scarious-margined, with a not-always-distinct midrib; receptacle flat or slightly convex, alveolate, naked; corolla filiform, 2.5-3.5 mm. long, with 5 minute linear lobes about 0.1 mm. long; style exserted; pappus biseriata, flaccid, (9-) 10-12 (-14) mm. long; achene 8- to 10-ribbed, 1-1.7 mm. long, glabrous; *staminate head* about 20-flowered; involucre hemispheric, 4-4.5 mm. high; phyllaries ovate-lanceolate, obtuse to acute, scarious-margined; receptacle flat to convex, alveolate, fimbriate to naked; corolla filiform, gradually funnelform, 3-3.5 mm. long, with 5 lanceolate lobes about 1 mm. long; style clavellate; pappus 3-4 mm. long, crisped, plumose-tipped, flaccid; ovary abortive. Often abundant in open sandy places, e. and s.e. Tex., less common w. to n.-cen. Tex.; Coastal States, Mass. to Tex., inland to Okla.

7. *Baccharis neglecta* Britt. ROOSEVELT WEED, NEW DEAL WEED, JARA DULCE. Shrub 1-3 m. tall; branchlets striate-angled, glabrous; leaves sessile, punctate, partially glutinous, narrowly linear to narrowly elliptic, acute, upper entire, lower entire to serrate, prominently 1-nerved with an obscure lateral nerve on each side parallel to the margins; blades 2-4 (-5) mm. broad, the lower ones 3-5 (-8) cm. long; bract leaves reduced; some of the heads aggregated closely in clusters, others nearly solitary; *pistillate heads* with about 15 to 30 flowers; involucre campanulate, about 5 mm. high; phyllaries ovate to lanceolate, obtuse or acute, green or tipped with reddish-brown, erose; receptacle flat, naked and pitted; corolla filiform, 2.5-3.3 mm. long, minutely 5-toothed, the lobes to 0.3 mm. long; style exserted; pappus in 1 to 2 series, 7-12 mm. long, exceeding style by 1-8 mm.; achenes 1.1-1.3 mm. long, glabrous, 10-ribbed; *staminate heads* with about 10 to 15 flowers; involucre hemispheric to subhemispheric, 3.5-4 mm. high; phyllaries ovate-lanceolate, obtuse to acute, scarious-margined, their tips stramineous or green or reddish-brown; receptacle flat, naked, pitted; corolla gradually funnelform, 2.7-3.3 mm. long, its 5 lanceolate lobes about 1 mm. long; pappus not exceeding the style, plumose-tipped, crisped; ovary abortive. Roadsides and other disturbed habitats, usually in calcareous soil, nearly throughout except the dense forests of e. Tex. and the higher elev. of the Plains Country, late summer-fall; N.C. to Ariz. and s. to Dgo. and Coah.

This species and *B. salicina* have been confused; they are extremely closely related. Texas plants of *B. neglecta* have often been incorrectly referred to *B. angustifolia* Michx., a closely related plant of eastern United States.

8. *Baccharis salicina* T.&G. Shrub 1-3 m. tall; branchlets striate-angled, glabrous; leaves nearly sessile, oblanceolate-oblong, obtuse to acute, 3-4 (-6) cm. long, 4-8 (-15) mm. broad, serrate with salient teeth about 5 mm. apart, the broader leaves distinctly 3-nerved; *pistillate heads* with 25 to 30 flowers; involucre campanulate, 6 (-8) mm. long; phyllaries ovate-lanceolate, obtuse to acute, reddish-brown-tipped, marginally scarious, erose, spreading at maturity; receptacle flat, naked and slightly pitted; corolla filiform, 3-4 mm. long, its 5 minute linear lobes to 0.3 mm. long; pappus biseriata, flaccid, to 12 mm. long, basally united into a ring; achenes 1.2-2 mm. long, glabrous, 8- to 10-ribbed; *staminate involucre* hemispheric, 3.5-4.5 mm. long; phyllaries ovate-lanceolate, obtuse to acute, marginally scarious and erose; receptacle flat, naked, pitted; filiform corolla gradually funnelform, 3.3-4.3 mm. long, its linear lobes about 1 mm. long; pappus equal to corolla, plumose-tipped, 3-4.5 mm. long, crisped; ovary abortive. Abundant in the higher parts of the Plains Country, less so in the lower parts, and in the Trans-Pecos, usually in disturbed places, often in sandy subsaline soil, summer-fall; Okla., Tex. and N.M.

9. *Baccharis Bigelovii* Gray. Glabrous shrub a few dm. tall; branchlets striate-angled; leaves punctate, oblong-obovate, obtuse, cuneate to short-petiolate at base, irregularly incised to coarsely serrate, 2-3.5 cm. long, 3-15 mm. broad, 1-nerved or obscurely 3-nerved; heads usually in a somewhat corymbiform aggregation; *pistillate involucre* campanulate, 5 mm. high; phyllaries loosely imbricate, lanceolate, acute, marginally scarious, the midrib green to brownish; receptacle slightly alveolate, flat, naked; corolla filiform, 2-2.6 mm. long, each of the 5 teeth about 0.2 mm. long; pappus antrorsely barbellate, slightly rigid, uniseriate, 3-4.5 mm. long, only slightly exceeding style; mature achenes about 1.6 mm. long, yellow, brown or reddish, glabrous, 5-ribbed; *staminate involucre* campanulate, 4-5 mm. long; phyllaries loosely imbricate, lanceolate, acute,

scarios marginally, erose, the midrib green to brownish; receptacle slightly alveolate, flat, naked; corolla about 3.6 mm. long, filiform, enlarging to a funnellform throat, its 5 lanceolate lobes about 1.3 mm. long; pappus about 3.5 mm. long, not exceeding the style, plumose-tipped, crisped; ovary abortive. Mts. of the Trans-Pecos, 4,500-6,500 ft. elev., Aug.-Nov.; Chih., Coah. and Tex.

10. *Baccharis Havardii* Gray. Glabrous glutinous subshrub 15-70 cm. tall; branchlets striate-angled; leaves 1-nerved, sessile, spatulate to narrowly linear, to 4 cm. long and 3 mm. broad, upper margins with irregular teeth to 2 mm. long or entire and leaves spatulate, upper leaves bracteiform; inflorescence broadly paniculate; *pistillate involucre* campanulate, 4 (-4.5) mm. high; heads pedunculate from axils of leafy bracts; phyllaries oblong or lanceolate with obtuse to acuminate apices, their midribs green or brownish, margins scarios and slightly erose; receptacle flat, naked and nearly smooth; corolla filiform, about 2.8 mm. long, truncate or with 5 lobes to 0.3 mm. long; pappus uniseriate, 4 mm. long, rigid, minutely antrorsely barbed; achenes about 2.3 mm. long, glabrous, 5-nerved; *staminate involucre* semicampanulate, 3 mm. high; phyllaries oblong or lanceolate with obtuse or acute apices, green or brownish midribs and scarios margins; receptacle flat, naked, nearly smooth; corolla 3 mm. long, filiform and abruptly funnellform, its 5 lobes about 1.1 mm. long; pappus nearly 3 mm. long, rigid, plumose-tipped and antrorsely barbellate; ovary abortive. Mts. of the Trans-Pecos, 5,000-7,500 ft. elev., local, July-Aug.; also Coah.

11. *Baccharis viminea* DC. Shrub; branchlets glabrous or glandular; leaves crowded, punctate, narrowly elliptic, entire to minutely serrate, tapering acutely at both ends, 3-5 cm. long, 5 (-10) mm. broad, 1-nerved with 2 indistinct lateral nerves narrowly paralleling the margin; heads in small corymbiform aggregations terminating numerous lateral branches; *pistillate heads* with 50 or more flowers; involucre campanulate to semi-hemispheric, about 4 mm. high; phyllaries ovate to lanceolate, obtuse to acute, stramineous to brown-purplish-tipped, scarios-margined and erose; receptacle flat, smooth, naked; corolla filiform, with 5 small lobes; pappus uniseriate; achene glabrous; *staminate heads* with about 20 flowers; involucre broadly hemispheric, about 3 mm. high, to 5 mm. thick; phyllaries ovate to lanceolate, obtuse to acute, marginally scarios and erose; receptacle flat, naked; corolla-tube filiform, the limb funnellform, with 5 lanceolate lobes; pappus 3 mm. long, plumose-tipped, crisped; ovary abortive. Rare and local near El Paso, Apr.; Baja Calif., Calif., Wash., Ariz., N.M. and Tex.

14. CROPTILON RAF.

SCRATCH-DAISY

A small North American genus, possibly monotypic. We have a single species represented by 3 varieties. *Croptilon* is often treated as a section [*Isopappus* (T.&G.) Benth. & Hook. f.] of *Haplopappus*, but it has a number of peculiarities that distinguish it adequately.

1. *Croptilon divaricatum* (Nutt.) Raf. Annual, rarely overwintering, 3-40 cm. tall; stems often pubescent or glandular-pubescent; leaves alternate, sessile, oblanceolate (in 2 varieties somewhat reduced in the head-bearing region), the margins (especially in the lower half) provided with a comb of stiff spreading setae 1-3 mm. long and in the distal half often saliently serrate or the teeth obsolete in one variety; heads scattered in a widely-branched nearly naked paniculiform aggregation or solitary, never closely bunched, narrowly turbinate, with both ray and disk flowers; receptacle 2-5 mm. broad, flat or slightly convex, often very rough; involucre 5-8 (-9) mm. high, of a few series of strongly graduated rigidly erect linear-subulate phyllaries, each phyllary with scarios margins and a narrow herbaceous median stripe which basally gives way to the broadening pale midvein; *ray flowers* 5 to 29, pistillate, fertile; *disk flowers* 10 to 40, perfect, fertile, with a 5-toothed yellow corolla; style appendages linear-acute, exceeding the stigmatic portion; achenes dark, linear, cylindric-turbinate or subprismatic, not ribbed, 2-3 mm. long; pappus a single series of persistent subequal off-white or rusty-white bristles.

Var. *hirtellum* (Shinners) Shinners. Usually low-growing or rosetted, with fairly well-developed leaves (even in the head-bearing region); stems often glutinous but capitate hairs absent. *Haplopappus rigidifolius* E. B. Sm. Frequent in Rio Grande

Plains, n. to s. part of e. Tex. and s. part of s.e. Tex., various times of the year; also N.L.

Var. *divaricatum*. Diffuse, ascending head-bearing region; stems with capitate hairs; 5 to 11 rays per head; receptacle 2.5-4 mm. across. *Haplopappus divaricatus* (Nutt.) Gray. Frequent in e. Tex., rarely w. to n.-cen. Tex., mostly fall; Gulf States, n. to N.C., Ark. and Okla.

Var. *Hookerianum* (T.&G.) Shinn. Diffuse, ascending head-bearing region; stems with capitate hairs; rays 10 to 29 per head; receptacle 3.5-7 mm. across. *Haplopappus validus* (Rydb.) Cory and subsp. *Torreyi* E. B. Sm. and subsp. *graniticus* E. B. Sm. Frequent in Plains Country and n.-cen. Tex., infrequent s.e. to s. part of s.e. and e. Tex., n. part of Rio Grande Plains and the Central Mineral Region of the Edwards Plateau, summer-fall; Kan., Okla. and Tex.

15. BRADBURIA T. & G.

A monotypic genus that is very closely related to *Heterotheca*. *Mauchia* O. Ktze.

1. *Bradburia hirtella* T.&G. Taprooted annual 1-7 dm. tall, rather freely branched, sparsely pilose-hispid; leaves alternate, essentially sessile, pilose-hispid; leaves of base and lowermost stem (usually withered before flowering time) oblanceolate, in the outer half coarsely toothed or short-lobed; cauline leaves (mostly) linear to linear-oblanceolate, entire, ascending; upper parts of the stem (5-10 cm.) essentially nude-pedunculiform; heads solitary at the ends of the branches; involucre hemispherical, about 1 cm. across; phyllaries in 4 or 5 series, ovate-lanceolate, acute, appressed, mostly scarious but with a median green or dark stripe (the midvein often appearing as a very narrow pale stripe within the median dark strip); ray flowers pistillate, fertile, with prominent often ascending yellow rays; achenes obpyramidal, pubescent; pappus of several very unequal rigid thick somewhat dorsiventrally flattened bristles; disk flowers present, perfect but infertile; corolla yellow, the pappus quite different from that of the rays (merely 1 or 2 longer slender bristles or awns). Local in open sandy usually gravelly areas in e., s.e. and n.-cen. Tex. and n. part of the Rio Grande Plains, spring-early summer; endemic.

16. HETEROTHECA CASS.¹⁹⁴

GOLDEN ASTER. CAMPHOR WEED

Annual or perennial herbs, more or less densely and conspicuously pubescent, often strongly aromatic; leaves alternate, simple, entire to dentate; lower leaves mostly petiolate; upper leaves cuneately sessile to clasping; inflorescence corymbiform to cymose-paniculate; involucre cylindrical-turbinate to broadly campanulate; phyllaries imbricated in 3 to 9 graduated series, at least the inner ones with scarious-stramineous margins; receptacle naked, flat or slightly convex; heads radiate (in Texas species); ray florets pistillate, sometimes abortive, the yellow ligules spreading and linear to oblong-elliptic; disk flowers numerous, perfect, fertile; disk corollas yellow, tubular with 5-lobed limb; ray and disk florets with slender glabrous styles, bifid stigmas with flattened puberulent lobes and syngenesious anthers with lanceolate terminal appendages usually exerted beyond the corolla tube at anthesis; pappus double (absent in ray florets of Sect. *Heterotheca*), with an inner series of numerous elongated barbellate-setose stiffish capillary bristles and an outer series (in Texas species) of numerous to few short fimbriate-squamellate or squamellate-setose appendages. *Chrysopsis* (Nutt.) Ell.; *Pityopsis* Nutt.

A North American genus of about three dozen species.

1. Pappus of ray florets absent; the sequence from the lower petiolate leaves to the sessile clasping upper leaves marked by a progressive petiole lamination from basal lobes (except in certain spring forms lacking sessile upper leaves); herbage markedly aromatic, with stipitate glands; plants annual or rarely weakly perennial (Sect. *Heterotheca*) (2)
1. Pappus of ray florets present; the sequence from lower to upper leaves not involving progressively expanded petiole basal lobes; plants perennial (except annual in *H. pilosa*) (4)

¹⁹⁴ Contributed by Vernon L. Harms.

- 2(1). Height usually less than 1 m.; stems scabrous to short-hirsute; leaves scabrous on both surfaces, with distinctly greenish aspect; lower leaves mostly narrower than 15 mm., with petioles shorter than 3 cm.; phyllaries densely short-hirsute, especially along midrib, glandular; Gulf Coast Texas . . . 1. *H. subaxillaris*.
2. Height to 2 m.; lower stem portions densely long-hirsute; leaves pilose-hirsute at least below, with grayish-green aspect; lower leaves often broader than 15 mm.; phyllary pubescence less densely short-hirsute, more glandular (3)
- 3(2). Lower stems less than 1 cm. thick; lateral branches usually slender; upper leaves only semiclasping, not conspicuously cordate-clasping; peduncles foliate, pubescent, not greatly elongated; involucre less than 12 mm. wide and 8 mm. high; phyllaries more pubescent than glandular; disk corollas shorter than 4 mm.; inner pappus bristles shorter than 6 mm. 2. *H. latifolia*.
3. Lower stems mostly thicker than 1 cm.; lateral branches robust; upper leaves conspicuously cordate-clasping; peduncles elongate, relatively leafless, densely glandular, scarcely at all pubescent; disk corollas longer than 4 mm.; inner pappus bristles longer than 6 mm.; Trans-Pecos Texas 3. *H. psammophila*.
- 4(1). Leaves graminiform, parallel-nerved; leaves and stems with long soft silvery-white sericeous pubescence; achenes narrowly cylindrical to fusiform (Sect. *Pityopsis*) (5)
4. Leaves not graminiform nor parallel-nerved; achenes obovoid or conical, usually conspicuously compressed radially (Sect. *Chrysopsis*) (6)
- 5(4). Peduncles and stems nonglandular; phyllaries nonglandular or more or less glandular, grading into the peduncular bracts below; east Texas 4. *H. graminifolia*.
5. Stems, peduncles and involucre glandular throughout; heads fewer than 8, large, with involucral height mostly exceeding 8 mm.; phyllaries not grading into peduncular bracts below 5. *H. oligantha*.
- 6(4). Leaves thin, pliant; pubescence soft, nonrigid, silky-arachnoid or pilose; east Texas (7)
6. Leaves thicker, less pliant; pubescence coarser, rigid at least near hair bases; stem pubescence of two size-classes, with the primary pubescence more or less spreading; plants perennial; central and west Texas (*H. villosa* complex) (8)
- 7(6). Plant perennial, with thick woody taproot and caudex; herbage pubescence silky-arachnoid, becoming glabrate; inflorescence branches and peduncles minutely but densely glandular; achenes only 2- to 4-ribbed 6. *H. mariana*.
7. Plant annual, with slender taproot; pubescence pilose, persistent; inflorescence branches and peduncles not glandular; achenes conspicuously 10-ribbed 7. *H. pilosa*.
- 8(6). Upper stems, leaves and involucre densely hirsute to sericeous-strigose-pubescent, canescent, nonglandular or with only small inconspicuous sessile glandular-punctations; upper leaves not markedly coarse and rigid; secondary pubescence of stem mostly appressed (in Texas material); outer pappus inconspicuous, of narrow setaceous squamae (9)
8. Herbage less densely pubescent (at least in upper plant portions), distinctly greenish, copiously covered with conspicuous large sessile and stipitate glands or if more densely pubescent or less conspicuously glandular than upper leaves markedly coarse and stiff, and peduncular leaves broad and closely subtending heads; phyllaries more or less glabrate; outer pappus conspicuous, of lanceolate fimbriate squamae (10)
- 9(8). Phyllaries, peduncles, secondary pubescence of stems and leaves densely white appressed-sericeous; primary pubescence of stems sparsely fine hirsute, not harsh; upper leaves oblance-linear, acute, mostly over 5 times longer than broad; the petiolate oblanceolate or spatulate lower leaves very early deciduous; heads closely subtended by narrow peduncular leaves distinctly longer than the phyllaries; heads small, with involucre generally narrower and shorter than 7 mm.; ligule-

- length mostly less than 8 mm.; plants mostly lower than 35 cm., markedly rhizomatous, often forming large clones 9. *H. canescens*.
9. Phyllaries, peduncles, stems and leaves less densely and more coarsely pubescent; primary pubescence of stems more densely and more harshly hirsute to hispid with pustulate-based hairs; upper and middle leaves usually broader, acute or obtuse; heads tending larger with involucre mostly broader and higher than 7 mm.; peduncular leaves usually not closely subtending heads, often reduced and grading into phyllaries; ligules mostly longer than 8 mm.; plants often higher than 35 cm., only short-rhizomatous if at all 8. *H. villosa*.
- 10(8). Heads more or less sessile, closely subtended by peduncular leaves not grading into the phyllaries (11)
10. Heads appearing pedunculate; peduncular leaves distant from heads or (if closer) reduced and grading into the phyllaries; middle and upper leaves less than 5 times longer than broad, often semiclasping; both primary and secondary pubescence of stem usually divergent (12)
- 11(10). Middle and upper stem leaves linear to narrowly oblanceolate, over 5 times longer than broad, cuneately sessile; peduncular leaves linear, harshly hispid-ciliate; stems slender, brittle, glandular, with sparsely hispid-strigose primary pubescence and minute appressed secondary pubescence; lower stems early-defoliate, becoming glabrate and appearing smooth-varnished with age; Texas Plains Country 10. *H. stenophylla*.
11. Middle and upper stem leaves broader, often semiclasping; peduncular leaves broadly to narrowly oblanceolate or oblong; plants coarser, with thicker lower stems; primary pubescence of stems dense, long, often retrorsely hirsute-hispid; secondary pubescence of stems short-hirsute and often stipitate-glandular; lower stems becoming more or less defoliate but retaining some pubescence; Trans-Pecos Texas 11. *H. fulcrata*.
- 12(10). Middle and upper stem leaves broad, obovate or elliptical, only about twice as long as wide, not markedly reduced upward, coarsely ciliated, only sparsely hispid, densely covered with stipitate glands; peduncular leaves distant from heads, not reduced or the closest abruptly narrower than those below; heads few, large, with involucre wider and usually higher than 8 mm., in open cymose inflorescences; Trans-Pecos Texas 12. *H. viscida*.
12. Middle and upper stem leaves oblanceolate or oblong, over twice as long as broad, markedly reduced and stiffish in inflorescence, hirsute, resinous with mostly sessile glandular-punctations; peduncular leaves progressively reduced upward, grading into the phyllaries; heads usually numerous, in subumbellate-corymbiform inflorescences; High Plains 13. *H. horrida*.

1. *Heterotheca subaxillaris* (Lam.) Britt. & Rusby. CAMPHOR WEED. Annual aromatic herbs, rarely overwintering; stems slender, procumbent to erect, rarely over 1 m. high, scabrous or short-hirsute; basal and lower stem leaves petiolate, ovate to elliptical, (1-) 3-7 (-10) cm. long, 4-15 (-30) mm. wide, entire to dentate; upper leaves sessile, ovate to lanceolate, 10-25 mm. long, 3-18 mm. wide, entire or serrate; leaves scabrous on both surfaces; inflorescence a loose corymbose panicle; involucre turbinate to campanulate, 6-15 mm. wide, 4-8 mm. high; phyllaries in 4 to 6 series, the inner about twice as long as the outer, usually densely short-hirsute especially along distal part of midrib and glandular; rays 15 to 35, 3-5 mm. long; disk florets 35 to 40, with corolla tubes 2-4 mm. long; inner pappus bristles 3.5-5.5 mm. long; outer pappus conspicuous, composed of short narrow squamae about 0.5 mm. long; disk achenes obovate, compressed, 1.5-3 mm. long, densely sericeous; ray achenes epappose, nearly glabrous. Chromosome no.: $n = 9$. *Inula subaxillaris* Lam., *Heterotheca Lamarckii* Cass., *H. scabra* (Pursh) DC. Coastal sands of e. and s. Tex. (Brazoria, Cameron, Chambers, Galveston, Kleberg and Nueces cos.), spring-fall; Coastal States, N.J. to Tam.

A procumbent form with entire to only remotely serrate leaves and obscure lateral veins has been distinguished as var. *procumbens* Wagenkn., but may represent only an environmental response to a coastal sand dune habitat.

2. *Heterotheca latifolia* Buckl. Similar to *H. subaxillaris* but height to 2 m., at least lower stem portions densely long-hirsute; basal leaves tending to be broader, 5-40 (-60) mm. wide, with longer petioles; leaves more distinctly toothed, serrate to mostly strongly dentate, longer pilose-hirsute at least on under surfaces; phyllaries less densely hirsute and more glandular than the previous species. Chromosome no.: $n = 9$. A weedy species, primarily on sandy soil, abundant and widespread throughout most of Tex., spring-fall; a species of the interior, w. to Ariz. and Son., s. to Coah. and N.L., n. to Kan. and e. Colo., recently expanding its range in s.e. U.S. to N.C., also a weed adv. elsewhere in cen. and e. U.S.

Most Texas plants belong to var. *latifolia* with longer, more coarsely toothed leaves with scabrous upper surfaces and generally taller stature, but many of the Plains Country plants are of the more northern var. *Macgregoris* Wagenkn. with denser and longer hirsute pubescence of both upper and lower surfaces of leaves, less toothed leaves and generally shorter stature. The poorly marked var. *arkansana* Wagenkn., reported from extreme northeast Texas, is characterized by its more robust habit, coarser lateral branches, more prominent lateral veins of leaves and larger heads.

3. *Heterotheca psammophila* Wagenkn. Similar to *H. latifolia* and *H. subaxillaris* but showing a general gigantism of most characters; stems to 2 m. high and 15 mm. thick, densely long-hirsute below; upper leaves conspicuously cordate-clasping; both leaf surfaces densely long hirsute; herbage with a distinctive leaden-gray aspect; peduncles elongate, leafless, highly glandular; involucre over 12 mm. wide and over 8 mm. high; phyllaries densely glandular, scarcely at all pubescent; outer phyllaries usually over 3 mm. long and inner phyllaries over 7 mm. long; disk corolla tubes usually longer than 4 mm.; inner pappus bristles longer than 6 mm. Chromosome no.: $n = 9$ (based on an Ariz. report). Infrequent on sandy river banks and bars in the Trans-Pecos, summer; also Ariz. and Son.

Most closely related to *H. latifolia* with which it should perhaps be considered conspecific.

4. *Heterotheca graminifolia* (Michx.) Shinn. SILK-GRASS. Perennial stoloniferous herb with 1 to several slender erect stems 2-6 (-10) dm. tall, with soft appressed silvery-white sericeous-pubescent throughout; leaves narrow, elongate, gramineous, flexible, with 3 to 5 (to 7) parallel nerves and appressed silver-white silky-pubescent; basal leaves 1-3 dm. long, the upper leaves progressively reduced with those of the inflorescence bractlike and grading into the phyllaries; inflorescence an open cymose-panicle with several to usually numerous heads each terminating a distinct peduncle; involucre turbinate to turbinate-campanulate, 8-10 (-13) mm. high, 7-10 (-14) mm. wide; phyllaries in 5 to 10 series, narrowly lance-linear, the inner usually over 5 times longer than the outer, loosely white-hairy, nonglandular to often somewhat glandular especially toward tips; rays narrow, (7-) 8-10 (-12) mm. long; disk corollas 5-8 mm. long; inner pappus bristles 5-7 mm. long; outer pappus composed of inconspicuous narrow setaceous squamae about 0.5 mm. long; achenes narrowly fusiform, strongly ribbed, appressed-sericeous-pubescent, about 3 mm. long. Chromosome no.: $n = 9$ (based on 2 non-Texas reports). *Inula graminifolia* Michx., *Erigeron nervosum* Willd., *Chrysopsis nervosum* (Willd.) Fern., *C. argentea* (Pers.) Ell., *C. microcephala* Small, *C. Tracyi* Small, *C. Correllii* Fern., *C. graminifolia* (Michx.) Ell., *Heterotheca nervosa* (Willd.) Shinn. E. Tex., on Coastal Plain, n. to Cass Co., s. to Matagorda Co. and w. to Bastrop Co., spring-fall; s.e. U.S., from Fla. and Del. to n.e. Okla. and Tex.; disjunctly in Guat., s. Mex. and Bah. I.

Closely related to *H. aspera* (Small) Shinn. and often considered conspecific with it but separable by its completely nonglandular stems and peduncles and peduncular bracts grading into the phyllaries.

5. *Heterotheca oligantha* (Chapm.) Harms. Much like *H. graminifolia* but stems and peduncles copiously stipitate-glandular throughout, upper portions not otherwise pubescent; peduncular bracts not grading into the phyllaries; heads fewer than 8, averaging larger; rays longer. *Chrysopsis oligantha* Chapm., *Pityopsis oligantha* (Chapm.) Small. A Coastal Plain species of the *H. graminifolia* (*sens. lat.*) complex in s.e. U.S., from Fla. to s.e. Okla.; not yet noted from Tex. but possibly to be encountered in extreme e. cos.

6. *Heterotheca mariana* (L.) Shinn. Perennial herb with one to several stems from a thick rootstock; stems erect, stout, (1-) 3-6 (-7) dm. high, loosely silky or arachnoid-

floccose, becoming more or less glabrate with age; peduncles and inflorescence branches minutely but densely glandular; leaves numerous, thin, green, soft silky-arachnoid, becoming glabrate; lower leaves spatulate to oblanceolate, 5-10 (-18) cm. long, 1-3 cm. wide, generally obtuse, narrowed to a petiole; upper leaves smaller, oblong or elliptic to lanceolate, 2-5 cm. long, acute to obtuse, sessile; heads several, rather large and showy in congested terminal corymbs; involucre hemispheric, 7-10 mm. high, (10-) 15-20 (-25) mm. wide; phyllaries linear, acute, short-stipitate-glandular and ciliate but otherwise glabrous; achenes obovate, radially compressed, with 2 to 4 glandular ribs. *Inula mariana* L., *Chrysopsis mariana* (L.) Ell. Infrequent in open pine-grassland formation in extreme e. and s.e. Tex. along the La. border (Hardin, Jasper, Jefferson, Newton, Sabine, San Augustine and Tyler cos.), spring-fall; Tex., e. to Fla. and n. to s. O. and N.Y.

7. *Heterotheca pilosa* (Nutt.) Shinners. Taprooted annual with single stems, (2-) 3-6 (-9) dm. tall, usually branched only above the middle, with double pubescence (the primary hairs long, soft, pilose and the secondary pubescence spreading short-puberulent and glandular); leaves numerous and crowded, flexible, soft-textured, distinctly green, soft-pilose, narrowly to broadly oblong-lanceolate, mostly acute, sessile or the lowermost with short petioliform bases; lower leaves oblanceolate, (2-) 3-6 (-8) cm. long, usually denticulate to incised; upper leaves smaller, 1-2 cm. long, entire; inflorescence irregular, with several showy heads each terminating separate branches; involucre hemispherical, (7-) 10-20 mm. wide, (5-) 6-12 (-15) mm. high; phyllaries in 3 or 4 only loosely imbricated series, the inner only slightly longer than the outer, linear-lanceolate, acuminate, with green elliptical midrib area and stramineous-scarious edges, pilose and somewhat glandular; inner pappus tawny; outer pappus conspicuous, composed of broad white squamae; achenes fusiform, distinctly 10-nerved, sparsely silky-pilose. Chromosome no.: $n = 4$. *Chrysopsis pilosa* Nutt. [not *C. pilosa* (Walt.) Britt.], *C. Nuttallii* Britt. Abundant in dry open sandy places, e., s.e. and n.-cen. Tex., summer-fall; Mo. and Kan. to La. and Tex.

8. *Heterotheca villosa* (Pursh) Shinners. Perennial herb with thick woody taproot and caudex, sometimes rhizomatous; stems several to numerous, erect to ascending (in Texas material), (1-) 2-5 dm. tall, simple to usually branched; primary pubescence of stems pustulate-based hirsute to hispid, elongated and relatively persistent on lower stems; secondary pubescence of stems with hairs divergent to usually appressed in Texas material; leaf pubescence appressed to ascending, coarse bulbous-based hirsute to finely strigose-sericeous; lower leaves petiolate, spatulate or oblanceolate; middle leaves oblanceolate, 1-3 cm. long, 3-8 mm. wide; upper leaves linear to oblanceolate, cuneately sessile; inflorescence subumbellate-corymbiform to cymose-paniculate, congested to open; heads 3 to 30 (to 63) per aerial stem, with (35 to) 50 to 100 florets; involucre turbinate to hemispherical, (6-) 7-12 mm. high, (5-) 7-15 mm. wide; phyllaries narrowly lance-linear, closely imbricated in 4 to 9 series, the inner 4.5-7.5 mm. long, about 2 to 3 times the length of the outer, with pubescence usually dense and appressed in Texas material; rays (15 to) 20 to 35, (6-) 8-14 mm. long; disk corolla tubes 5.5-8 mm. long; inner pappus bristles (0.5-) 7-9 mm. long; outer pappus composed of uneven narrow setaceous to fimbriate squamae, the longest 0.5-1 mm. Chromosome no.: $n = 18$. *Amellus villosus* Pursh, *Chrysopsis villosa* (Pursh) Nutt., *C. hispida* (Hook.) DC., *C. foliosa* Nutt., *C. pumila* Greene, *C. Bakeri* Greene, *H. hirsutissima* Greene, *C. imbricata* A. Nels., *C. angustifolia* Rydb., *C. Ballardii* Rydb. Throughout w. Tex., spring-fall; widespread in w. U.S. from Wisc., Neb. and Tex., w. to Pac., n. to s. Can., s. to cen. Mex.

A markedly polytypic species of many intergrading tetraploid races and forms. Most Texas material belongs to var. *foliosa* (Nutt.) Harms (characterized by dense canescent appressed pubescence of involucre and herbage, and larger heads) or to var. *angustifolia* (Rydb.) Harms (characterized by narrower leaves, coarser and sparser herbage pubescence and smaller heads); these varieties intergrade on a broad scale, and much Texas material appears more or less intermediate between them.

9. *Heterotheca canescens* (DC.) Shinners. Similar to *H. villosa* but differing in its denser, softer, white, appressed-sericeous pubescence of phyllaries, peduncles, leaves and stems (secondary hairs), its hirsute but never harsh primary pubescence of stems, its smaller heads and the reduced size of most other quantitative characters; plants lower, 15-35 (-40) cm. high, often highly rhizomatous, frequently with markedly white-sericeous reduced axillary shoots, later becoming highly and finely branched; lower leaves oblanceo-

late to spatulate, petiolate, early-deciduous; middle and upper leaves linear to linear-oblongate, mostly over 5 times longer than broad; heads more or less closely subtended by narrow peduncular leaves longer than the phyllaries; inflorescence loose, rather indefinite, the heads smaller; involucre cylindrical to turbinate, 4-7 mm. wide, 5-7 mm. high; phyllaries closely imbricated in 3 to 5 series, the inner phyllaries less than 6 mm. long; rays usually fewer than 20, shorter than 10 mm.; disk corolla tubes 5-7 mm. long; inner pappus bristles 5-7 (-8) mm. long; outer pappus inconspicuous, composed of narrow setaceous squamae seldom exceeding 0.6 mm. in length. Chromosome no.: $n = 9$. (*H*)*Aplopappus canescens* DC., *Chrysopsis canescens* (DC.) T.&G., *C. villosa* var. *canescens* (DC.) Gray, *C. Berlandieri* Greene. Cen. Tex., e. to Dallas Co., n. to Wichita and Childress cos., s. to Kleberg and Uvalde cos., w. to Swisher, Scurry, Crockett, Brewster and Jeff Davis cos., summer-fall; Tex., w. Okla. and s.-cen. Kan.

Trans-Pecos material seems to represent a more robust race with thicker caudices. In Texas, it sometimes is difficult to clearly distinguish herbarium specimens of this species from certain canescent, strigose-sericeous, smaller-headed, more narrow-leaved forms of *H. villosa*.

10. *Heterotheca stenophylla* (Gray) Shinnery. Perennial herb with thick woody taproots and caudices, often short-rhizomatous; stems several to numerous, slender, erect, brittle, simple or branched above, (1-) 2-4 dm. high, sparsely hispid-strigose and copiously covered with stipitate or sessile resin-glands; lower stem portions early-defoliate, becoming glabrate with a smooth varnished appearance; lower leaves long-petiolate, oblongate to spatulate, early-deciduous; middle and upper leaves rigidly ascending, linear to oblong-linear, 1-4 cm. long, 1-7 mm. wide, usually over 5 times longer than broad, acute, sparsely hispid-strigose and densely beset with large sessile or short-stipitate glands often exceeding 0.1 mm. diameter; proximal leaf portions conspicuously hispid-ciliate; heads closely subtended by several narrow harshly hispid-ciliate peduncular leaves often exceeding the involucre, (1 to) 3 to 20 (to 50) in rather compact clusters, showy, with 40 to 80 (to 100) florets; involucre cylindrical to campanulate, 5-7 (-10) mm. high, 4-8 (-12) mm. in diameter; phyllaries lance-linear, in 3 or 4 imbricated series, the inner about twice as long as the outer, copiously glandular-viscid, only sparsely hispid-strigose; rays 15 to 30, bright-yellow, (5-) 7-15 mm. long, 1.8-2.5 mm. wide; disk corollas (4.5-) 5.5-7 (-8) mm. long; inner pappus (4.5-) 5.3-7 (-9) mm. long; outer pappus conspicuous, composed of uneven narrow squamae, the longest 0.5-1 mm.; achenes densely appressed-villous. Chromosome no.: $n = 9$. *Chrysopsis hispida* DC. var. *stenophylla* Gray, *C. villosa* var. *stenophylla* (Gray) Gray, *C. stenophylla* (Gray) Greene, *C. scabrifolia* A. Nels. On sandy or granitic soils, from Tex. Panhandle Plains, s.e. through the hill country as far as Clay and Hays cos., spring-fall; Tex., Okla., Kan. and disjunctly in n. Neb.

Apparently quite distinct in Texas, but a tetraploid ($n = 18$) chromosome race, known along the eastern edge of the species' range from s.-cen. Kan. to the Wichita Mts. of Okla., tends to intergrade with *H. villosa*.

11. *Heterotheca fulcrata* (Greene) Shinnery. Perennial taprooted herb with thick woody caudices; stems several to numerous, decumbent to erect, 1-8 dm. high, simple to usually divaricately branched at least in the inflorescence; primary stem pubescence dense, long and often retrorsely hirsute-hispid, with at least the hair bases persistent on lower stems; secondary pubescence densely short-hirsute, usually stipitate-glandular; leaves sparsely to densely hirsute to rarely strigose, usually densely short-stipitate-glandular; lower leaves oblong-spatulate, 2-6 cm. long, 5-20 mm. wide, with petioles 5-25 mm. long; middle and upper leaves sessile to clasping, oblongate or oblong to sometimes obovate, 2 to 4 (rarely 7) times longer than broad; heads 1 to 10 (to 25) in loosely cymose to sometimes subumbellate-corymbose or compactly globose inflorescences, appearing sessile, closely subtended by several peduncular leaves distinctly larger than the phyllaries and 3 to 5 (rarely 7) times longer than broad; involucre cylindrical-turbinate to broadly hemispherical, 6-15 mm. wide, 6-13 mm. high; phyllaries lance-linear, in 3 to 5 imbricated series, the outer 2-4 mm. long, the inner 2 or 3 times longer than the outer, more or less glandular, glabrate to sparsely (or rarely quite densely) strigose-hirsute; florets (35 to) 45 to 75 (to 90) per head; rays linear to elliptical, 5-13 mm. long, 1.8-3 mm. wide; disk corolla tubes 5-7 (-8) mm. long; inner pappus bristles

4-9 mm. long; outer pappus conspicuous, composed of lanceolate fimbriate squamae. Chromosome no.: $n = 9$. *Chrysopsis fulcrata* Greene, *C. resinolens* A. Nels., *C. cryptocephala* Woot. & Standl., *C. senilis* Woot. & Standl. Mts. of the Trans-Pecos, spring-fall; generally a higher elev. species of the southwest U.S. and s. Rocky Mts.

A problematic, highly variable group broadly interpreted here to include several semidistinct races. Much of the Trans-Pecos Texas material belongs to a smaller, less glandular race somewhat similar to the type of *Chrysopsis senilis*, but at least two other racially different forms also occur here. Discussion of possible infraspecific distinctions must be deferred pending further investigation.

12. *Heterotheca viscida* (Gray) Harms. Perennial taprooted herb with thick woody caudices; stems several to numerous, decumbent to erect, 1-3 dm. tall, more or less branched; primary pubescence of stems long-hirsute-hispid to 2 mm., often sparse, the secondary pubescence densely stipitate-glandular and short-puberulent (as in Sect. *Heterotheca*); leaves densely stipitate-glandular, sparsely hispid at least on veins; lower stem leaves broadly spatulate, with petioles shorter than 2 cm.; middle and upper leaves obovate to broadly elliptic or oblong, 15-40 mm. long, 7-25 mm. wide, usually about twice as long as broad, with sessile blades obtusely-based to cordate-clasping; heads distinctly pedunculate with peduncular leaves distant and scarcely reduced or else the closest abruptly narrower than those below; inflorescence open-cymose with a few large heads; involucre turbinate to hemispherical, 7-12 mm. high, (7-) 8-12 (-15) mm. wide; phyllaries linear-lanceolate, the inner about 3 times longer than the outer; outer phyllaries stipitate-glandular and sparsely strigose-hirsute to glabrate; rays 8-15 mm. long; disk corolla tubes 5-7 mm. long; inner pappus bristles 4.5-7 mm. long; outer pappus conspicuous, of irregular lanceolate fimbriate squamae 0.5-1.5 mm. long; achenes 3-4 mm. long, sericeous. *Chrysopsis villosa* var. *viscida* (Gray) Greene, *C. viscida* (Gray) Greene. Rare on rocky slopes, ledges and igneous soil in mts. of the Trans-Pecos where it is known from Culberson Co. (Guadalupe Mts.), Jeff Davis Co. (Davis Mts.) and Presidio Co. (Chinati Mts.), summer-fall; Trans-Pecos Tex., N.M. and Ariz.

A rare, little recognized entity with affinities to *Chrysopsis fulcrata* but appearing amply distinct from the latter. In the southwest U.S., the name, *H. viscida*, has most frequently been applied to plants belonging to *H. horrida* or *H. fulcrata*.

13. *Heterotheca horrida* (Rydb.) Harms. Similar to and apparently most closely related to *H. fulcrata*, from which it differs primarily in its distinctly pedunculate-appearing heads, progressively reduced distant peduncular leaves grading into the phyllaries, and heads with cylindrical to cylindrical-turbinate involucre less than 8 mm. wide and 8 mm. high (numerous in subumbellate-corymbose inflorescences). Chromosome no.: $n = 9$. Ariz. and Ut., e. to s. Wyo., w. Neb., e. Colo., w. Okla. and e. N.M., summer.

A low elevation species of the southern Rocky Mts., extending eastward onto the High Plains and the Colorado and Cheyenne Piedmont; not yet noted from Texas but may possibly be found in extreme northwest Texas Panhandle Plains or Trans-Pecos. In the southwest U.S., this entity has most frequently been referred to as *Chrysopsis hispida* but the type of the latter belongs to a common, more northern, tetraploid race of *H. villosa*.

17. XANTHISMA DC. SLEEPY-DAISY

A monotypic genus.

1. *Xanthisma texanum* DC. Taprooted annual herb 2-10 dm. tall, branched near the middle, the branches rather rigidly ascending; leaves alternate, essentially sessile, the basal ones deeply pinnately lobed and those of lower stem oblanceolate in outline but often shallowly pinnately lobed or dentate; leaves of midstem nearly entire, linear or lance-linear, 1-3 cm. long, 2-3 cm. broad, becoming smaller and appressed upward on the pedunculiform upper portion of the branchlets; heads solitary, not crowded; receptacle nearly flat, with long subulate persistent chaffy scales; involucre broadly hemispheric, 5-10 mm. high; phyllaries about 2-3 mm. broad, in several series, very firm, mostly stramineous but with a prominent basally truncate somewhat deltoid dark tip-patch, strongly graduated; ray flowers several, pistillate, fertile, with yellow rays often as much as 1 cm. long; disk flowers numerous, perfect, fertile; corolla yellow, with a basal tube

scarcely distinguished from the long scarcely ampliate shallowly 5-lobed limb; achene narrowly obpyramidal, rather densely covered with stiffish ascending whitish pubescence; pappus alike in disk and ray, double, of an inner series of long lance-acuminate scales and an outer series of linear-subulate scales more or less alternating with the inner series.

We have 2 varieties.

1. Phyllaries oblong to oblong-ovate, with rounded tips ..var. *texanum*.
1. Phyllaries oblong-lanceolate to ovate-lanceolate, abruptly contracted to a sharp stiff pointvar. *Drummondii*.

Var. *texanum* is frequent in sandy open places, Rio Grande Plains, Apr.-Nov.; endemic.

Var. *Drummondii* (T.&G.) Gray is infrequent in open sandy places, Plains Country and the Llano region of the Edwards Plateau, rare e. to n.-cen. Tex., Apr.-Nov.; also Okla.

18. GRINDELIA WILLD.¹⁹⁵

GUMWEED. TARWEED

Taprooted herbs with leafy stems (or in *G. oolepis* stoloniferous), often sticky, usually with numerous ascending branches; leaves alternate, sessile, not deeply lobed, usually serrate; heads mostly about 1-2 cm. broad, hemispherical; phyllaries in 4 to 8 series, usually linear to linear-subulate, the lower part usually pale and very firm and appressed, the upper portion firm and often darker in color and either ascending or usually spreading or even squarrose-reflexed; receptacle nearly flat or slightly convex, rough; *disk flowers* perfect, the central ones usually sterile, the peripheral ones usually fertile, with yellow corollas that consist of a slender basal tube sharply differentiated from the ampliate limb that is equally 5-toothed; *ray flowers* 0 to 45, pistillate, fertile; pappus of ray and disk alike, of 2 to 10 caducous awns that vary from slender to stout or even sometimes scale-like; achenes glabrous, oblong-obovoid, slightly laterally compressed.

About 60 species found in western North America and South America.

1. Upper portions of phyllaries erect, ascending, horizontally spreading or slightly reflexed-squarrose (2)
1. Upper portions of phyllaries revolute, strongly recurved or strongly reflexed-squarrose (10)
- 2(1). Pappus awns filiform or if somewhat scalelike then the upper portion of the phyllary subcoriaceous, firm and thick (3)
2. Pappus awns slightly scalelike or if linear-filiform then the achenes not wrinkled (6)
- 3(2). Rays absent; perennial with rhizomes 8. *G. oolepis*.
3. Rays present; annual or biennial (4)
- 4(3). Leaves not much-reduced toward the heads, the uppermost ones subtending the heads in the manner of auxiliary bracts; mature achenes about as broad as long ..
..... 2. *G. microcephala*.
4. Leaves gradually reduced toward the heads, the uppermost leaves not closely clustered around the heads; mature achenes longer than broad (5)
- 5(4). Upper and middle cauline leaves dentate to setuliferous or spinulose-denticulate; achenes smooth to striate or somewhat coarsely ribbed, 2.5-4 mm. long
..... 6. *G. scabra*.
5. Upper and middle cauline leaves finely and closely crenulate; achenes with 9 to 10 slender ribs, 2-2.3 mm. long 1. *G. grandiflora*.
- 6(2). Ray flowers absent (7)
6. Ray flowers present (8)
- 7(6). Upper and middle cauline leaves entire to remotely or closely crenulate-serrate to -denticulate; pappus awns remotely to moderately setulose-serrulate; mature achenes deeply ribbed or furrowed 5. *G. aphanactis*.
7. Upper and middle cauline leaves closely and evenly crenate or crenate-serrate, the teeth obtuse; pappus awns mostly entire; mature achenes merely striate at the angles 4. *G. squarrosa*.

¹⁹⁵ Adapted from J. A. Steyermark in Ann. Missouri Bot. Gard. 21:433-608. 1934.

- 8(6). Leaves entire or with short salient acute or bristle-tipped teeth
7. *G. lanceolata*.
8. Leaves saliently toothed (9)
- 9(8). Stems minutely puberulent in part; leaves minutely scabridulous in part; pappus awns 4-7 mm. long, equaling the corolla in the disk; Trans-Pecos Texas
3. *G. Havardii*.
9. Stems and leaves glabrous; pappus awns 3-5 mm. long, shorter than the disk corollas; east of Trans-Pecos Texas4. *G. squarrosa*.
- 10(1). Ray flowers absent (Return to couplet 7 above).
10. Ray flowers present4. *G. squarrosa*.

1. *Grindelia grandiflora* Hook. Robust annual to 15 dm. tall, freely branched in the upper part, the branches ascending; upper and middle cauline leaves finely and closely serrulate-crenulate, each side with 20 to 50 crenulae, reduced upward on the stems and appressed so that the upper part of the branches are somewhat penduculiform; heads solitary, not crowded; upper portions of phyllaries erect or spreading; rays orangish or golden-yellow; achenes with 9 to 10 slender ribs, about 2 mm. long. Local in w. part of Edwards Plateau (Crockett, Edwards, Schleicher, Sutton and Val Verde cos.), Aug.-Sept.; also Coah. and N.L.

2. *Grindelia microcephala* DC. Taprooted annual, 1-15 dm. tall, often branched above; leaves usually somewhat oblong, those of midstem on each side with 25 to 60 closely set small teeth, those of upper part of stem not much reduced towards the heads, the uppermost leaves subtending the head in the manner of auxiliary bracts; upper portions of phyllaries ascending or spreading; rays present; mature achenes about as long as broad. Frequent, often in poorly drained clay, in Rio Grande Plains, n.-cen. Tex. and less frequent in s. part of e. Tex. and e. and s. parts of Edwards Plateau, late spring-summer; also Tam.

In the Rio Grande Plains the plants are often of low stature and have some glandular-pubescent (var. *microcephala* and var. *pusilla* Steyererm.) whereas in the northern part of the distribution, especially in north-central Texas, the plants average taller and lack the glandular-pubescent (var. *adenodonta* Steyererm. and f. *angustior* Steyererm.)

3. *Grindelia Havardii* Steyererm. Apparently biennial or weak perennial with several stems (that often bear minute scabridulous pubescence) from the base, erect, 3-5 dm. tall, each stem simple in lower part and with some ascending branches above (each topped by a head); leaves of midstem firm, mostly oblong, varying to slightly ovate or obovate, on each side with 5 to 10 small but rather sharp salient (or slightly antrorse) teeth; some of the lower leaves often with sparse and microscopic scabridulous pubescence, especially near the margin; upper portion of phyllaries ascending or spreading; rays present; pappus 4-7 mm. long, equaling the corolla of the disk flowers; achenes about 3 mm. long, smooth. Infrequent in open places in the Trans-Pecos (to 6,000 ft.) in Chisos and Guadalupe mts., rare in w. part of Edwards Plateau (Crockett Co.), July-Sept.; also N.M.

4. *Grindelia squarrosa* (Pursh) Dun. CURLY-CUP GUMWEED. Taprooted annual, occasionally overwintering; leaves of midstem mostly approaching an oblong shape, firm, on each side with 13 to 30 salient or slightly antrorse teeth, somewhat reduced in size upwards on the stem, not forming auxiliary bracts to the head; upper portions of phyllaries rarely ascending, usually spreading or even strongly reflexed-squarrose; rays rarely present, usually absent; pappus awns narrowly linear, in the disk slightly shorter than the corolla; achenes oblong, 2.3-3 mm. long, usually with 4 angles and with a few shallow striations, but usually smooth. Frequent in open areas in Plains Country, infrequent e. to n.-cen. Tex., s. to Edwards Plateau and s.w. to Trans-Pecos, summer-fall; in most of U.S. (except S.E. states.)

The var. *squarrosa* (with rays) is rare in the Plains Country of Texas; most of our plants are of the var. *nuda* (Wood) Gray (rayless), including f. *angustior* Steyererm.

5. *Grindelia aphanactis* Rydb. Taprooted herb (said to be perennial) with one to several erect stems sparingly branched and each erect branch head-tipped; leaves of midstem membranous, mostly oblanceolate, 2-4 cm. long, 4-8 mm. broad, with about 5 to 8 remote salient teeth on each side, the upper leaves reduced and more nearly linear with nearly entire margins; upper portions of phyllaries ascending or spreading; ray flowers

absent; pappus awns slender, subentire to microscopically serrulate-roughened toward the apex, shorter than the corolla; achenes dark, the four angles prominent and marked on each side by prominent furrows, the ridges sometimes rugulose. Rare in Davis Mts. in the Trans-Pecos, summer; Ut., Ariz., Colo., N.M. and Tex.

6. *Grindelia scabra* Greene. Taprooted annual or biennial herb, several dm. tall, sparingly branched with each branch head-tipped; leaves of midstem approaching oblong in shape, about 2-3 cm. long, on each side with 10 to 25 salient or usually slightly antrorse teeth, upward on stem the leaves slightly reduced and not at all crowded below the head; upper portion of phyllaries ascending or spreading; rays present; achenes 2.5-3 mm. long, longer than broad, pale-brown, smooth or often with some few broad ribs; pappus awns filiform, shorter than the disk corolla. Incl. var. *neomexicana* (Woot. & Standl.) Steyerl. Infrequent to rare in Davis Mts. in the Trans-Pecos, Aug.-Oct.; also N.M.

7. *Grindelia lanceolata* Nutt. Perennial herb from woody crowns (in the extreme n. portion of the range short-lived perennials); stems one to several, ascending, branched in the uppermost portion where each branch terminates in a head; leaves firm, lanceolate to deltoid, rarely oblong-deltoid, tapered nearly the full length to the acute apex, those of midstem 2-5 (-6) cm. long and on each side with 7 to 15 sharp pronounced somewhat antrorse-salient teeth (teeth occasionally bristle-tipped); upper portions of phyllaries ascending or spreading; rays present; pappus awns filiform to linear, nearly as long as the disk corolla; achenes oblong to obovate, 2-5 mm. long, smooth or weakly striate. Incl. var. *texana* (Scheele) Shinnars, *G. littoralis* Steyerl., *G. texana* Scheele. Frequent in open calcareous soil, Edwards Plateau and n.-cen. Tex., local in calcareous soil near Galveston, summer (-fall); Mo. and Tenn., s. to Ala. and s.w. to Tex.

The plants from most of Texas have rather large achenes and mostly deltoid leaves (*G. texana*), but in north-central Texas this type grades northward into a type (true *G. lanceolata*) with shorter achenes, shorter duration (biennial?) and more elongate leaves.

8. *Grindelia oolepis* Blake. Perennial forming clumps from slender branched rhizomes; aerial stems 1-4 dm. long, ascending, mostly simple; leaves membranous, mostly oblanceolate (the lower ones occasionally pinnately lobed), those of midstem 2-6 cm. long, nearly entire or usually on each side with about 6 to 8 small appressed teeth; heads solitary, remote from each other; the broadly deltoid dark tips of the phyllaries erect; ray flowers absent. Infrequent in tight black clay-gumbo soil, coastal part of Rio Grande Plains and s. part of coastal Tex. (Bee, Cameron, Nueces and San Patricio cos.), May, Sept.-Dec.; endemic.

A singular species that is quite distinctive.

19. PRIONOPSIS Nutt.

A monotypic genus whose solitary species is often considered as merely a species of *Haplopappus*. It is closely related to *Grindelia* to which genus it probably should be referred.

1. *Prionopsis ciliata* (Nutt.) Nutt. Stout essentially glabrous annual herb 5-15 dm. tall; stems erect, mostly simple except in the upper 1-2 dm. where numerous short branches arise (each terminating in a head); leaves alternate, simple, sessile, oblong to narrowly or broadly obovate, with coarse salient teeth (each mucronate or with a short bristle), not much reduced upward, the uppermost leaves clustered at the base of the head as auxiliary bracts; heads 15-40 mm. broad; involucre hemispherical, 10-15 mm. high; phyllaries in 3 or 4 series, not strongly graduated, linear-subulate, the lower portion dark-stramineous and very firm, appressed, the upper portion firm, darker and spreading or even squarrose; receptacle flat or slightly convex, roughish; *disk flowers* numerous, perfect, the central ones sterile, the outer fertile, the corolla yellow, the tube weakly differentiated from the equally 5-toothed limb; *ray flowers* pistillate, fertile, the ray yellow; achene glabrous, turgid, oblong or ellipsoid, somewhat laterally compressed, basally attached at a whitish cartilaginous ring; pappus of ray and disk similar, of several somewhat unequal brownish-white slender bristles, the longer ones slightly dorsiventrally flattened; pappus of fertile achenes disposed to be deciduous as a unit. *Haplopappus*

ciliatus (Nutt.) DC. Frequent in open ground, Plains Country and n.-cen. Tex., less common in s.e. Tex., rare in e. Tex. and the Trans-Pecos, Aug.-Oct.; Mo., Kan. and Colo., s. to Tex. and N.M.

20. GYMNOSPERMA LESS.

A monotypic genus; included in *Xanthocephalum* by at least one author.

1. *Gymnosperma glutinosum* (Spreng.) Less. TATALENCHO. Straggly shrub 5-20 dm. tall; leaves alternate, sessile or essentially so, linear or lance-linear, entire, membranous, glutinous, often 2-5 cm. long, 2-6 mm. broad; heads borne in dense terminal corymbiform masses often several cm. across; receptacle nearly flat or somewhat convex, essentially naked; involucre turbinate, usually 3-5 mm. long, glutinous; phyllaries in about 3 series, strongly imbricated, mostly firm and stramineous except for a darker patch at the tip; ray flowers few, the corolla yellow with a relatively long tube and a very short ascending ray shorter than the tube and usually not equaling the adjacent disk corollas; disk flowers few, corolla yellow, with a basal tube and a 5-lobed limb; achene pubescent; pappus in both kinds of flowers reduced to a microscopic ring or essentially absent. *Xanthocephalum glutinosum* (Spreng.) Shinners. Frequent in dry brushy or grassy areas, Rio Grande Plains, Edwards Plateau and in the Trans-Pecos up to 6,500 ft. elev., (spring-) summer-fall; Tex., N.M. and Ariz., s. to Guat.

21. THUROVIA ROSE

A monotypic genus.

1. *Thurovia triflora* Rose. Taprooted ericoid-scoparioid annual 1-3 dm. tall, profusely branched (especially in the upper half); leaves alternate, entire, glutinous, appressed, (1-) 2-4 mm. long, about 1 mm. broad, not much diminished upward, the uppermost often subtending a head as an auxiliary bract; heads numerous, borne in very short leafy branchlets; receptacle essentially flat and naked; involucre 3-4 mm. long, urceolate-turbinate; phyllaries few, in about 3 series, strongly graduated, mostly stramineous but each with a small darker patch at the tip; ray flowers absent; disk flowers usually about 3 in number, perfect, fertile, the corolla cream-colored or very pale-yellow with a short basal tube and a broadly flaring equally 5-lobed limb; pappus of about 10 acute scales nearly as long as the corolla; achene narrowly obpyramidal, rather densely covered with ascending stiff white pubescence. Rare and local in s.e. Tex. (Aransas, Brazoria, Calhoun, Harris, Jackson and Refugio cos.), Sept.-Nov.; endemic.

Closely related to *Xanthocephalum texanum*; this doubtless should be included in that genus.

22. XANTHOCEPHALUM WILD.¹⁹⁶

BROOMWEED. SNAKEWEED

Herbs or low shrubs with taproots; leaves alternate, unlobed, entire, usually resinous; heads either solitary or in fascicles, relatively small; receptacle flat or convex, rarely conical, naked; involucre campanulate to usually turbinate or urceolate, or even nearly spherical or cylindrical; phyllaries in about 3 series, strongly graduated, mostly firm and rather thick and stramineous, closely appressed, often at the very tip with a somewhat darker splotch, often resinous; ray flowers pistillate, usually fertile, the rays yellow and longer than the corolla tube and usually longer than the disk corollas; pappus either absent or a low rough crown or of small paleae; disk flowers perfect, fertile or infertile, the corollas yellow, with a basal tube and a 5-lobed limb; pappus either reduced to a minute crown or else with well-developed scales or (in one species) with a few linear or strap-shaped scales which basally are united; achene obpyramidal, usually rather densely covered with ascending stiffish white hairs or rarely nearly glabrate. *Gutierrezia* Lag.; *Amphiachyris* (DC.) Nutt.

Some of the species are extremely common weeds that increase enormously under the

¹⁹⁶ Adapted partly from O. T. Solbrig in *Rhodora* 62:43-54. 1960; 63:151-164. 1961.

prevalent regime of abusive overstocking. The herbage of several species is known to be toxic to livestock. The annual species are called "broomweed" and the shrubby species "snakeweed." An American genus of perhaps 30 species.

1. Pappus of both ray and disk flowers composed of several well-developed paleae (except these nearly absent in the ray flowers of *X. texanum*) (2)
1. Pappus of both ray and disk flowers of linear or strap-shaped scales and/or merely a low toothed crown, or absent (5)
- 2(1). Plants shrubby or subshrubby perennials (3)
2. Plants taprooted annuals with one stem at base (4)
- 3(2). Each head with 3 to 7 ray flowers and 2 to 6 disk flowers, the latter fertile 2. *X. Sarothrae*.
3. Each head with only 2 or 3 (rarely 4) fertile (ray) flowers; involucre very narrow; achenes of disk flowers aborted 3. *X. microcephalum*.
- 4(2). Involucre campanulate; heads terminal on the secondary branches; pappus present in both ray and disk; disk flowers 20 to 40 per head 4. *X. sphaerocephalum*.
4. Involucre turbinate to campanulate; heads terminal on ascending tertiary pedunculiform branchlets; pappus of ray flowers absent or reduced; disk flowers 10 to 20 per head 5. *X. texanum*.
- 5(1). Rays 50 to 70; pappus of disk flowers merely a crown of minute scales or with 2 or 3 squamellae 1. *X. gymnospermoides*.
5. Rays fewer than 20; pappus of disk flowers of a few strap-shaped scales which at the base are dilated and united 6. *X. dracunculoides*.

1. *Xanthocephalum gymnospermoides* (Gray) Rothr. Stout annual to 2 m. tall; branchlets often with stipitate glands; leaves lanceolate, 3-15 cm. long, 5-30 mm. broad, glabrous, with entire or serrate margins, acute, above shiny and somewhat glutinous; heads solitary at the ends of the branchlets but clustered in subcymose aggregations; involucre campanulate, glutinous, 3-7 mm. thick, 3-6 mm. high; phyllaries numerous in 2 loose series, glabrous, appressed, usually with green midrib and tips, apically spreading; receptacle flat or slightly convex, alveolate; ray flowers 50 to 70, the yellow rays 2-4 mm. long and 1-1.5 mm. broad, about the same length as the tube; disk flowers 150 to 200, 2 to 3 times as many as the ray flowers; corolla about 4 mm. long, with a narrow tube and expanded throat; style with pointed collecting hairs and these restricted to the short deltoid tips; pappus in some plants a low crown, in others a few irregular awns up to half as long as the disk corollas; achenes terete, glabrous or slightly pubescent, 1-2 mm. long. Infrequent or rare in Davis Mts.; Ariz., Son., Chih., Dgo. and Tex.

2. *Xanthocephalum Sarothrae* (Pursh) Shinn. Shrublet 15-90 cm. tall, much-branched at the base and above; leaves linear, 5-70 mm. long, 1-3 mm. broad, resinous, usually glabrous; the entire plant usually more or less corymbiform with numerous heads borne at the densely branched rounded top; involucre 3-10 mm. high, turbinate; phyllaries narrow, acute; ray flowers 3 to 7, fertile, with pappus about half as long as that of the disk; disk flowers 2 to 6, fertile, the pappus of 8 to 10 acute paleae, shorter than the achene. *Gutierrezia Sarothrae* (Pursh) Britt. & Rusby, *G. tenuis* Greene. Locally abundant in open calcareous areas in the Trans-Pecos, Rio Grande Plains and Plains Country, rarely e. to n.-cen. Tex. and s. part of s.e. Tex., usually summer and fall; Man., Sask. and Alta., s. to Chih., N.L. and Tam.

3. *Xanthocephalum microcephalum* (DC.) Shinn. Shrublet 3-10 dm. tall, much-branched; leaves linear, 1-5 cm. long, 1-4 mm. broad, resinous, usually glabrous; the entire plant usually corymbiform with very numerous heads densely crowded all over the rounded top; involucre 3-4 mm. high, narrowly turbinate to nearly cylindroid; ray flowers 1 to 3 (to 4), fertile, with pappus of a few scales shorter than those of the disk; disk flowers 1 to 3, perfect but not fertile; pappus of a number of acute scales 2-3 mm. long. *Gutierrezia microcephala* (DC.) Gray, *G. longipappa* Blake. Locally abundant in the Trans-Pecos, rarely e. to w. part of Edwards Plateau and the Plains Country, usually summer-fall; Calif., Ut., Colo., Ariz., Son., N.M., Chih., Coah. and Tex.

4. *Xanthocephalum sphaerocephalum* (Gray) Shinners. Annual 2-60 cm. tall, much-branched in the upper two thirds; leaves lance-linear, 2-3 mm. long, 2-3 mm. broad, glabrous, glutinous; heads not crowded, terminating leafy secondary branches; involucre broadly campanulate, 3-5 mm. high; *disk flowers* 20 to 40, fertile, with a pappus of several pointed scales usually 1-2.5 mm. long; *ray flowers* 10 to 20, fertile, with a pappus of several scales similar to but shorter than that of the disk. *Gutierrezia glutinosa* Gray, *G. eriocarpa* Gray. Widespread and frequent nearly throughout except the extreme e. and n. parts of Tex., summer-fall; N.M., Tex. and Chih., s. to Qro.

5. *Xanthocephalum texanum* (DC.) Shinners. Annual 1-8 dm. tall, much-branched in the upper half; leaves lance-linear, 1-5 cm. long, 1-5 mm. broad, glabrous, glutinous; heads not crowded, terminating relatively short ascending pedunculiform branchlets; involucre turbinate to campanulate, 3-4 mm. high; *disk flowers* about 10 to 20, fertile, with a pappus of several pointed scales 0.4-1.2 mm. long; *ray flowers* 10 to 15, fertile, with the pappus greatly reduced or nearly obsolete. *Gutierrezia texana* (DC.) T.&G. Widespread and abundant, nearly throughout, summer-fall; Okla. s. to S.L.P.

6. *Xanthocephalum dracunculoides* (DC.) Shinners. Annual 1-12 dm. tall, much-branched in the upper two thirds; leaves lance-linear, 1-5 cm. long, 0.6-2 mm. broad, glabrous, glutinous; heads sometimes a little crowded, terminating fairly short pedunculiform tertiary branchlets; involucre urceolate-turbinate, about 3-5 mm. high; *disk flowers* 10 to 35, perfect but not fertile, the pappus a short thin white cylindrical crown from which emerge about 5 white linear strap-shaped projections equaling the corollas; *ray flowers* 7 to 15, fertile, the pappus of several separate acute scales. *X. amoenum* Shinners and var. *intermedium* Shinners, *Amphiachyris dracunculoides* DC., *Gutierrezia dracunculoides* (DC.) Blake. Local nearly throughout, abundant in n.-cen. Tex., summer-fall; also Okla.

23. EUTHAMIA Nutt.

Essentially glabrous often slightly glutinous rhizomatous perennials; stems erect, 4-8 dm. tall, 2-4 mm. thick basally, freely branching in the upper half, the branches rather stiffly ascending, the entire branch-system then forming a flat or somewhat corymbiform top to the plant, rather densely leafy even up to the top with some diminution of the upper leaves; leaves usually ascending, linear to linear-lanceolate, those of the middle of the plant usually at least 10 times as long as broad, membranous, essentially entire, smooth (except the minutely roughened margins), dark-green, (3-) 4-6 (-8) cm. long, with very minute areolate nervation, otherwise only the midvein visible usually or with two obsolescent longitudinal secondary nerves, often with minute dark punctations and somewhat glutinous; head-bearing region nearly plane or roughly corymbiform at top of plant; heads essentially sessile or very short-pedunculate, solitary or borne in fascicles of 2 to 4 on the ultimate branchlets; involucre turbinate to rarely hemispheric, about 4-6 mm. high, often glutinous; receptacle about 2 mm. across, convex, very rough; phyllaries in about 3 to 5 series, oblong, usually blunt, about 0.6-1.3 mm. broad, mostly stramineous, very firm except the extremely narrow scarious margins, the only dark-herbaceous portion being the extreme tip (this area basally truncate and not at all extending below into the midnerve area); *ray flowers* few, pistillate and fertile, the rays yellow, minute, not exceeding the disk corollas; *disk flowers* perfect, fertile, about 10 to 15 per head, with 5-toothed yellow corollas, only slightly exceeding the involucre; pappus alike in disk and ray, of a single series of more or less equal whitish capillary bristles.

We have three species, based on a somewhat narrow view of each. *Euthamia* is often considered a section of *Solidago*, but the relationship is not as close as this treatment would imply. The genus, entirely American, is considered to consist of about 6 species.

1. Leaves of midstem 1-1.5 (-2) mm. broad, only the midnerve visible even under a lens; involucre about 5-6 mm. high; ligules 2-4 mm. long 3. *E. pulverulenta*.
1. Leaves of midstem 3-5 mm. broad, usually 2 longitudinal secondary nerves visible under a lens in addition to the midnerve; involucre about 4-5.5 mm. high; ligules about 2 mm. long (2)

- 2(1). Middle phyllaries 0.9-1.2 mm. broad; Plains Country 1. *E. camporum*.

 2. Middle phyllaries 0.5-0.9 (-1) mm. broad; mostly eastern half of Texas
 2. *E. leptcephala*.

1. *Euthamia camporum* Greene. As in the key. *Solidago camporum* (Greene) A. Nels. Infrequent in Plains Country (Lipscomb, Wheeler and Wichita cos.), in sandy floodplains of creeks and rivers, Aug.-Sept.; Kan., Okla., Tex. and Colo., probably farther n. and e.

Our plants have been called *E. gymnospermoides* Greene by some authors, apparently incorrectly.

2. *Euthamia leptcephala* (T.&G.) Greene. As in the key. *Solidago leptcephala* T.&G. Frequent in open sandy areas, s.e. Tex., less frequent inland into e. Tex., rare along the coast as far s. as Cameron Co., Sept.-Nov.; Gulf States, n. to N.C., Ky. and Mo.

3. *Euthamia pulverulenta* Greene. Less densely leafy, on the average, than the others, with longer heads and rays and narrower leaves. *Solidago texensis* Friesner. Local near the coast in s.e. Tex. (Calhoun, Galveston, Harris, Jackson, Matagorda, Refugio, San Patricio and Waller cos., rare inland to Austin and Newton cos. and s.w. to Brooks Co.); also La.

There is a superficial and perhaps more than superficial resemblance of this to *Ericameria austrotexana*, but in that species the narrow midribs of the phyllaries are dark.

24. BIGELOWIA DC.

Of the approximately 40 species that occur from North America to Ecuador, we have one. A genus closely related to *Chrysothamnus* and through it to *Ericameria*.

1. *Bigelowia virgata* (Nutt.) DC. Perennial herb from rhizomes or woody branched caudexes, 5-10 dm. tall, rigidly erect, each wiry stem essentially simple except in the upper 4-8 cm. (head-bearing portion); leaves alternate, sessile, linear, entire, firm, often resinous, mostly densely crowded at the very base, becoming extremely remote or absent for most of the length of the scapelike stem; heads densely crowded in a somewhat corymbiform aggregation at the top; involucre nearly cylindrical, 6-8 cm. long; phyllaries in 3 or 4 series, strongly imbricated, often in fairly distinct vertical ranks, firm, resinous-glutinous, mostly stramineous except the darker-colored tip-patch which is not continuous downward on the midrib area; receptacle flat or very slightly convex; ray flowers absent; disk flowers 4 to 6, the corolla yellow, the tube not sharply distinguished from the gradually ampliate deeply 5-lobed limb; achenes narrowly obpyramidal to nearly prismatic, rather densely coated with antrorse stiff white hairs; pappus copious, of numerous slightly unequal bristles that are very slightly dorsiventrally flattened basally. *Chondrophora virgata* (Nutt.) Greene. Infrequent in open sandy places, gravelly clays and rock outcrops, e. Tex., rare in s.e. Tex., fall; Coastal States, N.C. to Tex.

25. CHRYSOTHAMNUS NUTT.¹⁹⁷

RABBIT-BRUSH

Much-branched rounded shrubs 4-18 dm. tall; leaves alternate, simple, linear to narrowly spatulate-oblongate, 1-5 cm. long, 1-4 mm. broad, glabrous to finely puberulent or tomentose, margins smooth or minutely pectinate-ciliate; heads borne in dense irregularly subcorymbose clusters; receptacle flat or somewhat raised in the center; involucre cylindrical, 6-15 mm. long; phyllaries coriaceous, mostly stramineous, strongly graduated in 4 or 5 series and in distinct vertical files, carinate with a slightly discolored midrib which expands into a subrhombic spot near the tip; ray flowers yellow, rarely present (only in *C. spathulatus*), if present 1 per head, inconspicuous; disk flowers 4 or 5, yellow; corolla 6-12 mm. long, tubular, gradually amplified upwards with 5 lobes; achenes narrowly cylindrical, terete or slightly angled, glabrous or pubescent; pappus of several unequal capillary bristles, dull-white.

Chrysothamnus consists of about a dozen species in western North America. It is closely related to *Macronema* Nutt. and *Ericameria* Nutt.

¹⁹⁷ Contributed by Loran C. Anderson.

1. Twigs white-tomentose (2)

1. Twigs not white-tomentose (3)

2(1). Achenes pubescent 1. *C. nauseosus* subsp.

graveolens.

2. Achenes glabrous 2. *C. nauseosus* subsp.

Bigelovii.

3(1). Involucre 5-6 mm. high 3. *C. spathulatus.*

3. Involucre 10 mm. high or more 4. *C. pulchellus.*

1. *Chrysothamnus nauseosus* (Pall.) Britt. subsp. *graveolens* (Nutt.) Piper. Shrub 5-12 dm. tall; younger branches densely white-tomentose; leaves linear, 2-4 cm. long, 1-2 mm. wide, glabrescent to densely tomentose; involucre 7-8 mm. long; phyllaries glabrous, acute; corollas 7-8 mm. long, the lobes 1 mm. long; achenes pubescent. Infrequent in draws on Rolling Plains of Panhandle, 3,000 ft. elev., Sept.-Oct.; from Ariz. and Ut. to N.D., Kan. and Tex.; the species (as a whole) over most of w. U.S.

2. *Chrysothamnus nauseosus* subsp. *Bigelovii* (Gray) Hall & Clem. Shrub 5-6 dm. tall; younger branches tomentose; leaves linear, 2.5-3.5 cm. long, 1-2 mm. wide, glabrescent; involucre 9-10 mm. long; phyllaries pubescent, acuminate; corollas 9-10 mm. long, the lobes 1 mm. long; achenes glabrous. Infrequent in Guadalupe Mts. at 5,000-6,000 ft. elev., Sept.-Oct.; Ariz., Colo., N.M. and Tex.

3. *Chrysothamnus spathulatus* L. C. Anderson. Shrub 5-10 dm. tall; younger branches puberulent; leaves linear-oblongate, 2.5-4 (-5) cm. long, 1-3 mm. wide, glabrous or finely puberulent; involucre 5-6 mm. long; phyllaries obtuse to acute; *ray flowers* rare, 5.5 mm. long, the limb 3 mm. long, somewhat involute and appearing like a tubular corolla; *disk flowers* with corollas 5-6 mm. long, the lobes 2.5-3 mm. long; achenes sparsely pubescent, nearly glabrous at maturity. *C. viscidiflorus* (Hook.) Nutt. var. *ludens* Shinn. Rare in Guadalupe Mts. at 5,500-6,000 ft. elev., Aug.-Sept.; also mts. of adj. N.M.

4. *Chrysothamnus pulchellus* (Gray) Greene. Shrub 6-12 (-18) dm. tall; branches glabrous or rarely puberulent; leaves mostly linear, 1.5-3 cm. long, 1-2 (-4) mm. wide, usually glabrous, rarely finely puberulent, the margins smooth or finely scabrous-ciliate; involucre 10-15 mm. long; phyllaries strongly ridged, tips acuminate or cuspidate; corollas (8-) 10-12 (-14) mm. long, lobes 1 mm. long; achenes glabrous. *C. Baileyi* Woot. & Standl. Frequent in sandy soil, Panhandle, High Plains and Trans-Pecos, 2,000-6,000 ft. elev., Aug.-Oct.; Ariz., N.M., Kan., Tex. and Chih.

26. ERICAMERIA NUTT.

Rounded shrubs from taproots, much-branched, 2-10 dm. tall, essentially glabrous, glutinous, at least slightly aromatic; leaves firm, dark-green, often with pellucid dots or minute craters (visible with a lens), glutinous, linear, 5-20 mm. long, 1-2 mm. broad, flat or often seemingly nearly terete but then with a ventral channel, entire, often ascending; heads 5-10 mm. long; borne at the ends of branches in a subcorymbiform zone near the top of the plant or 2 or 3 often so close as to seem fascicled, or solitary; involucre 3.5-7 mm. long, narrowly turbinate to campanulate, of several (3 or 4) series of graduated phyllaries; receptacle about 2 mm. across, fimbriate, very slightly if at all convex; phyllaries usually resinous, mostly stramineous in color; *ray flowers* present or absent, when present few (1 to 5) and inconspicuous, pistillate and fertile, 3-5 mm. long, yellow (sometimes very pale yellow but never with any bluish cast); *disk flowers* perfect, fertile, 10 to 20 (to 35), exceeding the involucre; corolla yellow, with a cylindrical tube from which the very gradually ampliate throat is not at all sharply delineated; pappus alike in disk and ray, composed of numerous somewhat unequal brownish-white stiff subcapillary bristles, these being very slightly dorsiventrally flattened toward the base; achene usually prismatic, rather densely hirsute with ascending whitish hairs.

Ericameria, an American genus of perhaps 12 species, is often treated as a section of the dustbin genus *Haplopappus*. It is closely related to *Chrysothamnus*, with which it possibly should be merged. If *Ericameria* is placed in *Haplopappus*, *Chrysothamnus* should be too.

1. Shrublets only about 3 dm. tall; lobes of disk corolla equal in length; phyllaries subulate, acute, with a long very narrow dark median strip running nearly their full length and not expanded near the tip 1. *E. laricifolia*.
1. Shrubs usually 3-10 dm. tall; lobes of disk corolla unequal in length; phyllaries linear, bluntish, the darkish median strip confined to the upper half and roughly rhombic (2)
- 2(1). Rays present; disk corolla with the shorter lobes 0.9-2.7 mm. long, the longer lobe(s) 1.7-3.3 mm. long; southern half of Texas east of the Pecos River 2. *E. austrotexana*.
2. Rays apparently absent; disk corolla with the shorter lobes 0.5-1 mm. long, the longer lobe(s) 1.4-1.5 mm. long; in Trans-Pecos Texas 3. *E. triantha*.

1. *Ericameria laricifolia* (Gray) Shinn. Rounded much-branched resinous-aromatic shrub 3-8 dm. tall; internodes of twigs 1-3 cm. long; leaves 4-10 (-20) mm. long, 1-2 mm. broad, rather conspicuously dotted with "glands," the upper ones often with smaller leafy twigs in the axils; heads 9-10 mm. long, broadly turbinate to campanulate; phyllaries subulate, not strongly graduated and not in distinct vertical rows (shortest ones about half as long as the longest), relatively thin and chaffy, brownish-stramineous, each with a very thin darker median strip running essentially the full length and essentially unexpanded toward the apex; disk corolla about 5.5-5.6 mm. long, with a tube 2.6 mm. long, a throat 1.9-2 mm. long and 5 equal lobes 0.9-1 mm. long; ray flowers 0 to 6. *Haplopappus laricifolius* Gray. Infrequent in desert mts. in the Trans-Pecos (Franklin and Hueco mts. of El Paso Co.; Chinati Mts. of Presidio Co.), Oct.-Nov.; Ariz., N.M., Son., Chih. and Tex.

2. *Ericameria austrotexana* M. C. Johnst. Rounded shrub (3-) 5-15 dm. tall, somewhat aromatic, much-branched; internodes of twigs 2-6 mm. long; leaves 1-2 (-3) cm. long, 1-2 mm. broad, the glandularity perceptible only under a strong lens; upper leaves rarely with axillary fascicles; heads 6-9 mm. long; involucre usually turbinate, 4-5 mm. long; phyllaries rarely in noticeable vertical rows, strongly graduated, linear, blunt or very slightly acute, thick, firm, sticky, mostly stramineous but in the upper half with a narrowly rhombic dark patch occupying much of the tip-region; rays only about 2-3 mm. long, very pale yellowish; disk corolla pale, 3.6-5.5 mm. long, with a tube 1-1.8 mm. long and poorly differentiated from the limb which is asymmetrically 5-lobed, most of the lobes 0.9-2.7 mm. long but 1 or 2 of them on one side 1.7-3.3 mm. long. *Aster Palmeri* Gray, *Isocoma Palmeri* (Gray) Shinn. Frequent in open ground, coastal part of Rio Grande Plains and s. part of s.e. Tex., n. to San Patricio, Atascosa and Maverick cos., (spring) summer-fall; Tex., N.L. and Tam.

3. *Ericameria triantha* (Blake) Shinn. Rounded shrub about 1 m. tall, aromatic, much-branched; internodes of twigs 2-6 mm. long; leaves 5-10 (-18) mm. long, the glandularity perceptible under a lens, the upper ones very rarely with axillary fascicles; heads about 7-8 mm. long; involucre turbinate, (3.3-) 4-5 mm. long; phyllaries strongly graduated, often in vertical rows, linear, blunt or very shortly acute, thick, firm, sticky, mostly stramineous but in the upper half with a rhombic dark patch occupying much of the tip-region; rays absent; disk corolla pale-yellow, 4.1-5.4 mm. long, with a tube 1.7-2.4 mm. long and poorly differentiated from the limb which is asymmetrically (4- or) 5-lobed, most of the lobes 0.5-1 mm. long but 1 or 2 of them on one side 1.4-1.5 mm. long. *Haplopappus trianthus* Blake, *H. pseudobaccharis* Blake. Local in deserts in s. Trans-Pecos (s.w. Brewster Co.), late Aug.-Sept.; Tex., Chih., Coah. and Dgo.

27. ISOCOMA NUTT.

Glabrous glutinous subshrubs with woody taproots, 2-8 dm. tall, much-branched (especially at the base and again in the upper head-bearing region), the main (woody) branches often partly reclining; leaves either linear or oblanceolate-linear, nearly entire or rarely saliently toothed or rarely obovate in outline but deeply cut into linear lobes, the nervation inconspicuous, finely areolate, marked by slightly sunken usually dark-pellucid "resin-pits" or "glandular punctations" visible under a lens; heads in glomerules of 2 to 6 or less commonly solitary at the tips of the branches, the whole plant thus often essentially corymbiform or a round-topped mass of heads; heads campanulate to narrowly so, 8-15 mm. long; receptacle very slightly convex, rough, a few mm. across;

involucre 4-12 mm. high, of about 3 or 4 series of strongly graduated phyllaries; phyllaries firm, extremely glutinous, mostly whitish-stramineous but the entire tip herbaceous, this darker tip-color *not* extending down in the median midnerve strip but truncate below; *ray flowers* absent; *disk flowers* usually 10 to 40 per head; corolla yellow, 4-9.5 mm. long, divided into a basal cylindrical tube and a rather abruptly dilated throat plus 5 equal teeth; achenes 2-3 mm. long, narrowly obpyramidal, with about 4 angles, covered rather completely with stiffish whitish ascending pubescence; pappus persistent, copiously provided with coarse brownish-white bristles that are rather unequal but do not fall into 2 size-classes.

Though this American genus of about 25 species is well-defined and internally homogeneous, it is by some authors included in the sack-genus *Haplopappus*. These plants that are nonpalatable to grazing animals increase in abundance because of the prevailing range-regime of ruthless and destructive overstocking in much of southern and western Texas.

1. Involucres 4-5.3 (-6.6) mm. high; corollas 4.1-6 mm. long, the basal tube 2.2-3.3 mm. long and the throat 1-1.5 (-2) mm. long; in the Trans-Pecos and Plains Country3. *I. Wrightii*.
1. Involucres (5-) 6-12 mm. high; corollas 6-9.4 mm. long, the basal tube 3-6.2 mm. long and the throat 1.3-2.8 mm. long; east of the Pecos River (2)
- 2(1). Involucre (5-) 6-7 mm. long; leaves (at least some of each plant) deeply lobed, often with fascicles of small leaves in their axils1. *I. coronopifolia*.
2. Involucre (6.6-) 7-12 mm. long; leaves entire or rarely lobed, even more rarely toothed, very rarely with fascicles in the axils2. *I. Drummondii*.

1. *Isocoma coronopifolia* (Gray) Greene. Leaves to 4 cm. long, sometimes rather regularly pinnately lobed with as many as 3 or 4 lobes on each side, the whole leaf 15-20 mm. long but usually there are fewer and longer lobes; involucres (5-) 6-7 mm. long; corollas 6-6.8 mm. long, divided into a tube 3-4 mm. long, a throat 1.5-2.8 mm. long and lobes (0.6-) 0.8-1.3 mm. long. The Texas plants have often incorrectly passed under the name *Haplopappus fruticosus* (Rose & Standl.) Blake or *H. Hartwegii* (Gray) Blake. Frequent locally in Rio Grande Plains, dry open calcareous places (Atascosa, Bexar, Brooks, Maverick, Webb and Zapata cos.), Sept.-Nov. (rarely at other seasons); also N.L.

Plants of this species at a very few places occur with plants of *I. Drummondii*, which is closely related; the former are easily distinguished by the lobed leaves and smaller involucres and corollas. Usually *I. coronopifolia* flowers later than *I. Drummondii* but there is some overlap. Probably the variability in foliage and in head- and corolla-size of *I. coronopifolia* can be traced to genetic "swamping" or dilution in the direction of *I. Drummondii*, which is a more aggressive, weedy species greatly increasing in abundance.

2. *Isocoma Drummondii* (T.&G.) Greene. Leaves usually (slightly oblanceolate-) linear, several cm. long, (1-) 2-3 (-4) mm. broad, usually entire, rarely with a few salient teeth; involucres (6.6-) 7-12 mm. long; corollas 6-9.4 mm. long, divided into a tube (3.2-) 4-6.2 mm. long, throat 1.3-2.3 mm. long and lobes 0.8-1.1 mm. long. *Haplopappus Drummondii* (T.&G.) Blake, *Isocoma megalantha* Shinnars. Locally abundant, coastal half of Rio Grande Plains and s. Tex. (Atascosa, Austin (?), Cameron, Jim Wells, Karnes, Kenedy, Kleberg, LaSalle, McMullen, Nueces and Willacy cos.), spring-fall; also Tam.

3. *Isocoma Wrightii* (Gray) Rydb. JIMMY-WEED. Leaves usually (slightly oblanceolate-) linear, several cm. long, 2-4 mm. broad, entire; involucres 4-5.3 (-6.6) mm. long; corollas 4.1-5.9 mm. long, divided into a tube 2.2-3.3 mm. long, a throat 1-2 mm. long and lobes 0.8-1.1 (-1.4) mm. long. *Haplopappus heterophyllus* (Gray) Blake. Locally abundant, often in open alkaline places, Trans-Pecos and Plains Country, July-Sept.; Ariz., N.M., Tex., Chih. and Son.

Our plants have been referred, perhaps incorrectly, to *I. pluriflora* (T.&G.) Greene, of southeastern Colorado. This plant is known to be toxic to cattle, horses and sheep.

28. MACHAERANTHERA NEES

Herbs; leaves alternate, essentially sessile (especially the basal ones), often pinnately or bipinnately lobed but in some species merely toothed or essentially entire; heads

about 1-2 cm. in diameter, usually borne more or less solitary at the ends of branches though occasionally the whole plant subcorymbose or rarely the heads nearly sessile in the upper axils; involucre mostly hemispheric; phyllaries usually linear to lanceolate or subulate, basally and laterally stramineous, the midrib in the upper half herbaceous-green (or at least darker than the stramineous base) and expanded into a somewhat rhombic patch that in some species occupies essentially the entire tip-region, the tip either erect or in some species spreading or even squarrose and apically acute to very shortly acute or even blunt; receptacle 3-10 mm. wide, rough, flat or very slightly convex; ray flowers pistillate, fertile; rays yellowish or white and often tinged with blue, violet and/or red; disk flowers numerous, perfect, fertile; corollas yellowish, with a cylindrical tube that is not distinctly delimited from the greatly ampliate limb (which is composed of a throat and 5 usually short teeth); style appendages various; achenes narrowly turbinate to broadly linear or clavate (compressed in species 1 to 5), rather densely antrorsely pubescent; pappus persistent, in some species absent from the ray flowers but present in the disk flowers, in other species present and alike in both disk and ray, composed of numerous somewhat unequal usually sordid-white slender bristles, the larger ones often slightly dorsiventrally flattened at the base. *Haplopappus* Sect. *Blepharodon* DC.; *Psilactis* Gray; *Eriocarpum* Nutt.; *Xylorhiza* Greene.

The first four species show evidence of intergradation, some specimens being identifiable with one or another species only on arbitrary grounds; possibly extensive introgression has occurred. An American genus of about 50 or 60 species.

1. Ray flowers without pappus (*Psilactis*) (2)
 1. Ray flowers and disk flowers with pappus of the same kind (4)
 - 2(1). Ligules of ray flowers 2-4 (-5) mm. long; involucre 2-4 mm. high; achenes 1-2 mm. long 17. *M. brevilingulata*.
 2. Ligules of ray flowers (4-) 5-7 mm. long; involucre 3-5 mm. high; achenes 2-3 mm. long (3)
 - 3(2). Involucre broadly turbinate, 5-7 mm. across; flowers 30 to 75 (to 90) per head; stems and leaves with crisp spreading hairs; phyllaries 0.5-0.7 mm. broad 16. *M. tenuis*.
 3. Involucre hemispheric, 5-10 mm. across; flowers 75 to 100 per head (fewer in late-flowering heads); stems with glandular-pubescent above or glabrate; leaves with appressed hairs or glabrate; phyllaries 0.75-1 mm. broad 15. *M. Boltoniae*.
 - 4(1). Rays white or white with more or less strong reddish, violet or purplish pigmentation, never yellow (*Machaeranthera sens. str.*, *Xylorhiza*) (5)
 4. Rays yellow, occasionally with tinges of reddish, violet or purplish (*Blepharodon*) (9)
 - 5(4). Leaves pinnately dissected (6)
 5. Leaves merely toothed (7)
 - 6(5). Involucre 6-11 mm. high; disk 10-25 mm. broad; achenes 2-3 mm. long 13. *M. tanacetifolia*.
 6. Involucre 4-6 mm. high; disk 6-10 mm. broad; achenes 1.5-2 mm. long 14. *M. parviflora*.
 - 7(5). Involucre 20-30 mm. high (*Xylorhiza*) 10. *M. Wrightii*.
 7. Involucre 6-11 mm. high (8)
 - 8(7). Achenes about 1 to 2 times as long as thick; each leaf on each side with 15 to 30 teeth 11. *M. blephariphylla*.
 8. Achenes linear, about 5 times as long as thick; each leaf on each side with 5 to 10 teeth 12. *M. linearis*.
 - 9(4). Annuals, some plants occasionally living over one winter (10)
 9. Perennials, usually with a woody crown (14)
 - 10(9). Largest phyllaries of the head 1.3-1.7 mm. broad .. 7. *M. phyllocephala*.
 10. Largest phyllaries of the head 0.5-1.1 mm. broad (11)

- 11(10). Leaves linear, 13-40 mm. long, 1-2 mm. broad, membranous and spreading; southeast Texas 9. *M. aurea*.
11. Leaves not linear or if approaching linear then shorter than 13 mm. and ascending (12)
- 12(11). Involucre of mature head about 15 mm. broad; broadly spreading or squarrose herbaceous tips of phyllaries about 0.9-1 mm. broad . 8. *M. annua*.
12. Involucre of mature head about 8-10 mm. broad; tips of phyllaries erect or slightly spreading, the herbaceous portion 0.3-0.7 mm. broad (13)
- 13(12). Leaves 1-3 mm. broad, canescent-pubescent, rather stiffly ascending, the apex and each tooth bristle-tipped 5. *M. gracilis*.
13. Leaves pubescent but not grayish, slightly ascending or spreading, the apex and teeth not bristle-tipped 6. *M. Havardii*.
- 14(9). Upper 5 or 6 leaves nearest the head reduced, appressed and remote, nearly entire and entire-margined, the head-bearing branch thus distinctly pedunculiform and several cm. long; leaves farther down the stem ascending or appressed, toothed or slightly pinnately lobed, only those at the extreme base of the plant (if any) elaborately pinnately lobed 1. *M. scabrella*.
14. Upper 5 or 6 leaves nearest the head not much-reduced, pinnately lobed, appressed or usually spreading; leaves farther down stem various (15)
- 15(14). Stems rather simple, rigidly erect in the lower two thirds of the height, much-branched only in the upper 3-7 cm. of the length where each branch terminates in a head; leaves ascending to appressed, usually quite green and nearly glabrous, rarely elaborately bipinnate (except the extreme basal leaves which wither before flowering time), usually simply pinnate, the central portion usually at least twice as broad as the lateral lobes 2. *M. pinnatifida*.
15. Stems usually freely branched at several levels; leaves usually spreading, variously pubescent, variously lobed (16)
- 16(15). Plants (20-) 30-50 (-70) cm. tall, dark grayish-green; leaves rarely bipinnately lobed; Rio Grande Plains 3. *M. texensis*.
16. Plants (5-) 10-20 (-30) cm. tall, usually pale-green to canescent or even whitish-tomentose; leaves of midstem usually elaborately bipinnately lobed; Plains Country, rarely as far south as northern Rio Grande Plains . . 4. *M. australis*.

1. *Machaeranthera scabrella* (Greene) Shinn. Perennial herb from woody crowns, (1-) 2-4 dm. tall; extreme basal leaves pinnately or bipinnately lobed; cauline leaves (even those of the lower half of the stem) ascending or appressed, toothed or slightly pinnately lobed, each tooth with a short bristle-tip; upper 5 or 6 leaves nearest the head reduced, appressed and remote, nearly entire and entire-margined, the head-bearing branch thus distinctly pedunculiform and several cm. long; heads solitary, terminal, not crowded; involucre broadly turbinate to broadly campanulate; phyllaries in 4 or 5 series, strongly graduated, ascending, the larger ones about 0.5-0.7 mm. broad, linear, often at the very tip shortly acute or even blunt, the midrib and margins mostly stramineous but the upper half of the phyllary mostly occupied by a roughly elliptical dark (often green) patch which is vertically oriented and which takes up most of the width, displaces the midrib and is covered by microscopic glandular tubercles; disk yellow; rays yellow; style branch appendages conical, much shorter than the stigmatic portion; pappus of ray and disk similar; achene 2-2.5 mm. long, 0.5-0.7 mm. thick, linear, densely fuzzy with short ascending hairs. *Eriocarpum scabrellum* Greene, *E. Wootonii* Greene, *Haplopappus spinulosus* var. *canescens* Gray and subsp. *scabrellus* (Greene) Hall. Included here are many plants which have erroneously been called *Haplopappus spinulosus* var. *turbinellus* (Rydb.) Blake. Abundant, more or less weedy in a number of habitats, in the Trans-Pecos, less frequent e. to Val Verde Co. on the Edwards Plateau, in genetically dilute form n. to the s. Plains Country, spring-fall; Tex., N.M., Ariz., Baja Calif., s. to Hgo., Gto., Gro. and Zac.

On a broad scale this intergrades with *M. pinnatifida* and to a lesser extent with *M. australis*.

2. *Machaeranthera pinnatifida* (Hook.) Shinners. Perennial herb from woody root-stocks, mostly glabrous, (2-) 3-5 (-6) dm. tall, rather simple and rigidly erect in the lower two thirds, much-branched only in the upper 3-7 cm. of the length where each short leafy branch terminates in a head; leaves (even those at the very base of the plant) rarely bipinnately lobed, usually simply pinnately lobed with the central portion along the midrib much broader than the lobes, the leaves rather strongly ascending or often even appressed, not much reduced upwards, those 5 or 6 nearest the head almost as large as those of the midstem; heads not crowded; involucre mostly hemispheric; phyllaries in about 4 series, graduated, the larger ones about 0.7-1 mm. broad, linear, often apically acute and minutely bristle-tipped (the short bristles often spreading but the phyllary otherwise ascending), the midrib and margins stramineous but the upper third to half of the phyllary with a very narrowly elliptical dark often green vertically oriented patch which takes up about half the width (displacing the midrib) and usually not microscopically glandular; disk and rays yellow; style branch appendages narrowly conical, somewhat shorter than the stigmatic portion; pappus of ray and disk similar; achene as in *M. scabrella*. *Machaeranthera pinnata* (Nutt.) Shinners (an illegit. name), *Haplopappus spinulosus* (Pursh) DC. and var. *glaberrimus* (Rydb.) Blake, *Sideranthus glaberrimus* Rydb., *S. turbinellus* Rydb. Locally frequent in High Plains Country, rare e. to the lower Plains Country and in the limestone mts. of the Trans-Pecos (Glass Mts., Brewster Co.), late May-Sept.; cen. prairies and plains of the continent n. to Alta., Sask. and Minn.

Intergrading on a broad scale with both *M. scabrella* and *M. australis* but, locally, populations adjacent to each other retain their distinctions. *Sideranthus glaberrimus* may eventually prove to be the more correct name for our plants.

3. *Machaeranthera texensis* (R. C. Jackson) Shinners. Erect perennial herb from woody crowns, (2-) 3-5 (-7) dm. tall, dark-grayish-green, with patches of floccose tomentum on the stems (and lower sides of the leaves), freely branched near the base, near the middle and again near the top of the plant; basal leaves always withered prior to flowering, lowermost stem leaves occasionally very slightly bipinnately lobed (the pinnae with very short pinnules), almost all the leaves spreading and simply pinnately lobed, the median portion near the midrib not much broader than the lobes (each of which has a minute sharp mucro), the upper 5 or 6 leaves nearest the heads only slightly reduced as compared to those of midstem; heads solitary, terminal, not crowded; involucre broadly hemispheric, 6-8 mm. high; phyllaries in about 4 series, graduated, ascending except at the very tip, the larger ones 0.8-1 mm. broad, linear, apically acute, the midrib (at the base) and margins mostly pale-stramineous but the upper half to two thirds of phyllary with a dark midrib which greatly expands near the tip into a narrowly rhombic dark patch (this often thinly floccose), the extreme tip spreading and with a spinose mucro; disk and rays yellow; style branch appendages considerably shorter than the stigmatic portion; pappus of ray and disk similar; achene as in *M. scabrella*. *Haplopappus texensis* R. C. Jackson. Infrequent in sandy loam, coastal part of Rio Grande Plains (Brooks, Jim Hogg, Jim Wells, Kleberg and San Patricio cos.), Aug.-Nov.; endemic.

A characteristic of this species which may prove reliable in its determination is the unusual roughness of the receptacle, which bears projections nearly as high as or higher than the achenes at least in some specimens.

4. *Machaeranthera australis* (Greene) Shinners. Perennial herb from woody crowns, (5-) 10-20 (-30) cm. tall, often whitish-tomentose or canescent or less frequently pale-green and glandular-puberulent or glabrous; leaves usually spreading, those of the lower half or even the lower two thirds of the stem bipinnately lobed, the upper 5 or 6 leaves below the head not much reduced in size and usually only pinnately lobed, the median portion of all the leaves only slightly or not at all broader than the lobes; heads solitary, terminal, not crowded; involucre turbinate to hemispheric; phyllaries in 3 or 4 series, graduated, ascending except at the very tip, the larger ones 0.5-0.7 mm. broad, linear, acute, spinulose-mucronate, the midrib and margins mostly stramineous, the midrib in the upper 2 mm. of the length displaced by a roughly rhombic dark-green or brown patch and this continuing as a narrow dark line about half way down the midrib; disk and rays yellow; pappus of ray and disk similar; style branch appendages conical, shorter than the stigmatic portion; achene as in *M. scabrella*. *Eriocarpum australe* Greene,

Haplopappus spinulosus subsp. *australis* (Greene) Hall. Abundant in Plains Country, less common and usually genetically dilute s. to the Trans-Pecos and Edwards Plateau, rare to Rio Grande Plains, spring-summer; Colo. and Okla. s. to Tex. and Coah.

In many plants (about a third of the populations) of this species the apical phyllary patch is tomentose.

5. *Machaeranthera gracilis* (Nutt.) Shinners. Annual taprooted herb, rarely if ever overwintering, 15-35 cm. tall, usually erect, branched at various levels including the base, the stems and leaves rather densely covered with antrorsely appressed whitish hairs so the plant appears gray-green; very lowest leaves of the main stem occasionally pinnately lobed and oblanceolate in outline but nearly all leaves appressed, linear, 3-15 mm. long, 1-3 mm. broad, apically and at each tooth bristle-tipped; heads solitary, terminal, not crowded; involucre 6-7 mm. high, broadly turbinate; phyllaries in about 5 series, strongly graduated, linear, the longer ones 0.5-0.8 mm. broad, appressed except at the extreme tip, acute, stramineous only at the very narrow margins, the upper half mostly occupied by the elongate (rhombic to nearly linear) dark (usually green) tip-patch; disk and rays yellow; pappus of ray and disk similar; style branch appendages conical, shorter than the stigmatic portion; achenes as in *M. scabrella*. *Haplopappus gracilis* (Nutt.) Gray. Infrequent in open places in Trans-Pecos at elev. of 4,000-5,000 ft., Aug.-Oct.; Calif., Nev., Ut., Colo., s.e. to Dgo., Coah. and Tex.

Closely related to *M. scabrella*. Often each phyllary of *M. gracilis* has a distinctive narrow stramineous margin extending completely around the darker apex as well as the lower portions.

6. *Machaeranthera Havardii* (Waterfall) Shinners. Annual taprooted herb, erect, 2-4 dm. tall, branched in the upper half to two thirds or less commonly at the base, the branches ascending; leaves firm, oblong to narrowly obovate, those of the lower half of the plant 15-35 mm. long and 5-12 mm. broad, those higher up becoming less than half that size, those in the upper part mostly about 10 × 3 mm., clasping, apically blunt, on each side with 3 to 8 shallow teeth; the smaller leaves rather crowded, continuing up all the way to the base of the head; heads more or less solitary on branches 1-5 cm. long; involucre about 7 mm. high, hemispheric; phyllaries in about 4 series, graduated, linear, the largest about 0.5 mm. broad, firm, with stramineous margins and bases, the upper part of the midrib green and very near the tip expanded into a narrowly rhombic dark patch; disk and rays yellow, sometimes rather pale-yellow; pappus of ray and disk similar; style branch appendages conical, shorter than the stigmatic portion; achenes 2-2.5 mm. long, linear, somewhat compressed, sericeous-pubescent or nearly glabrous. *Haplopappus Havardii* Waterfall. Rare in calcareous (perhaps sometimes gypseous) soil in Trans-Pecos (Culberson Co.) and s. part of Plains Country (Ector Co.), July-Nov.; also N.M.

7. *Machaeranthera phyllocephala* (DC.) Shinners. CAMPHOR DAISY. Aromatic often glutinous annual herb, sometimes living over one winter, either erect or near the coast usually prostrate, freely branched especially near the base; leaves usually oblanceolate to narrowly obovate, firm or even fleshy, 15-50 mm. long, on each side with 5 to 8 prominent salient teeth or short lobes, only slightly reduced toward the head, crowded even up to the base of the head; heads solitary; involucre 9-11 mm. high, hemispherical; phyllaries in about 3 series, not much-graduated, the largest ones in any mature head 1.3-1.7 mm. broad, the tip-region often of a different texture from the base being more herbaceous and sometimes spreading; disk and rays yellow; style branch appendages subclavate, shorter and thicker than the stigmatic portion; pappus of ray and disk similar; achene columnar, thick, about 2 mm. long, slightly compressed to plump and subcylindric, fuzzy with whitish ascending pubescence. *Haplopappus phyllocephalus* DC., *H. rubiginosus* T.&G., *Eriocarpum megacephalum* Nash. Abundant in subsaline areas near the coast, s.e. Tex. and Rio Grande Plains, spring-fall; coastal areas, La. to Tam.

Represented by another variety in the highlands of Mexico.

8. *Machaeranthera annua* (Rydb.) Shinners. Annual taprooted herb, somewhat glutinous, erect, 3-6 dm. tall, with ascending branches in the upper part (never near the base), the ultimate branches (which are 1-4 cm. long) somewhat crowded and pedunculiform; leaves oblanceolate to narrowly obovate, firm, 2-5 cm. long, 3-14 mm. broad, on each side with 7 to 10 prominent salient teeth with each tooth mucronate or even with a short bristle; uppermost leaves much-reduced; involucre hemispheric, 7-8 mm. high; phyllaries

in a few series, somewhat graduated, linear, acute, the broadest on any head 0.5-1.1 mm. wide, mostly stramineous but the upper third to half occupied mostly by the dark (often green) roughly rhombic tip-splotch; disk and rays yellow; style branch appendages subclavate, thicker and shorter than the stigmatic portion; pappus of ray and disk alike; achenes as in *H. phyllocephala*. *Haplopappus annuus* (Rydb.) R. C. Jackson, *M. phyllocephala* var. *annua* (Rydb.) Shinn. Infrequent in open places, Plains Country, rare in s. part of e. Tex. (Gonzales Co.) and in the Trans-Pecos, Aug.-Oct.; Colo. and Kan., s. to N.M. and Tex.

9. *Machaeranthera aurea* (Gray) Shinn. Annual taprooted herb, nearly glabrous, ascending, 15-30 cm. tall, freely branched, the branches arcuate-ascending and nearly simple except in the upper 2-5 cm., again branched and each branch bearing a head, the whole plant thus subcorymbiform; leaves linear-oblongate, 1-4 cm. long, 1-2 mm. broad, entire or on each side with 2 to 4 remote salient teeth; involucre about 8 mm. high, hemispheric; phyllaries in about 4 series, graduated, the largest on any head about 1 mm. broad, each with a very prominent dark rhombic tip-splotch which does not extend down onto the midrib; disk and rays yellow; pappus of ray and disk alike; style branch appendages subclavate, shorter than the stigmatic portion; achene about 2 mm. long sericeous-pubescent. *Haplopappus aureus* Gray. Rare near Houston, Harris Co., Oct.; local endemic. Related to *M. annua*.

10. *Machaeranthera Wrightii* (Gray) Cronq. & Keck. Strongly perennial herb with short woody crowns, 15-40 cm. tall; leaves narrowly obovate, 2-5 cm. long, firm, nearly entire or with a few salient teeth; upper leaves remote and reduced, the long upper branches thus distinctly pedunculiform; heads relatively enormous for this genus, 3-5 cm. broad; phyllaries not strongly graduated, mostly herbaceous except the very narrow scarious margins; disk yellow; rays usually bluish to bluish-violet or so pale as to be almost white but never yellow; pappus of ray and disk similar. *Aster Wrightii* Gray, *Xylorhiza Wrightii* (Gray) Greene. Infrequent but conspicuous in desert areas in the Trans-Pecos, Mar.-Apr. (-June); also Chih.

11. *Machaeranthera blephariphylla* (Gray) Shinn. Strong nearly glabrous perennial herb with stout woody crowns; many stems 15-35 cm. long, erect, usually simple in the lower half and sparingly branched above, the branches stiffly ascending and each terminating in a head; leaves oblong to narrowly obovate, 1-4 cm. long, 5-13 mm. broad, blunt apically, sessile and subclasping, on each side with 10 to 15 sharp teeth (each often bristle-tipped), the upper leaves somewhat reduced so that the heads are somewhat pedunculate; involucre hemispheric, 8-10 mm. high; phyllaries in several series, graduated, mostly stramineous except for the elongate-deltoid dark (green or usually purplish) terminal patch; disk yellow; rays white, occasionally on the undersurface bluish, never yellow; pappus of ray and disk similar; style branch appendages subulate, longer than the stigmatic portion; achene about 2 mm. long, stout and tumid, fuzzy. *M. Correllii* Shinn, *Haplopappus blephariphyllus* Gray. Local in limestone mts. (Diablo, Glass and Guadalupe) in the Trans-Pecos at about 5,000-7,000 ft. elev., spring-fall; N.M., Tex. and Coah.

Our plants have been known incorrectly as *H. gymnocephalus* DC.

12. *Machaeranthera linearis* Greene. Robust taprooted annual 3-10 dm. tall, erect, often nearly simple in the lower half, barely branched with ascending branches, the upper branches 2-7 cm. long and pedunculiform; pubescence of leaves and stems microscopic, appressed; leaves lanceolate to oblong-lanceolate, acute to blunt, sessile, the ones of midstem usually 2-5 cm. long and 6-11 mm. broad, rather bright green, on each side with 3 to 6 small but salient teeth; upper leaves much-reduced, ascending; heads essentially solitary, not crowded; involucre 6-9 mm. high, hemispheric; phyllaries in 5 or 6 series, strongly graduated, the largest on any head 0.9-1.3 mm. broad, mostly whitish or stramineous but with a large roughly rhombic green or dark patch almost completely occupying the tip-region, appressed except at the very tip; disk yellow; rays white or occasionally bluish- or violet-tinged, never yellow; pappus of ray and disk similar; style branch appendages subulate, nearly as long as the stigmatic portion; achene linear, 2-2.5 mm. long but only 0.2-0.3 mm. thick, with antrorsely appressed sordid pubescence. *Aster linearis* (Greene) Cory. Local in open places, Trans-Pecos deserts (El Paso, Hudspeth and Winkler cos.), rare in s. Plains Country (Hockley Co.), Sept.-Oct.; Ut., Colo., Ariz., N.M., Chih. and Tex.

13. *Machaeranthera tanacetifolia* (H.B.K.) Nees. ТАХОКА DAISY. Annual herb; stems erect or often partially reclining, 1-4 dm. long, nearly glabrous, densely leafy; leaves membranous and most of them elaborately bipinnately parted; heads solitary and not crowded, showy, on peduncles 5-30 mm. long, (3-) 4-6 cm. broad when the rays are fully expanded; involucre hemispheric, 6-7 mm. high; phyllaries in several series, mostly stramineous, appressed but with spreading-subulate or elongate-deltoid green tips; disk yellow, 10-25 mm. broad; rays whitish or usually rather strongly violet-blue, never yellow; pappus of ray and disk similar; achenes 2-3 mm. long, oblong or broadly linear, compressed, densely covered with short antrorse appressed whitish hairs. *Aster tanacetifolius* H.B.K. Abundant in sandy soils, Plains Country and Trans-Pecos, rarely e. to stream beds of Edwards Plateau, late spring-summer; S.D. to Alta., s. to n.-cen. Mex.

14. *Machaeranthera parviflora* Gray. Annual herb; stems erect or partially reclining, 1-4 dm. long, nearly glabrous, leafy; leaves membranous, 1-3 cm. long, 2-5 (-10) mm. broad, usually merely pinnately parted, rarely the pinnae with shorter lobes, the upper leaves reduced and appressed; head solitary and not crowded; involucre hemispheric, 4-6 mm. high; phyllaries in a few series, weakly graduated, mostly stramineous, appressed even up to the herbaceous deltoid-acute microscopically glandular-puberulent tips; disk yellow, 6-10 mm. broad; rays rarely whitish, usually violet-blue, never yellow; pappus of ray and disk similar; achene 1.5-2 mm. long. *Aster parvulus* Blake. Infrequent or rare in sandy soil along the Rio Grande in the Trans-Pecos, summer-fall; Ut., Ariz., N.M., Tex. and Chih.

15. *Machaeranthera Boltoniae* (Greene) Turner & Horne. Annual taprooted herb, erect and nearly simple below, to 1 m. tall or more, with glandular-pubescent above or glabrate; leaves essentially entire, oblanceolate to linear, reduced above, with appressed hairs or glabrate; heads solitary, not crowded; involucre hemispheric, 5-10 mm. across, 3-5 mm. high; phyllaries 0.75-1 mm. broad; flowers 75 to 100 per head (fewer in late-flowering heads); disk yellow and pappus present; rays light-blue or violet-blue to white, never yellow, (4-) 5-7 mm. long; pappus of ray flowers absent; achenes 2-2.4 mm. long. *Psilactis asteroides* Gray, *P. lepta* Shinnars. Infrequent in alluvial sandy soil, 3,000-4,000 ft. elev. in the Trans-Pecos (El Paso, Hudspeth and Presidio cos.), June-Nov.; Ariz., N.M., Tex., s.e. to Michoac. and Pue.

16. *Machaeranthera tenuis* (Wats.) Turner & Horne. Annual taprooted herb, erect and nearly simple below, with ascending branches above; stems and leaves with crisp spreading hairs; leaves linear to oblanceolate, nearly entire, the upper ones reduced; heads solitary; involucre broadly turbinate, 5-7 mm. across, 3-5 mm. high; phyllaries 0.5-0.7 mm. broad; flowers 30 to 75 (to 90) per head; disk yellow, pappus present; rays blue-violet to white, never yellow, 5-7 mm. long; pappus of ray flowers absent; achenes 2-3 mm. long. *Psilactis tenuis* Wats. Local in Davis Mts., Jeff Davis Co., at elev. above 4,000 ft., Aug.-Oct.; Chih., Coah., N.L. and Tex.

Near Sinton, San Patricio Co., collections have been made in October and November that are doubtfully referred to *M. tenuis*; they are distinguished by their appressed pubescence, nearly glabrous strongly 8-ribbed achenes and small linear leaves.

17. *Machaeranthera brevilingulata* (Hemsl.) Turner & Horne. Annual herb, rather freely branched, to 1 m. tall or more, the branches ascending; leaves linear to oblanceolate, 6-30 mm. long, the lower larger ones weakly pinnately lobed, the higher ones merely toothed or usually essentially entire; heads small, solitary; involucre 2-4 mm. high; disk yellow, pappus present; rays white to violet, never yellow, 2-4 (-5) mm. long; pappus of ray flowers absent; achenes 1-2 mm. long. *Psilactis brevilingulata* Hemsl. Infrequent in the Trans-Pecos at 4,000-6,000 ft. elev., July-Sept.; Tex. and Chih., s.e. to Chis.; also Col.

29. SOLIDAGO L. GOLDENROD

Rhizomatous perennials; rhizomes sometimes short and forming merely a crown or sometimes extensively creeping; aerial stems usually long and slender, ascending gracefully, branched in the upper head-bearing portion, the branches in turn bearing very many short head-bearing branchlets which are often ascending; leaves alternate, sessile, not lobed, the lower portions occasionally narrowed to a subpetiolar base; heads rarely more than 1 cm. long; receptacle flat or slightly convex, not chaffy; involucre usually

narrowly campanulate; phyllaries in a few series, graduated, usually linear-lanceolate or linear, mostly stramineous and chaffy in texture with a slightly darker more herbaceous median strip which is slightly dilated near the tip (in Sect. *Oligoneuron*, comprising *S. rigida* and *S. nitida*, each phyllary oblong and blunt with a broad herbaceous median zone which is composed of vertical nerves); ray flowers pistillate and fertile, several in number (in one species only 2 per head), with yellow rays; disk flowers perfect and fertile, with yellow corollas; pappus simple, of numerous essentially equal capillary bristles; achenes many-ribbed, nearly terete.

Solidago is a large North American genus (with one species also in Europe). It is one of our more difficult genera probably because of rampant hybridization. Our species 7 through 18 are particularly apt to hybridize. Often hybrids or genetically contaminated individuals are more common than "pure" plants at disturbed sites. Only complete specimens with lower stem leaves and mature heads can be determined with any degree of confidence. The descriptions do not attempt to account for all the variability due to contamination, but only for the "purer" genetic states. Some writers treat the Sect. *Oligoneuron* as a separate genus while others include not only Sect. *Oligoneuron* but the genus *Euthamia* as well.

1. Head-bearing branchlets few, borne on short branches about as long as to shorter than the remote upper serrate leaves from whose axils they arise 1. *S. caesia*.
1. Head-bearing branchlets usually borne on branches longer than the leaves from whose axils they arise or if (as in, for example, *S. petiolaris*) the branches shorter than their subtending leaves then the leaves only obscurely serrate and/or crowded (2)
- 2(1). Head-bearing branchlets only slightly if at all upwardly secund on ascending branches which are so graded in length as to form a roughly flat-topped or corymbiform aggregation about as broad as long at the top of the plant (aberrant forms of *S. petiolaris* might also be sought under this lead) (3)
2. Head-bearing branchlets definitely secund on the branches and/or the entire aggregation of heads longer than it is thick (5)
- 3(2). The entire terminal aggregation of heads only about 3-6 (-9) cm. long and broad; Trans-Pecos mountains 19. *S. Wrightii*.
3. The terminal aggregation of heads usually 6-20 cm. long and/or broad; east of the Trans-Pecos (Sect. *Oligoneuron*) (4)
- 4(3). Leaves of midstem only 2 to 3.5 times as long as broad, usually a little rough 20. *S. rigida*.
4. Leaves of midstem 5 to 10 times as long as broad, usually smooth 21. *S. nitida*.
- 5(2). Stems strict, the terminal head-bearing portion loose or dense, spicoid to cylindrical or rarely rhomboid, not one-sided, several times longer than thick, with leaves crowded so that the axillary ascending branches (which bear the head-bearing branchlets and are not curled at the tips) overlap each other at least slightly, the head-bearing branches not markedly secund (6)
5. Stems rarely strict, usually merely virgate and arcuate, the terminal head-bearing portion usually irregularly ovoid or more elongate but rarely more than twice as long as thick (except in *S. sempervirens*), often one-sided and/or loosely branched and/or with the branches spreading and terminally curled under (7)
- 6(5). Leaves usually smooth on the surface (not the margins!), 3 to 7 times as long as broad, usually with 2 of the lower secondary veins strongly ascending and more prominent than the rest (thus the leaves "triplinerved"), in the basal third of the length acuminate strongly narrowed to a subpetiolar base; phyllaries usually erect 17. *S. speciosa*.
6. Leaf surfaces at least slightly rough to the touch, 1.5 to 4 (or 5) times as long as broad, usually merely penninerved, in the basal third rarely strongly narrowed, usually merely acute or even rounded; phyllaries often spreading 18. *S. petiolaris*.

- 7(5). Plants perfectly smooth and glabrous, virgate; leaves fleshy or thinner, perfectly entire and with inconspicuous venation or merely with finely reticulate pattern, rarely with readily discernible secondary nerves; basal leaves ascending, often long, grasslike, terminally rounded and narrowed to the subpetiolar base for most of the length; stem leaves much smaller, grasslike to narrowly elliptic, often ascending or appressed and apically acute or rarely blunt; leaves of the head-bearing portion usually reduced; head-bearing portion of the plant often elongate and slender but definitely one-sided and its branches nearly always curly at the tips 6. *S. sempervirens*.
7. Plants usually pubescent, if nearly glabrous then the leaves usually with 2 fairly conspicuous lower secondary nerves and/or not entire marginally and/or not at all grasslike (8)
- 8(7). Leaves of midstem or lower midstem narrowly lanceolate or linear-lanceolate, broadest in the lower half, apically and basally acute, 25-90 mm. long, 2.5-10 mm. broad, 7 to 15 times as long as broad; plants of eastern half of Texas (varieties of *S. altissima* from the western half of Texas might also be sought here as well as *S. missouriensis* of the Plains Country) (9)
8. Leaves of midstem usually proportionately shorter and broader, if as much as 7 times as long as broad then broader than 10 mm. or broadest in the upper half (10)
- 9(8). Leaves as seen under a lens pubescent12. *S. tortifolia*.
9. Leaves as seen under a lens glabrous on the surfaces (not always on the margins) and with pellucid dots11. *S. odora*.
- 10(8). Upper half of the stem roundly quadrangular, the ridges usually narrowly winged 2. *S. salicina*.
10. Upper half of stem not quadrangular nor 4-winged (11)
- 11(10). Lower stem leaves with a dilated auriculate-clasping base 3. *S. auriculata*.
11. Lower stem leaves not amplexicaul (12)
- 12(11). Leaves of midstem ovate, 1.3 to 2.5 times as long as broad, the lower surfaces with conspicuous and prominent pale network of nerves, each side with 10 to 20 rather evenly spaced conspicuous marginal serrations 7. *S. rugosa*.
12. Leaves of midstem mostly proportionately longer and narrower or if only 2.5 times as long as broad then broadest in the upper half and/or the lower surfaces with less prominent nervation, the margins usually with fewer teeth or if as many then these concentrated in the outer two thirds the length (13)
- 13(12). Midstem leaves rather dark-olive-green, mostly obovate to lance-obovate, usually with a few weak marginal serrations in the terminal third to half the length, the surfaces not closely pubescent but with scattered mostly antrorse microscopic barbs which make the surface exceedingly raspy to the touch16. *S. radula*.
13. Midstem leaves usually bright-yellowish-green to cinereous, varying in shape but rarely obovate, the surface occasionally roughish but not raspy (14)
- 14(13). Most of foliage and stems glabrous and yellowish or pale-green with the exception of the margins of the leaves and often scattered pubescence in narrow vertical lines on the upper part of the stems (15)
14. Most of foliage and stems closely pubescent with microscopic hairs, making parts of the plant at least slightly cinereous or sordid (18)
- 15(14). Upper leaves just below the head-bearing region 2 to 3 times as long as broad; leaves of midstem not triplinerved (16)
15. Upper leaves just beneath the head-bearing region 4 to 8 times as long as broad; leaves of midstem usually with 2 of the lower lateral nerves more prominent than the rest (17)

- 16(15). Leaves membranous, the lowest ones withering and disappearing long before flowering times; lower stem leaves when present mostly 4-7 cm. long and with subpetiolar bases to 3 cm. long 4. *S. delicatula*.
- 16. Leaves firm, the lowest ones usually withered but often still attached at flowering time; lower stem leaves (5-) 7-20 cm. long, distinctly divided into an upper expanded bladelike portion and a long subpetiolar base 5. *S. Boottii*.
- 17(15). Stems 2-4 (-6) dm. long from the rhizome, 2-3 mm. thick basally 10. *S. missouriensis*.
- 17. Stems 5-25 dm. long from the rhizome, 3-8 mm. thick basally 9. *S. gigantea*.
- 18(14). Leaves of midstem broadest at or usually slightly below the middle (19)
- 18. Leaves of midstem broadest in the distal half (20)
- 19(18). Stems 6-25 dm. long; heads usually several hundred per stem 8. *S. altissima*.
- 19. Stems 3-4 dm. long from the rhizome; heads 50 to 130 per stem 13. *S. mollis*.
- 20(18). Trans-Pecos area; leaves of lower stem usually more than 1 cm. broad 15. *S. sparsiflora*.
- 20. East of the Trans-Pecos area; leaves of lower stem usually about 1 cm. broad or narrower 14. *S. nemoralis*.

1. *Solidago caesia* L. BLUE-STEM GOLDENROD. Glabrous perennial; stems slender and often slightly zigzag, the internodes even in the head-bearing portion of the plant 1-3 cm. long; branches about as long as to usually shorter than the upper leaves in the axils of which they are borne and in turn bearing a few head-bearing branchlets; upper leaves remote, spreading, mostly broadly lanceolate, very thin, serrate most of the length. Rare, rich woods in e. Tex., Sept.-Oct.; e. U.S. and s.e. Can., w. to Wisc. and Tex.

2. *Solidago salicina* Ell. Plant coarse, glabrous, about 1 m. tall; upper half of stem roundly (obscurely) quadrangular, often with narrow wings on the ridges; leaves of midstem membranous, broadly lanceolate, to 14 cm. long and 4 cm. broad, about 3.5 times as long as broad, in the basal third of the length narrowed to a subpetiolar (but broadly winged) base, marginally closely serrate on the upper two thirds of the length; terminal head-bearing portion diffuse, somewhat one-sided, with long whiplike branches, the glomerules of head-bearing branchlets (or occasionally tertiary branches) definitely secund on the outer half to two thirds of these whiplike branches. Rare in moist loam, e. Tex. (Nacogdoches Co.), Oct.; Coastal States, Va. to Tex.

3. *Solidago auriculata* Shuttlew. Plant 5-13 dm. tall; stems finely and densely pubescent; basal leaves contracted basally into a long linear subpetiolar base which expands into an auriculate-clasping base; lowest stem leaves about 8-9 cm. long and 3-4 cm. broad, membranous, reticulate-veiny, softly pubescent beneath, roughish above, sharply and coarsely serrate, acute, the ovate terminal portion abruptly narrowed to a linear subpetiolar base which is at its base auriculate-clasping; uppermost leaves usually entire; head-bearing region diffuse, somewhat one-sided, with long branches which bear the secund head-bearing branchlets; involucre narrowly turbinate, 3.5-4.5 mm. long, 2-2.5 mm. thick; phyllaries acute; disk flowers 5 to 8; ray flowers 1 or less commonly 2; achenes pubescent. *S. amplexicaulis* of many auth., not of Martens, *S. notabilis* Mack. Rare in wooded ravines (Harrison, Jasper and Newton cos.) in e. Tex., July-Aug.; apparently also Gulf States plus Tenn. and Ark.

4. *Solidago delicatula* Small. Mostly glabrous with the exception of the margins of the leaves and pubescent striation in the head-bearing region; leaves thin-membranous and smooth; lowest stem leaves always withered and absent by flowering time and therefore unknown; leaves just below the middle of the stem narrowly elliptic, 2.5 to 4 times as long as broad, broadest near the middle, about 4-7 cm. long including the broad subpetiolar base which is to 3 cm. long, with the secondary nerves all equally obscure, marginally serrate in the outer two thirds the length; upper leaves just below the head-bearing region 2 to 3 times as long as broad, usually elliptic; head-bearing region some-

what one-sided, extremely diffuse with long ascending leafy branches which in their outer portions usually bear tertiary branches which in turn bear the decidedly secund head-bearing branchlets, the secondary and tertiary branches arcuate distally. *S. ulmifolia* var. *microphylla* Gray, *S. microphylla* Small, *S. Helleri* Small. Frequent in loamy soil, e., s.e. and n.-cen. Tex., rarely July, usually (Aug.-) Sept.-Oct. (-Nov.) or even Jan.; Kan., Mo., Ark., Okla. and Tex.

Perhaps not separable from *S. ulmifolia* Muhl. of eastern United States.

5. *Solidago Boottii* Hook. Perennial, mostly glabrous (except the margins of the leaves); leaves firm and relatively persistent, the lowest ones though withered often still attached at flowering time, (5-) 7-20 cm. long, distinctly divided into an upper coarsely serrate expanded bladelike portion and a long subpetiolar base; leaves of midstem not triplinerved, the surfaces (not the margins) smooth, about 3 to 4 times as long as broad, marginally serrate in the outer two thirds of the length; upper leaves just below the head-bearing region 2 to 3 times as long as broad; head-bearing region one-sided, very diffuse, with long whiplike distally arcuate branches which bear the crowded heads on strongly secund head-bearing branchlets; involucre 4.5-5.5 (-6) mm. long; disk corolla 3.8-5.2 mm. long; pappus 3.5-5 mm. long. *S. ludoviciana* (Gray) Small. Frequent in usually moist sandy soil, e. and s.e. Tex., Aug.-Oct.; s.e. U.S. n. to N.J., Ky. and Ark.

6. *Solidago sempervirens* L. var. *mexicana* (L.) Fern. SEASIDE GOLDENROD. Rhizomes often extensive; plants altogether glabrous and smooth; aerial stems usually 1-2 m. tall; leaves often somewhat fleshy, perfectly entire, the inconspicuous venation forming merely a fine reticulate pattern rarely with readily discernible secondary nerves; basal leaves ascending, often long, grasslike, terminally rounded and narrowed to the subpetiolar base for most of the length; stem leaves much smaller, grasslike to narrowly elliptic, often ascending or appressed and apically acute or rarely blunt; leaves of the head-bearing portion usually reduced; head-bearing portion often elongate but definitely one-sided and its branches nearly always curly at the tips. *S. stricta* Ait., *S. angustifolia* Ell. Frequent in marshy often slightly brackish swales and ditches, s.e. Tex. (infrequent inland in e. Tex. to Austin and Gonzales cos.), fall; Coastal Plain from Mass. to Ver. (the var. *sempervirens* from Nfld. to Va.)

This is somewhat variable in habit and size of head; plants with highly reduced upper leaves, relatively narrow head-bearing region and small heads have been segregated as *S. stricta*; every conceivable intergradation occurs.

7. *Solidago rugosa* Ait. var. *celtidifolia* (Small) Fern. Rhizomes creeping; aerial stems about 8-15 dm. tall, shortly hispid; basal leaves divided into an expanded bladelike portion and a linear subpetiolar base; leaves of midstem dark-green or sordid, ovate or narrowly ovate, 4-7 (-10) cm. long, 1.3 to 2.5 times as long as broad, apically acute, somewhat wrinkled, essentially penninerved, marginally with 10 to 20 conspicuous serrations on each side spaced out rather evenly from the apex nearly to the base, often stiffly pubescent on the nerves beneath and with very slight scabrosity on the upper surface which has the nerves impressed and the internerve areoles slightly raised, on the lower surface the nerves prominent and the areoles depressed; head-bearing region one-sided, usually very diffuse with several long whiplike branches the outer portions of which bear the markedly secund head-bearing branchlets. *S. aspera* Ait. Referred here are some Texas plants which have been called *S. ulmifolia* (cf. also *S. delicatula*). Frequent in sandy soil, e. and s.e. Tex., Sept.-Oct.; Que., Ont. and e. U.S. w. to Mich., Ind., Mo., Ark. and Tex.

Many, many goldenrods show combinations of characteristics of this species and others, especially *S. altissima*. While genetic mixing is not at all unusual in goldenrods, still the abundance of the plants of hybrid origin is remarkable in this instance. In fact, what has been called *S. rugosa* var. *aspera* (Ait.) Fern. in Texas is probably merely a group of such plants that are primarily *S. rugosa* but contaminated to varying degrees by *S. altissima* genes.

8. *Solidago altissima* L. Rhizomatous perennial, usually with numerous stems (6-) 10-20 dm. tall, the stems and foliage totally more or less densely covered with a fine or microscopic pubescence (thus cinereous or sordid-green) and roughish; leaves of midstem broadest at or below the middle, lanceolate to lance-elliptic, (3 to) 4 to 5 (to 10) times as long as broad, (5-) 10-16 mm. broad, usually triplinerved (i.e., with 2 of the

lower secondary nerves nearly as prominent as the midvein beneath and ascending nearly the full length of the blade), marginally usually with a few close teeth (5 to 10) on each side in the upper half to two thirds of the length; head-bearing portion of stem usually dense, somewhat one-sided, with a number of crowded arcuate branches each for nearly its total length crowded with definitely secund head-bearing branchlets, the total number of heads usually 150 to 500; heads small, the involucre usually only 3-4 mm. high. Open low areas nearly throughout Tex. but most frequent in e., s.e. and n.-cen. Tex., (summer-) fall; Que., Ont. and e. U.S., w. to Wisc., Neb., Okla. and Tex.

The plants of stream margins of the Edwards Plateau (east to Kendall and Uvalde cos.) and of the Trans-Pecos (Brewster, Presidio and Reeves cos.) and even rarely the Plains Country (Oldham Co.) have proportionately narrower leaves and smoother, canescent-pubescent, only obsolete marginal teeth and usually looser head-bearing portions. These are the var. *canescens* (Gray) M. C. Johnst. Plants of Cameron Co. (Brownsville region) have dark-sordid, small, narrow, crowded leaves and extremely crowded heads, up to 1500 heads on some stems; these are the var. *pluricephala* M. C. Johnst.

9. *Solidago gigantea* Ait. Rhizomes extensive; aerial stems 5-25 dm. long, 3-8 mm. thick basally, glabrous or with scattered pubescence in vertical lines on the upper part of the stem; leaf transition from midstem to upper stem very gradual and involving mainly diminution in size; leaves of midstem smooth, thin-membranous, glabrous or with only very slight pubescence on the nervation of the undersurface, bright-green, triplinerved, elliptic or lance-elliptic, 5 to 10 (to 15) times as long as broad, 6-15 cm. long, (8-) 10-19 mm. broad, on each side with 10 to 20 salient teeth which are spaced out evenly from apex nearly to base; upper leaves just beneath the head-bearing region 4 to 8 times as long as broad, smaller and less prominently toothed than the midstem leaves; head-bearing region one-sided, usually fairly dense and compact in relation to the size of the plant, with a number of spreading arcuate branches which nearly to their bases are densely beset with the decidedly secund head-bearing branchlets; involucre about 4 mm. high. Incl. var. *leiophylla* Fern. Frequent in tight moist calcareous soil, Plains Country and n.-cen. Tex. and Edwards Plateau, less frequent s.e. to e. and s.e. Tex. (s. to San Patricio and Karnes cos.), (Aug.-) Sept.-Oct.; s. Can. and most of U.S., s. to Ut., Colo., Tex. and Gulf States.

10. *Solidago missouriensis* Nutt. var. *fasciculata* Holz. Perennial from subrhizomatous bases; stems often obliquely ascending, only 2-6 dm. long, 2-3 mm. thick basally, essentially glabrous; leaves firm, glabrous except for rough margins, (slightly yellowish-) green; leaf transition from bottom to top of plant fairly gradual, mainly involving diminution in size; lowest leaves oblanceolate with a few close teeth in the upper third; midstem leaves narrowly elliptic-oblanceolate, 4-6 cm. long, 4-5 mm. broad, about 10 times as long as broad, triplinerved, on each side with 4 to 6 close teeth on the upper half or these obsolete; upper leaves just below the head-bearing region 4 to 8 times as long as broad, elliptic-linear, entire; head-bearing region variable but one-sided and usually with a number of ascending or spreading arcuate branches which are fairly thickly beset (except at the extreme bases) with the secund head-bearing branchlets. *S. glaberrima* Martens. Rare in calcareous prairies, Plains Country, very rare in n.-cen. Tex., (July-) Aug.-Sept.; the species in plains of N.A. n. to B.C., Ida., Mont., N.D. and Wisc., s. to Ariz., N.M. and Tex., e. to prairies of Ind. and barrens of Tenn.

11. *Solidago odora* Ait. SWEET GOLDENROD. Rhizomatous perennial 5-10 dm. tall; leaves membranous, smooth, essentially glabrous except for the rough margin, pellucid-punctate and usually with a pleasant aroma after bruising, the transition upward on the stem very gradual and involving only diminution in size; midstem leaves narrowly lanceolate, 25-75 (-90) mm. long, 2.5-8 (-10) mm. broad, 7 to 10 (to 15) times as long as broad, essentially entire or with a very few close teeth near the end, with very obscure nervation; head-bearing portion somewhat one-sided, with a number of spreading branches each (to its base) bearing the decidedly secund head-bearing branchlets (3-5 mm.) which are fairly long for this genus; involucre narrowly turbinate, 4-5 mm. high, with only 2 or 3 series of very strongly graduated semirigid erect linear-subulate phyllaries, each phyllary with a very sharply defined darkish midrib. Frequent in open moist sandy places, s.e. Tex. (s. to Aransas Co.), less frequent inland to e. Tex., Sept.-Nov.; s.e. U.S. n. to N.E., O., Mo. and Okla.

When crushed the fresh leaves have a licoricelike odor, when air-dried they are used to make "goldenrod tea."

12. *Solidago tortifolia* Ell. Rhizomatous perennial 5-10 dm. tall; leaves membranous, roughish, minutely pubescent beneath especially near the veins, the transition up the stem very gradual; midstem leaves narrowly lanceolate to linear-lanceolate, 25-55 mm. long, 2.5-5 mm. broad, 7 to 15 times as long as broad, usually with some close teeth on the upper half, with obscure nervation (occasionally very obscurely triplinerved); head-bearing portion somewhat one-sided, with a number of spreading branches each to its base crowded with decidedly secund head-bearing branchlets 1-4 mm. long; involucre narrowly turbinate, about 4 mm. long. Infrequent in s.e. Tex., rare in e. Tex., in sandy land, (Aug.-) Sept.-Oct.; Fla. to Tex. n. to Va.

This has most of the characters of *S. odora* but it has the pubescence and toothing of the leaves, shortness and crowding of the head-bearing branchlets and the characters of the involucre of *S. altissima*. The probable origin is thereby indicated.

13. *Solidago mollis* Bartl. var. *angustata* Shinn. Perennial from a rather tight subrhizomatous base; stems 3-4 dm. long, minutely and a little roughly pubescent; leaves gradually reduced upward; leaves of upper midstem usually narrowly elliptic, 25-35 mm. long, 4-12 mm. broad, about 6 times as long as broad, basally long-cuneate to a subpetiolar base, triplinerved, minutely and densely roughish-pubescent on both surfaces, essentially entire or with a very few nearly obsolete teeth near the acutish apex; head-bearing region one-sided, of several strongly arcuate branches beset with the decidedly secund head-bearing branchlets, the heads numbering 50 to 130. Rare in the Plains Country in dry open or brushy usually sandy prairies, Sept.-Oct.; endemic.

Plants passing under this name are closely related to *S. nemoralis* and probably represent, basically, *S. nemoralis* genetically contaminated by some other species, perhaps *S. petiolaris* (*S. Lindheimeriana*). What has been passing as *S. mollis* var. *mollis* in the Great Plains (s. to Kan. and N.M., not known in Tex.) is a rather different species probably closely related to *S. radula*. The correct application of Bartling's name remains conjectural. Possibly our plants should be called *S. incana* T.&G.

14. *Solidago nemoralis* Ait. Closely clumped perennial from subrhizomatous bases; stems 3-6 dm. long, ascending; stems and leaves minutely and densely cinereous-pubescent, a little rough in some specimens; leaves gradually diminishing upward, firm; leaves of midstem oblanceolate, definitely widest about a third the distance from the apex which is usually slightly acute or less commonly blunt, 3-8 cm. long, 4-10 mm. broad, about 7 to 8 times as long as broad, essentially entire or rarely with the suggestions of 1 or 2 obsolete teeth near the apex, basally long-narrowed to the sessile base, usually triplinerved; head-bearing region one-sided, usually dense, of a number of relatively short strongly arcuate branches bearing the decidedly secund head-bearing branchlets; heads relatively large; involucre 5-6 mm. high, of several series of strongly graduated phyllaries. Incl. var. *Haleana* Fern. and var. *decemflora* (DC.) Fern. Frequent in dry open areas in Edwards Plateau and n.-cen. Tex., less common in Plains Country and rarely to e. Tex., Aug.-Nov.; P.E.I., N.B. to Alta., s. to Ga., the Gulf States, N.M. and Ariz.

Plants of the calcareous soils of north-central Texas and the Edwards Plateau have denser head-bearing regions with more and shorter branches, the head-bearing branchlets several (about 3) mm. long; these plants are the var. *decemflora*. Plants of sandy soils in east Texas have more open inflorescences with head-bearing branchlets only about 1-2 mm. long and represent the var. *Haleana*. The varieties intergrade over a broad zone. Some authors consider *S. decemflora* DC. to be a distinct species.

15. *Solidago sparsiflora* Gray. Perennial from subrhizomatous bases; stems ascending, 4-9 dm. long; stems and leaves closely and densely cinereous-pubescent; leaves diminishing gradually upward; leaves of midstem oblanceolate, 6-10 cm. long, 10-17 mm. broad, about 6 to 7 times as long as broad, triplinerved, mostly entire but with 2 or 3 teeth on each side of some leaves in the apical fifth of their length; head-bearing region one-sided, of 1 or a few ascending very strongly arcuate and curled branches each bearing in its outer two thirds the decidedly secund crowded head-bearing branchlets; involucre about 5 mm. long. *S. trinervata* Greene, a probable synonym, at least as to those Texas plants which have been passing under that name. Frequent above 4,000 ft. elev. in Chisos and Davis mts. in the Trans-Pecos, also at Hueco Tanks, El Paso Co., Aug.-Oct.; S.D. and Wyo. s. to Tex., N.M. and Ariz.

16. *Solidago radula* Nutt. Rhizomatous perennial; rhizomes short in chalky soil, in sandy soil extensive; stems ascending, 3-7 (-10) dm. long; stems and leaves furnished with microscopic translucent pustular-based antrorse barbs (feeling like a reversed cat's tongue); leaves dark-green, often olivaceous when dry, firm, often abruptly diminishing in size at about two thirds the total height; leaves of midstem narrowly obovate to narrowly elliptic-obovate, (3-) 4-5 (-6) cm. long, 10-17 mm. broad, 2.5 to 3.5 times as long as broad, triplinerved, on each side with 3 to 6 salient or obsolescent teeth in the distal half; uppermost leaves often much-reduced, nearly rotund; head-bearing portion one-sided, of several branches rather densely furnished with the decidedly secund head-bearing branchlets. *S. rotundifolia* DC. Frequent in e. Edwards Plateau, n.-cen. Tex. and e. Plains Country on calcareous prairies, less frequent e. to s. part of e. Tex., rare to s.e. Tex., fall, occasionally as late as Jan.; Ill. to La. and Tex.

17. *Solidago speciosa* Nutt. var. *rigidiuscula* T.&G. Clumped perennial or rarely the base subrhizomatous; stems rather rigidly erect, 5-10 dm. tall, glabrous except margins of leaves and uppermost part of stem; leaves firm; leaves of midstem elliptic to usually narrowly so, almost imperceptibly narrowed in the basal third of their length to a cuneate base, essentially entire, apically acute or a little blunt, 35-70 mm. long, 9-15 (-20) mm. broad, 3.5 to 4.5 (to 6) times as long as broad, with a fine reticulate nervation but with 2 lower secondaries very slightly more conspicuous than the rest; upper leaves becoming much smaller and very narrow; head-bearing portion 15-30 cm. long, 25-100 mm. thick, little if at all one-sided, usually cylindroid or narrowly pyramidal, of a number of rather rigidly ascending branches each bearing (in its outer half to two thirds) about 5 to 50 ascending head-bearing branches, these little if at all secund; involucre narrowly turbinate, about 6 mm. long, the longer phyllaries blunt and nearly their entire apical region of the darker color of the expanded midnerve. *S. rigidiuscula* (T.&G.) Porter. Infrequent to rare in sandy openings, e. and s.e. Tex., (June-) Sept.-Oct.; the species as a whole from Mass., N.Y. and s. Minn. s. to the Gulf States; the var. *rigidiuscula* in the s.w. portion of that range n.e. to Mo.

Some of our plants have mistakenly been referred to the var. *angustata* T.&G. which does not occur in Texas.

18. *Solidago petiolaris* Ait. Rhizomatous perennial; stems 5-15 dm. long, rather rigidly erect, often rather densely but minutely cinereous-pubescent at least on the younger parts; leaves numerous, overlapping, marginally raspy and either entire or with a few close teeth, the surfaces rather closely and minutely pubescent with hairs a little stiff and roughish or so soft and small that the leaf is smooth, the venation usually rather obscure except for minute areoles but occasionally decidedly penninerved on the under surface; upward leaf transition often very gradual, in some specimens well-developed leaves found even well up into the head-bearing region; leaves of midstem usually narrowly ovate, varying to elliptic or narrowly elliptic or rarely oblanceolate, 4-7 (-8) cm. long, 10-15 (-20) mm. broad, (2.5 to) 4 to 5 times as long as broad; head-bearing region usually elongate, spicoid to cylindroid or less commonly pyramidal, little if at all one-sided, of several to many ascending branches each crowded nearly to its base with the head-bearing branches which are little if at all secund; heads rather large, 7-11 mm. long (including pappus); involucre of several series of lanceolate phyllaries, the narrow tips of the larger phyllaries being nearly wholly dark and herbaceous (not scarious) in texture and very often spreading or even rarely squarrose; rays often conspicuous, as much as 1.5 mm. broad and slightly surpassing the disk. *S. Wardii* Britt., *S. Lindheimeriana* Scheele (?). Frequent in Plains Country and n.-cen. Tex., less frequent s. to Edwards Plateau and e. to e. Tex., fall; Gulf States, n. to N.C., Mo. and Neb.

The species name is very misleading since the leaves are sessile.

19. *Solidago Wrightii* Gray. Clumped perennial from subrhizomatous bases; stems 3-7 dm. long, ascending or even rather rigidly erect, densely and finely spreading-pubescent, somewhat cinereous, in the head-bearing region the stem pubescence often somewhat glandular (i.e., the hairs capitate); leaves finely and rather densely hispidulous, slightly cinereous, the transition upward very gradual; basal leaves cuneate-oblanceolate, with a very few nearly obsolete teeth near the rounded apex; leaves of midstem narrowly elliptic or usually slightly elliptic-oblanceolate, 3-6 cm. long, (5-) 10-15 (-20) mm. broad, occasionally with a few obsolescent teeth near the blunt or acute apex, nervation

obscure except for minute areoles; head-bearing region only 3-6 (-9) dm. long and about as broad as long, not one-sided, comprising several branches of which the lowest are so long that the whole aggregation [of 5 to 25 (to 50) heads] is almost corymbiform; heads large, 9-12 mm. long and broad; tips of longer phyllaries herbaceous and often slightly spreading, densely pubescent, the hairs often capitate; rays large and showy for this genus, about 4 mm. long and 2 mm. broad. Incl. var. *adenophora* Blake, *S. Bigelovii* Gray var. *Wrightii* (Gray) Gray. Locally frequent at elev. of 4,000-8,000 ft., Glass, Chisos and Davis mts. in the Trans-Pecos, July-Sept.; Tex. to Ariz., presumably also Chih.

20. *Solidago rigida* L. Rhizomatous stout perennial; stems 6-12 dm. long, 3-8 mm. thick basally, rather rigidly erect, usually densely and rather roughly pubescent (or in some plants essentially glabrous and smooth); leaves roughly pubescent or in some plants essentially glabrous and smooth, firm, usually sordid or grayish-green; basal leaves long-oblong and basally very long-petioled, obsolescently serrate; stem leaves usually ovate, sessile, only 2 to 3 (to 3.5) times as long as broad, 3-10 cm. long, marginally obsolescently serrate; head-bearing region (4-) 6-15 (-20) cm. long and about as broad, rarely even broader than long, flat-topped or roughly corymbiform, not one-sided, of 15 to 100 heads which are scarcely secund on the major branches; heads large, about 1 cm. long and broad; phyllaries often somewhat yellowish-stramineous, in about 3 series, oblong, very blunt, the longer ones about 1.5-2 mm. broad near the end, their broad median strips with several distinct vertical nerves seen under a lens, the median strip occupying essentially the full width. Incl. var. *humilis* Porter and var. *laevicaulis* Shinners, *S. parvirigida* Beaudry, *Oligoneuron rigidum* (L.) Small. Infrequent in dry open places, n.-cen. Tex., rare to e. and s.e. Tex. and the Plains Country, Sept.-Oct.; Mass. to Sask. s. to Ga., La., Tex. and Colo.

21. *Solidago nitida* T.&G. Rhizomatous perennial; stems smooth, essentially glabrous, 5-12 dm. long, rather rigidly erect; leaves smooth, glabrous, firm, drying olive-green; basal leaves narrowly oblanceolate, almost grasslike, basally narrowed to a long subpetiolar base; stem leaves linear-lanceolate to linear-oblong, 5 to 10 or more times as long as broad, essentially entire, with obscure nerves or near the base with a few prominent longitudinal secondaries; head-bearing region 2-10 cm. long, 5-10 cm. broad, flat-topped or roughly corymbiform, not one-sided, of 8 to 75 heads which are not secund on the major branches; heads 7-9 mm. long, 4-8 mm. broad; phyllaries in about 3 series, often somewhat yellowish-stramineous, oblong, blunt, about 1.5 mm. broad near the end, their broad median strip (which takes up nearly the whole width) with several distinct vertical nerves as seen under a lens. *Oligoneuron nitidum* (T.&G.) Small. Frequent in open sandy places, e. and s.e. Tex., s. to Aransas Co., July-Sept.; also La. and Okla.

30. ASTER L. ASTER

Annual or usually perennial herbs, when perennial often with caudexes or horizontal rhizomes; leaves when present alternate, not dissected, usually sessile; perennial species usually with basal leaves dissimilar to cauline leaves and the latter usually passing into the much-reduced leaves of the head-bearing branchlets which are usually leafy to the summit; *disk flowers* present and perfect, their corollas yellowish or less commonly tinged with blue, rose or violet; *ray flowers* present, fertile, their corollas white or bluish-white or violet or even rosy at least on the underside but *never* yellow; heads usually numerous and borne at the ends of the usually leafy branches; head-bearing branchlets usually aggregated into paniclelike inflorescences; receptacle of head flat or slightly convex; disk corolla consisting of a basal cylindrical tube plus an expanded usually funnelform limb, the limb consists of a throat plus 5 lobes; phyllaries in several series, imbricate, the outer ones usually green at least near the tip and often on part of the midrib; pappus of numerous capillary bristles in essentially a single series, similar in disk and ray; achenes more or less flattened, with one or more ribs on the faces; style branches usually subulate.

Aster has several hundred species, mostly in temperate regions. It is one of our more difficult genera, both as to its over-all circumscription and the limitation of the species contained. Probably hybridization and back-crossing has occurred frequently, blurring

lines between our species 1 through 15 (especially between species 5 through 9). Only complete specimens, with rhizomes and mature flowers (with anthers exerted), can be determined with any degree of confidence.

1. Head-bearing branchlets relatively few (10 to 30 per plant), remote and ascending, 6-20 cm. long, each terminated by a single hemispheric or campanulate head 12-30 mm. broad; leaves of head-bearing branchlets elliptic, not much diminishing in size upward toward the head, the upper ones crowding around the outer phyllaries of the head, longer and broader than them and partly hiding them or even grading into them and often discolored apically; outer phyllaries white-indurated basally (2)
1. Head-bearing branchlets usually more numerous or if few then their leaves much narrower and pointed; highest leaves of the branchlets not large enough to hide the outer true phyllaries (3)
- 2(1). Outer phyllaries 2-3 mm. broad, on the outer surface glabrous to slightly pubescent, marginally with a distinct fringe of minute porrect rigid cilia; heads hemispheric, the involucre 10-20 mm. broad14. *A. pratensis*.
2. Outer phyllaries 1.3-2 mm. broad, on the outer surface with antrorse-appressed whitish pubescence, not distinctly fringed; heads campanulate, the involucre 7-12 mm. broad15. *A. sericeus*.
- 3(1). Phyllaries with the midrib greenish but this greenish area not expanded toward the apex or at the broadest part not more than twice as wide as at the narrowest part, usually appearing linear, the marginal areas pale and chaffy in texture; leaves when present usually subulate, tapered all the way from base to apex, rarely with a few serrations, mostly entire and glabrous; head-bearing branchlets not very leafy (Sect. *Oxytripolium*) (4)
3. Phyllaries usually with a green splotch toward the apex formed by the lateral expansion of the greenish area near the midrib; leaves variously ovate to lanceolate or linear but usually serrate, rarely subulate; head-bearing branchlets usually leafy (6)
- 4(3). Leaves small or nearly absent, often on some branchlets transformed into green thorns; plants forming colonies from extensively creeping rhizomes18. *A. spinosus*.
4. Leaves well-developed at least in the lower part of the plants; rhizomes if present not extensively creeping (5)
- 5(4). Salt marsh and brackish mud perennial 3-6 dm. tall; heads numbering only 3 to 30 per plant or per shoot, broadly turbinate; involucre 11-17 mm. broad at top16. *A. tenuifolius*.
5. Annual forming colonies in poorly drained areas, (2-) 4-20 dm. tall; heads numbering up to several hundred per plant, turbinate; involucre 7-11 mm. broad at top17. *A. subulatus*.
- 6(3). Tips of phyllaries (as seen under a strong lens) with numerous crowded "glands," i.e., swollen shiny tubercles either sessile or stalked (7)
6. Tips of phyllaries either glabrous or with hairs but these not glandular (*A. praealtus* and *A. hesperius* may have some very minute capitate hairs on the margin of the tip of the phyllaries) (9)
- 7(6). Midstem leaves linear, several cm. long; on breaks of High Plains and Panhandle13. *A. Fendleri*.
7. Midstem leaves oblong to obovate, usually only about 1-2 cm. long (8)
- 8(7). Leaves of the ultimate few cm. of the elongated head-bearing branchlets extremely reduced and sharply contrasted to the midstem leaves, usually only 1-3 mm. long and 0.5-1 mm. broad and tightly appressed11. *A. patens*.
8. Leaves of the ultimate few cm. of the relatively short head-bearing branchlets either not sharply reduced from the other branchlet leaves or else not appressed, usually 3-10 mm. long and 1-2 mm. broad12. *A. oblongifolius*.

- 9(6). Longest phyllaries usually only about 3-4 mm. long, obtuse, marginally with at least a few short rigid cilia forming a fringe quite distinct in appearance from the rest of the pubescence if any 10. *A. ericoides*.
9. Longest phyllaries usually longer than 4 mm., if only that long then lacking a ciliate fringe (10)
- 10(9). Leaves of lower stem and base (at least) with a long narrowly linear subpetiolar base quite distinct from the distal widened portion (11)
10. Leaves of lower stem and base not sharply differentiated into a narrowly linear subpetiolar base and a distal bladelike portion (13)
- 11(10). Bladelike portion of lower leaves abruptly narrowed basally 3. *A. vernalis*.
11. Bladelike portion of lower leaves truncate or even cordate basally (12)
- 12(11). Lower and middle stem leaves usually cordate, less commonly truncate; leaves of upper branches in the head-bearing region mostly obovate-elliptic, not linear 1. *A. texanus*.
12. Lower and middle stem leaves usually truncate; leaves of upper branches linear 2. *A. azureus*.
- 13(10). Leaves of midstem linear, 10-25 (-34) mm. long, 1-2 mm. broad; leaves of the head-bearing branchlets numerous, linear-subulate, ascending 9. *A. dumosus*.
13. Leaves of midstem usually averaging longer than 20 mm. and always broader than 2 mm. (14)
- 14(13). Leaves of midstem with slight basal auricles which make it appear as if the leaves clasp the stem more than half the circumference though the scar involves only about half 4. *A. scabricaulis*.
14. Leaf scar commonly involving as much as half the circumference of the stem but leaf auricles absent (15)
- 15(14). Mature disk corolla (that is, corolla from a floret with anthers exerted or beginning to be exerted) 3-3.5 (-3.9) mm. long, consisting of a tube 1-1.5 mm. long, plus a throat 0.8-1.2 (-1.4) mm. long, plus lobes 0.7-1 (-1.2) mm. long ... 8. *A. lateriflorus*.
15. Mature disk corolla 4-6 mm. long, consisting of a tube 1.3-2.5 mm. long, plus a throat 1.5-3 mm. long, plus lobes 0.5-1.1 mm. long (16)
- 16(15). Phyllaries relatively weakly graduated, the shortest outer ones about half as long as the longest inner ones 5. *A. praealtus*.
16. Phyllaries relatively strongly graduated, the shortest outer ones about a third as long as the longest inner ones (17)
- 17(16). Mature disk corolla 5-5.6 mm. long, with lobes 0.7-1 mm. long, plus throat 2.4-2.7 mm. long, plus tube 2.2-2.5 mm. long; in Trans-Pecos Texas 6. *A. hesperius*.
17. Mature disk corolla (4.1-) 4.5-5 mm. long, with lobes 0.5-0.9 mm. long, plus throat 1.5-2.5 mm. long, plus tube 1.3-2.2 mm. long; in eastern half of Texas 7. *A. Eulae*.

1. *Aster texanus* Burgess. Perennial from short subrhizomatous bases; stem erect, 3-8 dm. tall, freely branched in the upper portion, the branches widely spreading; leaves at first membranous but becoming thickish, brittle and crumbly, those of the lower and middle stem with an ovate basally truncate or usually cordate portion and a linear petiolelike (but broadly winged) basal portion, those of the upper third of the plant (not those of the ultimate head-bearing branchlets) mostly obovate-elliptic; head-bearing branchlets relatively short, usually 1-4 cm. long, with much-reduced leaves; involucre turbinate to hemispheric; rays several mm. long, usually bluish-white but variable. Frequent or local in loamy soils or well-drained clay, open woods and prairies, e., s.e. and n.-cen. Tex. and e. margin of Edwards Plateau, Oct.-Nov., rarely Mar.-Apr.; Ark., La. and Tex.

Not adequately distinct from, and intergrading with, *A. sagittifolius* Willd. var. *Drummondii* (DC.) Shinnars which occurs s.w. to La. and Okla.

Var. *parviceps* Shinners, of Bowie Co., Tex. and Marion Co., Ark. is said to have involucre 3.8-4.2 mm. high and 4-6 mm. broad, whereas the var. *texasus* has involucre 4.2-5.2 mm. high and 6-9 mm. broad; further evaluation is needed.

2. *Aster azureus* Lindl. Perennial from short subrhizomatous bases, the branches stiffly ascending; leaves at first membranous but becoming thickish, brittle and crumbly, those of the lower and middle stem with an enlarged distal basally usually truncate portion and a linear petiolelike (but broadly winged) basal portion, those of the upper third of the plant linear or narrowly lanceolate; head-bearing branchlets with minute subulate leaves; involucre 5-8 mm. high; rays deep-violet-blue, rarely rosy or white. Rare, known only in Grayson Co., n.-cen. Tex., Oct.-Nov.; e. U.S., excluding Fla., w. to Minn. and Tex.

Poorly distinguished from *A. vernalis*, from which it is doubtless only varietally distinct. The leaf character is tenuous, to say the least, and the alleged differences in involucre height are at best merely slight average differences.

3. *Aster vernalis* Burgess. Perennial from short rhizomes; branches stiffly ascending; leaves at first membranous, becoming thickish, brittle and crumbly, the lower and basal ones with fairly well-differentiated basal subpetiolar portion and expanded elliptic distal portion, the higher leaves narrowly lanceolate to linear, those of the head-bearing branchlets minute and subulate; involucre 4-5 (-6) mm. high; rays bluish-white. *A. azureus* var. *poaceus* (Burgess) Fern. Infrequent in openings in woods on sandy soil, e. Tex. and rare in s.e. Tex. (Harris Co.), Oct.-Nov. (rarely Mar.-Apr.); Mo., Ark. and Tex.

See remarks under *A. azureus*.

4. *Aster scabricalis* Shinners. Perennial with rhizomes; stems ascending, weak, 14-18 dm. long, with branches at middle or below to 35 cm. long, scabrous-pubescent throughout, with about 25 to 35 nodes, the middle and upper internodes 1.5-4.5 cm. long; stem leaves withering early, oblong-lanceolate, acute, entire or very shallowly toothed, sessile and clasping (i.e., basally slightly auriculate), scabrous-pubescent on both surfaces or nearly glabrous beneath, about 7 cm. long and 2 cm. broad; leaves of branches similar but much smaller, rather numerous and uniform; heads rather numerous and crowded, the ultimate head-bearing branchlets 3-12 mm. long; involucre 7-8 mm. high; phyllaries in about 5 to 7 rows, subequal, loosely spreading or squarrose. Rare in boggy ground, e. Tex. (Tyler and Van Zandt cos.), Oct.; endemic.

Said to be related to *A. puniceus* L. of northeastern United States.

5. *Aster praealtus* Poir. Rhizomatous perennial with ascending stems and branches; stem leaves sessile, generally lance-linear or very narrowly elliptic, the lower ones 4-10 (-15) cm. long and about 1 cm. broad, those higher up gradually smaller and smaller; leaves of the numerous short rarely somewhat secund head-bearing branchlets very small and subulate or linear-subulate; involucre usually hemispheric, about 6 mm. high, with a few rows of weakly graduated phyllaries, the outer shorter of which are about half as long as the inner longest ones; rays several mm. long, usually bluish-white or less commonly pure-white; mature disk corollas 4.5-6 mm. long, with a tube 1.5-2.5 mm. long, a throat 1.5-3 mm. long and lobes 0.5-1.3 mm. long. Frequent on usually moist banks and in ditches, loamy soil, n.-cen. Tex. and lower Plains Country, less frequent or rarely to e. and s.e. Tex., n. part of Rio Grande Plains and e. part of Edwards Plateau, (Sept.-) Oct.-Nov., less commonly other seasons; Que. and Ont. s. to Md., W.Va. and Ky., s.w. to Ia., Mo., Okla., Tex. and Chih. (?)

The plants of north-central, east and southeast Texas and Rio Grande Plains (most of which are referable to the weak var. *texicola* Wieg.) have disk corolla proportions as follows: tube 1.8-2.5 mm. long, throat 1.5-2 mm. long, lobes 0.8-1.3 mm. long. The stem leaves are narrowly elliptic and often slightly narrowed about a third the length from the base, suggesting a very broad subpetiolar portion. Most plants from the Edwards Plateau and lower Plains Country have disk corolla proportions as follows: tube 1.5-2.2 mm. long, throat 2-3 mm. long, lobes 0.5-1.1 mm. long; the stem leaves generally uniformly lance-linear. These constitute the *Aster coeruleus* DC., which is actually as good a "species" as several other "species" recognized by *Aster* specialists. *A. praealtus* var. *imbricator* Wieg. is a genetically contaminated form with the involucre and inflorescence showing certain characteristics of *A. lateriflorus* and *A. Eulae*.

6. *Aster hesperius* Gray. Erect rhizomatous perennial; stem leaves linear to lance-linear with relatively obscure venation pattern, to 16 cm. long and to 15 mm. broad; leaves of the fairly numerous erect (not secund) head-bearing branchlets much smaller,

oblong to subulate; heads hemispheric; involucre 6-7 mm. high, with several rows of strongly graduated phyllaries; rays several mm. long, bluish; mature disk corolla with tube 2.2-2.5 mm. long, throat 2.4-2.7 mm. long and lobes 0.7-1 mm. long. *A. coerulescens* of many auth., not DC. Rare in the Trans-Pecos (at Muzquiz Swamp, Jeff Davis Co., and Guadalupe Mts., Culberson Co.), Oct.; Alta., N.D. and Wisc. s. to Calif., Ariz., Chih. and Tex.

This is exceedingly close to the *A. praealtus* complex (especially to *A. coerulescens*) and the merit of recognizing it as specifically distinct is doubtful.

7. *Aster Eulae* Shinn. Rhizomatous perennial; stem erect and with many ascending or spreading branches; head-bearing branchlets mostly 1-3 cm. long, usually somewhat secund; leaves membranous; midstem leaves several cm. long (quite variable in size), usually elliptic to oblanceolate but in their basal third broadly cuneate, usually obscurely serrate; leaves in the upper branches similar in shape but smaller, usually 15-30 mm. long, 3-6 mm. broad; leaves of the head-bearing branchlets linear or linear-lanceolate, not crowded, 3-10 mm. long, about 1-2 mm. broad; involucre hemispheric, 4-5 mm. high, of a few series of well-graduated phyllaries, the shortest of which are about a third or even only a fourth as long as the longest; rays 20 to 30, about 4 mm. long, usually white but less commonly bluish-white; mature disk corollas (4.1-) 4.5-5 mm. long, with a tube 1.3-2.2 mm. long, plus a throat 1.3-2.5 mm. long, plus lobes 0.5-0.9 (-1.1) mm. long. Frequent in usually heavy clay or clay-loam soil, ditches, banks and openings in river bottom woods, n.-cen. Tex., infrequent to the s. part of e. and s.e. Tex., perhaps as far s. as Nueces Co., Oct.-Nov.; endemic.

This combines some of the characteristics of *A. praealtus* var. *texicola* and *A. lateriflorus* var. *flagellaris*, and the origin is thereby suggested; but *A. Eulae* seems to be a fairly stable, discrete entity, as *Aster* species go, and regardless of its possible origin should be recognized by a separate name.

8. *Aster lateriflorus* (L.) Britt. Perennial from subrhizomatous bases or slender short rhizomes; stems ascending or usually long-arching, semireclining, usually with several whiplike arching secondary branches, the latter bearing in turn a number of very short secund head-bearing branchlets; leaves of midstem usually membranous, elliptic or lance-elliptic, serrate, to several cm. long and 15 mm. broad but usually smaller, sessile, those of the distal head-bearing region still smaller and those few of the very short head-bearing branchlets minute and subulate; heads not very crowded; involucre turbinate to hemispheric, 4-5.5 mm. high; phyllaries in 3 or 4 rows, strongly graduated, the shorter row only about a fourth as long as the longest, mostly pale-stramineous, the dilated portion of the midrib rather small (so nearly the whole involucre appears stramineous); rays few and only about 3 mm. long, usually white; mature disk corolla 3-3.5 (-3.9) mm. long, with a tube 1-1.5 mm. long, plus a throat 0.8-1.2 (-1.4) mm. long, plus lobes 0.7-1 (-1.2) mm. long. Incl. var. *flagellaris* Shinn. and var. *indutus* Shinn., and Tex. plants which have through error been determined as *A. ontarionis* Wieg. (*A. pantotrichus* Blake). Frequent in sandy usually moist or boggy areas in e. Tex. (s.w. to Gonzales Co.), rare to s.e. Tex. (Harris Co.), Oct.-Nov.; other varieties occur in s.e. Can. s. to Ga., Tenn. and Ark.

Possibly our plants should not be referred to *A. lateriflorus*, which is said to have the lobes of the disk corolla 1-1.6 mm. long.

9. *Aster dumosus* L. Perennial from slender rhizomes; branches (at least the upper ones) usually ascending and much-branched; leaves firm-membranous, those of midstem linear, 10-25 (-34) mm. long and 1-2 mm. broad, usually falling before the end of Sept. and leaving in Oct. only the numerous nearly uniform minute subulate appressed leaves of the upper branches and of the head-bearing branchlets; head-bearing branchlets not markedly secund; involucre 5-7 mm. high; rays a few mm. long, usually bluish-white but variable; mature disk corolla with a tube 1.4-2 mm. long plus a narrowly funnelform throat 1.4-2.3 mm. long, plus usually erect lobes 0.4-1 mm. long, the proportions quite variable. Incl. var. *subulaefolius* T.&G. and var. *coridifolius* (Michx.) T.&G. Infrequent in loamy prairies, s.e. Tex., rare inland in e. Tex., late Sept.-Nov.; s.e. U.S. n. to Me.; other varieties inland as far as Ont., Mich. and Ill.

Some few specimens combine characters of this species and of *A. lateriflorus*.

10. *Aster ericoides* L. Rhizomatous perennial, usually much-branched, the long primary branches either erect or usually arching or reclining and bearing numerous very

short ascending head-bearing branchlets which are usually decidedly secund; leaves mostly linear or oblong, those of the midstem 1-2 cm. long, usually withered by flowering time; leaves of the branchlets very numerous and crowded, about 1 mm. broad and 2-3 mm. long, often appressed; head very crowded; involucre hemispheric, 4-7 mm. broad; phyllaries in few series, the longest ones 3-4 mm. long, obtuse and marginally short-ciliate-fringed; rays several, slightly exceeding the pappus and almost always white. *A. multiflorus* Ait., *A. commutatus* Gray as to specimens but not as to basionym, *A. commutatus* var. *crassulus* (Rydb.) Blake. Frequent in a variety of open situations, n.-cen. and s.e. Tex. and Plains Country, s. and w. parts of e. Tex., n. part of Rio Grande Plains and the Trans-Pecos, late summer or usually fall; s. Can. s. to Gulf States (excl. Fla. and La.), n. Coah., n. Chih. and Ariz.

This species is somewhat variable, especially in degree of pubescence. The heads tend to be of maximum size (*A. commutatus*) toward the western part of Texas, but no subdivision is practicable as every possible intergradation occurs.

11. *Aster patens* Ait. Erect perennial, 40-75 cm. tall from slender rootstocks which in sandy soil are extensive; leaves minutely serrate, those of the lower and middle stem somewhat obovate or spoon-shaped, with a broadly winged subpetiolar clasping base; upper leaves also clasping, becoming ovate to oblong or short-lanceolate and fairly abruptly differentiated from the minute appressed leaves of the elongate stiffly ascending head-bearing branchlets; heads not crowded; involucre turbinate, 7-15 mm. broad; phyllaries in 4 or 5 series, their tips glandular-pubescent; rays several mm. long and usually blue. Incl. var. *gracilis* Hook. Frequent in open dry situations, e. Tex., infrequent w. to n.-cen. Tex., rare in n. part of Rio Grande Plains and in Edwards Plateau and lower Plains Country, late Aug.-middle Nov.; e. temp. N.A. w. to Minn., Kan. and Tex.

Some few specimens seem intermediate between *A. patens* and *A. oblongifolius*.

12. *Aster oblongifolius* Nutt. Rhizomatous perennial, erect, 2-4 dm. tall; leaves minutely serrate, those of the lower and middle stem oblong, with subclasping bases, 1-2 (-3) cm. long, those of the head-bearing branchlets (which are ascending and only 1-4 cm. long) spreading, 3-10 mm. long and 1-2 mm. broad; heads not crowded; involucre usually hemispheric, 8-12 mm. broad; phyllaries in 3 or 4 series, their tips glandular-pubescent; rays several mm. long and usually blue or purple. Incl. var. *rigidulus* Gray and var. *angustatus* Shinners, *A. Kumlienii* Fries. Frequent in calcareous prairies, Edwards Plateau and lower Plains Country, infrequent and local e. to n.-cen. Tex., late Sept.-Nov. (rarely to early Jan.); N.C., Ala., Ark. and Tex. n. to Pa., Wisc., Minn. and N.D.

13. *Aster Fendleri* Gray. Perennial from subrhizomatous ligneous crowns, erect, 2-4 dm. tall; stems leafy nearly to the base even at flowering time; leaves firm, minutely serrate or the lowest leaves spinulose-ciliate, those of the lower and middle stem linear, 20-45 mm. long, 2 mm. broad (often with tufts of smaller leaves in the axils), sessile but not clasping; leaves of the head-bearing branchlets (which are 1-4 cm. long) only 2-4 mm. long, 1-2 mm. broad, ascending; involucre hemispheric, 8-15 mm. broad; phyllaries in a few series, the tips glandular-pubescent; rays several mm. long, bluish. On calcareous prairies, caprocks and stony breaks, High Plains Country, Sept.-Oct.; Kan., Colo., N.M., Okla. and Tex.

14. *Aster pratensis* Raf. Perennial with caudexes and fibrous root systems, (3-) 5-8 dm. tall, (1-) 1.5-3 mm. thick basally; branches few, stiff, ascending; leaves firm, mostly falling before flowering, those of the flowering branchlets persistent, elliptic, the uppermost not reduced, encroaching on the head to form a supplementary involucre; true phyllaries linear to oblong, in few series, each in its lower portion pale, indurate or at least firm-herbaceous to subcoriaceous, the upper portion appressed and hirsute-fringed; rays purple, 10-18 mm. long, 1.5-2 mm. broad; pappus of numerous coarse brownish-white bristles; achenes flattened, glabrous, with several ribs on each face. *A. phyllolepis* T.&G. Prairies and open woods, usually sandy soil, frequent in e., s.e. and n.-cen. Tex. s. to Aransas and DeWitt cos., Sept.-Nov., rarely as late as early Jan.; also La.

15. *Aster sericeus* Vent. Perennial with caudexes and fibrous root systems; branches few, stiff, ascending, 3-5 dm. tall, 1.2-2 mm. thick basally; leaves firm, grayish or sordid, falling before flowering, those of the flowering branchlets persistent, elliptic, the uppermost not much-reduced, encroaching on the head to form a supplementary involucre;

true phyllaries linear, in few series, each in its lower portion pale-indurate and appressed and in the upper portion firm and grayish- or sordid-pubescent, either appressed or rarely spreading; rays purple, 1 cm. long, 1-1.5 mm. broad; pappus of numerous coarse brownish-white bristles; achenes flattened, glabrous, with about 5 ribs on each face. Local in open rocky calcareous soils, s. and e. margin of Edwards Plateau and rare in s. part of e. Tex. (Bastrop, Bexar and Travis cos.), late Oct.-early Dec.; Man. to Mich. s. to Tenn., Mo. and Tex.

Aster sericeus and *A. pratensis* together are as distinct from the genus *Aster*, proper, as are *Ionactis*, *Doellingeria*, and *Leucelene* and perhaps other segregates. *Aster sericeus* in Wisconsin has been known to hybridize with a species of *Aster* but the hybrid was sterile.

16. *Aster tenuifolius* L. Relatively low turgid-succulent perennial; rhizomes apparently creeping in mud; leaves only about 2 mm. broad, to 1 dm. long; heads larger (but fewer) than in *A. subulatus* and *A. spinosus* (see below) but with most of the same characters; each plant or shoot from the rhizome with usually only about 10 to 20 remote heads. Infrequent, salt marshes or brackish mud, s.e. Tex. (Aransas, Brazoria, Calhoun and Galveston cos.), June-Nov.; coastal areas n.e. as far as L.I. and N.H.

17. *Aster subulatus* Michx. HERBA DEL MARRANO. Robust much-branched glabrous annual; leaves linear-subulate, rarely serrate, mostly 1-10 (-20) cm. long, 2-4 (-7) mm. broad, much-reduced toward the top of the plant; involucre turbinate, of a few series of linear phyllaries, each phyllary pale but with a darker linear midrib (if laterally expanded then the widest portion no more than twice as wide as the narrowest).

Most of our plants belong to the var. *ligulatus* Shinnery in which the ligules are several mm. long, surpassing the disk corollas and the pappus; these plants have long passed under the dubious name *A. exilis* Ell. It is an abundant weed in ditches, swales, margins of ponds, lakes and streams and poorly drained places in general, throughout Tex., our most abundant *Aster*, summer-fall; widespread in the warmer parts of Am., n. to S.C., Mo., Kan., N.M., Ariz. and Calif. The var. *euroauster* Fern. & Griseb., characterized by its much-reduced to essentially nonexistent ligules, is extremely rare in s.e. Tex. (Orange Co.) where it grows about and in ponds, Aug.-Sept. It occurs from Conn. to Fla., w. to Tex. One old Galveston collection is referable to the var. *australis* Shinnery, in which the ligules are about equal to the disk corollas and to the pappus in length. It is widespread in C.A. and S.A. The var. *subulatus* is very near the coast from Me. to La.

It has been suggested that *A. spinosus*, *A. subulatus* and *A. tenuifolius* should be segregated as a genus. They do form a coherent natural group somewhat different from our other *Asters*.

18. *Aster spinosus* Benth. MEXICAN DEVIL-WEED. Colonial by rhizomes, essentially leafless or producing a few small leaves when injured near the ground, with minute subulate leaves scattered in some stems; axillary branches often transformed into thorns; heads as in *A. subulatus* (rays short as in var. *euroauster*) but the phyllaries more strongly graduated and the pale narrow margins narrower than the median dark stripe. *Leucosyris spinosa* (Benth.) Greene. Locally very abundant on roadsides and other weedy slopes and banks, s. and w. half of Tex., uncommon n.e. to Brazos, Robertson and McLennan cos., summer-fall; C.R. n. and w. to Calif., Ut., Ariz., N.M. and Tex.

31. HELEASTRUM DC.

A North American genus of 2 or 3 species.

1. *Heleastrum hemisphaericum* (Alex.) Shinnery. Rhizomatous perennial; stems simple (except in the head-bearing region), rising strictly erect, single usually from swollen knots or corms that occur at intervals along the rhizomes, 3-7 dm. tall; leaves firm to subcoriaceous, ascending, linear, the lower ones to 12 cm. long, 5 mm. broad, sessile, marginally essentially entire, often with axillary fascicles of small leaves; the leaves higher on the stem becoming smaller, the upper ones subtending very short [1-10 (-30) mm.] head-bearing branchlets; the whole head-bearing portion of the plant spiciform or subracemiform with few (rarely one, usually 2 to 10) large heads, rarely some of the head-bearing branches becoming much more elongated, equaling or slightly surpassing

the finally determinate main axis; involucre hemispheric, 1-2 cm. broad, about 1 cm. high, with a number of rows of strongly graduated broad squarrose phyllaries; each phyllary with a broad tip which is green to the margin and is not formed by expansion of a midnerve, the green portion giving way abruptly below to the stramineous coriaceous basal portion of the phyllary; rays several cm. long, showy, bluish; disk yellow; pappus alike in ray and disk, of numerous rather coarse bristles, at least some of the bristles expanded in the apical third to as much as twice as thick as the basal portion. *Aster hemisphaericus* Alex., *A. paludosus* subsp. *hemisphaericus* (Alex.) Cronq. Low places, sandy soil, infrequent in e. and s.e. Tex., s. to Victoria and Calhoun cos., late summer to early spring; also La.

32. DOELLINGERIA NEES

A monotypic North American genus.

1. *Doellingeria umbellata* (Mill.) Nees var. *latifolia* (Gray) House. Rhizomatous perennial; aerial stems simple for most of their length, rising at intervals from the rhizome, to 1 m. high; leaves alternate, the lowest leaves (near ground level) actually smaller than those of the midstem, there being an increase in size of the leaves proceeding up the lowest part of the stem; leaves in general ascending or appressed, narrowly ovate-elliptic or broadly lanceolate, several cm. long or reduced in the head-bearing region; upper 3-20 dm. of the plant branched, the branches erect and forming a dense corymbiform grouping of heads, each head on a short erect peduncle 3-10 mm. long; involucre about 4 mm. high, of perhaps 3 series of strongly graduated mostly stramineous phyllaries with unexpanded or only very slightly expanded green midribs; rays 2-3 mm. long, whitish; disk yellow; pappus slightly double, of very unequal capillary bristles, alike in disk and ray. *Aster umbellatus* Mill. var. *latifolius* Gray. Rare in wet usually boggy ground, e. Tex. (Bowie, Freestone and Nacogdoches cos.), Sept.-Oct.; the species as a whole occurs in s.e. Can. and e. U.S. s. to N.C., Ga., Tenn. and w. to Minn., Ia., Ark. and Tex.

33. IONACTIS GREENE

We have a single species; about 3 in North America.

1. *Ionactis linariifolia* (L.) Greene. Tufted perennial; several stems rising stiffly from the ligneous crown, simple except in the upper 3-10 cm. where there are a few erect head-bearing branches; leaves linear or slightly oblanceolate-linear, crowded over most of the stem, about 3 cm. long but in the lowest part of the stem reduced to mere scales, in the branched upper portion reduced to about 3-10 mm. long and about 1 mm. broad; involucre turbinate, 7-15 mm. high; phyllaries in about 5 series, firm, mostly appressed, mostly stramineous, strongly graduated, each with a green midrib very slightly expanded toward the top; rays several mm. long, violet-blue; disk yellow; pappus alike in ray and disk, double, the more copious inner pappus of capillary bristles, the outer pappus short and setulous. *Aster linariifolius* L. Rare in sandy pine-oak woods in e. Tex., fall; s.e. Can. and e. U.S. w. to Minn., Ia., Okla. and Tex.

34. LEUCELENE GREENE¹⁹⁸

There is but a single somewhat variable species.

1. *Leuceleene ericoides* (Torr.) Greene. WHITE ASTER, ROSE HEATH. Perennial, usually about 10-15 cm. high, rarely to 20 cm., from much-branched subrhizomatous bases, with 10 to 100 ascending stems usually branched in the upper two thirds of their lengths; leaves of the stems near or just below ground level reduced to scales, those of the lower half of the plant usually thick, linear to clavate or slightly spatulate, 2-12 (-15) mm. long, 1-2 mm. broad, usually ascending or appressed, densely hirsute and often bristly-ciliate marginally; leaves of the upper half of the plant smaller, often minute and subulate or clavate; heads numerous and borne in a corymbiform group

¹⁹⁸ Adapted from L. H. Shinnars in *Wrightia* 1:82-89. 1946.

because of the nearly uniform height of the upper branches; involucre usually about 5-10 mm. broad, hemispheric to turbinate; phyllaries in a few series, graduated, the shortest phyllaries about a third as long as the longest ones, each phyllary with a broad green median stripe plus very narrow whitish sides, the tip of the green midstripe often discolored purplish; rays about 2-3 mm. long, white; disk yellow; pappus alike in ray and disk, in each flower of 20 to 30 approximately equal capillary bristles. *Aster ericaefolius* Rothr., *A. arenosus* (Heller) Blake, *Leucelene hirtella* (Gray) Rydb. and many other synonyms. Abundant in dry calcareous open places in the Trans-Pecos, Plains Country and Edwards Plateau, e. to Palo Pinto, Concho and Edwards cos., usually with 2 seasons, spring and fall; Kan. to Ut. and Calif., s. to Tex., S.L.P., Dgo. and Son.

35. CHAETOPAPPA DC.¹⁹⁹

Annual or perennial herbs, often much-branched and only 1-3 dm. tall; leaves alternate, simple, entire, essentially sessile; heads usually not crowded, solitary at the ends of branches; involucre hemispheric to subcylindric; phyllaries elliptic to linear-lanceolate, stiff, chartaceous medially, mostly green, scarious-margined, appressed, imbricated in about 2 to 6 series, the outermost not more than half as long as the innermost; receptacle flat or slightly convex, naked, rough; *ray flowers* pistillate, fertile, with oblong white to rosy-white or bluish-white rays; *disk flowers* perfect, fertile (or the innermost ones sometimes not fertile); corolla yellow, with the equally 5-lobed limb being scarcely distinguished from the short basal tube; style branch appendages deltoid; achenes 2-, 3-, 4-, 5- or 10-nerved, compressed to subterete; pappus of scales and sometimes also with awns or in *C. effusa* and *C. bellidifolia* essentially absent.

About 9 species in southwestern United States and Mexico.

1. Involucre campanulate or hemispherical in flower, rather broad and rounded at base, with 12 to 28 rays and 32 to 106 disk flowers; disks 4-12 mm. across 6. *C. bellioides*.
1. Involucres narrowly cylindrical to broadly conical in flowers (broader in fruit), more or less acute basally, with 5 to 18 rays and 6 to 26 disk flowers; disks 1.5-5 mm. across in prepared specimens (2)
- 2(1). Involucres 5-6.5 mm. high or higher (3)
2. Involucres 3-4.9 mm. high (4)
- 3(2). Stem leaves broadest near the base or nearly the same width throughout, the upper more or less clasping 2. *C. effusa*.
3. Stem leaves broadest near the middle or above, not at all clasping 3. *C. Parryi*.
- 4(2). Middle and upper stem leaves broadest near the base or about the same width throughout, the uppermost more or less clasping . . . 2. *C. effusa*.
4. Middle and upper stem leaves broadest above the middle, not at all clasping (5)
- 5(4). Plants low, matted, almost mosslike perennials from rather woody much-divided rootstocks; stem leaves linear-oblongate, coriaceous, persistent, of nearly uniform size 1. *C. Hersheyi*.
5. Plants annual from a slender taproot; stem leaves spatulate to linear, the lower soon withering, the upper much smaller (6)
- 6(5). Inner phyllaries glabrous and entire or with very minutely erose margins, abruptly pointed and often awn-tipped; pappus represented merely by a thickened ring or minute erose crown 4. *C. bellidifolia*.
6. Inner phyllaries with prominently lacerate-ciliate margins especially near the apex, the excurrent midvein made inconspicuous by the ciliation; pappus of well-developed scales in either the ray or disk flowers or both, with or without longer awns in addition 5. *C. asteroides*.

1. *Chaetopappa Hersheyi* Blake. Matted perennial from woody forked rootstocks; stems to 5 cm. high, simple, flexuously ascending; sparsely pubescent with ascending or

¹⁹⁹ Adapted from L. H. Shinnars in *Wrightia* 1:63-81. 1946.

loosely appressed hairs, terminated by a solitary head on a peduncle naked for 1-5 mm. or a few by a tuft of small leaves: basal rosettelike leaf clusters with spatulate or oblanceolate subacute apiculate leaves 1.5-6 mm. long and 0.3-1 mm. broad; stem leaves 4 to 7, linear-oblanceolate or linear, 3-7.5 mm. long, 0.4-1 mm. broad, acute and with a translucent spiny tip, coriaceous, 1-ribbed (rib almost keel-like beneath), sparsely hispid-strigose or glabrous, persistent; lower leaves with narrowed, subpetiolar bases, the upper slightly smaller; involucre 4-4.6 mm. high; phyllaries lanceolate, acute or acuminate and slenderly spine-pointed, sparsely appressed-pubescent on the midrib or glabrous, with white-scarious ciliate margins, imbricated in about 4 series; ray flowers 6 to 10; rays when fresh bluish, fading to white, about 5 mm. long; disk flowers 5 or 6; corollas 3.3-4.3 mm. long, yellow; achenes of ray flowers 2- or 3-nerved, 1.3 mm. long; achenes of disk flowers 5-nerved, 0.8-1 mm. long; pappus similar in disk and ray, of about 5 awns (3.6-4.2 mm. long) and as many very minute ciliate or erose scales about 0.1 mm. long. Local, limestone cliffs and ledges, Guadalupe Mts. in the Trans-Pecos, May; endemic.

2. *Chaetopappa effusa* (Gray) Shinn. Perennial from a somewhat woody irregular crown; stems 1 to several, 2-7 dm. long, loosely pubescent with rather long whitish spreading to appressed hairs, simple up to the diffusely branched head-bearing region (which occupies the terminal one fourth to one half of the plant) with about 15 to 35 leaves below the head-bearing region; leaves firm, dark-olive-green, sparsely strigose on both surfaces and ciliate on the margin with hispid hairs; lowest leaves oblong- to oblong-lanceolate with more or less narrowed bases, 18-55 mm. long, 5-13 mm. broad, the narrowed base making up one sixth to one third the total length; middle and upper leaves gradually and slightly reduced, lanceolate-oblong to deltoid-oblong, the upper broadest at base, sessile and more or less clasping, 1-2 cm. long and 5-10 mm. broad; leaves of the branches abruptly much-reduced to narrowly oblong or (on the branchlets and peduncles) linear-subulate bracts, the larger ones 6-15 mm. long and 3-6 mm. broad, the smaller as little as 0.3 mm. long; involucre 4-5.2 mm. high; phyllaries imbricated in 3 to 5 series; rays 6 to 9, 3-4.5 mm. long, white; disk flowers 4 to 7, the corollas yellow; achenes of ray flowers compressed, 2-ribbed, pubescent, 2-2.2 mm. long; achenes of disk flowers 3-, 4- or 5-ribbed, pubescent on the ribs, 1.6-2 mm. long; pappus a thickened ring or cuplike erose crown, similar in disk and ray. Locally common in calcareous open places, Edwards Plateau, July-Sept.; endemic.

3. *Chaetopappa Parryi* Gray. Perennial forming loose tufts from superficial rhizomes or stolons; rhizomes producing a few leafy rosettes; stems erect, 10-28 cm. tall, normally simple for 4-18 cm. above the base (the terminal one fourth to two thirds of the plant with few elongate spreading-ascending branches), sparsely to rather densely pubescent with appressed to loose or spreading somewhat hispid hairs, with about 8 to 25 leaves below the head-bearing region; basal leaves crowded in a persistent rosettelike cluster, narrowly oblanceolate to broadly spatulate, 1-3 cm. long (the petiolar base 4-16 mm.), 1.5-9 mm. broad, apiculate, sparsely strigose and ciliate, with a single prominent vein beneath; proper stem leaves few, like the basal ones but rather abruptly smaller, the upper gradually reduced, the middle ones about 8-20 mm. long and 1-3.7 mm. broad, those of the branches reduced to narrowly oblanceolate or linear bracts; involucre conical or broadly subcylindric, 5.2-6.5 mm. tall; phyllaries imbricated in about 3 to 5 series; ray flowers 7 to 9, the rays 2.5-3.5 mm. long and pink or white; disk florets 10 to 15, the corollas yellow; achenes 2.2-2.8 mm. long, those of the ray flowers 3-ribbed, those of the disk flowers 3-, 4-, or 5-ribbed; pappus of 5 hyaline fimbriate-ciliate scales united up to halfway into a cuplike crown 0.25-0.85 mm. long, similar in disk and ray florets but that of the latter usually shorter; awns absent or 1 or 5, 0.8-2.5 mm. long. Rare in the Del Norte Mts. in the Trans-Pecos, spring (?); Tam., N.L., Coah. and Tex.

4. *Chaetopappa bellidifolia* (Gray & Engelm.) Shinn. Taprooted annual; stems single or few, 8-40 cm. tall, loosely and rather widely bushy-branched from the base, branches ascending or spreading-ascending; stem and main branches rather coarsely and densely pubescent with widely spreading hairs; pubescence of branchlets and peduncles spreading to loosely appressed; basal leaves (which soon wither) oblanceolate to oblong-spatulate, hispid on both surfaces and ciliate on the margin especially in the narrowed basal portion, subacute or obtuse, 7-35 mm. long, the subpetiolar base about half as long,

3-8.5 mm. wide; stem leaves similar, the upper gradually smaller, the subpetiolar base shorter and less distinct; involucre narrowly to broadly conical, 3.8-4.5 mm. high; phyllaries imbricated in about 3 or 4 series; ray flowers 6 to 15, 2.6-4 mm. long, violet or lavender to violet-blue; disk flowers 8 to 22, yellow; achenes subterete, somewhat clavate, 10-ribbed, glabrous or sparsely pubescent, 1.7-2.2 mm. long; pappus usually none, represented by a thickened ring on the summit of the achene or rarely by a minute erose crown. Abundant in open calcareous places, Edwards Plateau, spring; endemic.

5. *Chaetopappa asteroides* (Nutt.) DC. Taprooted annual; stem single or less often several, 35-300 mm. tall when in flower, simple or usually divaricately branched; branches spreading-ascending to horizontal, rather distant and elongate, each ultimate branchlet or peduncle terminated by a solitary small head; stems and branches with appressed to spreading pubescence; basal rosette leaves (which soon wither) oblanceolate to spatulate-orbicular, obtuse, apiculate, loosely strigose, hispid-ciliate, 4-25 mm. long, with a subpetiolar base one half to two thirds the total length, 1-5 mm. broad; stem leaves similar but narrower, the upper gradually smaller, those of the branches reduced to linear or subulate bracts; involucre 3.5-4.5 mm. high, cylindrical to conical; phyllaries imbricated in 3 or 4 series; ray flowers 5 to 18; rays 2.5-4 mm. long, white, sometimes turning lilac or rosy-violet; disk flowers 6 to 25, the corollas yellow; achenes 1.6-2 mm. long, prismatic, 5-nerved or -ribbed, pubescent; pappus of 5 hyaline scales 0.1-0.8 mm. long alternating with as many awns 1-3 mm. long, or awns less commonly absent; pappus of ray like that of the disk or shorter, rarely the reverse. Incl. var. *imberbis* Gray and var. *grandis* Shinnars. Common in open sandy places, e., s.e. and n.-cen. Tex., Rio Grande Plains and the Llano region of the Edwards Plateau, rarely w. of the e. part of the Plains Country, Mar.-June; Mo., Kan., Ark., La. and Tex.

6. *Chaetopappa bellioides* (Gray) Shinnars. Perennial but flowering the first year and appearing annual, with a taproot or ultimately a forked caudex; stems several to many, 35-280 mm. tall when in flower; basal rosettelike cluster of leaves oblanceolate or spatulate, hispidly strigose and ciliate, 5-47 mm. long, the subpetiolar base being 3-27 mm. of that length, 2-8 mm. broad, soon withering and disappearing; stem leaves narrower, the upper gradually smaller; heads solitary and terminal on the stems, the later ones on peduncles naked for as much as 25 mm. below the head; involucre hemispherical or broadly campanulate, 4-5.1 mm. high; phyllaries imbricated in about 4 or 5 series, broadly lanceolate or oblong, appressed-pubescent on the back, the broad white scarious margin lacerate-ciliate; middle phyllaries 1-1.3 mm. broad; ray flowers 12 to 18, the ray 3.5-5.2 mm. long; disk flowers 33 to 106; achenes about 2 mm. long; pappus of 5 narrowly oblong hyaline erose scales 0.6-1.8 mm. long (often united at base) and as many scabrous setiform awns 2.2-3 mm. long. Frequent in open calcareous uplands, s.w. part of Edwards Plateau, rare in the Trans-Pecos and Rio Grande Plains, Spring-fall; Agh., Chih., Coah., N.L., S.L.P., Zac. and Tex.

Another variety is known from the mountains of west-central Tamaulipas.

36. ERIGERON L. FLEABANE

Herbs, usually pubescent; leaves alternate, essentially sessile (the blades often narrowed to subpetiolar bases); heads solitary, terminating ascending branches which are often somewhat pedunculiform; involucre usually hemispheric, usually 3-8 mm. tall; receptacle flat or often convex, essentially smooth; phyllaries in only about 2 or 3 series, not or only weakly graduated, usually lance-subulate, acute, mostly herbaceous with very narrow scarious margins; ray flowers present, usually in about 2 series, pistillate, fertile; rays linear, white or pale shades of bluish or rose, never yellow; disk flowers perfect and fertile (except sometimes a few central ones abortive); corollas yellow, with a very short basal tube and a slightly broader subcylindric 5-toothed limb; achene laterally flattened, strongly 2-ribbed (or the extreme peripheral ones often 3-ribbed), nearly glabrous; pappus various, either essentially absent or a palaceous crown or of fragile capillary bristles and short scales or usually of unequal capillary bristles, these often in 2 size-classes (the pappus then said to be "double").

With about 200 species, nearly cosmopolitan, *Erigeron* is a difficult group of daisylike plants, often simulating such plants as *Aphanostephus*, *Astranthium*, *Dichaetophora*, etc.

1. Strong perennials from woody caudexes or stout woody roots (2)
1. Weak or short-lived perennials and biennials or annuals, with slender taproots or fibrous root systems (3)
- 2(1). Lower leaves oblanceolate to ovate, 3-15 cm. long including the subpetiolar bases, 10-33 mm. broad; leaves of midstem slightly smaller, lanceolate to ovate or oblong 1. *E. superbus*.
2. Lower leaves oblanceolate; leaves of midstem nearly linear, usually less than 2 cm. long and 2 mm. broad 2. *E. Bigelovii*.
- 3(1). Pappus of both kinds of flowers merely a minute cartilaginous ring or a scaly crown less than 0.2 mm. long (4)
3. Pappus otherwise (5)
- 4(3). Achene about 1.3 mm. long; rays 2.5 mm. long ... 9. *E. mimegletes*.
4. Achene about 0.6 mm. long; rays about 3.6 mm. long ..13. *E. Geiseri* var. *calcicola*.
- 5(3). Pappus of ray and disk unlike, that of the disk flowers composed of bristles and short outer setae, that of the ray flowers lacking the longer bristles (6)
5. Pappus of ray and disk essentially similar, of bristles, sometimes also with outer setae or squamellae (8)
- 6(5). Foliage ample; plants mostly 6-15 dm. tall; stem pubescence long, spreading 5. *E. annuus*.
6. Foliage sparse; plants mostly 3-7 dm. tall; stem pubescence short and appressed at least in the upper part of the stem (7)
- 7(6). Rays 0.8-1.2 mm. broad; basal leaves usually very shallowly few-lobed around the upper margins 7. *E. Traversii*.
7. Rays 0.5-1 mm. broad; basal leaves usually merely weakly toothed or slightly notched or even entire 6. *E. strigosus*.
- 8(5). Pappus simple (9)
8. Pappus double (13)
- 9(8). Annuals, the slender elongate taproot obviously longer than the lateral roots and not at all woody (10)
9. Biennials or perennials (often short-lived) with a fibrous root system or a definitely ligneous taproot (11)
- 10(9). Plants taking on a grayish cast due to relatively dense pubescence; leaves (of the part of the stem which is 5-10 cm. below the heads) 4 to 8 times as long as broad, long-narrowed to the linear base15. *E. Bellidiastrum*.
10. Plants greenish, relatively sparsely pubescent; leaves (of the part of the stem which is 5-10 cm. below the heads) 2 to 4 times as long as broad, often truncate basally and partially clasping14. *E. tenellus*.
- 11(9). Trailing plants of sandy soil near the coast; stems often subrhizomatous12. *E. myrionactis*.
11. Erect plants; rhizomes usually absent (except in *E. pulchellus*) (12)
- 12(11). Plants with superficial rhizomes; disk corollas 4.5-6 mm. long; rays 1 mm. broad or broader 3. *E. pulchellus*.
12. Rhizomes absent; disk-corollas 2.5-3.2 mm. long; rays 0.5 mm. broad or narrower 4. *E. philadelphicus*.
- 13(8). Annual, the slender elongate taproot obviously longer than the lateral roots and not at all woody; pappus of about 10 to 12 fragile capillary bristles alternating with about the same number or fewer extremely minute scales13. *E. Geiseri* var. *Geiseri*.
13. Biennials or perennials (often short-lived) with a fibrous root system or a definitely ligneous taproot; pappus of 10 to 30 capillary bristles and some much shorter microscopic bristles (these rarely united into fimbriate scales) (14)
- 14(13). Essentially all the hairs of the stem appressed or ascending; some branches long-trailing; mountains of the Trans-Pecos11. *E. flagellaris*.
14. At least a few of the hairs (at least on the lower part of the stem) spreading; branches only occasionally trailing (15)

- 15(14). Root system fibrous, the taproot itself stubby and long-surpassed by the adventitious and/or lateral roots; rays 2.5-4.5 mm. long, 0.3-0.5 mm. broad
 8. *E. tenuis*.
15. Roots few, the taproot pronounced, usually ligneous; rays 4-8 mm. long, 0.7-1.2 mm. broad 10. *E. modestus*.

1. *Erigeron superbus* Rydb. Strongly perennial herb 15-60 cm. tall, from woody caudexes; lower leaves oblanceolate to ovate, 3-15 cm. long (including the subpetiolar base), 10-33 mm. broad; heads usually fewer than 8 per plant; involucre 7-9 mm. high; rays 40 to 80, 12-20 mm. long, 1-2 mm. broad, blue or rose-purple, rarely white; pappus double, of bristles. Rare in higher parts of Davis Mts. in the Trans-Pecos, Sept.; Wyo., Colo., Ut., Ariz., N.M. and Tex.

2. *Erigeron Bigelovii* Gray. Strongly perennial herb 1-3 dm. tall, from stout woody roots; stems 1-3 dm. long, ascending, hispid-hirsute with stiff spreading hairs; leaves pubescent like the stems, the lowermost ones oblanceolate and deciduous, the others numerous and linear or nearly so, not more than about 2 cm. long and 2 mm. broad; involucre 4-5 mm. high; rays about 30 to 50, pink, purple or violet, 5-7 mm. long, 0.9-1.2 mm. broad; pappus double, of capillary bristles, alike in ray and disk. Rare in the Franklin Mts. near El Paso in the Trans-Pecos, spring (Apr.-May); endemic.

3. *Erigeron pulchellus* Michx. ROBIN'S-PLANTAIN. Hirsute short-lived erect perennial, 15-60 cm. tall, with fibrous root system and superficial rhizomes; basal leaves oblanceolate to suborbicular, tapering to short subpetiolar bases, 2-13 cm. long, 6-50 mm. broad, shallowly toothed above the middle or subentire; stem leaves lanceolate or oblong to more commonly ovate, obtuse or rounded to slightly acute at apex, entire or nearly so, the middle and lower leaves 2-7 cm. long and 6-20 mm. broad; heads few in a flat-topped arrangement; disk corollas 4.5-6 mm. long or usually longer; rays 1(-2) mm. broad, 6-10 mm. long; pappus simple, of capillary bristles, alike in ray and disk. Rare in open places, deep sandy soil, e. and s.e. Tex., Apr.-May; most of e. U.S.

4. *Erigeron philadelphicus* L. PHILADELPHIA FLEABANE. Short-lived erect perennial 2-7 dm. tall, with fibrous root system; rhizomes absent; stems and leaves usually with spreading hairs; basal leaves narrowly to broadly oblanceolate or even obovate, coarsely crenate-toothed or lobed, rounded at the apex, tapering to the short subpetiolar base, mostly not more than 15 cm. long and 3 cm. broad; stem leaves clasping basally, crenate to dentate or subentire; head region not crowded; involucre 4-6 mm. high; disk corollas 2.5-3.2 mm. long; rays 5-10 mm. long, 0.2-0.5 (-0.6) mm. broad, never bluish; pappus alike in ray and disk, simple, of capillary bristles (often shorter than the corolla in the disk). Frequent, e., s.e. and n.-cen. Tex. and Edwards Plateau, usually in moist loam, spring; most of U.S. and s. Can.

Reports of *E. quercifolius* Lam. in Texas are based partly on specimens of *E. philadelphicus*.

5. *Erigeron annuus* (L.) Pers. DAISY-FLEABANE. Short-lived perennial mostly 6-15 dm. tall, with fibrous root systems; pubescence of stem long, spreading; basal leaves to 1 dm. long (not including the base) and 7 cm. broad, elliptical to broadly ovate or suborbicular, coarsely toothed, contracted into a subpetiolar base to 1 dm. long; stem leaves numerous, most of them toothed, rarely subentire; head-bearing region large and leafy; rays 80 to 125, 0.5-1 mm. broad, to 10 mm. long; disk corolla 2-2.8 mm. long; pappus of rays simple, of a low ring of very short bristles (the longer capillaries absent); pappus of disk double, with capillary bristles plus the very much shorter bristles such as those present in the rays. Rare in open ground, e. and n.-cen. Tex. (Bowie and Grayson cos.), spring; most of U.S. and s. Can.

6. *Erigeron strigosus* Willd. WHITE-TOP. Fibrous-rooted short-lived perennials 3-7 dm. tall; stem pubescence short and appressed at least in the uppermost part of the stem; basal leaves usually merely weakly toothed or slightly notched or even less commonly entire, narrowed to a long subpetiolar base; stem leaves often sparse and reduced, linear to lanceolate, entire on the lower and middle ones or slightly toothed; head arrangement never crowded, often very sparse; involucre 2-5 mm. high; rays 50 to 100, 0.4-1 mm. broad, to 6 mm. long; disk corollas 1.5-2.6 mm. long; pappus of ray and disk unlike, that of the disk flowers composed of bristles and short outer setae, that of the ray flowers lacking the longer bristles. Incl. var. *Beyrichii* (Fisch. & Mey.) Gray. Infrequent, open loamy ground, e. and n.-cen. Tex., Plains Country and extreme n. Rio Grande Plains, Apr.-June (-Sept.); most of U.S. and s. Can.

7. *Erigeron Traversii* Shinn. Short-lived fibrous-rooted perennial, mostly 3-7 dm. tall; stem pubescence short and appressed at least in the uppermost part of the stem; basal leaves usually very shallowly few-lobed around the upper margins; upper foliage very sparse; rays about 70, 0.8-1.2 mm. broad, 5-8 mm. long; pappus of ray and disk unlike, that of the disk flowers composed of bristles and short outer setae, that of the ray flowers lacking the longer bristles. Infrequent in sandy soil, e. Tex., Mar.-Apr.; also La.

Flowering, on the average, earlier in the spring than *E. strigosus*, to which it is exceedingly closely related.

8. *Erigeron tenuis* T.&G. Fibrous-rooted short-lived perennial (the taproot stubby and long-surpassed by the adventitious and/or lateral roots); at least a few of the hairs (at least on the lower part of the stem) spreading; branches only occasionally trailing; basal leaves oblanceolate, 5-10 cm. long including the subpetiolar base, either subentire or usually with a few shallow (rarely deep) pinnately disposed lobes; stem leaves sparse and reduced, often oblong or oblanceolate, infrequently nearly linear, basally subamplexicaul; rays 2.5-4.5 mm. long, 0.3-0.5 mm. broad; pappus of ray and disk essentially similar, double, of about a dozen capillary bristles and some much shorter microscopic bristles. Frequent in open often tight clay soils, e., s.e. and n.-cen. Tex., rare w. to Burnet Co. on the Edwards Plateau, spring; Mo., Ark., La., Okla. and Tex.

The erroneous reports of *E. quercifolius* Lam. from Texas have been based largely on specimens of *E. tenuis*.

9. *Erigeron mimegletes* Shinn. Plant annual from a slender vertical taproot; stems 1 to few, 20-55 cm. tall, sparsely to densely hispid-pubescent; basal and lower stem leaves oblanceolate, with a few coarse teeth, narrowed to the long linear subpetiolar base, in all 3-6 cm. long; stem leaves sparse, narrowly oblong or oblong-lanceolate, about 2-3 cm. long, 3-7 mm. broad; heads not crowded; involucre 3-3.5 mm. high; receptacle conical; rays to 2.5 mm. long and 0.5 mm. broad, numerous; disk corolla about 1.9 mm. long; achene about 1.3 mm. long; pappus of both kinds of flowers represented merely by a blunt whitish cartilaginous ring on the summit of the achene. Infrequent and local, w. part of Edwards Plateau (Crockett, Edwards, Schleicher, Sutton and Val Verde cos.), Apr.-June (-July-Oct.); endemic.

10. *Erigeron modestus* Gray. Perennial, usually about 1-2 (-3) dm. tall and often grayish-pubescent, sometimes short-lived (flowering the first year) with few roots, the taproot pronounced and usually ligneous, often a few other roots present; at least a few of the hairs (at least on the lower part of the stem) spreading; branches only occasionally trailing; basal leaves oblanceolate, several cm. long, usually with a few coarse teeth on pinnate lobes, narrowed to the subpetiolar base; stem leaves mostly narrowly oblong or linear to narrowly oblanceolate, usually 1-2 (-3) cm. long, always extremely narrow at the very base; rays 4-8 mm. long, 0.7-1.2 mm. broad; pappus of ray and disk essentially similar, double, of about a dozen capillary bristles and some much shorter microscopic bristles. *E. divergens* T.&G. var. *cinereus* Gray, *E. nudiflorus* Buckl., *E. commixtus* Greene, *E. Tracyi* Greene, *E. plateauensis* Cronq., *E. lobatus* A. Nels. var. *Warnockii* Shinn. Abundant in open usually dry calcareous uplands, w. half of Tex., e. to Young, Palo Pinto, Somervell and Travis cos., spring, usually; N.M. and Tex., Okla., Ariz., Nev. and n.w. Mex.

11. *Erigeron flagellaris* Gray. RUNNING FLEABANE. Short-lived perennial with few roots, the taproot pronounced and usually ligneous and often a few other roots present; some branches long-trailing; essentially all the hairs of the stem appressed or ascending; otherwise extremely similar to *E. modestus*; pappus of ray and disk essentially similar, double, of about 10 to 15 capillary bristles and some much shorter microscopic bristles. Infrequent in mts. of Trans-Pecos; S.D., Wyo. and Nev. s. to Tex., N.M. and Ariz.

12. *Erigeron myrionactis* Small. Perennial with stems stoloniferous or subrhizomatous in coastal sands, rooting at the nodes, prostrate; stems often to 1 m. long; herbage with spreading hairs; leaves obovate to spatulate or cuneate, 2-8 cm. long, 5-25 mm. broad, coarsely few-toothed near the end; heads solitary, borne about 1 dm. above ground; rays very numerous, white, 5-7 mm. long, about 0.3 mm. broad; disk corollas 3.5-4.5 mm. long; pappus of ray and disk essentially similar, simple, of about 20 to 25 fragile capillary bristles. Frequent in coastal sands, s.e. Tex. and Rio Grande Plains, spring-fall; La., Tex. and Tam.

13. *Erigeron Geiseri* Shinners. Annual, 1-3 dm. tall, the slender elongate taproot obviously longer than the lateral roots and not woody; hair spreading in lower part of stem, ascending or subappressed above; lower leaves spatulate-ob lanceolate to oblanceolate, several cm. long, much-narrowed to the linear subpetiolar base; stem leaves oblong to oblanceolate, ascending, 1-4 cm. long, 2-10 mm. broad; heads solitary at the ends of the branches; involucre 3-3.7 mm. high; receptacle blunt-conical; rays 50 to 70, about 3.6 cm. long and 0.5 mm. broad; disk corolla about 1.6 mm. long; achene about 0.6 mm. long; pappus essentially similar in ray and disk, differing in the varieties below.

Var. *Geiseri*. Pappus represented by 10 or more capillary bristles and about as many minute setuliferous scales. Locally abundant in open usually sandy areas, n. to Young and Hood cos., s. to DeWitt and Nueces cos., e. to Brazoria, Washington and Brazos cos. and w. to Burnet and Young cos., spring; endemic.

Var. *calcicola* Shinners. Pappus represented by a minute denticulate scaly or subcartilaginous crown less than 0.2 mm. long. Known only from near Leakey, Real Co., Edwards Plateau, Apr.; endemic.

14. *Erigeron tenellus* DC. Annual (1-) 2-3 (-4) dm. tall, the slender elongate taproot obviously longer than the lateral roots and not woody; plants greenish, relatively sparsely pubescent; stems often several from the base when plant is not crowded; basal leaves oblanceolate, 3-10 cm. long, with a few pinnate lobes; leaves (of that portion of the stem which is 5-10 cm. below the heads) 2 to 4 times as long as broad, often truncate basally and partially clasping; heads solitary at the ends of the branches; involucre 2-3 mm. high; rays 2-3 mm. long; pappus of ray and disk alike, simple, of about 10 fragile capillary bristles. Infrequent on exposed loamy soil, Rio Grande Delta (Cameron and Hidalgo cos.), rare in Kleberg Co. on Rio Grande Plains, Feb.-May; also Tam.

15. *Erigeron Bellidiastrum* Nutt. WESTERN FLEABANE. Annual, the slender elongate taproot obviously longer than the lateral roots and not woody; plants 1-5 dm. tall, taking on a grayish cast due to relatively dense pubescence; basal leaves (soon withering) oblanceolate, nearly entire; stems usually solitary at the base, often with many ascending branches above; leaves (of that portion of the stem which is 5-10 cm. below the heads) 4 to 8 times as long as broad, long-narrowed to the linear base; heads terminating the numerous branches but not crowded; involucre 3-5 mm. high; rays 30 to 70, 4-6 mm. long, about 1 mm. broad; disk corollas 2.5-3 mm. long; pappus similar in ray and disk, simple, of about 15 very fragile capillary bristles. Incl. var. *robustus* Cronq. Locally abundant in open sandy loam, Plains Country s. to Ward and Winkler cos., May-Aug.; Colo. and S.D., s. to Tex. and N.M.

There is a rare, unnamed race of this species in Trans-Pecos Texas (El Paso, Hudspeth, Presidio and Reeves cos.) marked by the dense, grayish hispid pubescence and small stature (8-11 cm.).

37. CONYZA L.

Annual taprooted herbs, often much-branched, variously pubescent; leaves alternate, entire to dentate or pinnately to bipinnately lobed, usually oblanceolate in general outline; heads variously disposed; receptacle somewhat convex but often with a depressed area in the center, naked; involucre broadly turbinate, 3-8 mm. high; phyllaries in 2 or 3 series, weakly if at all imbricate, mostly thin-herbaceous or with scarious margins, ascending, appressed, usually pubescent on the back; *ray flowers* pistillate, fertile, in 1 to 3 rows on the periphery; corolla cream-colored, with a filiform tube and an extremely minute "ray," this ray much shorter than the tube and often merely represented by an oblique orifice of the tube; *disk flowers* perfect, fertile; corolla cream-colored, with a tube and a 5-toothed limb; achene laterally compressed, 2-ribbed (or the outermost nearly trigonous and 3-ribbed), narrowly obovate in outline, usually pubescent; pappus of both kinds of flowers of bristles which in some species are of 2 size-classes (the outer smaller) and in some species are capillary and fragile, in others stiff and persistent.

More than 50 species, chiefly tropical and subtropical in both hemispheres.

1. Stem leaves slightly narrowed to the clasping base which is about 0.5 to 1 times as broad as the broadest part of the leaf 6. *C. Coulteri*.

1. Stem leaves much-narrowed at base or linear throughout, not clasping (2)

- 2(1). "Ray" flowers in 2 or 3 rows, their corollas usually shorter than the pappus (almost as long in *C. bonariensis*) (3)
- 2. Ray flowers in a single peripheral row, their corollas usually longer than the pappus (5)
- 3(2). Stems and leaves whitish floccose-pubescent5. *C. flaginoides*.
- 3. Stems and leaves variously pubescent but not floccose (4)
- 4(3). Leaves bipinnatifid4. *C. sophiaefolia*.
- 4. Leaves entire to shallowly pinnatifid1. *C. bonariensis*.
- 5(2). Stems glabrous or pubescent with widely spreading hairs; plants normally erect, with stem branching well above the base; larger stem leaves more than 2 mm. broad2. *C. canadensis*.
- 5. Stems with antrorsely appressed hairs; plants usually freely branched at all levels, the branches weak, the entire plant 1-3 dm. tall; larger leaves about 2 mm. broad ...
.....3. *C. ramosissima*.

1. *Conyza bonariensis* (L.) Cronq. Robust annual usually 1 m. tall, somewhat branched near the base, otherwise simple except in the upper 2-5 dm. of the length; stem leaves numerous, ascending or subappressed, usually slightly grayish-green, not clasping, narrowed at the base, in the upper half of the stem 3-6 cm. long and 5-10 mm. broad, saliently toothed (some of those of the lower half of the stem often saliently lobed); head-bearing region of the plant 2-5 dm. long, 5-10 cm. thick, cylindric, rounded apically; heads about 7 mm. high; ray flowers in 2 or 3 rows, their corollas usually shorter than the pappus or almost as long in this species. Rare in e. Tex., collected once near College Station, Brazos Co. and once at Orange, Orange Co., July; widespread in the warmer parts of Am., n. to Fla. and Tex.

2. *Conyza canadensis* (L.) Cronq. HORSE-WEED. Robust annual, virgately erect, 1-2 m. tall; stems nearly simple, glabrous or pubescent with widely spreading hairs; leaves linear-oblancheolate, those of the upper half of the stem 4-10 cm. long and 3-6 mm. broad, often saliently toothed, pubescent, not clasping, narrowed to the base; head-bearing region much as in *C. bonariensis* but perhaps usually more ample; heads 3-5 mm. high; ray flowers in a single peripheral row, their corollas usually longer than the pappus. *Erigeron canadensis* L., *Leptilon canadense* (L.) Britt. Nearly throughout the state, Aug.-Nov.; widespread in temp. N.A.

The species has been separated into 3 weak varieties.

Var. *canadensis* is the abundant and familiar phase of n. and cen. U.S.; in Tex. it is uncommon, restricted to n.-cen Tex. and Plains Country; marked by stems with spreading pubescence.

Var. *glabrata* (Gray) Cronq. replaces var. *canadensis* throughout much of s.w. U.S.; in Tex. it is the most widespread and common of the three varieties; it is marked by nearly glabrous stems and stramineous phyllaries.

Var. *pusilla* (Nutt.) Cronq. is the race of s.e. U.S., marked by nearly glabrous stems and tips of phyllaries stained purplish-red; e. Tex.

3. *Conyza ramosissima* Cronq. Annual herb, much-branched from the base and at all other levels; stems with antrorsely appressed hairs about 1 mm. thick basally, 1-2 (-3) dm. long; leaves ascending, 5-13 mm. long, 0.5-1 (-2) mm. broad, grayish-pubescent, linear; heads not crowded, borne in a zone at the rounded top of the plant, 3-5 mm. high; ray flowers in a single peripheral row, their corollas usually longer than the pappus. *Erigeron divaricatus* Michx., *Leptilon divaricatum* (Michx.) Raf. Locally frequent in waste places and lawns, usually in black calcareous clay soil, n.-cen. Tex., less frequent w. to Plains Country, June-Sept.; Ala., La., Miss. and Tex., n. to Wisc. and N.D.

4. *Conyza sophiaefolia* H.B.K. Annual herb, simple or much-branched from the base, 1-5 dm. tall; leaves rather deeply pinnately or often even bipinnately lobed, with some essentially appressed and rather sparse pubescence; the upper 1-3 dm. of each stem bearing numerous heads in a subracemose arrangement; heads numerous, crowded, 2-3 mm. high; ray flowers in 2 or 3 peripheral rows, the corollas shorter than the pappus. *Eschenbachia tenuisecta* (Gray) Woot. & Standl. Infrequent to rare in igneous rock, Chisos and Davis mts. in the Trans-Pecos, Aug.-Oct.; Tex., N.M., Ariz. and arid-temp. parts of n. and cen. Mex.

5. *Conyza filaginoides* (DC.) Hieron. Annual herb 2-8 dm. tall, with numerous ascending branches in the middle portion, the entire plant linear or somewhat spindle-shaped, rigidly erect, sparsely floccose-tomentose, the main stem 1-3 mm. thick basally; leaves narrowed basally, not clasping, with a few salient teeth marginally or the lower ones very shallowly lobed, in over-all shape linear-oblongate, 1-3 cm. long, 1-3 mm. broad; heads crowded on the lateral as well as the main branch in a spikelike arrangement, each head 5-6 mm. high; ray flowers in 2 peripheral rows. Chisos Mts. in the Trans-Pecos, 6,000-7,500 ft. elev., infrequent, Sept.; also mts. of Mex.

6. *Conyza Coulteri* Gray. Annual herb 2-10 dm. tall, rather rigidly erect, sparingly with ascending branches; leaves narrowly obovate or oblong, with a few salient teeth or shallow lobes, apically rounded, basally rounded or usually with auricles and somewhat clasping; heads numerous and crowded in the upper 1-3 dm. in a subpaniculiform arrangement; heads about 4 mm. high; ray flowers in 2 or 3 peripheral rows. *Eschenbachia Coulteri* (Gray) Rydb. Frequent in the Trans-Pecos, less common in Edwards Plateau and rare in Rio Grande Plains, June-Sept.; s.w. U.S. and Mex.

This plant is known to be toxic to livestock.

38. BOLTONIA L'HÉR.

Perennial herbs 2-10 dm. tall, essentially glabrous, with taproot plus fibrous root systems and very slender creeping rhizomes (these easily broken off); stems slender, branched, wiry, striate-angled, uppermost parts of the branches pedunculiform; leaves linear, those of midstem 1-3 (-12) cm. long, green, alternate, entire, essentially sessile, grading upward into leaves as small as 1-3 mm. long; heads small, solitary at the ends of the branches, 5-10 mm. across (excluding rays); receptacle conic or hemispheric, naked; involucre hemispheric, 2-4 mm. high, of about 3 series of slightly imbricated lanceolate appressed phyllaries with pale scarious margins and darker midribs which are slightly expanded toward the apex; *ray flowers* present, pistillate, fertile; rays white (or pink when dry) or lilac, never yellow; *disk flowers* numerous, perfect, fertile; corollas yellow, the tube not sharply demarcated from the gradually ampliate shallowly 5-lobed limb; achenes laterally compressed, brown, with 2 wings (or in the ray achenes 3-winged); pappus of a number of small pointed scales or broad bristles plus 2 (in ray flowers 3) longer awns over the wings of the achene.

About 7 species occur in North America; one in eastern Asia.

1. Phyllaries 0.5-1 mm. broad; rays 8-15 mm. long, lilac ..1. *B. asteroides*.

1. Phyllaries 0.2-0.5 mm. broad; rays 5-8 mm. long, usually pure-white when fresh ...
.....2. *B. diffusa*.

1. *Boltonia asteroides* (L.) L'Hér. Characters as in the key. *B. latisquama* Gray. Rare in e. and s.e. Tex., summer-fall; most of e. U.S.

2. *Boltonia diffusa* Ell. Characters as in the key. Infrequent in e. and s.e. Tex., summer-fall; Ga. and Gulf States, n. to Ky., Ill. and Mo.

39. TOWNSENDIA Hook.²⁰⁰

Annual, biennial or perennial herbs with taproots, 1-25 cm. tall, sparingly branched, often grayish with appressed pubescence; leaves alternate, oblanceolate, entire, grayish-green, essentially sessile though long-narrowed basally, 1-10 cm. long, not greatly reduced upward, the uppermost usually subtending the head in the manner of an auxiliary bract; heads solitary on the branches; receptacle convex; phyllaries in 3 to 5 series, strongly imbricated, appressed, lanceolate, acute with thin pale lacerate or fimbriate margins but mostly dark (greenish or purplish), thick-herbaceous, especially dark in a large elliptical median zone in the upper half; *ray flowers* rather numerous, pistillate, fertile; corolla white or bluish-white, or purplish-white, never yellow, the pappus similar to that of the disk but shorter or else united into a scaly corona; *disk flowers* perfect, usually fertile; corolla yellow (also frequently tinged with pink or purple), the pappus of

²⁰⁰ Adapted from John H. Beaman in Contr. Gray Herb. n.s. 183:1-151. 1957.

a single series of subulate broad (dorsiventrally flattened) barbellate unequal bristles (some of these divided at top into several bristle-tips); achene oblanceolate, somewhat laterally compressed, 2-ribbed with ascending capitate hairs.

About 20 species in western North America and Mexico.

1. Plant a rosette, rarely to 5 cm. tall; heads appearing at ground level surrounded by a mass of leaves1. *T. exscapa*.
1. Plants caulescent with stems (3-) 10-30 cm. long (2)
- 2(1). Plant annual with several decumbent or ascending stems from the base, each stem about 1 mm. thick2. *T. annua*.
2. Biennial or weak perennial with a single erect stem 3-5 mm. thick at ground level ..
.....3. *T. texensis*.

1. *Townsendia exscapa* (Richards.) Porter. Dwarf perennial from branched woody rootstocks; aerial shoots barely protruding out of the ground, comprising merely a dense rosette of leaves and a solitary central large head 3-4 cm. across. Infrequent in open grama grasslands in the Trans-Pecos, rare in Plains Country and extremely rare e. to n.-cen. Tex., Mar.-May; B.C. to Man. and s. to Chih. and Tex.

2. *Townsendia annua* Beaman. Annual with several decumbent or ascending stems from the base, each stem 3-20 (-25) cm. long and about 1 mm. thick; involucre about 1 cm. high and broad; disk pappus 1.8-3 mm. long, almost always shorter than the corolla. Rare in calcareous deserts in the Trans-Pecos (El Paso and Hudspeth cos.), Mar.-May (also Aug.); Colo., Ut., Ariz., N.M. and Tex.

3. *Townsendia texensis* Larsen. Biennial or weak perennial, at ground level with a single stem 3-5 mm. thick, shortly above branching into a number of ascending stems, the whole plant 1-3 dm. tall; involucre about 1 cm. broad and high; rays about 1 cm. long, disk pappus about 3.5 mm. long. Infrequent in calcareous prairies, higher parts of Plains Country, May-Sept.; also Okla.

40. ASTRANTHIUM Nutt.²⁰¹

Taprooted annuals 5-40 cm. tall, branched; branches ascending, leafy in the lower part; leaves spatulate or obovate-spatulate, a few cm. long, essentially entire, blunt, narrowed to a subpetiolar base, the upper parts of the branches erect, naked and pedunculiform for the last few cm.; heads solitary at the ends of the branches; involucre saucer-shaped, 3-6 mm. high; phyllaries in a single series, green, membranous; receptacle very high-conic, pointed; *ray flowers* present, pistillate, fertile, the rays white or upon drying tinged with blue or red; *disk flowers* numerous, perfect, fertile; corollas yellow, minute, the basal tube sharply distinguished from the abruptly amplified 5-lobed limb; achenes slightly laterally compressed, obovate, glochidiate-pubescent with bifurcate hairs, brown, elliptic in transection, with 2 rounded ribs at the narrower ends of the ellipse; pappus absent or a minute ring or crown.

A North American genus of a few species.

1. Plant 5-30 cm. tall; stems erect or ascending even at the base; leaves not densely crowded, the internodes almost as long as the leaves; involucre 2.5-4.5 mm. high; east of the Trans-Pecos1. *A. integrifolium*.
1. Plant 5-40 cm. tall; stems often decumbent basally but mostly ascending; leaves densely crowded; involucre 4-6.8 mm. high; Trans-Pecos area
.....2. *A. robustum*.

1. *Astranthium integrifolium* (Michx.) Nutt. var. *triflorum* (Raf.) Shinners. WESTERN DAISY. Characters as in the key. Incl. subsp. *ciliatum* (Raf.) DeJong. Abundant in open sandy places, n.-cen., e. and s.e. Tex., infrequent in e. part of Plains Country and in Rio Grande Plains, (Mar.-) Apr.-May (-July); Kan., Ark., Okla., Tex. and N.L.; the species as a whole also in Ky., Tenn., Mo., Ala., Miss. and Ga.

²⁰¹ Adapted from D. C. D. DeJong in Publ. Mich. State Univ. Mus. 2:429-528. 1965.

2. *Astranthium robustum* (Shinners) DeJong. Characters as in the key. Frequent in open sandy places in parts of the Trans-Pecos (Pecos, Brewster, Jeff Davis, Presidio and Reeves cos.), Mar.-June; endemic.

41. *DICHAETOPHORA* GRAY²⁰²

The genus is monotypic.

1. *Dichaetophora campestris* Gray. PLAINS DAISY. Taprooted annual; stems several, erect or decumbent at base, 4-24 cm. tall, simple or sparingly forked, terminating in long naked peduncles 2-9 cm. long below the heads; leaves alternate, oblanceolate, obtuse, entire; heads solitary and terminal on the ends of branches; involucre 3-4.5 mm. high; phyllaries in 2 series, equal, lanceolate, acute, 0.6-1.2 mm. broad, membranaceous, green except for the scarious margin, sparsely and somewhat hispidly appressed-pubescent on the back; receptacle conical to subglobose, naked; ray flowers about 16 to 24, pistillate, fertile; rays white, 5-9 mm. long; disk flowers perfect, fertile; corollas yellow, about 2.5 mm. long, abruptly constricted just above the flared and slightly thickened base to form a very short tube about 0.2 mm. long, the cylindrical-campanulate limb equally 5-lobed at summit; achenes laterally compressed, oval or orbicular in outline, densely pubescent with ascending whitish glandular-tipped hair, surrounded by a broad coriaceous wing margin equal in width to the central portion at either side, densely fringed with glandular-capitate hairs; pappus consisting of 2 antrorsely scabrous erect or diverging equal or slightly unequal awns 0.7-1.1 mm. long, usually with several additional minute awns 0.25 mm. long forming an elliptical ring with long awns on either end over the wing margins. Local in open sandy places of Rio Grande Plains, Feb.-May; Chih., Coah., N.L. and Tex.

Extraordinarily similar in habit and habitat to *Astranthium integrifolium* var. *triflorum* and replacing it geographically. Perhaps the few technical differences in achene and pappus are controlled by a single gene or a few genes and the two taxa could be conspecific. Almost certainly they should be congeneric.

42. *EGLETES* CASS.²⁰³

A tropical American genus of about 10 species.

1. *Egletes viscosa* (L.) Less. Taprooted herb, probably annual; stems subsimple on small plants or bushy branched on larger ones, erect or ascending, 12-60 cm. tall, terete, striate, hispid with widely spreading flat-jointed hairs 1-3 mm. long and pubescent with short widely spreading glandular-capitate hairs 0.1-0.5 mm. long, very densely so in the upper part and on the branches; leaves alternate, simple, the stem leaves usually withering before flowering is over, oblong to obovate, 4-11 cm. long, 2-6 cm. broad, shallowly to deeply pinnatisect or bipinnatisect, the divisions coarsely toothed, the lower ones with narrow clasping subpetiolar bases a third the total length; leaves of upper branches smaller, relatively narrower, less deeply divided, the basal third often entire; upper branchlets or peduncles short, to 2 dm. long, shorter than the small leaves in whose axils they arise; heads rather numerous and crowded toward the tips of the branches; involucre urn-shaped; phyllaries equal or slightly unequal, in 2 or 3 series, 0.8-1.6 mm. broad, lanceolate to ovate-lanceolate, acute, hispid, glandular-pubescent; receptacle conical, naked; ray flowers in one series, 18 to 28, usually shorter or only slightly longer than the phyllaries; rays white, oblong-elliptic, erect, 1.6-2 mm. long, 0.6-0.8 mm. broad; disk flowers perfect; corolla yellow, tubular-funnelform, the limb 4- or 5-lobed; achenes similar in disk and ray, more or less compressed, 2-ribbed, basally constricted, 1.3-1.4 mm. long, glandular-pubescent, with a narrow uneven cartilaginous ring around the summit representing the pappus. Rare in loamy soils at the edges of resacas and lakes on the Rio Grande Delta in Cameron and Hidalgo cos. of extreme s. Tex., summer-fall; Tex., s.e. to C.R.; Cuba.

²⁰² Adapted from L. H. Shinners in *Wrightia* 1:90-94. 1946.

²⁰³ Adapted from L. H. Shinners in *Lloydia* 12:239-250. 1949.

We have the f. *bipinnatifida* Shinnars, characterized by its bipinnatifid leaves having acute dentate lobes. The species is also represented by another variety in Sinaloa.

43. APHANOSTEPHUS DC.²⁰⁴

LAZY DAISY

Annuals or perennials from taproots; leaves alternate, simple, entire to deeply pinnatifid; heads solitary and terminal on the branchlets; peduncles with widely spreading to downwardly appressed hairs; involucre hemispherical; phyllaries narrowly lanceolate to oblong-oblancheolate; receptacle hemispherical to conical, naked, rough; *ray flowers* present, pistillate, fertile; rays white to lavender or rose-purple, never yellow; *disk flowers* numerous, perfect, fertile; corollas yellow, base of tube in some species with thickened or hardened walls, becoming slightly to greatly enlarged in fruit; style branches flattened, tipped with a short broadly triangular acute appendage; achenes of disk and ray similar, columnar or subterete to quadrate, slightly expanded toward the summit, glabrous or sparsely pubescent, with 4 to 12 distinct to very obscure grooves or superficial ridges not differing from the rest of the achene-surface in texture and usually not extending completely from base to summit, true ribs absent; pappus alike in disk and ray, an uneven scaly crown around the periphery of the broad summit of the achene, ciliate or the lobes sharp-pointed or prolonged into narrow awn tips, in all 0.25-1.8 mm. long, or pappus a rather minute crown of equal hairs or cilia 0.1-0.25 mm. long.

A small North American genus.

1. Plant conspicuously hispid with coarse jointed translucent hairs, those of the stem and branches 0.7-2.2 mm. long (easily broken) and spreading at right angles; heads somewhat crowded; peduncles short, naked for 3-12 mm. or (in age) for as much as 22 mm.; rays 12 to 181. *A. pilosus*.
1. Plant soft-pubescent to hispid-pubescent, the hairs widely spreading to deflexed or downwardly subappressed and 0.2-1 mm. long; heads not crowded; peduncles naked for 15-100 mm. or (in age) as much as 150 mm.; rays 16 to 65 or more (2)
- 2(1). Pappus uneven and scaly; scales variously lacerate-ciliate, acute or prolonged into awnlike tips, in all 0.25-1.8 mm. long; corolla bases becoming whitened, hardened and inflated in age to twice or more their original diameter (3)
2. Pappus a ring of very short equal hairs or cilia 0.1-2.5 mm. long; corolla only slightly hardened or thickened at the base or slightly above (4)
- 3(2). Involucres (of well-developed plants) 6-8.2 mm. high; phyllaries in about 4 or 5 series; rays 8-15 mm. long, 1.5-2.3 mm. broad; mature achenes 1.5-2.2 mm. long; pappus an irregular scaly crown or of about 5 unequal acute scales 0.25-0.9 mm. long2. *A. skirrhobasis*.
3. Involucres (4.5-) 5-6.3 mm. high; phyllaries in about 3 series; rays broad for their length, 6-8 mm. long, 1.8-2.4 mm. broad; achenes about 1.5 mm. long; pappus typically of 5 or 10 acute to acuminate or awn-tipped (sometimes also lacerate-ciliate) scales 0.3-1.8 mm. long3. *A. Kidderi*.
- 4(2). Rays 40 to 65 (to 85); achenes 1.5-2 mm. long; hairs of peduncles coarse and hispid, from swollen bases, usually rather sparse, widely spreading, 0.2-0.6 mm. long; lower leaves toothed to deeply pinnatifid, passing rather abruptly into the narrowly oblanceolate or linear entire middle and upper ones, the uppermost 5-30 mm. long and 0.7-2.8 mm. broad; plant clump-forming perennial from obliquely branched or almost creeping woody bases5. *A. Riddellii*.
4. Rays 16 to 42; achenes 1.3-1.5 mm. long; hairs of peduncles rather fine and soft, from slightly swollen bases, sparse to dense, widely spreading to deflexed, 0.3-1 mm. long; lower leaves saliently toothed to deeply pinnatifid, passing gradually into the smaller and less divided middle and upper ones, the uppermost 5-20 mm. long and 0.3-2 mm. broad; plants annual from a taproot, rarely overwintering4. *A. ramosissimus*.

²⁰⁴ Adapted from L. H. Shinnars in *Wrightia* 1:95-121. 1946.

1. *Aphanostephus pilosus* Buckl. Annual 6-33 cm. tall, naked for 3-12 mm. or as much as 25 mm. in age at the top of the stem; whole plant conspicuously hispid-pilose with coarse jointed translucent hairs; involucre 4.5-5.8 mm. long; phyllaries coarsely hispid on the back, in about 3 or 4 series; rays 12 to 18; disk corollas more or less hardened in age but not inflated; pappus a distinct cuplike shallowly lobed lacerate-ciliate scaly crown about 0.3-0.4 mm. long. Locally abundant in prairies, Plains Country, June; also Okla.

2. *Aphanostephus skirrhobasis* (DC.) Trel. Annual to 5 dm. tall, usually much less; ultimate branchlets or peduncles naked for 5-70 mm.; whole plant moderately to very densely gray-pubescent with rather fine and soft hairs; involucre about 6-8.2 mm. high; phyllaries imbricated in about 4 or 5 series; disk flowers more than 250 per head; corollas about 2-2.5 mm. long, the base becoming whitened, hardened and bulbous-enlarged in age, to 1 mm. thick; pappus an irregular lacerate-ciliate scaly crown or of distinct acute scales of unequal length, 0.25-0.9 mm. long.

Two varieties are recognized in Texas.

Var. *skirrhobasis*. Pubescence of the involucre rather coarse and hispid. Abundant in open sandy places, Plains Country and n.-cen. Tex., s. part of e. Tex. and the Llano Region of the Edwards Plateau, infrequent s. to the n. part of the Rio Grande Plains, Mar.-June; also Ark. and Okla.

Var. *thalassius* Shinners. Low spreading habit and soft gray felty pubescence; pubescence of the involucre much finer and softer than in typical variety. Abundant in coastal sands in s.e. Tex. and Rio Grande Plains; also to Fla., La. and Tam.

3. *Aphanostephus Kidderi* Blake. Annual 7-35 cm. tall; involucre 5-6.5 mm. high; phyllaries hispid-pubescent on the back, imbricated in about 3 series; disk corollas with whitish hardened bulbous-enlarged base twice or more the original diameter of the tube; pappus a scaly crown, most typically of 5 or 10 acute to acuminate or awn-tipped often lacerate-fimbriate scales 0.3-1.8 mm. long, conspicuous pointed tips sometimes developed only above the angles of the achene. Abundant in open sandy places, Rio Grande Plains, Apr.-June (-Aug.); Tex., N.L. and Tam.

This species perhaps intergrades to some extent with *A. skirrhobasis*.

4. *Aphanostephus ramosissimus* DC. Annual 5-45 cm. tall; involucre 3.3-7 mm. high; phyllaries hispid-pubescent on the back, imbricated in about 3 series; disk corollas thickened at about 0.5 mm. above the base but only slightly swollen; pappus a minute ciliate crown to 0.25 mm. long. *A. arizonicus* Gray. Exposed calcareous sandy loam, Plains Country, Edwards Plateau, Rio Grande Plains and the Trans-Pecos, rarely e. to n.-cen. Tex., Mar.-June (-Aug.); N.M., Ariz., Tex., Chih., Coah., N.L. and Tam.

5. *Aphanostephus Riddellii* T.&G. Perennial from a woody base; old plants forming dense clumps as much as 35 cm. thick; stems 1-5 dm. tall; long peduncles naked for 2-10 cm. below the heads in flower and 3-15 cm. in fruit; stems, branches and leaves glabrate to moderately densely pubescent with hispid hairs from swollen bases, widely spreading or slightly curled and appearing very slightly deflexed; involucre 4.5-6.2 mm. high; phyllaries hispid on the back, in about 3 or 4 series; corollas only slightly hardened or thickened at base in age, not swollen; pappus a rather minute ciliate crown, rarely as much as 0.2 mm. long. Calcareous open places, abundant on Edwards Plateau, frequent in Plains Country and limestone cuestas on the Rio Grande Plains, Mar.-June (-Oct.); N.M., Coah., N.L., Tam. and Tex.

44. EVAX GAERTN.

RABBIT-TOBACCO. COTTON-ROSE

Low taprooted annuals, gray floccose-woolly all over, usually branching near the base and above; leaves alternate, mostly spatulate, usually 2-15 mm. long; heads smaller in comparison, somewhat urceolate in very dense woolly glomerules terminating stems and branches, the glomerules subtended and often intruded by leaves, branches ultimately emerging from the axils of the subtending leaves; true involucre absent, the apparent phyllaries being pales of the receptacle; receptacle often slightly raised or even conical, chaffy nearly throughout, the pales thin, often woolly, often tardily deciduous; *ray flowers* absent; *disk flowers* of 2 sorts, pistillate, fertile ones in a broad peripheral zone and a few perfect but usually infertile ones at the center; pistillate

flowers with only a vestige of a tubular-filiform corolla; central flowers with a slightly flared 4-toothed corolla and four microscopically caudate anthers; achenes oblong-elliptic in outline, dorsiventrally compressed, elliptic or lenticular in transection, less than 1 mm. long, brownish-translucent, often microscopically papillose; pappus absent.

A temperate region genus of perhaps two dozen species.

1. Glomerules of heads mostly sessile in the axils of leaves and distributed along elongate stems; perfect (central) flowers usually fertile3. *E. candida*.
1. Glomerules of heads nearly all terminal at the ends of branches; perfect (central) flowers usually infertile (2)
- 2(1). Glomerules of heads subtended by leaves 6-12 mm. long and with numerous shorter internal leaves whose tips conspicuously protrude from between the heads; achenes usually sharp-edged, lenticular in transection2. *E. prolifera*.
2. Glomerules of heads subtended by leaves 3-10 mm. long and with very small leaves among and about equaling the heads; achenes blunt-edged, elliptic in transection1. *E. verna*.

1. *Evax verna* Raf. Annual 3-12 (-15) cm. tall; glomerules of heads terminal on usually divergent branches, the internal leaves of the glomerules barely if at all protruding above the rounded woolly surface of the glomerule; leaves subtending the glomerules only 3-10 cm. long; achenes elliptic in transection, the thinner sides blunt or rounded. *E. multicaulis* DC., *Filaginopsis Drummondii* T.&G., *Filago verna* (Raf.) Shinnery, *F. nivea* Small. Often abundant in a variety of soils nearly throughout the state (rare in the higher parts of the Plains Country and Trans-Pecos), spring; Tex., Okla., N.M., N.L. and Coah.

2. *Evax prolifera* DC. Annuals very much like *E. verna* but the glomerules of heads slightly larger, the internal leaves subtending the glomerules of heads 6-12 mm. long; achenes lenticular in transection, the edges sharpish. *Filago Nuttallii* Shinnery, *F. prolifera* (DC.) Britt. Locally abundant on limestone, Edwards Plateau and lower Plains Country, infrequent in n.-cen. Tex. and rare in n. parts of Rio Grande Plains, spring; also Okla.

3. *Evax candida* (T.&G.) Gray. Annual usually 6-12 (-25) cm. tall, from the base with 1 to usually several stems nearly simple and ascending, in the upper axils with sessile glomerules of heads. *Calymandra candida* T.&G., *Filago candida* (T.&G.) Shinnery. Locally abundant on sandy prairies, e. and s.e. Tex., rare w. to n.-cen. Tex. and extremely rare farther w. (Burnet and Llano cos.), spring; endemic.

45. STYLOCLINE NUTT.

A small genus of Eurasia and North America.

1. *Stylocline micropoides* Gray. WOOLLY-HEAD FANBRACT. Taprooted annual (2-) 5-15 cm. tall, whitish-woolly essentially throughout, branched, each branch terminating in a glomerule of heads tightly subtended by a mass of woolly leaves; leaves alternate, nearly linear to linear-spatulate, (5-) 8-20 mm. long, those just below the heads linear-oblanolate to spatulate; heads extremely crowded in the terminal glomerules; a true involucre absent, the apparent phyllaries being outer pales of the receptacle subtending the peripheral flowers; receptacle somewhat mushroom-shaped, flat on top, chaffy only in a peripheral zone below the edge of the flat top; pales cymbiform, with a pronounced dorsal keel in the lower half which reflects the ventral infolding and enclosure of the flower, woolly in lateral-dorsal zones in the lower half, the tip scarious and acutish, the pale and its enclosed fruit eventually falling in late spring as a unit; ray flowers absent; disk flowers of three sorts: (1) peripheral pistillate fertile flowers without corollas, subtended by the pales and lacking pappus; (2) pistillate fertile flowers in an annular intermediate zone, not subtended by any pales, with filiform-tubular corollas and with a pappus of several almost plumose bristles united at the base and caducous as a unit; (3) apparently perfect fertile flowers numbering only 1 to 3 immediately in the

center of the head, not subtended by pales, with 4-toothed corollas somewhat more amply developed and slightly flaring, with anthers caudate basally (i.e., each of the 2 thecae of each of the four anthers with a linear appendage basally), with a pappus as in the last; achenes somewhat dorsiventrally compressed, oblong-elliptic in outline and elliptic in transection, brownish, translucent, less than 1 mm. long, microscopically papillose in vertical lines (less so or almost smooth in the case of the achenes of the peripheral subtended flowers). Rare at El Paso in the Trans-Pecos, spring; reported to occur also in Calif., Nev., Ut., N.M. and Ariz. but there is some doubt that the same species is represented throughout this range. Our species was described on the basis of poor immature material, and has perhaps been misinterpreted.

46. GNAPHALIUM L. CUDWEED. EVERLASTING

Usually floccose-woolly taprooted annual herbs or rarely weak perennials; leaves alternate, sessile, often decurrent; heads cymosely clustered or in dense glomerules at the top; receptacle naked, essentially flat; phyllaries in several series, subequal or more strongly graduated, nearly totally scarious but usually with a green semirigid midnerve; ray flowers absent; disk flowers numerous, all fertile but those toward the center of the head lacking the androecium; corolla linear with 5 minute teeth apically, with two basal tails (one on each theca); style branch appendages absent; achenes terete or flattish, essentially nerveless; pappus of numerous scabrous capillary bristles in one series, minute.

A cosmopolitan genus of perhaps 200 species.

- 1. Pappus bristles united basally, deciduous together as a unit (2)
- 1. Pappus bristles not united basally, if deciduous then severally (4)
- 2(1). Leaves narrowly oblanceolate to nearly linear, 1-6 mm. broad, about equally gray-woolly on both surfaces8. *G. falcatum*.
- 2. Leaves narrowly obovate or broadly oblanceolate, 5-20 mm. broad, not as densely pubescent on upper surface as on lower (3)
- 3(2). Leaves closely whitish-pannose on the lower surface (the hairs subappressed and tightly interwoven, not loosely villous), the upper surface green and sparsely pubescent; involucre with dense wool only at the base, mostly glabrous7. *G. purpureum*.
- 3. Leaves loosely villous-woolly on the lower surface, the upper surface much less densely pubescent and grayish-green; involucre rather densely and abundantly woolly not just at the base6. *G. pensilvanicum*.
- 4(1). Leaves at maturity on the upper surface bright green (often drying brown) and somewhat glandular-pubescent (5)
- 4. Leaves at maturity gray-woolly on both surfaces (7)
- 5(4). Leaves not decurrent5. *G. obtusifolium*.
- 5. Leaves decurrent (6)
- 6(5). Tips of phyllaries pearly white, papery, not shiny; stem densely whitish-woolly even at maturity2. *G. leucocephalum*.
- 6. Tips of phyllaries whitish-stramineous to pale-brownish, thin-scarious, shiny; stems glandular-pilose1. *G. Macounii*.
- 7(4). Leaves mostly strongly decurrent3. *G. chilense*.
- 7. Leaves not at all or only obsoletely decurrent4. *G. Wrightii*.

1. *Gnaphalium Macounii* Greene. CLAMMY CUDWEED. Annual; stems rather stiffly erect, glandular-pilose, usually 3-10 dm. tall, usually simple below, branched only at the very top; leaves bright-green (drying brown) and glandular-pubescent above, whitish-tomentose beneath, all decurrent as thin wings on the stem; heads campanulate-subglobose, 5-6 mm. high, with about 130 to 150 flowers; phyllaries with the shiny thin-scarious tips stramineous to pale-brownish, strongly graduated, conspicuously scarious nearly throughout; pappus bristles not united basally, separately attached.

G. decurrens Ives. Local in Rio Grande Plains and Trans-Pecos, rare in s.e. Tex. and the Llano region of the Edwards Plateau, (Apr.-) July-Oct.; widespread in temp. N.A.

2. *Gnaphalium leucocephalum* Gray. WHITE CUDWEED. Robust annual with a pleasant aroma; stems numerous, densely whitish-tomentose, usually 30 dm. tall or more; leaves bright-green and strongly glandular-pubescent above, whitish-tomentose beneath, all short-decurrent, the cauline ones narrowly linear; heads 4-6 mm. high; phyllaries strongly graduated, conspicuously scarious nearly throughout; tips of phyllaries pearly white, papery, not shiny; pappus bristles not united basally, separately attached. Infrequent, Davis and Glass mts. in the Trans-Pecos, Aug.-Oct.; also Ariz., Son. and Calif.

3. *Gnaphalium chilense* Spreng. COTTON-BATTING. Annual, usually 25 cm. tall or more, often with several simple stems erect or ascending from the base; leaves mostly strongly decurrent, gray-tomentose above as well as beneath; heads in glomerules, 4-6 mm. high, campanulate-subglobose; phyllaries graduated strongly, very obtuse, scarious nearly throughout; tips of phyllaries scarious, yellowish or stramineous; corollas yellowish; achene smooth; pappus bristles not united basally, attached separately. *G. sulphurescens* Rydb. Davis Mts. in the Trans-Pecos, recently reported from Garza and Wheeler cos. in the Plains Country (not seen), May-Oct.; Mont. to Wash. s. to Tex., Ariz. and Calif.

4. *Gnaphalium Wrightii* Gray. Taprooted annual or weak perennial, usually 25 cm. tall or more; pubescence closely woolly but not glandular; leaves not or only obsoletely decurrent, gray-tomentose on both sides; heads 4-6 mm. high; phyllaries strongly graduated, woolly only at the base, scarious nearly throughout; tips of phyllaries white or only slightly stramineous, mostly obtuse; pappus bristles not united basally. *G. texanum* I. M. Johnst. Frequent in mts. of the Trans-Pecos, rare e. to Edwards Plateau, May-Oct.; Tex. to Calif. and n. Mex.

5. *Gnaphalium obtusifolium* L. CAT-FOOT, FRAGRANT CUDWEED. Annual, usually rather strictly erect and usually 25-50 cm. tall, somewhat aromatic; stems at first woolly, later glandular-puberulent or glandular-villous; leaves not decurrent, thinnish, lanceolate to linear, often undulate-margined, basally narrowed, woolly when young but soon bare and green and commonly viscid-puberulent or glandular on the upper surface; heads in glomerules; involucre dull-white, soon with a rusty tinge; phyllaries oblong, obtuse, in 3 to 5 lengths, somewhat graduated; perfect flowers few; achenes sometimes lightly 3- or 4-nerved; pappus bristles not united basally. *G. polycephalum* Michx. Frequent in e., s.e. and n.-cen. Tex., infrequent w. to Edwards Plateau, Sept.-Nov.; Gulf States n. to e. Can.

6. *Gnaphalium pensilvanicum* Willd. Annual or biennial 1-4 dm. tall, resembling *G. purpureum*, usually with several stems from the base; leaves obovate or broadly oblanceolate, 5-20 mm. broad, lower surfaces loosely villous-woolly, grayish, the upper surfaces less densely pubescent and slightly greener; heads in spikelike arrangements, i.e., the few-headed glomerules nearly sessile in the axils of the leaves of the upper dm. of the stem; involucre 3-4 mm. high, brownish to purplish but nearly buried in the wool so that the color is not too apparent; pappus bristles united in a ring basally, all the pappus deciduous as a unit. *G. spathulatum* of many auth., not Lam., *G. peregrinum* Fern. Widespread but scattered in the e. half of Tex., more common in sandy soils of Rio Grande Plains, spring; Gulf States n. to Pa.; also s. Calif.

7. *Gnaphalium purpureum* L. PURPLE CUDWEED. Annual, usually 1-3 dm. tall, often with several ascending stems from the base; leaves oblanceolate, lower surfaces closely white-pannose with the subappressed hairs tightly enmeshed, upper surfaces much less densely pubescent, usually green and sparsely pubescent; the few-headed glomerules of heads nearly sessile in the axils of the upper dm. of the stems, thus in a spikelike arrangement; involucre 4-6 mm. high, densely woolly only at the base; pappus bristles united in a ring basally, deciduous as a unit. E. half of Tex., most common in e. Tex. in sandy soils but as far w. as the Llano region of the Edwards Plateau, spring; widely distributed in warmer parts of Am., n. to N.E., N.Y., O., Ind., Ill., Mo. and Kan.; also Ore.

8. *Gnaphalium falcatum* Lam. Annual, closely resembling *G. purpureum* but the narrower leaves linear or linear-oblanceolate and about equally woolly on both surfaces; involucre 4-6 mm. high, densely woolly only at the base; pappus bristles united in a ring basally, the entire pappus deciduous as a unit. *G. purpureum* var. *falcatum* (Lam.) T.&G. E. half of Tex., local, spring; introd. (?) in the s.e. states and occurring w. to Tex.

47. FACELIS CASS.

A genus of 4 species of South America.

1. *Facelis retusa* (Lam.) Sch. Bip. Annual taprooted herb 6-20 cm. tall, with usually several or numerous branches near the base, these often decumbent for most of their length, usually covered with a close gray wool; leaves alternate, essentially sessile, 15-30 mm. long, 2-4 mm. broad, spatulate, apically usually retuse but with a central mucro; heads in a tight leafy glomerule at the terminal 1-2 cm. of the stem or branch; receptacle naked, essentially flat; phyllaries (at least the inner ones) mostly scarious; *ray flowers* absent; *disk flowers* of 2 sorts, the central ones perfect and usually fertile and with a 5-lobed corolla, the peripheral ones pistillate and with a slender truncate or obscurely lobed corolla; each anther at the base with 2 short tails or long points; achenes whitish-pubescent; pappus of numerous whitish plumose bristles several times longer than the achene. *F. apiculata* Cass. Infrequent roadside weed in sandy soils, e. Tex., Apr.-May; nat. of S.A., now widely distributed in s.e. U.S.

48. ANTENNARIA GAERTN. EVERLASTING. LADIES' TOBACCO.
PUSSY'S TOES

Perennial herbs with dark slender branching rhizomes or stolons; aerial stems arcuate-ascending at intervals, (3-) 6-25 (-35) cm. tall, simple, leafy below, each terminating in a few-headed glomerule; leaves alternate, the blades olive-green and glabrate above but grayish woolly-floccose beneath, usually spatulate to narrowly obovate, often much-reduced or sparse above, the larger ones (to 3-6 cm. long) with narrow subpetiolar bases, crowded near ground level; heads campanulate, about 1 cm. high; phyllaries in 1 or few series, linear or oblong, blunt, the distal part being shiny white-scarious (or silvery in aspect); receptacle convex, naked or papillate; *ray flowers* absent; heads and disk flowers unisexual (pistillate on some plants, staminate on other plants), numerous; flowers of *pistillate plants* with tubular-filiform corollas and a pappus of numerous nearly capillary bristles; achene less than 1 mm. long, brownish, oblong, densely papillate; flowers of *staminate plants* with a flaring 5-toothed corolla, 5 caudate anthers and a pappus of whitish bristlelike members which toward the tips are clavate-expanded and dorsiventrally flattened.

A very widely distributed genus of more than 100 liberally interpreted species. Some "species" reproduce asexually, staminate plants being absent; but populations of our 2 species include plants of both sexes in about equal abundance.

1. Head-bearing stems only 3-10 cm. long and with only 2 or 3 remote appressed leaves; leaves of the other (procumbent) stems only 1-2 cm. long, spatulate 1. *A. marginata*.
1. Head-bearing stems taller and with usually more leaves; leaves of the procumbent stems often 3-4 cm. long, usually with an ovate or obovate bladelike portion and a very narrow subpetiolar base 2. *A. fallax*.

1. *Antennaria marginata* Greene. Characters as in the key. Rare in Davis Mts. in the Trans-Pecos (Mt. Livermore, Madera Canyon), May-June; Colo., Ariz., Ut., N.M. and Tex.

2. *Antennaria fallax* Greene. Characters as in the key. *A. plantaginifolia* (L.) Rich. var. *ambigens* (Greene) Cronq. Frequent in sandy forested areas in e. Tex., infrequent w. to n.-cen. Tex., spring; most of e. U.S.

49. PTEROCAULON ELL. BLACKROOT

A genus of 4 species of warmer parts of the Americas.

1. *Pterocaulon virgatum* (L.) DC. Perennial herb, each woody crown with only 1 (or 2) erect simple virgate stems (5-) 8-15 dm. tall; leaves linear, 5-15 cm. long, green or brown above, densely white-woolly beneath, long-decurrent on the stem as narrow wings; heads densely crowded in an interrupted spikelike aggregation at the top of the stem; involucre campanulate, 4-5 mm. long; phyllaries lanceolate, in about

3 or 4 series, densely white-woolly except the very tip; receptacle less than 1 mm. broad, essentially naked or with a few hairs, flat or slightly concave, blackish; *ray flowers* absent; *disk flowers* of 2 kinds, the more peripheral ones pistillate and fertile with a filiform corolla, the central ones perfect but infertile with the corolla tubular; each of the 2 cells of each of the 5 anthers with a slender tail on the lower end; achenes about 1 mm. long, columnar, several-ribbed, pubescent; pappus of a single series of persistent very fragile white bristles. Infrequent in sandy soils, e. and s.e. Tex. and Rio Grande Plains, late summer-fall; W.I., e. Mex. and Tex.

50. PLUCHEA CASS.²⁰⁵

MARSH-FLEABANE. STINKWEED

Aromatic annual or perennial herbs; leaves alternate; blades simple, unlobed, usually crenate or serrate, ovate to linear-lanceolate, glabrous to glandular-pubescent to floccose; petioles present or absent; heads usually crowded in corymbiform terminal aggregations; involucre campanulate to hemispheric; phyllaries strongly imbricated, herbaceous to chartaceous; receptacle flat, naked; *ray flowers* absent; *disk flowers* very numerous, a few central ones perfect but infertile, the much more numerous outer ones pistillate and fertile; corolla rose to rose-purple or creamy-white, tubular, the corolla of the staminate central flowers 5-lobed, that of the fertile flowers 3-lobed; achenes less than 1 mm. long, cylindrical, dark-brown or reddish-brown, 4- to 6-angled or with prominent ridges, setose to hirtellous or glabrous and with a minute white enlargement basally; pappus a single series of fine barbellate bristles.

A genus of about 9 species of the Americas.

1. Leaves broadly elliptical to lanceolate or ovate to ovate-lanceolate, petiolate or sessile, if sessile the bases of the blades narrowed to the midribs, neither auriculate-clasping nor truncate (2)
1. Leaves oblong to oblong-ovate or oblong-elliptical to oblong-lanceolate, sessile, the bases of the blades auriculate-clasping to truncate, not narrowed to the midribs (3)
- 2(1). Leaves petiolate; phyllaries with resin-globules, only the outermost puberulent and ciliate; the aggregation of heads characteristically elongate and paniculiform, not flat-topped, each branch terminating in a convex aggregation 1. *P. camphorata*.
2. Leaves sessile or petiolate; phyllaries glandular or not, the outermost and median ones copiously puberulent and ciliate, the inner ones sparsely puberulent on their summits; the overall aggregation of heads cymiform, the younger branches elongating and exceeding the more central ones, thus producing a flat-topped or layered inflorescence 2. *P. purpurascens*.
- 3(1). Corollas creamy-white; heads 8-10 mm. high; outer phyllaries obtuse or obtuse-apiculate 3. *P. foetida*.
3. Corollas rose-purplish; heads 4-6 mm. high; outer phyllaries acuminate 4. *P. rosea*.

1. *Pluchea camphorata* (L.) DC. CAMPHOR-WEED. Annual or perennial herb to about 15 dm. tall; stems glabrate below, puberulent on the upper portions and the head-bearing branchlets, leafy to the summit; blades elliptical to oblong-elliptical, 6-15 cm. long, 3-7 cm. broad, marginally dentate-serrate to repand-serrate or essentially entire, upper and lower surfaces with sparsely distributed resin-globules, the lower surfaces puberulent; overall aggregations of heads characteristically elongate-paniculiform, the branches numerous and terminating in smaller convex paniced cymose clusters, the central uppermost "cymes" maturing first but the lateral ones not nearly equaling them in height, occasionally only one terminal "cyme" of heads developing on the entire plant; phyllaries with resin-globules, the outermost sparingly pubescent and ciliate, the

²⁰⁵ Largely adapted from R. K. Godfrey in Jour. Elisha Mitchell Sci. Soc. 68:238-271. 1952.

median and inner not pubescent. Frequent in moist places, e., s.e. and n.-cen. Tex., summer-fall; s.e. U.S.

2. *Pluchea purpurascens* (Sw.) DC. CANELA. Annual herb to about 15 dm. tall; stems glabrate below, copiously puberulent on the upper portions and on the cyme-bearing branches, the latter sometimes cinereous or sordid, leafy to the summit; leaves sessile or petiolate, generally short-ovate to ovate-lanceolate, sometimes lanceolate or elliptical, the apex generally obtuse varying in the more lanceolate or elliptical blades to long-acute, the margins from evenly to unevenly serrate or serrate-dentate or entire; surfaces of the blades varying from essentially glabrous or very sparsely puberulent to copiously puberulent or essentially tomentose; overall placement of heads basically cymiform, the central axis maturing first, the lateral branches equaling or exceeding it in length, thus giving a flat-topped or layered structure; outer and median phyllaries copiously puberulent and ciliate, the inner sparsely puberulent on the summits. Throughout Tex. in muddy places, our most abundant species, summer-fall; s. half of U.S. s. to n. S.A.; W.I.

3. *Pluchea foetida* (L.) DC. STINKING-FLEABANE. Perennial herb 5-8 dm. tall; stems glabrate below, sparingly pubescent in the median portions, densely pubescent and approximately lanate on the head-bearing branchlets; leaves 3-10 (-13) cm. long, 1-3 cm. broad, sessile; lower cauline leaves lanceolate or oblanceolate with cuneate or truncate bases; median and upper leaves oblong to oblong-elliptical or occasionally ovate-oblong, rarely lance-elliptic, typically shallowly auriculate-clasping but occasionally the median and upper leaves as well as the lower with cuneate bases; leaf margins shallowly and unevenly apiculate-serrate; leaf surfaces glandular above, pubescent below; overall arrangement of heads usually loose panicle-cymelike tending to be flat-topped; heads about 8 mm. high; corollas creamy-white. Infrequent in mud, e. and s.e. Tex., s. to Aransas Co., summer-fall; s.e. U.S.; W.I.

4. *Pluchea rosea* Godfrey. Perennial herb 30-55 cm. tall, gray-green; stems glabrate below; surfaces of the stems, leaves and involucre with sessile hemispherical glands and resin-globules, upper stems pubescent, the upper head-bearing branches and involucre tomentose or sometimes rufescent; leaves sessile, the lower oblanceolate with truncate to cuneate-truncate bases, midstem leaves larger and wider, oblong to ovate-oblong or elliptical-oblong with cordate subclasping bases or lanceolate to oblanceolate with cuneate-truncate bases, about 2-7 cm. long, 5-30 mm. broad; upper leaves smaller but similar; margins of the leaves apiculate-serrate; involucre 4-6 mm. high; corollas rose-purple. Infrequent in s.e. Tex. (Hardin and Harris cos.), summer; coastal areas, N.C. to Tex., S.L.P. and Q.Roo; W.I.

51. TESSARIA R. & P.

ARROW-WEED

An American genus of 3 or 4 species, of which we have one.

1. *Tessaria sericea* (Nutt.) Shinn. Shrubs 1 m. tall or more with numerous erect branches, willowlike, gray-green, with a "rank" odor; leaves alternate, simply sericeous, linear-lanceolate, entire, essentially sessile, 1-6 cm. long, (2-) 3-5 (-6) mm. broad; heads crowded into convex subcorymbiform aggregations 2-5 cm. across at the ends of the branches; involucre campanulate, 4-5 mm. high; outer phyllaries ovate, obtuse and tomentose; inner phyllaries linear, deciduous with the flowers; receptacle slightly concave, naked; ray flowers absent; disk flowers very numerous, a few central ones perfect but infertile (their corollas flared, purplish, 5-lobed), the much more numerous outer ones pistillate and fertile (the corollas filiform, 4-lobed terminally); achenes of fertile flowers about 0.5 mm. long, brownish, about 5-ribbed, nearly columnar or slightly flattened; pappus of infertile (staminate, central) flowers persistent, of flattened whitish bristlelike members which near the tips are discolored brownish and about twice as broad as the lower part; pappus of fertile flowers white, bristlelike, persistent, not thickened or discolored. *T. borealis* T.&G. *Pluchea borealis* (T.&G.) Gray, *P. sericea* (Nutt.) Cav., *Polypappus sericeus* Nutt., *Bertholetia sericea* (Nutt.) Rydb. Locally abundant near streams in the Trans-Pecos, summer; Tex., N.M., Chih., Son., Ariz. and Calif.

Reported to be a good honey plant.

52. POLYMNIA L.²⁰⁶

LEAF-CUP

An American genus of 19 species.

1. *Polymnia Uvedalia* (L.) L. BEAR'S-FOOT. Perennial herb occasionally to as much as 3 m. tall; roots fibrous, often partly tuberous; stems few, erect, furrowed, purple-spotted, glabrous to densely pilose, to 3 cm. thick at the very base; leaves (at least the lower ones) opposite, to 68 cm. long and 39 cm. broad, sessile or winged to base, palmately 3- to 5-lobed and veined, ovate to deltoid, scabrous to nearly glabrous above, glabrous or resin-dotted and puberulous below, the hairs larger on the main veins, the base abruptly cuneate to the winged portion; upper leaves sparsely dentate, often not lobed; heads solitary at the ends of the pedunculiform stems; peduncles glabrous, densely pilose, with or without glandular-tipped hairs; phyllaries 4 to 6, in about 2 series, about 20 mm. long and to 12 mm. broad, broadly ovate to ovate-lanceolate, glabrous above, glabrous or with sparse pubescence or greenish-yellow sessile glands below; receptacle flat or convex; *ray flowers* in 1 series, pistillate, fertile, 7 to 13; rays yellow, to 3 cm. long, about 1 cm. broad, the tube 2 mm. long, pilose or glandular-pilose externally; *disk flowers* infertile, staminate, 45 to 80, the corollas yellow, sparsely pilose externally; pales subtending the disk flowers lanceolate, chartaceous; achene 6 mm. long, 4 mm. broad, longitudinally multistriate, ovoid and somewhat laterally compressed, at first white, turning red, purple and finally black; pappus absent. Infrequent or rare in moist crevices of limestone soil near streams, n.-cen. Tex. and e. edge of the Edwards Plateau. Our plants are all of the var. *densipilis* Blake which occurs from Tex. and Okla., s. and cen. Mo. into s.w. Ill., e. to Pa. and Del., and along the Coastal Plain to cen. Fla., also in O., Ind., Tenn., Ky. and W.Va. The species as a whole, including 3 varieties altogether, occurs through much of e. U.S. w. to Okla. and Tex.

Polymnia maculata Cav., of Mexico and Central America, is probably conspecific, too.

53. MELAMPODIUM L.²⁰⁷

BLACK-FOOT

Taprooted annual herbs or caespitose perennials; leaves opposite and decussate, sessile, entire or lobed; heads solitary, arising on peduncles from the middle or upper dichotomies; outer involucre cupulate; outer phyllaries 5, lanceolate-ovate, margin opaque, apex acute, gamophyllous or free; inner phyllaries each enclosing a single ray achene, generally somewhat ribbed and tuberculate, often expanded above the achene into a hood and sometimes bearing an extended awn; *ray flowers* pistillate, the corollas yellow or white, apically bidentate (sometimes obscurely tridentate); *disk flowers* few to many; corollas yellow, regular, 5-lobed, throat salverform-funnelform; ovaries linear and abortive; paleae scarious with a conspicuous midrib, at apex dentate-laciniate.

A genus of 36 species found chiefly in Mexico and Central America.

1. Annual; rays yellow, inconspicuous (0.6-1.5 mm. long); outer phyllaries lanceolate-elliptic; disk flowers 4 to 6 1. *M. hispidum*.
1. Perennials; rays white, conspicuous (2-13 mm. long); outer phyllaries ovate; disk flowers 25 to 50 (2)
- 2(1). Outer phyllaries gamophyllous for more than half their length 2. *M. leucanthum* var. *leucanthum*.
2. Outer phyllaries gamophyllous a third or less their length (3)
- 3(2). Margin of leaf base hispid with hairs 0.6-1.5 mm. long; stems strigose-hispid with hairs 0.2-1.5 mm. long 3. *M. cinereum* var. *hirtellum*.
3. Margin of leaf base strigose with hairs 0.3-0.6 mm. long; stems strigose-hispidulous with hairs 0.1-0.8 mm. long (4)

²⁰⁶ Adapted largely from James R. Wells in *Brittonia* 17:144-159. 1965.

²⁰⁷ Contributed by Tod F. Stuessy.

4(3). Leaves linear, 7-32 mm. long, 2-5 mm. broad; mature heads 3-5 mm. high; diameter of outer involucre 4.5-9 mm.; outer phyllaries 2.7-4 mm. long, 1.3-2.8 mm. wide; hood 0.8-1.5 mm. high 3. *M. cinereum* var.

ramosissimum.

4. Leaves linear-oblong, 12-55 mm. long, 1-14 mm. broad; mature heads 5-8 mm. high; diameter of outer involucre 7-14.3 mm.; outer phyllaries 3.5-7.3 mm. long, 2.3-5 mm. wide; hood 1.3-2.9 mm. high 3. *M. cinereum* var.

cinereum.

1. *Melampodium hispidum* H.B.K. Annual herb; stems moderately hispid-strigillose, 3-25 (usually 15-20) cm. tall; leaves 6-50 mm. long, linear-oblong to oblanceolate, entire to pinnately lobed (lobes 2 to 4), both surfaces strigose; heads 4-8 mm. broad (including awns on hoods, if present), 3-4 mm. high; outer phyllaries lanceolate-elliptic, at margin ciliate, free to very slightly gamophyllous at base, 2.7-6 mm. long; innermost phyllaries completely closed over ray achene apex (rarely with an opening about 0.3 mm. in diameter), sometimes expanded above the achene into a hood usually bearing a cirrhous apical appendage; rays 5 to 8, yellow, 0.6-1.1 mm. long, oblong-ovate; disk flowers 4 to 6; paleae yellow-tipped; chromosome number: $n = 20$. Davis Mts., local in and around Madera Canyon, Trans-Pecos, Aug.-Oct.; Tex. to Ariz. and s. to cen. Mex.

2. *Melampodium leucanthum* T.&G. var. *leucanthum*. Perennial herb or very weak subshrub, strigillose, 15-50 cm. tall; leaves 21-45 mm. long, linear-oblong, entire to pinnately lobed (lobes 0 to 6), both surfaces strigose and with globules of exudate; heads 20-37 mm. broad (including rays), 6-8 mm. high; outer phyllaries ovate, margin entire, gamophyllous for half to three-fifths their length, 5-7 mm. long; apical aperture of innermost phyllaries at point of corolla tube attachment about 0.5 mm. wide; bract expanded above the achene into a hood with a muticous apex (rarely mucronate); rays 8 to 10, cream-white, 7-13 mm. long, oblong-elliptic; disk flowers 25 to 50; chromosome numbers: $n = 10, 20$. Calcareous soil, w. Tex. e. to n.-cen. Tex. and e. margin of Edwards Plateau, Mar.-Nov.; N.M., Ariz., Colo., Kan. and Okla., s. to Chih. and Coah.

3. *Melampodium cinereum* DC. Perennial herb or weak subshrub, strigose-hispid to hispidulous, 14-20 cm. tall; leaves 7-55 mm. long, linear-oblong, both surfaces strigose and with globules of exudate; heads 5-23 mm. broad (including rays), 3-8 mm. high; outer phyllaries ovate, margin entire, gamophyllous for a sixth to a third their length, 2.7-7.3 mm. long; apical aperture of innermost phyllaries at point of corolla tube attachment about 0.5 mm. wide; bract expanded above the achene into a hood with a muticous to cirrhous apex; rays 7 to 13, cream-white, 2-8.2 mm. long, oblong-elliptic; disk flowers 25 to 50; chromosome numbers: $n = 10, 20$. Rio Grande Plains, n. to Val Verde, Uvalde and Bexar cos.; represented by 3 varieties as follows:

Var. *hirtellum* Stuessy. Stems with hairs 0.2-1.5 mm. long; leaves 11-34 mm. long, 2-10 mm. wide, linear-oblong, pinnately 2- to 8-lobed, basal part of margin and midrib beneath with hairs 0.6-1.5 mm. long; heads 9-18 mm. broad (including rays), 4-5.5 mm. high; outer phyllaries 3.3-6 mm. long; hood apex muticous-mucronate; rays 8 to 13, 3-6 mm. long; disk flowers 25 to 50; chromosome number: $n = 10$. Rio Grande Plains n. to Maverick, Uvalde, Kinney and Val Verde cos., Jan.-Nov.; also Coah. and N.L.

Var. *ramosissimum* (DC.) Gray. Stems with hairs 0.1-0.8 mm. long; leaves 7-32 mm. long, 2-5 mm. wide, linear, entire to pinnately cleft (with up to 10 lobes), basal part of margin and midrib beneath with hairs 0.2-1 mm. long; heads 5-14 mm. broad (including rays), 3-5 mm. high; outer phyllaries 2.7-4 mm. long; hood apex mucronate-cirrhous (rarely muticous); rays 7 or 8, 2-3.8 mm. long; disk flowers 25 to 35; chromosome number: $n = 10$. Cameron and Hidalgo cos. in extreme s. Tex., June-Dec.; also Tam.

Var. *cinereum*. Stems with hairs 0.1-0.8 mm. long; leaves 12-55 mm. long, 1-14 mm. wide, linear-oblong, entire or pinnately parted (with up to 10 lobes), basal part of margin and midrib beneath with hairs 0.2-0.6 mm. long; heads 9-23 mm. broad (including rays), 5-8 mm. high; outer phyllaries 3.5-7.3 mm. long; hood apex muticous to cirrhous; rays 7 to 13, 3-8.2 mm. long; disk flowers 30 to 50; chromosome numbers: $n = 10, 20$. Rio Grande Plains s. to Cameron Co., w. to Webb Co., n. to Bexar Co., e. to Jim Wells Co., Jan.-Dec.; also Tam.

The tetraploids, apparently of spontaneous autopolyploid origin, are scattered throughout the range.

54. ACANTHOSPERMUM SCHRANK

A genus of 8 species, primarily tropical American but also reported from Madagascar.

1. *Acanthospermum australe* (Loeff.) O. Ktze. PARAGUAY GREEN-STRIPE. Perennial herb, the lower parts of the stems subrhizomatous, horizontal; leaves mostly 2-3 cm. long including petioles, 1-2 cm. broad, the blades subrhombic, coarsely serrate in upper two-thirds; heads borne in groups of (1 or) 2 or 3, few-flowered, nearly cylindrical, about 7 mm. long; involucre double; phyllaries of 2 sorts, the exterior ones nearly flat and with the texture of leaves, the single series of inner ones folded over and almost completely enclosing the ray achenes and bearing slender projections with hooks or coils at the very end; receptacle paleaceous throughout; *ray flowers* present, pistillate, fertile; *disk flowers* perfect but infertile; achenes with coriaceous or thicker wall, the fertile ones of the rays glabrous, enclosed by and falling with the inner phyllaries; pappus essentially absent. Infrequent or rare in disturbed soils, e. Tex., Mar.-Oct.; widespread in warmer parts of Am., n. to Gulf States, probably adv. with us during the last 50 years.

55. SILPHIUM L. ROSIN-WEED

Perennial herbs from stout rhizomatous bases; stems usually stout and scabrous-hispid at least above, usually sparingly branched; leaves opposite at least below, usually alternate above, usually coarse-textured and scabrous, the lower ones usually narrowed to a subpetiolar base, those in the upper parts usually sessile and sometimes clasping; heads large and showy, variously arranged; involucre usually shallowly campanulate; phyllaries in several series, the outer ones usually broad and foliaceous (very stiff in species No. 1 and 2), coarse, usually scabrous, the outermost shorter than the middle and the innermost smaller, thinner and each subtending a ray flower; receptacle flat or slightly convex, chaffy throughout, the pales firm, usually pubescent apically; *ray flowers* several, in 2 or 3 series, pistillate, fertile, the rays showy, usually 2-4 cm. long, yellow (white in *S. albiflorum*); *disk flowers* numerous, apparently perfect but infertile, the yellow corollas 5-toothed but obscured by the long chaff; ray achenes strongly dorsiventrally flattened, the thin edges broadly firm-winged, the wings often as broad as the body of the achene and often prolonged apically so that the apex of the achene is emarginate, the sides of the notch being defined by the 2 minute awnlike members which represent the pappus (or these absent).

An American genus of perhaps 20 species, the taxonomy of which is rendered difficult by the tendency of a number of the species to hybridize.

1. Leaves pinnatifid (2)

1. Leaves not pinnatifid (3)

2(1). Wings of the achene prolonged beyond the apex of the body of the achene to form a V-shaped notch 3-5 mm. deep 1. *S. albiflorum*.

2. Wings of the achene not so greatly prolonged apically 2. *S. laciniatum*.

3(1). Leaves basal, or mostly confined to the basal few cm. of the stem length, exceedingly reduced and represented only by bracts at midstem, the stem subscapose 5. *S. gracile*.

3. Leaves not so confined, some well-developed ones present even at midstem or above (4)

4(3). Leaves mostly opposite even in the upper half of the stem and entire- or sub-entire-margined (except the lowermost which are usually withered prior to anthesis), long-tapered to an acute apex, gradually reduced upward so that some well-developed leaves are present nearly up to the base of the head or of the tight subcorymbiform aggregation of heads . . . 3. *S. asperimum*.

4. Leaves alternate in the upper third to two-thirds of the stem, usually coarsely toothed (except the uppermost), ovate-elliptic, much-reduced upward so that well-developed leaves are rare in proximity to the solitary more or less irregularly scattered heads 4. *S. Simpsonii* var. *Wrightii*.

1. *Silphium albiflorum* Gray. Perennial herb (2-) 4-10 dm. tall; stems terete (striate when dried), very scabrous; leaves alternate, very rigid, deeply pinnatifid, about as broad as long; heads in a racemelike arrangement at the top, sessile or short-peduncled, large; involucre rigid; phyllaries ovate, thickened and at length coriaceous basally, the middle ones with equally long or longer-spreading foliaceous acumination but this seldom surpassing the disk; rays white, about 25 mm. long, numerous; achenes puberulent, the wings produced and dilated apically into somewhat triangular projections which are adnate to a pair of subulate and more or less projecting awns, the notch narrow, 3-5 mm. deep. Barren limestone knolls and prairies, n.-cen. Tex., Edwards Plateau and Plains Country, summer; endemic.

This might be considered merely a variety of the next.

2. *Silphium laciniatum* L. COMPASS-PLANT. Perennial herb (3-) 5-8 (-12) dm. tall; stems terete (striate when dried), very scabrous; leaves alternate, very rigid, deeply pinnatifid, longer than broad, usually; heads in a racemelike arrangement at the top, sessile or short-peduncled, large; involucre rigid; phyllaries ovate or lance-ovate, thickened and at length coriaceous basally, the middle ones with equally long or longer spreading-foliaceous acumination often surpassing the disk; rays yellow, about 25-40 mm. long, numerous; achenes nearly glabrous, the wings produced and dilated apically into rounded projections, forming a notch 1-3 mm. deep. Rare in prairies, n.-cen., e. and s.e. Tex., summer; Wisc., Ill. and Minn., s. to Tex.

3. *Silphium asperrimum* Hook. Perennial herb (3-) 5-12 dm. tall, with one or few stems from the base, very sparingly branched, usually very scabrous-hispid at least above; leaves opposite nearly throughout, sessile and entire over most of the stems (only the lowermost with subpetiolar bases and obscurely serrate margins), most of them long-tapering to an acute apex, very scabrous, only very gradually reduced upward so that even in the immediate vicinity of the head(s) the leaves are well-developed; heads solitary or in a tight few-headed subcorymbiform aggregation, large; rays yellow. Incl. Texas plants referred to *S. speciosum* Nutt. Frequent in n.-cen. Tex., infrequent or rare in e. Tex., e. part of Edwards Plateau, summer; Mo., Okla. and Tex.

Apparently intergrading with *S. Simpsonii* var. *Wrightii* which in turn intergrades with *S. gracile*.

4. *Silphium Simpsonii* Greene var. *Wrightii* Perry. Perennial herb with one or few stems from the base, each irregularly and sparingly ascending-branched above, usually very scabrous-hispid at least above; leaves opposite usually only in the lower third (to two-thirds in some specimens) of the stem, alternate and much-reduced in size and abundance above (so that no well-developed leaf is in proximity to a head), mostly serrate, ovate-elliptic; heads usually solitary, terminal on the branches which are few and of irregular lengths, thus scattered in no definite arrangement; rays yellow. *S. Reverchonii* Bush. Infrequent in n.-cen. and e. Tex., summer; also La.; the var. *Simpsonii* occurs in Fla.

This can be interpreted as a relatively unstable taxonomic segregate resulting from past introgression of *S. asperrimum* and *S. gracile*, for it is intermediate between them and grades into both.

5. *Silphium gracile* Gray. Perennial subscapose herb (2-) 3-6 dm. tall, usually with a single simple monocephalous stem; leaves few, crowded near the base, scabrous, serrate, only very reduced bracteal (if any) leaves are present at midstem; rays yellow. Infrequent, s.e. Tex., s. to Aransas Co., in sandy soil, late spring-summer; also La.

See remarks under *S. Simpsonii*.

56. BERLANDIERA DC.²⁰⁸

GREEN-EYES

Herbaceous or suffrutescent perennials, arising from fleshy taproots; stems usually branched, decumbent to erect; herbage pubescent with multicellular trichomes, tomentose to scabrous; leaves alternate, simple, sessile to long-petiolate, ovate, obovate, deltoid, lanceolate or spatulate, cuneate to truncate or cordate at base, obtuse to acute at apex, the margins dentate, to crenate or lyrate-pinnatifid; heads multiflowered, paleaceous, usually paniculate-corymbose; receptacle small, somewhat turbinate with flattened or

²⁰⁸ Contributed by Donald J. Pinkava.

slightly depressed summit; *ray flowers* 2 to 13, usually 8, uniseriate, ovulate; rays yellow to orange-yellow with 9 to 12 anastomosing abaxial veins either green or red to maroon; *disk flowers* effectively staminate and (in our species) with red to maroon corollas; pappus absent or an inconspicuous crown of 2 or 3 small teeth; achenes wingless, dorsiventrally compressed, pubescent adaxially; 2 adjacent pales and disk flowers and the subtending phyllary adhering to each ripening achene and abscising with it; stringlike appendages retained about the receptacle.

A genus of four species of southern United States and northern Mexico.

1. Veins on undersurfaces of rays red to maroon; peduncles scabrous to subscabrous *and* leaves velvety with usually at least some lyrate-pinnatifid; stems arising from a persistent basal rosette1. *B. lyrata*.
1. Veins on undersurface of rays green; plant *not* with *both* scabrous to subscabrous peduncles *and* velvety leaves; leaf shapes variable but not pinnatifid; stems not arising from a persistent rosette (2)
- 2(1). Peduncles with long fine matted hairs; blades velvety, usually ovate, petioled2. *B. pumila*.
2. Peduncles with coarser erect to spreading or curling hairs; blades finely hirsute to subscabrous, ovate to deltoid (3)
- 3(2). Midstem leaves hirsute to subscabrous, lanceolate to deltoid, serrate to dentate, about two thirds as broad as long, short-petiolate or sessile; peduncles densely long-hirsute3. *B. texana*.
3. Midstem leaves finely to coarsely hirsute, usually crenate, one half to one and one fourth times as broad as long, petioled; peduncles with spreading to erect hairs; intergrades to 2 and 3 above4. *B. × betonicifolia*.

1. *Berlandiera lyrata* Benth. Herb with erect to decumbent stems to 12 dm. tall, rising from a persistent basal rosette or a cluster of shortened leafy branches; leaves velvety, lower ones long-petiolate; blades except sometimes the uppermost and/or lowermost lyrate-pinnatifid, the terminal lobe crenate to irregularly incised; peduncles long, scabrous to subscabrous; heads 13-17 mm. wide; rays yellow to orange-yellow, 10-14 mm. long, 5-5.8 mm. wide, with red to maroon veins beneath (sometimes entire lower surfaces so colored); achenes small, elongate, 4.5-6 mm. long, 2.7-3.7 mm. wide, quick-maturing. *B. incisa* T.&G. Dry rocky limestone soils, roadsides, Tex. Panhandle and Pecos River westw., most seasons of the year except during coldest weather; Kan., Colo., N.M. and Ariz., s. to S.L.P. and Ags.

On some of the higher mountains (Guadalupe and Glass mts.) are populations with unlobed, merely crenate blades. These have been distinguished as var. *macrophylla* Gray.

2. *Berlandiera pumila* (Michx.) Nutt. Herbaceous to suffrutescent perennial to 7 dm. tall, erect, usually branching; leaves ovate, obtuse, usually cordate, well-distributed along stem, without a persistent basal rosette; midstem leaves usually three fourths to one and one fourth times as broad as long, velvety, with crenate margins; peduncles with dense fine long matted hairs; heads 14-18 mm. wide; rays 12-20 mm. long, 6-9 mm. wide, deep yellow to orange-yellow, with green veins beneath; achenes 4.5-6 mm. long, 3-4 mm. wide. *B. tomentosa* (Pursh) Nutt. (incl. var. *dealbata* T.&G.). Along roadsides and grazed areas, woodland borders and open woodlots, often in deep loose sandy soils, e. Tex., usually spring and summer, less commonly in the fall; S.C., Ga., Fla., Ala., La. and Tex.

3. *Berlandiera texana* DC. Suffrutescent perennial to 12 dm. tall, often much-branched; midstem leaves sessile or short-petioled, about one half to two thirds as broad as long, the wider leaves found on plants toward the eastern portion of range, triangular to ovate with serrate to partially doubly serrate to dentate margins, stiffly hirsute to subscabrous, leaves well-distributed or crowded near summit; peduncles short, densely long-hirsute, bearing heads 18-27 mm. wide; rays 10.5-17 mm. long, 6.5-9 mm. wide, deep yellow to orange-yellow, with green veins beneath; achenes large, obovate, 4.5-6 mm. long, 3-4.8 mm. wide. *B. longifolia* Nutt. Commonly of sandy soils, at woodland margins, on hill-sides or along lightly shaded river banks; cen. and w. Okla. and n.w. Tex. plants have scabrous leaves and hirsute to subscabrous peduncles; also Mo.

Arkansas and south-central Texas plants have wider leaves with more obtuse apices, the pubescence is less erect and is often matted on lower portion of stem.

4. *Berlandiera* × *betonicifolia* (Hook.) Small (pro. sp.) Herbaceous to suffrutescent perennial with well-distributed leaves; stem usually branching; leaves variable, triangular to ovate; blades one half to one and one fourth times as broad as long, with dentate or serrate to coarsely doubly crenate margins, finely hirsute to nearly subscabrous; peduncles with fine curling long somewhat spreading hairs; heads 12-18 mm. wide; rays 9-18 mm. long, 5.4-9 mm. wide, deep yellow to orange-yellow, with green veins beneath; achenes 4-5.5 mm. long, 2.5-4 mm. wide.

This is considered to be a product of crossing of *B. pumila* and *B. texana*. Most characters are intermediate to those of the putative parents in varying degrees and combinations over its range of east-central Texas and western Louisiana.

57. LINDHEIMERA GRAY & ENGELM.

A monotypic genus.

1. *Lindheimera texana* Gray & Engelm. TEXAS YELLOW STAR, LINDHEIMER DAISY. Slenderly taprooted annual, (5-) 8-20 (-30) cm. tall, typically with a single nearly simple stem, usually with slightly harsh spreading pubescence; leaves alternate, crowded over most of the stem, obovate (rarely ovate) to oblanceolate, narrowed to both ends, coarsely toothed in the distal half, essentially sessile, bright-green; heads solitary on peduncles 1-3 (-4) cm. long; involucre 10-15 mm. high, roughly hemispheric; phyllaries in 2 series, (4 or) 5 external and (4 or) 5 internal, the outer 5 longer, narrower, more roughly pubescent and more acute; receptacle in 2 parts, the outer a narrow ring where the ray flowers are attached and a central stele 1-2 mm. high where the disk flowers are attached, chaffy throughout; ray flowers (4 or) 5, pistillate, fertile, the yellow ray about 1 cm. long and 2-toothed apically, showy; disk flowers perfect but infertile, the corolla yellow or red-brownish-yellow, 5-toothed; ray achenes very large, dorsiventrally compressed, flat and appressed to and nearly as large as the (4 or) 5 inner phyllaries, nearly as broad as long, wing-margined; disk pappus of 2 persistent awned scales, one over each shoulder of the achene. Abundant in prairies of n.-cen. and s. part of e. Tex. and Edwards Plateau, less abundant in Plains Country, spring; also Coah.

58. ENGELMANNIA GRAY

A monotypic genus.

1. *Engelmannia pinnatifida* Nutt. ENGELMANN DAISY. Perennial densely hispid herb from stout woody taproot, (1-) 2-5 dm. tall; stems one to several from the crown; basal leaves (1-) 2-3 dm. long, deeply once-pinnatifid; stem leaves 8-30 cm. long, deeply pinnatifid; in the upper dm. of the plant the branches numerous and pedunculiform, each branch capped by a head; involucre 6-10 mm. high, hemispheric; phyllaries in about 3 subequal series, those of outer series linear and green for most of their length (slightly dilated and discolored at the very base), the middle series slightly broader and discolored in the basal half, the inner series very broad and white-indurate most of their length; receptacle essentially flat and chaffy throughout, the pales linear; ray flowers usually 8, pistillate, fertile, each subtended by one of the inner phyllaries, the rays yellow, about 1 cm. long, elliptical, minutely 3-toothed apically; disk flowers perfect but infertile, the corolla yellow and 5-toothed terminally; ray achene dorsiventrally flattened, obovate; ray pappus of a few tardily deciduous scales, 2 slightly larger than the rest (one over each edge of the achene). Frequent in calcareous open uplands over the state (not the forested sandy areas of e. Tex.), commonest in n.-cen. Tex. and Edwards Plateau, spring (-summer); Neb., Colo., Kan., Okla., Tex., N.M., Chih., Coah., N.L. and Tam.

59. PARTHENIUM L.²⁰⁹

Bitter aromatic herbs or shrubs; leaves alternate, entire to highly divided; heads small, many-flowered, inconspicuously radiate, white, borne singly or in terminal corymbose or paniculiform aggregations; involucre usually nearly hemispheric or broader, of several

²⁰⁹ Adapted largely from Reed C. Rollins in Contr. Gray Herb. n.s. 172:1-73. 1950.

broad green phyllaries, the inner ones usually subtending the ray achenes and slightly shorter than the outer ones; receptacle slightly convex or flattish, chaffy throughout; *ray flowers* 5, pistillate, fertile, the white corollas and styles persistent at the apex of the mature achenes; *disk flowers* seeming perfect but infertile, numerous, their corollas whitish; all the disk florets except the peripheral row of 10 disarticulating and falling as a unit with their subtending pales; ray achenes dorsiventrally compressed, very flat, rotund in outline, the margins thickened into riblike structures which are attached to the contiguous pair of infertile disk flowers and the subtending phyllary, the achene, 2 attached flowers and phyllary falling together at maturity; pappus of 2 or 3 awns or 2 scales, or absent.

An American genus of about 16 species.

1. Shrubs; pappus of 2 or 3 awns or absent; heads truncate apically (2)
1. Herbs; pappus scalelike or aristate; heads slightly convex on top (3)
- 2(1). Heads congested on a long (1-2 dm. long) naked peduncle arising from below the branch apex; leaves silvery-canescenscent from a dense covering of appressed trichomes1. *P. argentatum*.
2. Heads not congested, in paniculately corymbose arrangements terminating the branches; peduncles short and bracteate; leaves white-tomentose
.....2. *P. incanum*.
- 3(1). Pappus of 2 weak linear awns; leaves large, variously dentate but not lobed; heads in flat-topped corymbose arrangements3. *P. hispidum*.
3. Pappus of 2 lateral scales; leaves deeply lobed to divided; heads loosely paniculate on numerous fertile branches (4)
- 4(3). Upper leaves and bracts pinnatifid, not markedly reduced upward; peduncles stout, the adjacent bract well-developed and often bilobed; pubescence of stems and leaf veins usually of long white trichomes much longer than those of the leaf blades; biennial or perennial4. *P. confertum*.
4. Upper leaves and bracts entire or bilobed with a linear terminal segment, the leaves markedly reduced upward; head-bearing region widely branching; peduncles slender, the adjacent bracts much-reduced to obsolete; pubescence similar on stems, leaf veins and blades; annual5. *P. Hysterophorus*.

1. *Parthenium argentatum* Gray. GUAYULE. Shrub 3-10 dm. tall, intricately branching just above the base, extremities of branches silvery-canescenscent; leaves long-petioled, silvery-canescenscent with dense covering of peltate trichomes, spatulate to narrowly oblanceolate, acute to acuminate, 2-6 cm. long, 5-20 mm. broad, entire to several-toothed; pedunculi-form, nearly naked axillary branches rising 1-2 dm. and topped by a congested mass of flat-topped heads; pappus 3 erect to slightly spreading awns. Locally abundant in calcareous deserts in the Trans-Pecos, (spring-) fall; Tex., Chih., Coah., N.L., Dgo., Zac. and S.L.P.; with an outlying station in Hgo.

See remarks under the next species.

2. *Parthenium incanum* H.B.K. MARIOLA. Shrub 4-10 dm. tall, intricately branched from the base, the branches cottony-pubescent with long simple trichomes, at length glabrate; leaves mostly lyrate, broadly oblong to obovate, short-petioled, lobed, sometimes deeply so (the lobes rounded), densely cinereous-tomentose beneath, less densely so above, 1-6 cm. long, 5-20 mm. broad; heads in paniculately corymbose groups terminating the main branches, flat-topped; pappus of 2 lateral divergent to erect pubescent awns and a weaker ventral awn (the latter occasionally absent). Very frequent in Trans-Pecos deserts, infrequent e. to Plains Country, Edwards Plateau and along the Rio Grande s.e. to Starr Co. in the Rio Grande Plains, summer-fall; Ariz., N.M., Tex., s. and s.e. to Jal., Michoac. and D.F.

This species and *P. argentatum* have hybridized and occasional hybrid swarms or contaminated individuals are found which cannot be referred with certainty to one or the other species.

3. *Parthenium hispidum* Raf. FEWERFEW. Perennial herb; roots often laterally branched to form underground runners; stems pilose-hispid, unbranched below, striate, 2-4 mm. thick, 2-8 dm. tall; basal leaves long-petioled; blades pilose-hispid, broadly lanceolate to

ovate, crenate to somewhat dentate, 6-20 cm. long, 5-10 cm. broad, with subpetiolar base 6-15 cm. long; lower stem leaves similar to basal, sometimes with a interruptedly winged subpetiolar base; upper stem leaves sessile, auriculate to scarcely so, ovate to ovate-lanceolate, crenate to dentate, pilose-hispid particularly along the veins; heads slightly convex on top, in flat-topped corymbose groups; pappus of 2 rather weak linear awns. *P. integrifolium* of auth. Rare in extreme n.e. Tex. (Bowie Co.), spring?-summer; W.Va., Va., N.C., Mich., Ill., Mo., Kan., Okla., La., Ark. and Tex.

4. *Parthenium confertum* Gray. Biennial or perennial herb; stems 1 to few from the base, branched above, longitudinally striate, 2-7 dm. high, densely hirsute with long simple trichomes; lower leaves pinnatifid to lyrate, with subpetiolar base, densely hirsute; middle and upper leaves sessile, usually crowded, pinnatifid to bipinnatifid, oblong in outline, often crenate, the lobes obtuse; heads slightly convex on top, loosely paniculate on numerous branches; pappus scales 2, broadly oblong to ovate or triangular, petaloid, often erose apically. Incl. var. *divaricatum* Roll. and var. *microcephalum* Roll., *P. lyratum* (Gray) Gray. Frequent in Trans-Pecos deserts and mts., e. to s. Plains Country, Edwards Plateau and Rio Grande Plains, summer-fall; Tex., N.M., Chih., Coah., N.L., S.L.P. and Zac.

Somewhat variable in the presence or absence of minute rays on the ray flowers, the shape of the chaff paleae, etc.

5. *Parthenium Hysterophorus* L. FALSE RAGWEED, SANTA MARIA FEVERFEW, CICUTILLA. Taprooted annual; stems hirsute, single from the base, paniculately branched above, longitudinally striate, 3-10 dm. tall; lower leaves forming a basal rosette, pinnatifid to bipinnatifid, hirsute, with a subpetiolar base; upper leaves entire to slightly lobed, sessile or with a short subpetiolar base, hirsute; heads slightly convex on top, numerous, borne in open paniculiform arrangements 3-4 mm. broad, densely pubescent; pappus of 2 scales, petaloid, closely adjoining corolla on either side, ovate to oblong, entire to faintly notched. Locally very abundant in disturbed ground, Rio Grande Plains and s.e. Tex., less frequent n. into n.-cen. Tex. and infrequent elsewhere in the state, summer-fall; very widespread in the warmer parts of Am., adv. as a weed n. to Mass., Mich. and Okla.; perhaps adv. to Tex.

60. IVA L.²¹⁰

SUMP-WEED. MARSH-ELDER

Annual or perennial herbs, glabrous or pubescent; leaves alternate or opposite, entire, serrate, lobed or pinnately divided; heads in a spiciform, spiciform-racemiform or paniculate arrangement, 2-8 mm. broad, containing both pistillate and staminate flowers, the pistillate flowers peripheral, the staminate flowers representing the disk flowers in the center of the head; receptacle essentially flat, paleaceous throughout; involucre hemispheric or turbinate; phyllaries 3 to 9, sometimes imbricate, free or united; staminate (disk) flowers 3 to 20, their corolla funnelform, 5-lobed, to 6 mm. long; peripheral pistillate flowers 1 to 9, the corolla tubular, truncate, to 6 mm. long or in some species rudimentary; achenes 1-13 mm. long, cuneate to obovate, somewhat compressed, glabrous, resin-dotted, tuberculate or pubescent at maturity.

A North American genus of 19 species.

- 1. Leaves lobed or dissected, or rarely unlobed but serrate; corolla of the peripheral (fertile) flowers absent or rudimentary (2)
- 1. Leaves never lobed or dissected; peripheral (fertile) flowers with developed corolla (4)
- 2(1). Leaves serrate, sometimes 3- to 5-lobed, never pinnatifid 8. *I. xanthifolia*.
- 2. Leaves pinnatifid (3)
- 3(2). Perennial; leaves villous-tomentose 7. *I. dealbata*.
- 3. Annual; leaves not tomentose 6. *I. ambrosiaefolia*.
- 4(1). Phyllaries united (5)
- 4. Phyllaries free (6)

²¹⁰Largely adapted from R. C. Jackson in Univ. Kan. Sci. Bull. 41:793-876. 1960.

- 5(4). Taprooted annual4. *I. angustifolia*.
 5. Perennial with creeping rootstocks5. *I. axillaris*.
 6(4). Annual; phyllaries hispid; mature achenes with few remote resin-dots; leaves of midstem usually ovate3. *I. annua*.
 6. Perennials; phyllaries not hispid; mature achenes with numerous resin-dots; leaves of midstem lanceolate to obovate (7)
 7(6). Leaves of midstem alternate, glabrous and fleshy; phyllaries 6 to 9, imbricate ..
1. *I. imbricata*.
 7. Leaves of midstem opposite, puberulent, not fleshy; phyllaries 4 to 6, not or only slightly imbricated2. *I. frutescens*.

1. *Iva imbricata* Walt. Perennial, woody at the base; stems decumbent, branched above, to 1 m. high, glabrous; leaves 1-5 cm. long, sessile, entire or rarely serrulate, the lowermost opposite, the midstem and upper ones alternate, oblanceolate to oblong, acute, thick, indistinctly 3-nerved; leaves of the head-bearing region reduced to bracts, entire; heads in racemes; involucre hemispheric to campanulate, 5-8 mm. broad, 3.5-5.8 mm. tall; phyllaries 6 to 9, free, imbricate, broadly obovate to orbicular, the margins membranous and erose, the dorsal surfaces glabrous; pales subtending the staminate (disk) flowers spatulate or oblanceolate, erose apically, those subtending the peripheral pistillate flowers oblanceolate to elliptic; staminate flowers numerous, 4-6 mm. long; pistillate flowers 2 to 4, corolla 1-1.5 mm. long; achene 3.5-5 mm. long, brown, resin-dotted at maturity. Rare on sandy beaches in s.e. Tex., known only from Mustang Island, Nueces Co., Aug.; also beaches in Va., Fla., La., Bah. I. and Cuba.

2. *Iva frutescens* L. Bushy perennial; stems 5-35 dm. tall, strigose above, glabrous below; leaves 4-12 cm. long, opposite below, becoming alternate in the head-bearing region, ciliolate with usually 5 to 17 teeth on each side, narrowly lanceolate to lanceolate or elliptic to obovate, often petioled, 3-nerved, strigose above and below, 2.5 to 8 times as long as broad; bracteal leaves of the head-bearing region linear, mostly entire; heads numerous in leafy panicles; involucre hemispheric, 4-6 mm. broad, 2-4.5 mm. high; phyllaries 4 to 6, free, obovate or ovate, sparingly strigulose on the back; palea subtending the staminate flowers linear to narrowly spatulate to oblanceolate; pales subtending the pistillate flowers broadly oblanceolate to oblong or broadly spatulate to elliptic; staminate flowers 6 to 19, with corollas about 2 mm. long; pistillate flowers 4 to 6, corolla about 1 mm. long; mature achenes brown, resin-dotted, 1-3.9 mm. long. Infrequent in mud flats and shallow water in coastal areas, s.e. Tex., s.w. as far as San Patricio Co., June-Oct.; the species as a whole occurs from N.S. to Tex. along the coast.

Essentially all our plants are referable to the var. *frutescens* with their leaves mostly 5 to 8 times as long as broad, the measurements of the flower and head parts approaching the lower limits of those given in the general description and the entire plant usually over 1 m. high. Another variety, the var. *oraria* (Bartlett) Fern. & Griseb., has been collected rarely at Galveston, the specimens perhaps representing casual introductions. It differs from var. *frutescens* mainly in being a smaller plant with typically larger elliptic to broadly lanceolate leaves.

3. *Iva annua* L. MARSH-ELDER, PELOCOTE. Taprooted annual 4-20 dm. tall; leaves opposite, 3-12 cm. long, ovate or becoming lanceolate upward, reduced in the head-bearing region to bracts; petioles present; heads in a terminal spiciform arrangement; involucre turbinate, 4-5 mm. broad; phyllaries 3 or 4, free, cuneate, apically rounded or truncate, dorsally hispid, hispid-ciliate marginally; pales subtending the staminate flowers mostly linear with sessile glands, those subtending the pistillate flowers filiform or with clavate tips, sometimes absent; staminate flowers 9 to 17, corolla about 2.5 mm. long; pistillate flowers 3 to 5, corollas about 1.5 mm. long; mature achenes 2-4.5 mm. long, brown, broadly ovate, lenticular. *I. caudata* Small, *I. ciliata* Willd. E. half of Tex., w. to Wheeler, Taylor, Travis, DeWitt and Hidalgo cos., late summer and fall; most of e. U.S., w. to Neb., Kan., Okla., Tex. and Tam.

4. *Iva angustifolia* DC. Annual, rarely overwintering; stems 5-12 (-14) dm. tall, 1-10 (-25) mm. thick at the base, much-branched above, sparingly to densely strigose; leaves opposite below, becoming alternate above, petiolate, entire or serrate, linear-lanceolate to

lanceolate, conspicuously 3-nerved on the larger leaves, strigose above and below, 2-4 (-5) cm. long, 2-8 (-12) mm. broad, bracts of the head region lanceolate to linear or linear-filiform; heads subsessile in the axils of bracts; involucre turbinate, 2-3 mm. broad, 2-3 (-4) mm. high; phyllaries united into a cup, strigose to hispid on the backs, villous-ciliate at the tips; receptacular scales subtending the staminate flowers filiform to linear, those of the pistillate flowers absent; staminate flowers 1 to 3 (to 5), the corolla about 2 mm. long; pistillate flowers 1 or rarely 2 in each head, the corolla about 1.5 mm. long; mature achenes black, rugose, sometimes pubescent at the apex, 2-2.8 mm. long. E., s.e. and n.-cen. Tex., Edwards Plateau, Trans-Pecos and Rio Grande Plains, locally abundant, late summer-fall; Ark., Okla., Tex. and La.

The plants of the sandy coastal areas of the Rio Grande Plains have a tendency to be robust, the plants and the stems approaching the maximum values given in the general description above, and they may have a tendency to overwinter more often than those farther north. The leaves and especially the bracts in the head region have a tendency to be proportionately broader than those of the plants farther north. These have been called *I. angustifolia* var. *latior* Shinnery and *I. texensis* R. C. Jackson. They can at most be considered varietally distinct.

5. *Iva axillaris* Pursh. Perennial herb from creeping rootstocks; stems herbaceous or ligneous at base, 3-6 dm. tall, strigose to villous; leaves opposite or becoming alternate above, subsessile, unlobed, at margins entire, ovate to elliptic or sometimes spatulate, obtuse, indistinctly 3-nerved; leaves of the capitulescence smaller but similar; heads short-peduncled, solitary in the upper bract axils; involucre hemispheric, 4-5 mm. broad, about 2.5-3 mm. high; phyllaries 4 or 5, united to the middle or above to form a cup (rarely 1 phyllary free), the tips rounded; palea of staminate flowers oblanceolate to spatulate, those of the pistillate flowers oblanceolate or absent; staminate flowers 8 to 20; corolla 2-2.5 mm. long; mature achenes brownish, 2.5-3 mm. long. In the Panhandle (Bailey and Oldham cos.), in and about playa lakes, Apr.-July; Man., Alta. and Wash. s. to Tex., N.M., Ariz. and Calif.

6. *Iva ambrosiaefolia* (Gray) Gray. Much-branched annual; stems 3-8 dm. tall, terete, velutinous and hispid, or with only appressed hairs; leaves alternate, ovate, 5-6 cm. long, bipinnatifid with confluent segments, pubescent on both surfaces, sometimes hispid on the main veins, ultimate segments obtuse or acute and toothed; heads numerous, usually short-peduncled in axillary spikes or panicles and terminal naked panicles; involucre hemispheric, 2-2.5 mm. high, 4-5 mm. thick; phyllaries 5, obovate to oblanceolate, sparingly hispid on the backs; pales subtending the staminate flowers linear-spatulate, those subtending the pistillate flowers cuneate-obovate, obtuse to truncate, the apex entire or slightly erose; staminate flowers numerous, their corolla about 1.5 mm. long; pistillate flowers 6 to 8 in each head, corolla vestigial or absent; achenes corky and ridged when immature, usually smooth and black at maturity, 1.2-1.5 mm. long. Infrequent in the Trans-Pecos deserts, late summer and fall; Ariz., N.M. and Tex., s. to Dgo., Zac. and S.L.P.

7. *Iva dealbata* Gray. WOOLLY SUMP-WEED. Perennial; stems erect, 3-7 dm. tall, striate-angled, tomentose; leaves petioled, alternate, oblanceolate in outline, 5-12 cm. long, pinnately cleft and veined, rugose-tomentose above and below, the terminal divisions ovate or oblanceolate, the basal divisions usually lanceolate; heads numerous in terminal panicles; involucre hemispheric, about 3 mm. thick; phyllaries 5, distinct, slightly imbricate, ovate, the margins membranous and villous-ciliate, usually glabrous on the backs; pales subtending the staminate flowers absent, vestigial or rarely well-developed and oblanceolate, those subtending the pistillate flowers rarely present; staminate flowers 7 to 14, corolla about 1.5 mm. long; pistillate flowers usually 5, corolla 0.3-0.7 mm. long; achenes dark-brown or purplish-brown at maturity, 1.4-2 mm. long. Locally abundant in calcareous deserts in the Trans-Pecos, late summer and fall; N.M. and Tex. s.w. to Dgo., Zac. and S.L.P.

8. *Iva xanthifolia* Nutt. Robust annual; stem 4-20 dm. tall, usually glabrous but sometimes pubescent; leaves of midstem opposite, 7-30 cm. long, 3-nerved, usually scabrous above, strigose or tomentose below, ovate or subcordate, coarsely serrate and sometimes 3- to 5-lobed; heads numerous in axillary spikes or panicles and naked terminal panicles, sessile or pedunculate; involucre turbinate, 4-5 mm. broad; phyllaries 5, obovate,

acuminate, hispid on the backs; pales subtending the staminate flowers subulate or filiform but sometimes absent in the center of the receptacle, those subtending the pistillate flowers obovate, concave, ciliate; staminate flowers 8 to 20, corolla about 2.5 mm. long; pistillate flowers usually 5, corolla 0.5 mm. long or represented only by a small flange at the base of the style; mature achenes obovate, finely muricate, usually dark-brown, about 3 mm. long. Infrequent in sandy stream beds and sandy stream margins, higher parts of the Plains Country, late summer to fall; Que. to Alta. and s. to D.C., O., Mo., Tex., N.M. and Ariz.

61. HYMENOCLEA T. & G.

A western American genus of about 4 species.

1. *Hymenoclea monogyra* T.&G. BURRO-BRUSH. Perennial broomlike subshrub 5-10 (-20) dm. tall, densely branched, the branches ascending; leaves alternate, linear or usually filiform; heads in small roughly globose axillary clusters, about 5 mm. high, of 2 kinds, the more numerous heads of staminate flowers and the less numerous pistillate ones, both kinds present in the same cluster; *staminate heads* with about 5 to 10 flowers, with a few papery obovate phyllaries and the outer flowers subtended by chaff but the inner not; corollas off-white, tubular and 5-toothed apically; *pistillate heads* bizarre, 1-flowered; involucre papery, whitish, with a basal obconical portion about 1 mm. high and 9 to 12 spreading obovate outer phyllaries about 2 mm. long forming a saucer-shaped winglike structure, and in the middle of the "saucer" a few inner phyllaries united to form a tubular-conic corolla-like structure, the solitary pistillate flower comprising merely an ovary and deeply bifurcate style occupies the basal cup and the inner tube cone, the tips of the style protruding from the top of the cone; pappus absent; entire pistillate head becomes airborne as a unit. Locally frequent in sandy desert washes in the Trans-Pecos, rare e. in Edwards Plateau, Sept.-Oct.; Tex., N.M., Ariz., Calif., Baja Calif., Son. and Chih.

62. AMBROSIA L.²¹¹

RAGWEED

Annual or perennial herbs (when perennial usually proliferating from runnerlike roots), 2-30 dm. tall, leafy, resinous and aromatic with glandular trichomes; leaves alternate or opposite at the lower nodes (in some species opposite nearly throughout), entire or palmately lobed or (usually) pinnately lobed or dissected, usually petiolate; ray flowers absent; heads unisexual, both staminate and pistillate borne on the same plant; staminate usually in narrow elongate racemelike or spikelike aggregations; pistillate clustered in axils of leaves and bracts below; *staminate heads* nodding, usually hemispheric; phyllaries few, uniseriate, more or less united; involucre frequently oblique by elongation of the portion away from the stem; receptacle flattish, chaffy throughout (the pales narrow); flowers several to many with rudimentary pistil (pistillodium) and wholly aborted ovaries; anthers usually more or less separated at anthesis; pappus absent; *pistillate heads* with one or few flowers; phyllaries fused about flowers to form a hard indehiscent nutlike receptacle, the phyllary tips more or less evident as spiny processes that project from the surface of the involucre at maturity; flowers lacking pappus, corolla and androecium. *Franseria* Cav.

A predominantly American genus with approximately 43 species, many of these being desert shrubs. They are wind-pollinated, the pollen of all species being highly allergenic.

1. Tubercles or spines of the pistillate head scattered in several series over the body of the fruiting involucre (2)
1. Tubercles or spines of the pistillate head in a single series (or absent) near the apex of the fruiting involucre (4)
- 2(1). Pistillate heads with 2 apical beaks, 2 flowers and 2 cells; foliage silver-canescens
..... 1. *A. Grayi*.
2. Pistillate heads with a single apical beak, flower and cell; foliage green (3)

²¹¹ Contributed by Willard W. Payne.

- 3(2). Pistillate head at fruiting time 2-5 mm. long; involucre spines short and incurved; staminate involucre lacking striations2. *A. confertiflora*.
3. Pistillate head at fruiting time 6-10 mm. long; involucre spines elongate and straight; staminate involucre with three black striations on distal lobes3. *A. acanthicarpa*.
- 4(1). Staminate heads sessile in a spikelike arrangement; staminate involucre very oblique, produced on side away from the stem into a lanceolate-acuminate lobe4. *A. bidentata*.
4. Staminate heads stalked in racemelike arrangements; staminate involucre only slightly if at all oblique (5)
- 5(4). Annual; cauline leaves distinctly petiolate (6)
5. Perennial; cauline leaves sessile (7)
- 6(5). Leaves broadly 3- to 5-lobed or unlobed; staminate head with 3 striations on distal lobes5. *A. trifida*.
6. Leaves pinnately lobed or dissected; staminate head lacking striations on distal lobes6. *A. artemisiifolia*.
- 7(5). Median leaves of flowering stems entire, silky-pubescent7. *A. cheiranthifolia*.
7. Median leaves of flowering stems pinnately lobed and toothed, scabrous-pubescent8. *A. psilostachya*.

1. *Ambrosia Grayi* (A. Nels.) Shinn. Upright perennial herb, proliferating by adventitious shoots from runnerlike underground roots, forming large colonies; leaves alternate; blades narrowed to petiolar bases to 5 cm. long, with several small lobes below the main expanded blade-portion; main bladelike portion obovate-deltoid to lanceolate, to 1 dm. long and 8 cm. broad, irregularly pinnately lobed, major basal lobes and terminal lobe much the largest, large lobes lanceolate-elliptical, serrate, both surfaces (and entire herbage) silvery gray-canescens; staminate heads in racemiform arrangements; pistillate heads in small clusters (2 to 5) or singly in axils of lower leaves and bracts; *staminate involucre*s stalked, to 5 mm. broad, 5- to 9-lobed, the lobes often somewhat irregular, shallow, the upper surface with fine dark striations along the mid-veins obscured by pubescence; *fruiting involucre*s to 7 mm. long and 4 mm. broad, each 2-flowered; spines up to 15, scattered, narrowed to slender uncinat tips. *Franseria tomentosa* Gray. Locally abundant in wet or seasonally moist swales and buffalo wallows, and in moist clay soils under cult., higher parts of the Plains Country, summer-early fall; Kan., Neb., Okla., Colo. and Tex.

2. *Ambrosia confertiflora* DC. Erect perennial forming large colonies by means of proliferations from runnerlike roots, to 18 dm. tall; leaves alternate, narrowed to petiolar bases to 15 cm. long and often with 1 to several pairs of small lobes below the main blade portion; main blade ovate-lanceolate to lanceolate, pinnately to tetrapinnately lobed, the lobes lanceolate to linear, attenuated or abruptly terminated, to 16 cm. long and 15 cm. broad, usually smaller, both surfaces green to somewhat gray-green, glabrous or nearly so to densely strigose, becoming somewhat velutinous; staminate heads in racemiform arrangements, the inflorescence often much-branched; pistillate heads usually abundantly produced in massive glomerules below the staminate "racemes;" *staminate involucre*s stalked, to 1 cm. broad, 5- to 9-lobed, the lobes obscure and poorly defined to well-defined with the sinuses extending nearly halfway to point of stalk attachment; *fruiting involucre*s to 5 mm. long and 4 mm. broad, often much smaller, the base tending to be elongate leaving the spines arranged on the upper two-thirds of the body, 1- (rarely 2-) flowered; spines 10 (or fewer) to 20, short, 1 mm. (or less) to 2 mm. long, slender, uncinat, often appressed, the bases associated with prominent involucre ridges and depressions. *Franseria confertiflora* (DC.) Rydb., *F. tenuifolia* Harv. & Gray and var. *tripinnatifida* Gray, *F. caudata* Rydb., *Ambrosia simulans* Shinn. Abundant in the Trans-Pecos, less frequent in disturbed soil e. to Taylor, Travis, Nueces, Kleberg and Cameron cos., summer-fall; Tex., s.w. Okla. and Colo., w. to Calif. and s.e. to Gro. and Jal.; adv. in H.I. and P.R.

3. *Ambrosia acanthicarpa* Hook. Erect annual herb to 15 dm. tall, becoming much-branched; leaves opposite below, alternate above, narrowed to petiolar base; blade extremely variable, broadly deltoid to narrowly lanceolate, to about 8 cm. long and broad, pinnately to tripinnately lobed, the lobes from narrowly linear to obovate and abruptly acute, both surfaces green or the central portions of the lobes somewhat whitened by pubescence above, sparsely tomentulose to strigose or hispid-scabrous; staminate heads in racemiform arrangements, these often much-branched; pistillate heads in few- to many-headed clusters below; *staminate involucre*s stalked (stalks to 15 mm. long, usually shorter), 3-12 mm. broad, 3- to 9-lobed, the lobes shallow to well-defined with sinuses reaching halfway or more to point of stalk attachment, upper surface of three distal lobes usually marked with heavy black striations along midveins; *fruiting involucre*s to 10 mm. long and 14 mm. broad, 1-flowered; spines to 30, flattened (rarely nearly terete), linear to lanceolate, sharply pointed, to 8 mm. long, scattered, occasionally vestigial or absent. *Franseria montana* Nutt., *F. acanthicarpa* (Hook.) Cov. Locally abundant near El Paso, infrequent e. to Hudspeth Co., late summer-early fall; most of w. U.S., e. to Dak., Neb., Kan. and Tex.

4. *Ambrosia bidentata* Michx. SOUTHERN RAGWEED. Erect annual taprooted herb, 3-10 dm. tall, rough-hirsute, becoming much-branched, the lateral and terminal branches often reaching approximately the same height; leaves mostly alternate, sessile, lanceolate, acuminate, 3-5 cm. long, usually with one broad basal tooth on each side, green, both surfaces hirsute, the hairs commonly with somewhat pustulate bases; staminate heads numerous in dense spicate aggregations; pistillate heads 1 or few per cluster, nearly hidden in axils of leaves subtending the "spikes"; inflorescences usually unbranched; *staminate involucre*s sessile, glandular-granuliferous, very oblique, turbinate, 2 mm. or more broad, the outer margin produced into a lanceolate hispid incurved lobe; *fruiting involucre*s 1-flowered, hirsute, elongate, obovoid, usually 4-angled, each angle terminating in a very sharp subulate spine 1 mm. long or longer and directed forward, the beak subulate and fully 2 mm. long. Rare in prairies in n.-cen. Tex. (Lamar Co.), Aug.-Sept.; Ill., O. and Ky. to La., Tex., Neb. and Okla.

5. *Ambrosia trifida* L. GIANT RAGWEED. Tall erect annual taprooted herb, 1-3 (-5) m. tall; stem angled, striate and scabrous; leaves opposite nearly throughout, scabrous on both sides, with petioles 5-15 cm. long, wingless or very narrowly winged; blades of lower leaves orbicular in outline, 1-2 dm. long, usually deeply 5-cleft, the major divisions often 2- to 3-lobed, the upper commonly 3-cleft or simple, becoming rhombic or ovate-lanceolate in outline, blades sometimes simple throughout, margin serrate; staminate heads in racemiform arrangements, these often much-branched and paniculate; pistillate heads in small to large clusters in axils of bracteal leaves below the "racemes," subtended by (usually) lobed bracts; *staminate involucre*s saucer-shaped, 3 mm. broad, with 6 to 8 rounded lobes, the 3 outer lobes with dark striations on the upper surface, hispidulous between the ribs, pales of the receptacle rudimentary; *fruiting involucre*s obovoid, about 4 mm. long, reticulate and with 4 to 8 obtuse ridges and as many small or obsolete tuberculate spines, the conic beak 1 mm. long or more. Abundant in seasonally moist stream bottoms and overflow areas throughout the e. and n. halves of the state, late summer-fall; throughout the midwest. and cen. U.S. to the Rocky Mts. and from s. Can. to n. Mex., adv. in N.E., Fla. and the far West.

Our plants are all of the form known as var. *texana* Scheele (*A. aptera* DC.), characterized by relatively small fruiting involucre and exceptionally scabrous indument. In the central and southern United States much of the fall hayfever is correctly attributed to this species.

6. *Ambrosia artemisiifolia* L. SHORT RAGWEED, ALTAMISA. Erect annual taprooted herb; stems 3-10 dm. tall, more or less hirsute or hispidulous, branched; leaves opposite below, alternate above, with petioles 1-3 cm. long, often narrowly winged, becoming subsessile or sessile in the inflorescence; blades ovate in outline, to 10 cm. long and 7 cm. broad, usually smaller (sometimes larger), pinnatifid to usually bipinnatifid, the lobes lanceolate, acute, directed forward, the winged rachis to 3 mm. broad, upper leaves often less divided, hirsutulous-puberulent above, strigose beneath and often hirsute on the veins; staminate heads in racemiform aggregations; pistillate heads in few- to several-headed clusters below, the inflorescence often much-branched and paniculate, occasionally nearly all or wholly unisexual; *staminate involucre*s slightly oblique, about 3 mm. broad,

crenate, hirsutulous, hispidulous, or long-hirsute or villous, broadly obconic; pales of the receptacle filiform; *fruiting involucre* obovoid, about 3 mm. long, hispidulous-strigose or glabrate, angled and somewhat reticulate, beak subulate and usually more than 1 mm. long; spines 5 to 7, subulate, short. *A. elatior* L. Infrequent and scattered in local populations through much of Tex. except extreme s. and w., late summer-fall; nearly throughout the U.S. (except the far s.w.) and s. Can., adv. elsewhere.

This is the most widespread and abundant of the ragweed species, and the principal source of allergenic pollen in most of the central United States.

7. *Ambrosia cheiranthifolia* Gray. Erect perennial herb, forming usually restricted often close-spaced colonies from roots; stems 1-3 (-4) dm. tall, grayish strigose; leaves opposite below (or nearly throughout), alternate above, oblanceolate or oblong-lanceolate, 2-4 (-7) cm. long; blade gradually narrowed to the sessile base, unlobed and entire-margined or the lower and larger leaves of juvenile shoots undulate-margined or shallowly pinnate, finely and densely strigose on both sides; inflorescence usually unbranched; staminate heads in racemiform arrangement; pistillate heads in small clusters in axils of leaves below "racemes;" *staminate involucre* saucer-shaped, about 4 mm. broad, canescent, with 4 to 6 triangular-acute lobes; pales of the receptacle linear or oblanceolate, 1-nerved, ciliate toward the apex; *fruiting involucre* puberulent, somewhat angled, obovoid, the body about 3 mm. long; beak stout, conic, 1.5 mm. long; spines 4 or 5, more or less spreading, blunt, about 1 mm. long. Infrequent or rare in the coastal parts of the Rio Grande Plains and s. part of s.e. Tex., in open clay prairies, late summer-fall; also Tam.

8. *Ambrosia psilostachya* DC. WESTERN RAGWEED. Erect perennial herb forming extensive colonies from runnerlike roots; stem 3-6 (-10 or more) dm. tall, often branched above, striate, hirsutulous with short ascending hairs; leaves subsessile, lanceolate to ovate-lanceolate, pinnatifid with the divisions linear-lanceolate, acute or acuminate, entire or the lower few-toothed or weakly lobed, scabrous-hirsutulous and glandular-granuliferous, the hairs with pustulate bases; inflorescence often much-branched; staminate heads in racemiform aggregations; pistillate heads in few- to several-headed clusters below; *staminate involucre* oblique, broadly obconic, about 2.5 mm. broad, crenate at the margins, often with 2 larger teeth at the distal side, hispidulous, the short hairs with conspicuous pustulate bases; body of *fruiting involucre* about 2.5 mm. long, obovoid, rugose, hirsutulous; beak nearly 1 mm. long, stout, tubercles 4 to 6, short, acute or blunt. *A. Lindheimeriana* Scheele. Very abundant on the Coastal Plain and much of the cen. part of Tex., frequent in the Plains Country and becoming less frequent w. until rare in the Trans-Pecos, late summer-fall; throughout most of the U.S. and s. Can. except the Rocky Mts. and e.-cen. states, s. to cen. Mex.

63. XANTHIUM L. COCKLEBUR

Taprooted annuals, 2-20 dm. tall; leaves alternate (those at the very lowest nodes opposite), petiolate, often irregularly toothed or even lobed, several cm. long; heads axillary, nearly sessile, unisexual; *pistillate heads* in the middle axils, burlike, the involucre usually obovoid and completely enclosing the 2 pistillate flowers, forming a conspicuous 2-chambered bur, prickly on the outside; flowers without any corolla or pappus, the achenes solitary in the chambers of the bur; *staminate heads* in the upper axils much smaller; involucre cup-shaped; phyllaries in 1 to 3 series, separate, foliaceous in texture; the receptacle high-conic, chaffy, throughout; ray flowers absent; disk flowers several, with minute tubular corolla and 5 free anthers and vestigial style and ovary.

An American genus (now widely distributed) of two dozen species or possibly as few as 2 species depending on the criteria used. Closely related to some of the franserioid ambrosias, with exaggerated "burs." The fruits are known to cause mechanical damage to animals while the young herbage, when eaten, is known to be poisonous to pigs.

1. Most nodes with a trifold yellow lateral spine attached near the base of the leaf
 1. *X. spinosum*.

1. Herbage not armed, only the heads armed 2. *X. strumarium*.

1. *Xanthium spinosum* L. SPINY COCKLEBUR. As in the key; leaves lanceolate. Infrequent, locally abundant in the Trans-Pecos, Edwards Plateau and Plains Country, sum-

mer-fall; widespread in the warmer drier parts of the world.

2. *Xanthium strumarium* L. ABROJO. As in the key; blades often as broad as long. *X. orientale* L., *X. chinense* Mill., *X. italicum* Moretti, *X. pennsylvanicum* Wallr., *X. saccharatum* Wallr., *X. speciosum* Kearm., *X. cenchroides* Millsp. & Sherff. Frequent throughout Tex., summer-fall; widespread.

It seems useless at this point to try to recognize more than one entity in this complex, for all the proposed segregates intergrade completely.

64. ZINNIA L.²¹² ZINNIA

Low shrubs (usually about 1 dm. tall); taproots woody; stems usually several from near the base; leaves opposite, linear, entire, sessile, the bases connate to some extent; heads terminal on the stems and branches, not much elevated above the herbage; involucre cylindrical to subhemispheric; phyllaries oblong to obovate, imbricate, graduated, the apexes mostly rounded and erose; chaffy throughout, the pales folded around the achenes, erose, membranous, scarious; *ray flowers* present, pistillate, fertile; rays yellow or white, persistent on their achenes, vaguely 3-toothed terminally; *disk flowers* perfect, fertile, the corollas white or yellowish, 5-toothed terminally (but irregular, 1 tooth being longer than the others), the teeth ciliate ventrally; style branches densely velutinous, acute; disk achenes laterally compressed or angular, glabrous or pubescent; pappus of awns. *Diplothrrix* DC.

An American genus of 17 species.

In addition to our native species, the cultivated *Z. peruviana* (L.) L. (*Z. multiflora* L.), a taprooted annual with red flowers, has been reported to be feral in Texas; it probably has escaped from cultivation.

1. Leaves linear to acerose, 1-nerved only at the base; rays white 3. *Z. acerosa*.
1. Leaves linear to very narrowly lanceolate, 3-nerved for at least half their length; rays yellow (2)
- 2(1). Rays to 18 mm. long; heads 5-8 mm. high 1. *Z. grandiflora*.
2. Rays small or wanting; heads 8-10 mm. high 2. *Z. anomala*.

1. *Zinnia grandiflora* Nutt. Shrublet 8-22 cm. tall; leaves linear, 3-nerved for at least half their length, about 25 mm. long, 2.2 mm. broad, strigose-scabrous; peduncles of varying lengths, to 11 mm. long; heads narrow-campanulate to cylindrical, 5-8 mm. high; phyllaries oblong, obtuse, with or without a dark summital band, subsquarrose, their apical margins erose-ciliate, often red-tipped; rays 3 to 6, yellow, ovate or orbicular, to 18 mm. long; ray achenes oblanceolate-linear, 3-angled, the lateral awns generally adnate to the ray or only slightly free at the apex, the awn of the inner angle none or minute; disk flowers usually 18 to 24, red or green in the same population, to 1 cm. long, with lobes 1 mm. long; disk achenes oblanceolate, angular or compressed, 4-5 mm. long; awns absent or 1 to 4, mostly 2 and unequal. Abundant in dry calcareous areas in the Trans-Pecos and Plains Country, summer-fall; Colo., Kan., Ariz., N.M., Chih., Coah., Dgo., Zac. and Tex.

2. *Zinnia anomala* Gray. Very low shrublet about 11 cm. tall, often straggly; leaves linear, to 3 cm. long, 4 mm. broad, marginally scabrous; peduncles less than 19 mm. long, mostly strigose; heads broadly cylindrical, 8-10 mm. high; phyllaries oblong, green with a dark-purplish-brown summital band or discolored zone, the apexes rounded, ciliate; rays absent or when present 5 to 8, yellow, reduced, to 5.7 mm. long but usually much smaller, scarcely tubed; ray achenes oblance-linear, 3-angled, 7-8 mm. long, striate, sparsely strigose, the pappus absent or of 1 or 2 very short awns; disk corollas about 20, brick-red, 5.5-6.2 mm. long; disk achenes oblanceolate, 3.2-5.8 mm. long; pappus of 2 equal or 2 or 3 unequal awns. Infrequent in the Trans-Pecos, rare in Edwards Plateau, summer-fall; Zac., Coah., N.L. and Tex.

3. *Zinnia acerosa* (DC.) Gray. Shrublet to 16 cm. tall; stem greenish, slender, tomentose; leaves acerose to linear, 1-nerved, to 2 cm. long and 2 mm. broad, strigose to

²¹² Adapted from Andrew M. Torres in *Brittonia* 15:1-25. 1963.

essentially glabrous; peduncles to 25 mm. long; heads narrowly campanulate, about 6 mm. high; phyllaries oblong, herbaceous, becoming scarious, their apexes obtuse, ciliate, with a dark summital band or the summit only roughened and discolored; rays 4 to 6, white, oblong to suborbicular, 1 cm. long or shorter, tubeless, green-nerved beneath; ray achenes oblanceolate, 3-angled, truncate apically, 2.6-4 mm. long, the awns striate, ciliate above, fused to and continuous with the main corolla nerves or the 3 awns free, or a single free awn present on the inner angle; disk flowers 8 to 13, yellow (drying reddish), 6 mm. long; disk achenes oblanceolate, 2.4-3.6 mm. long, striate, strigose or only upwardly ciliate, the pappus usually of 2 or 3 unequal awns or these much-reduced. Frequent in Trans-Pecos deserts and desert-grasslands, summer-fall; Ariz., N.M., Tex., Chih., Son., Coah. and N.L.

65. SANVITALIA LAM.²¹³

Taprooted annual herbs; stems pubescent, obscurely striate, terete; leaves opposite, petiolate to sessile, entire, pubescent, at the base connate and sheathing the stem; peduncles terete, pubescent, striate or absent; heads terminal, hemispherical; receptacle low-conical to high-conical; pales of the receptacle conduplicate, hyaline, scarious, usually dark-colored on the upper third, colorless below, at apex acuminate-cuspidate or simply rounded; phyllaries ovate to obovate; ray flowers pistillate, fertile; rays mostly persistent, entire or two-lobed, white or very pale-yellow, shortly tubed to usually tubeless; ray achene mostly 3-angled, mostly with 3 awns at the top representing the pappus; disk flowers perfect, fertile, the corolla tubular with five lobes; disk achenes generally of 2 kinds, those toward the periphery usually 3- or 4-angled, those toward the center of the head compressed and winged, all these disk achenes 0- to 4-awned, at the angles usually of thick cartilage, otherwise smooth to tuberculate.

About 7 species in southwestern United States and Mexico.

1. Leaves more than 7 mm. broad; phyllaries imbricate and graduate; rays membranous; awns of the ray achenes 2.5 mm. long (more or less) 1. *S. ocymoides*.
1. Leaves 4 mm. broad or less; phyllaries valvate, in one series; rays firm; ray achenes with 3 very short stout awns 2. *S. Abertii*.

1. *Sanvitalia ocymoides* DC. Taprooted annual, much-branched from the base, to 2 dm. tall; stems strigose; leaves ovate to obovate, strigose-hispid, darker on the upper surface; petioles to 1 cm. long; blades to 23 mm. long and 18 mm. broad, bases cuneate, apexes rounded; heads sessile, to 8 mm. thick; receptacle conical; pales of the receptacle about equaling the disk flowers, persistent, apexes cuspidate and purple-tipped, the keel lightly pubescent; phyllaries imbricate, graduated, obovate, sometimes foliaceous, pubescent on the upper third, margins ciliated, apexes sometimes mucronate; rays 8 to 11, persistent, reflexed, obovate, about 2 mm. long, glabrous, apex entire to 2-lobed, base adnate to the entire achene apex; ray achene obtriangular, 3-angled, striate, about 3 mm. long, essentially glabrous, becoming tuberculate, the three diverging awns about 2.7 mm. long, slender, expanded basally; disk corollas numerous, with distinct tube and limb, glabrous, about 2 mm. long; peripheral disk achenes 3- or 4-angled, tuberculate, usually awnless or simply with slender hairs; central achenes generally compressed, without a wing or with 1 or 2 wings, ciliate on the inner wing, the inner wing often larger, the achene awnless or with 1 or 2 awns. Infrequent in loamy or clayey soils, Rio Grande Delta, extreme s. Tex., late summer and fall; Coah., N.L. and Tex., s. to Jal. and Gto.

2. *Sanvitalia Abertii* Gray. Annual with taproots, erect, slender, to 26 cm. tall; stems strigose; leaves linear, sessile, entire, scabrous, to 5 cm. long and 4 mm. broad; peduncles 1-30 mm. long; head broadly campanulate, 4-5 mm. high; phyllaries valvate, about 9, linear, uniseriate, essentially glabrous, spreading at maturity, margins narrowly hyaline; receptacle elongate-conical; rays 5 to 9, glabrous, yellow, each usually opposite a phyllary, ovate, weakly reflexed, about 4 mm. high, dorsally with 8 to 10 green nerves, firm, apically 2-lobed; ray achene about 4 mm. long, broadly obtriangular, 3-angled, cartilaginous, truncate basally and apically, the 3 awns very short and very stout; disk

²¹³ Adapted from Andrew M. Torres in *Brittonia* 16:417-433. 1964.

corollas numerous, about 2 mm. high with distinct tube and limb; peripheral disk achenes about 3.5 mm. long, with 3 or 4 angles, tuberculate, essentially glabrous; central achenes compressed, winged; all disk achenes apparently awnless; pales of the receptacle not persistent, linear, glabrous, reddish-brown at the apex, greenish below, acuminate apically. Infrequent in mts. of Trans-Pecos at about 4,000 ft. elev., summer-fall; Ariz., N.M., Tex., Son., Chih. and Coah.

66. HELIOPSIS PERS. OX-EYE

Perennial herbs; leaves opposite, ovate to ovate-lanceolate or deltoid to deltoid-ovate, petiolate; heads terminal on the branches with ray and disk flowers; phyllaries in 2 or 3 series, herbaceous or coriaceous, ovate-lanceolate to ovate, subequal, the outer series often foliaceous and longer than disks; receptacle rather broadly convex, often hollow; pales of the chaff of the receptacle firm, conduplicate, persistent, light-brownish-yellow to red or purple; *disk flowers* perfect, the corollas yellowish to brownish-yellow or purple; *ray flowers* pistillate and fertile; rays yellow or orange-yellow, ovate-lanceolate to oblong-lanceolate, notched apically, persistent; achenes of the disk flowers fertile, quadrangular at the apex, conical at the base, glabrous or minutely pubescent, those of the ray flowers triangular with outer surface convex (otherwise as the disk achenes); pappus absent or represented by 2 or 3 membranous teeth or merely a crenulate ridge or crown.

An American genus of about a dozen species.

1. Rays 6 to 8 1. *H. gracilis*.
1. Rays 10 to 18 (2)
- 2(1). Achenes smooth, brown to dark-brown 2. *H. helianthoides*.
2. Achenes rugose to subtuberculate, tan or black 3. *H. parvifolia*.

1. *Heliopsis gracilis* Nutt. Erect perennial herb 3-4 dm. tall, slender, unbranched to sparingly branched; stems 1-1.5 mm. thick, glabrous, smooth; leaves ovate-lanceolate to lanceolate, 45-55 mm. long; blade 18-20 mm. broad, bright-green below, deep-green above, lower surface glabrous, upper surface sparingly strigose, more dense along margins, somewhat cuneate at base, acuminate at apex, regularly dentate with teeth averaging 1 mm. long; petioles 8-10 mm. long, glabrous to sparingly pubescent, subterete; peduncles 15-22 cm. long, glabrous below, minutely pubescent above; heads 10-12 mm. thick, 7-10 mm. high; phyllaries in 2 series, minutely pubescent on back, becoming more dense along the margins; outer phyllaries slightly foliaceous, spreading, linear-oblong, obtuse apically; inner phyllaries shorter, linear, obtuse; rays 6 to 8, linear, glabrous, 18-22 mm. long, 5-8 mm. broad, 1- to 3-cleft apically, golden-yellow; disk corollas 3.5-4 mm. long, throat pale-brownish-yellow, glabrous, the lobes dull-yellow; pales of the receptacle lanceolate, keeled, 8-10 mm. long, obtuse; achenes glabrous to minutely pubescent on margin, dull-brown; pappus a lacinate crown or 1 to 3 pointed teeth; ray achenes triangular; disk achenes quadrangular. Infrequent in loamy soil in s.e. Tex. (Brazoria and Harris cos.), Nov.; Fla., Ga., Ala., La. and Tex.

This could well be considered a variety of the next species.

2. *Heliopsis helianthoides* (L.) Sweet var. *scabra* (Dun.) Fern. Erect perennial herb 10-15 dm. tall, branched or unbranched; stems terete, sparingly pubescent above, glabrous below, 3.5-5 mm. thick; leaves lanceolate to ovate-lanceolate or deltoid-ovate, 7-12 cm. long, 3-6 cm. broad, glabrous to scabrous; petioles 20-25 mm. long; blade margin coarsely and irregularly dentate; peduncles 11-17 cm. long, scabrous above; heads 12-14 mm. thick; phyllaries in 2 or 3 series, lanceolate to ovate, acute to obtuse, the outer phyllaries usually somewhat like leaves; rays 12 to 14, pale-yellow below, orange-yellow above, 12-14 mm. long, 5-6 mm. broad; pales of the chaff 8-8.5 mm. long, 0.9-2 mm. broad, obtuse, membranaceous to slightly puberulous, brownish-yellow at apex; disk corollas brownish-yellow; ray achenes triangular, outer surface convex, 3-3.5 mm. long; pappus either absent or represented by 2 or 3 membranaceous teeth; disk achenes quadrangular at apex, rounded at base, 2-3.5 mm. long, otherwise as in the ray. Infrequent in open sandy woods, n. part of e. Tex., late summer to fall; Ill., Mo., Ark., Okla., Tex. and La. The species as a whole, including 3 varieties, occurs over much of s. Can. and e. U.S., w. to the Dakotas, Neb., Colo. and N.M.

3. *Heliopsis parvifolia* Gray. Erect perennial herb, 2-4 dm. tall, slender; stems 1.5-4 mm. thick, glabrous or sparingly pubescent below, striate; internodes 15-75 mm. long; leaves deltoid-lanceolate, approaching deltoid-ovate; blade 15-55 mm. long, 8-15 mm. broad, pale-green below to deep-green above, becoming stramineous when dry, both surfaces sparingly pubescent to nearly glabrous, the margin irregularly dentate to nearly entire with the lowermost teeth usually larger and irregular, decurrent or tapering abruptly on the petiole, apex acuminate to obtuse; petioles 8-25 mm. long, slender, puberulous; peduncles 85-200 mm. long, pubescent, apex more or less enlarged and hollow; heads 12-20 mm. broad including the rays; disk 8-10 mm. high; involucre 2-seriate; outer phyllaries exceeding the inner, oblong to oblong-lanceolate, apically acuminate, 4- to 6-nerved, densely pubescent on the margins; rays 9 to 11, 27-29 mm. long, 12-14 mm. broad, oblong-ovate, 7- to 9-nerved, 3-cleft, glabrous, golden-yellow when young, pale-yellow with age; disk corollas yellowish-brown, glabrous, 4-4.5 mm. long, the lobes brighter yellow than tube, obtuse; pales of receptacle lanceolate to oblong, glabrous, keeled, acuminate at apex, 8.5-9 mm. long, brownish-black, triangular, glabrous, rugulose, faintly nerved on each face; disk achenes without pappus, quadrangular, brownish-black when mature, 4-4.5 mm. long. Infrequent in mts. of the Trans-Pecos, June-Nov.; Ariz., N.M. and Tex. s. to Dgo., N.L. and Tam.

67. TETRAGONOTHECA L.

NERVE-RAY

Perennial herbs often from enlarged soft-woody taproots; stems 2-12 dm. tall, ascending; leaves opposite, from deltoid and merely coarsely toothed to pinnatifid, sessile or even connate-perfoliate, some narrowed somewhat basally to subpetiolar bases; heads large (often 2-4 cm. across); involucre shallowly campanulate; phyllaries in roughly two size-classes, those of the outer series always 4 in number, very conspicuous, foliaceous in texture, acute and enfolding the others in bud, those of the inner series 6 to 15, small, each subtending a ray flower; receptacle high-conical, chaffy throughout, the pales folded around the disk achenes; *ray flowers* 6 to 15, pistillate, fertile, the rays conspicuous, yellow (often with some red venation); *disk flowers* numerous, perfect, fertile, the corollas 5-toothed terminally, yellow; achenes 4-angled, truncate; pappus of several short scales or absent.

An American genus of four species, of which we have three.

1. Leaf blades saliently toothed; tall herb of east Texas forested areas 1. *T. ludoviciana*.
1. Leaf blades pinnatifid or repand; herbs 2-5 dm. tall, of drier areas of central and southern Texas (2)
 - 2(1). Plants with the mainly repand leaves crowded at base; corolla tube glabrous; sandy prairies of coastal southern Texas 2. *T. repanda*.
 2. Plants with leafy stems, the mainly pinnatifid leaves not remarkably reduced upward; corolla tube pubescent; calcareous uplands 3. *T. texana*.

1. *Tetragonotheca ludoviciana* (T.&G.) Gray. Stems one or several from the base, (3-) 6-12 dm. tall, leafy; leaves oblong to ovate, 5-17 (-20) cm. long, acutish, closely and saliently toothed, the lower ones with broad bases, the upper ones connate-perfoliate. Infrequent in sandy forested areas, e. Tex., rare w. to n.-cen. Tex., summer-fall; La., Tex. and Okla.

2. *Tetragonotheca repanda* (Buckl.) Small. Stems 2-4 (-5) dm. tall, leaves much-reduced for most of the stem length, the most conspicuous ones being basal, ovate to ovate-lanceolate or rarely narrow toward the top of the stem, or spatulate near the base of the stem, mostly acute, repand, narrowed into slender subpetiolar bases. Frequent in sandy prairies, s.e. Tex. and coastal part of Rio Grande Plains, summer-fall; endemic.

3. *Tetragonotheca texana* (Gray) Engelm. & Gray. Stems (2-) 3-6 (-7) dm. tall, usually solitary or 2 or 3; leaf blades oblong to elliptic or ovate in outline, pinnatifid, incised or repand, 3-10 cm. long, the lower ones basally cuneate, the uppermost expanded and connate-perfoliate at the node. Frequent in calcareous uplands, Edwards Plateau, n.-cen. Tex. and cuestas of the Rio Grande Plains, summer-fall; Tex., Coah., N.L. and Tam.

68. SCLEROCARPUS JACQ.

A genus of perhaps half a dozen species of the American tropics and subtropics.

1. *Sclerocarpus uniserialis* (Hook.) Hemsl. MEXICAN BONE-BRACT. Taprooted annual, rarely overwintering, the stems often 1 m. long but the plants not that tall because the stems often weak and sprawling, rather densely pubescent with antrorse-appressed whitish pustule-based stiff hairs; lower leaves opposite, upper ones alternate; blades (1-) 2-5 (-9) cm. long, usually ovate-rhombic, 3-nerved basally, coarsely toothed distally, acute, basally cuneate to rounded; heads solitary, on naked peduncles (1-) 3-10 cm. long, 1-2 cm. high; involucre of a few spreading linear or oblong-linear phyllaries, so sparse that the individual flowers are readily seen without removal of the involucre; receptacle high-conic, chaffy throughout, the pales narrowly ovate and mostly wrapped around the flowers; *ray flowers* several, pistillate but infertile; rays 5-15 mm. long, rotundly elliptic, yellow; *disk flowers* perfect, fertile, the corollas yellow (usually with reddish veins) and deeply 5-lobed terminally, permanently wrapped up in the investing pales and falling thus enclosed; achenes of the fertile flowers laterally compressed, subrhombic in transection, smooth; pappus essentially absent. *S. major* Small. Frequent in disturbed areas, Coastal Plain of s. Tex. (n. to Jackson, Bastrop, Travis and Comal cos.), late summer-fall; widespread in Mex.

69. ECLIPTA L.

A genus of a few, perhaps only one, species, widespread in the warmer parts of the world.

1. *Eclipta alba* (L.) Hassk. YERBA DE TAGO. Annual with taproots and occasionally also rooting at the nodes, to 1 dm. tall but mostly decumbent stems to 1 m. long, throughout with antrorse-appressed stiff hairs about 0.3-0.5 mm. long; leaves opposite, short-petiole; blades membranous, 2-10 cm. long, linear-oblong to narrowly elliptic, usually remotely and obscurely toothed; heads solitary at the ends of short axillary peduncles, about 1 cm. high; involucre broadly campanulate; phyllaries in roughly 2 series, outer phyllaries about 6, oblong-obovate, apiculate, blunt, inner series fewer, shorter and narrower; receptacle slightly convex, chaffy throughout, the linear pales bristlelike; *ray flowers* numerous, pistillate, fertile, the linear rays minute and white; *disk flowers* numerous, perfect, fertile, the corollas minute and whitish; achenes laterally compressed, rhombic in transection, narrowed to the base, each side with an elongate medial patch of verrucose projections; pappus absent or represented merely by slight points above the corners of the achene. In mud at the edges of fresh water bodies, nearly throughout, though rare in the Trans-Pecos and the higher parts of the Plains Country, summer-fall; warmer parts of the world.

Some authors claim that the species is indigenous to the Old World and introduced in the New World.

70. VARILLA GRAY

A genus of 2 species, one found only in Coahuila.

1. *Varilla texana* Gray. SALADILLO. Subshrub 2-3 dm. tall, much-spreading and forming hummocks, many branching stems rising from the subrhizomatous bases; leaves fleshy, alternate, terete, 1-2 (-3) cm. long, dark-green, confined to the lower part of the stems; ultimate branches simply erect, nearly naked, 1-2 dm. tall, each bearing a single head; involucre 5-10 mm. high; phyllaries numerous, lanceolate, acute, pale-green drying blackish, fleshy, the median vein firmer and thicker than the lateral portion, in 4 or 5 series, strongly graduated, appressed; receptacle high-conic, chaffy, the concave pales merely subtending the flowers; *ray flowers* absent; *disk flowers* perfect, fertile, the corolla yellow, 5-toothed; anthers purplish; achenes columnar or falcate-columnar, black, with 6 or 7 ribs and an equal number of less prominent intervening ones; pappus absent. Locally abundant in gypseous soil, Rio Grande Plains, Apr.-July, often again in Sept.-Oct.; also N.L. and Tam.

This species is a primary host plant for the root parasite, *Orobanche multiflora*.

71. ISOCARPHA R. BR.

A genus of a few species in the warmer parts of the Americas.

1. *Isocarpus oppositifolia* (L.) R. Br. Annual herb (2-) 3-6 (-10) dm. tall; branches opposite, widely spreading; leaves opposite, narrowly rhombic-ovate, 3-9 cm. long, narrowed to the base but lacking a clearly defined petiole, essentially entire, not at all crowded, smaller and narrower in the upper part near the heads; heads ovoid, solitary on the branches or sometimes in clusters of 3 when the uppermost branches are short; involucre obconic; phyllaries in about 2 series, lanceolate, 2-3 mm. long, acute, 3-nerved; receptacle high-conic, chaffy throughout, the pales much like the phyllaries; *ray flowers* absent; *disk flowers* perfect, fertile, shorter than and hidden by the chaff, the corollas whitish and 5-toothed; achenes about 1.5 mm. long, dorsiventrally flattened, minute, stramineous, slightly tapered toward the base, 5-ribbed (2 ribs on the abaxial side, 2 at the sharp edges and one on the ventral side); pappus absent. Exceedingly rare in the Brownsville region in extreme s. Tex., fall; W.I., Mex. and Tex.

Probably not a member of our flora except through occasional waiving, but a very common weed not far south in Tamaulipas.

72. SPILANTHES JACQ.

A world-wide genus of about 60 species.

1. *Spilanthes americana* (Mutis) Hieron. var. *repens* (Walt.) A. H. Moore. CREEPING SPOT-FLOWER. Perennial herb extensively creeping and rooting at many nodes, also rhizomatous, only the flowering branches ascending; leaves opposite; blades narrowly rhombic-ovate or deltoid-ovate, 2-4 cm. long serrate; petiole 1-2 cm. long; heads solitary, about 1 cm. high, on naked axillary peduncles 5-15 cm. long; involucre about 5 mm. high, of 2 series of subequal linear phyllaries; receptacle very high-conic, chaffy throughout, the pales enfolding the flowers and about equaling them; *ray flowers* few, pistillate but infertile; rays only a few mm. long, yellow, irregularly 3-toothed terminally; *disk flowers* numerous, perfect, fertile, the corolla yellow and 5-toothed; achenes somewhat laterally compressed but not flat (elliptic in transection and with 2 rounded edges), blackish; pappus absent or rarely of one or two awns. *S. repens* (Walt.) Michx. Local in mud along streams, bayous, lakes, ditches, etc., s.e., e. and n.-cen. Tex., late summer-fall. The var. *repens* occurs in s.e. U.S., other varieties occur in North America and South America.

73. ECHINACEA MOENCH²¹⁴

PURPLE CONE-FLOWER

Perennial herbs; rootstalks vertical or horizontal; stems erect, simple or branched, hirsute, hispid, strigose or smooth, rarely glaucous; leaves petiolate below, sessile and reduced above, alternate, ovate to ovate-lanceolate or lanceolate to elliptical, obtuse or acute, entire or coarsely toothed, pubescent or smooth, 3- to 5-veined; heads singly terminating pedunculiform stems or branches, the involucre conical or hemispherical; phyllaries in 3 or 4 series, imbricated, foliaceous, lanceolate to linear-lanceolate, attenuate or acute, ciliate, smooth or pubescent, showing transition into pales; pales conduplicate, terminated into sharp or blunt spines, exceeding disk flowers; *ray flowers* sterile, in 1 series; rays strap-shaped, bifid or trifid, rose-colored, purple, white or yellow (*E. paradoxa* var. *paradoxa*); *disk flowers* fertile; corolla expanded below into a fleshy bulblike base and sessile on achene, the tube cylindrical, with 5-lobed erect limb, smooth or minutely pubescent, yellowish or purplish; stamens 5, the anthers sagittate at base and terminating in an ovate appendage; pollen yellow or white (*E. pallida*); styles usually enlarged at base, equaling or slightly shorter than corolla, branches acuminate, hairy; achenes 4-angled, 3-5.5 mm. long, terminated by a smooth or toothed crown; chromosome numbers $n=11$, $n=22$.

²¹⁴ Contributed by Ronald L. McGregor.

A North American genus of 9 species. The systematics of the genus is complicated due to frequent hybridization wherever 2 species are in proximity.

1. Leaves broadly to narrowly ovate, frequently coarsely toothed, rounded at base; pales of receptacle 9-13 mm. long, the awns 4-6 mm. long 1. *E. purpurea*.

1. Leaves lanceolate to lance-linear or narrowly elliptical, attenuate to base; pales with awns less than 3.5 mm. long (2)

2(1). Stems and leaves strigose or strigose-hirsute (3)

2. Stems and leaves hirsute or hispid (5)

3(2). Ligules definitely longer than width of head 2. *E. paradoxa* var. *neglecta*.

3. Ligules shorter to barely longer than width of head (4)

4(3). Plant 5-10 dm. tall 3. *E. atrorubens*.

4. Plant 2-5 dm. tall 4b. *E. angustifolia* var. *strigosa*.

5(2). Achenes 3 mm. long; heads nearly hemispherical .. 5. *E. sanguinea*.

5. Achenes 3.5-5 mm. long; heads conical (6)

6(5). Ligules 4-9 cm. long, drooping; pollen white 6. *E. pallida*.

6. Ligules 2-4 cm. long, spreading; pollen yellow 4a. *E. angustifolia* var. *angustifolia*.

1. *Echinacea purpurea* (L.) Moench. Stems erect, mostly branched, glabrous to hirsute, often glaucous, 6-18 dm. high; basal leaves with petioles to 25 cm. long, ovate to ovate-lanceolate, acute, coarsely or sharply serrate, rarely entire, to 20 cm. long and 15 cm. wide, cordate or abruptly narrowing to base; cauline leaves petiolate to sessile above, 7-20 cm. long, 1.5-8 cm. wide, coarsely serrate to entire, rough to the touch; heads 15-30 mm. high, 1-4 cm. wide (exclusive of rays); phyllaries linear-lanceolate, attenuate, entire, ciliate, hirsute; rays 3.2-6 cm. long, 5-10 mm. broad, purplish to rarely white; pales 9-13 mm. long, body 5-8 mm. long, awn 4-6 mm. long; achenes 4-4.5 mm. long; pappus a low crown of equal teeth; pollen yellow; chromosome number: $n = 11$. Rocky open woods and thickets in extreme n.e. Tex., May-Sept.; Ga. to La., e. Okla., Mo., n. to Ia., Ill., Mich., O. and Va.

Our plants would be included in the var. *arkansana* Steyerem. which is an early season ecological form associated with an open habitat.

2. *Echinacea paradoxa* (Nort.) Britt. var. *neglecta* R. L. McGreg. Stems simple, sparsely to densely strigose, sometimes hirsute just below the head, stramineous or yellowish-green; basal leaves with petioles 2-13 cm. long, oblong-lanceolate to long-elliptical, 4-25 mm. wide; upper leaves linear to lanceolate, strigose on both surfaces, the margins scabrous-ciliate; heads 20-35 mm. high, 3-4 cm. wide (exclusive of rays); phyllaries 7-12 mm. long, 1-3 mm. wide, lanceolate to ovate-lanceolate, strigose or glabrous, ciliate; rays 3-7 cm. long, 5-8 mm. wide, narrowly oblanceolate to lanceolate, rose-colored or whitish; pales 11-14 mm. long, body 9-11 mm. long, awn 2-3 mm. long, achenes 4.5-5.5 mm. long, glabrous; pappus a crown of equal teeth; pollen yellow; chromosome number: $n = 11$. Rocky prairies and open wooded hillsides, n. Tex. (?), May-June; Arbuckle Mt. area of Okla.

Included here on the basis of a specimen collected by Lindheimer in 1843 without stated locality. This variety and the following species have long been confused with var. *paradoxa*. The latter is a yellow-rayed plant endemic to the Ozarks of Mo. and n. Ark.

3. *Echinacea atrorubens* Nutt. Stems simple to rarely branched, 3-9 dm. high, glabrous below to strigose above, hirsute just below head; basal leaves with petiole 1-15 cm. long, the blade 4-15 cm. wide; upper leaves progressively smaller, becoming sessile, strigose and ciliate; heads 15-40 mm. high, 20-36 mm. wide (exclusive of rays); phyllaries in 3 or 4 series, narrowly lanceolate, strigose, ciliate, abruptly reflexed; body of pales 7-9 mm. long, awn 2-3 mm. long; ligules dark-purple, rarely pink or white, 19-33 mm. long, shorter than to as long as head, strongly reflexed; achenes 4-5 mm. long, glabrous, teeth of pappus crown unequal; chromosome number: $n = 11$. Sandy prairies and open woods, e., s.e. and n.-cen. Tex., May-June; a narrow band from s.e. Tex. to Ardmore, Okla. and Topeka, Kans.

4a. *Echinacea angustifolia* DC. var. *angustifolia*. Stems simple, rarely branched, 1-5 dm. high, hirsute below, tuberculate-hirsute to tuberculate-hispid; basal leaves short to long-petiolate, 5-27 cm. long, 1-4 cm. wide, becoming sessile above; heads 15-30 mm. high, 15-25 mm. wide (exclusive of rays); phyllaries in 3 or 4 series, lanceolate, entire, hirsute or hispid; rays spreading, 2-3 cm. long, white, pinkish or purplish; achenes 4-5 mm. long; pappus a toothed crown; pollen yellow; chromosome number: $n = 11$. Dry rocky prairies and hillsides, n.-cen. Tex., Edwards Plateau and Plains Country, rarely to the s.w. part of e. Tex., May-June; Minn. to Sask., s. to Okla. and Tex.

4b. *Echinacea angustifolia* var. *strigosa* R. L. McGreg. Similar to var. *angustifolia* except stem and leaves strigose-hirsute, stem often branched, rays usually reflexed, and stem somewhat flexuous. Dry rocky prairies, n.-cen. Tex. Most Texas colonies of this variety have a chromosome number of $n=22$, but to the north in Okla. plants have $n=11$. It appears that this variety represents a stabilized hybrid population derived from the hybridization of *E. atrorubens* and *E. angustifolia* var. *angustifolia* and in which both diploid and tetraploid colonies are found.

5. *Echinacea sanguinea* Nutt. Stems simple to frequently branched, 4-9 dm. high, glabrous to sparsely hirsute; basal leaves petiolate, entire, 10-24 cm. long, lanceolate to elliptical, upper leaves becoming sessile, hirsute; heads nearly hemispheric, becoming slightly conic in fruit, 1-2 cm. high, 17-25 mm. wide (exclusive of rays); peduncle half or more the height of plant; phyllaries lanceolate, 7-10 mm. long, hirsute, ciliate; rays rose-colored to dark-red, rarely white, 4-7 cm. long; pales 8.5-10 mm. long, awn 1.5-2 mm. long; achenes 3 mm. long; pappus a low crown; pollen yellow; chromosome number: $n=11$. Sandy open prairies and pine barrens, e. and s.e. Tex., May-June; s.w. Ark., s.e. Okla., w. La. and Tex.

6. *Echinacea pallida* Nutt. Stems simple, rarely branched, 4-9 dm. high, sparsely hirsute below to densely so above; basal leaves 10-35 cm. long, 1-4 cm. wide, oblong-lanceolate to long-elliptical, hirsute, triple-veined; cauline leaves 10-25 cm. long, petiolate below to sessile above; heads 20-35 mm. high, 15-30 mm. wide (exclusive of rays); phyllaries lanceolate to narrowly oblong, ciliate, hirsute; rays drooping, 4-9 cm. long, white, pink or purplish; pales 10-13 mm. long, awn 2.5-3.5 mm. long; achenes 3.7-5 mm. long, glabrous; pappus a toothed crown; pollen white; chromosome number: $n=22$. Prairies and open wooded hillsides, e. and n.-cen. Tex., May-June; n. Ind. and Ill., Ia., e. Neb., s. to Tex.

This is the only species in the genus with white pollen.

74. RUDBECKIA L.

BROWN-EYED SUSAN. CONE-FLOWER

Perennial or annual herbs; leaves alternate (the extreme basal ones sometimes opposite); involucre hemispheric; phyllaries imbricated in 2 or more series; receptacle conical, chaffy throughout, the pales acute; *ray flowers* present, infertile (styles absent); rays yellow or with a brown spot basally, rarely slightly reddish all over, never white, vaguely 3-toothed apically; *disk flowers* numerous, perfect, fertile, the corolla tubular, equally 5-toothed terminally and brown (at least terminally), the style branches with blunt or subulate pubescent tips; achenes truncate apically, 4-angled; pappus when present merely a toothed crown of 2 to 4 short teeth.

An American genus of perhaps 30 species.

1. Achenes with 4 nearly equal facets which are flat or convex, commonly expanded by the mature ovules, typically truncate basally and basally attached to the receptacle; pales of the receptacle characteristically 1.5 to 2 times as long as the achenes (2)
1. Not as above (5)
- 2(1). Style branches apically elongate, slenderly subulate 1. *R. hirta*.
2. Style branches short and blunt (3)
- 3(2). Pales of the receptacle canescent near the tip with short viscidulous hairs; leaves dotted with microscopic resin-globules 2. *R. grandiflora*.
3. Pales glabrous or ciliate; leaves not resin-atomiferous (4)

- 4(3). Plants never stoloniferous, the leafy tufts arising only at the base of the stem; basal leaves broadly linear to lance-spatulate; stems and leaves densely villous-hirsute; branches sharply ascending 3. *R. missouriensis*.
4. Plants commonly stoloniferous, most of the leafy tufts arising at the ends of the stolons; basal leaves lanceolate or broader; stems and leaves nearly glabrous to hirsute or strigose; branches distinctly spreading . . . 4. *R. fulgida*.
- 5(1). Leaf blades (at least those of the lower leaves) deeply lobed or divided 5. *R. laciniata*.
5. Leaf blades entire or merely toothed (6)
- 6(5). Leaves glaucous, the blades ovate to broadly ovate or oblong; plants 1-3 m. tall 6. *R. maxima*.
6. Leaves lustrous, the blades narrower; plants usually less than 1 m. tall 7. *R. nitida*.

1. *Rudbeckia hirta* L. Annual or short-lived perennial herb, with roughly pubescent herbage; leaves narrowed to a subpetiolar base or nearly sessile, unlobed but often obscurely toothed, variable in shape but nearly always longer than broad; rays yellow with red-brown spots basally or in the lower half; style branches (of the disk-flowers) apically elongate, slenderly subulate (absent in ray flowers); achenes equally quadrangular in transection, the sides flat or slightly bulging.

We have two varieties of this species:

Var. *pulcherrima* Farw. Annuals usually branching above the middle (if simple, the peduncle not more than a third as long as the height of the plant). *R. serotina* Nutt., *R. flexuosa* T. V. Moore. Frequent in a variety of situations in the e. two thirds of the state, spring-summer; Nfld. to B.C. and s. to n. Mex.

Var. *angustifolia* (T. V. Moore) Perdue. Short-lived perennial, branching at or near the middle (if simple, the peduncle at least half as long as the height of the plant); leaves relatively narrow. *R. divergens* T. V. Moore. Frequent in sandy wooded areas, e. and s.e. Tex., spring-summer; Ga. and Fla. to Tex.

Some plants in east and southeast Texas are intermediate between the two varieties.

2. *Rudbeckia grandiflora* (Sweet) DC. Herbage lacking resin-globules, the stem somewhat scabrous-pubescent below, the hairs short; leaves mainly on the lower part of the stem, very rough on both surfaces, with an ovate-elliptic to lanceolate unlobed bladlike portion 6-15 cm. long, apically acute or acuminate; pales canescent near the apex with short viscidulous hairs; style branches short and blunt; achene quadrangular in transection (the sides of the quadrangle subequal); pappus a conspicuous but low crown. *R. alismaefolia* T.&G. Local in e. and s.e. Tex., summer; Ark., Okla., La. and Tex.; Ga.

3. *Rudbeckia missouriensis* Boynt. & Beadle. Perennial, the leafy tufts arising from a crown; basal leaves broadly linear to lance-spatulate; stems and leaves densely villous-hirsute, the branches sharply ascending; phyllaries 8-10 mm. long, linear to linear-oblong; rays usually 12 to 14, 15-25 mm. long; style branches short and blunt; pappus very short-coroniform; achene with 4 nearly equal facets. *R. fulgida* var. *missouriensis* (Boynt. & Beadle) Cronq. Rare in e. Tex., late summer-fall; Mo., Ark., Okla. and Tex.

Closely related to *R. fulgida*.

4. *Rudbeckia fulgida* Ait. var. *palustris* (Eggert) Perdue. Stoloniferous perennial, most of the leafy tufts arising at the ends of the stolons; herbage nearly glabrous to hirsute or strigose; basal leaves elliptical to ovate or orbicular; stem leaves lanceolate to ovate-lanceolate, gradually reduced upward, the uppermost bracteiform; pales apically ciliate; rays mostly 15-30 mm. long; style branches short and blunt; achenes equally 4-faceted, facets flat or bulging. *R. Coryi* Shinn. Infrequent in e. and n.-cen. Tex., rare in moist places w. to Edwards Plateau, summer; Mo., Ark., Okla. and Tex.; the entire species widely distributed in e. U.S.

5. *Rudbeckia laciniata* L. Plants 6-15 dm. tall, cinereous-pubescent, branched above; leaves petioled, some or all of the lower ones 3-lobed or 3-parted, the terminal lobe elliptic to lanceolate, acuminate, serrate, the lateral lobes smaller and narrower, the upper stem leaves mostly undivided; heads numerous; phyllaries linear or nearly so, acuminate; pales apically canescent; rays several, yellow, 2-3 cm. long. Infrequent in e. Tex., summer-fall; e. U.S.

6. *Rudbeckia maxima* Nutt. Plants 1-3 m. tall, smooth, glaucous; leaf blades unlobed, ovate to broadly ovate or oblong, 6-20 cm. long, mostly obtuse, undulate to repand-denticulate or entire, the upper sessile and partly clasping; heads large; phyllaries linear or linear-lanceolate, acute, short; rays several, 15-40 mm. long; disks 25-60 mm. long, oblong usually; pales abruptly short-pointed, apically pubescent; achenes 6-8 mm. long; pappus of small teeth. Moist open places, e. Tex., spring-summer; Ark., Okla., La. and Tex.

7. *Rudbeckia nitida* Nutt. var. *texana* Perdue. Plants 6-12 dm. tall, simple or branched, glabrous; leaves unlobed, entire-margined or crenate, dentate or serrate, the teeth when present abundant; basal leaves narrowly to broadly elliptic or spatulate, the blades lustrous, 10-15 cm. long, 3-6 cm. broad, sharply or broadly acute, attenuate basally to a long slender subpetiolar base; rays several, yellow; disk conical to conical-cylindric, 20-45 mm. long; achenes 5-7.5 mm. long. Infrequent in s.e. Tex., rare in e. Tex., spring-fall; also La. (the var. *nitida* in Ga. and Fla.)

75. DRACOPIS CASS.

A monotypic genus, closely related to the *Ratibida-Rudbeckia* alliance.

1. *Dracopis amplexicaulis* (Vahl) Cass. Annual herb 3-7 dm. tall (rarely to 1.2 m.), usually branched above; leaves alternate, simple, spatulate to oblong-lanceolate or ovate, sessile, clasping, 4-10 cm. long, often obscurely serrate; phyllaries biseriate, the inner ones half as long as the outer, the outer ones few and somewhat foliaceous, 6-10 mm. long, lanceolate to linear-lanceolate; receptacle columnar, slender; *ray flowers* present, 5 to 9, styleless, infertile; rays yellow or often red-brown or brown-purple basally, 10-25 cm. long; disk oblong-cylindric at maturity; *disk flowers* numerous, perfect, fertile, the corollas brownish and 5-toothed terminally; style branches with small pubescent appendage; mature achenes terete, minutely transversely wrinkled, about 2 mm. long; pappus absent. *Rudbeckia amplexicaulis* Vahl. Moist places in the e. two thirds of the state, rare in Plains Country and Rio Grande Plains, spring-summer; Coastal States, Ga. to Tex.

76. RATIBIDA RAF.

MEXICAN HAT

Biennial or perennial herbs with taproots or rhizomes; stems usually branched, at least above, erect; leaves alternate, pinnatifid or bipinnatifid, the basal ones sometimes lanceolate, serrate or entire, acute, strigose-hirsute; heads borne singly at the tops of the ultimate branches which are often leafless; involucre very short-obconic; phyllaries biseriate, herbaceous in texture, linear to linear-lanceolate, the outer ones twice or more than twice as long as the inner; receptacle columnar, chaffy throughout, the pales folded around the achenes and deciduous with them; *ray flowers* always present but quite infertile, completely lacking any styles or stamens, the rays yellow or yellow with a red-brown spot basally, obscurely 3-toothed apically; *disk flowers* very numerous, perfect, fertile, the corolla 5-lobed terminally, usually brown or red-brown at least in the distal part; achenes laterally strongly compressed, narrowly rhombic in transection, sometimes fimbriate along the sharper of the two winglike edges, otherwise glabrous; pappus a microscopic corona or prolonged upward on each edge forming two awnlike teeth. *Lepachys* Raf.

An American genus of about 5 species.

1. Heads globular or oblong; achenial crown yellowish, thickened, bordered by minute lacerate setae 3. *R. Tagetes*.
1. Heads cylindrical or columnar; pappus consisting of 2 persistent toothlike projections (2)
- 2(1). Leaves not much reduced in the middle of the stem and upward 1. *R. columnaris*.
2. Leaves crowded near the base, the upper part of the plant comprising long essentially naked peduncles(s) 2. *R. peduncularis*.

1. *Ratibida columnaris* (Sims) D. Don. Stems 2-12 dm. tall, branched, closely strigose-hirsute throughout with occasional resin-dots, the lateral branches spreading; leaves including petioles 3-15 cm. long, closely strigose-hirsute on both surfaces, pinnately cleft to the midrib into 5 to 13 linear, narrowly lanceolate, oblong or oblong-lanceolate divisions, these entire or sometimes trifid, acute, 5-30 mm. long, 1-10 mm. broad; heads cylindrical, 10-55 mm. long, 7-10 mm. thick; outer phyllaries linear, 4-12 mm. long, acuminate, inner ones about 3 mm. long; rays 3 to 7, yellow throughout or with a red-brown spot at the base or in many plants almost the entire ray red-brown with only a narrow yellow margin, broadly oblong-elliptical, 1-2 cm. long, 6-10 mm. broad, trifid; mature achenes compressed, 2 mm. long, glabrous except the ventral edge which is fimbriate; pappus of 2 toothlike projections on each edge of the crown. Incl. var. *pulcherrima* (DC.) D. Don. Abundant in open usually calcareous soils over much of the w. two thirds of the state (absent only from extreme e. Tex.), (spring-) summer-fall; N.D., S.D., Ill., Mo., Ark., Minn., Neb., Kan., Okla., Tex., Mont., Colo., Wyo., N.M., Coah., Chih., N.L. and Tam.

Some authors use the illegitimate name *R. columnifera* for these plants.

2. *Ratibida peduncularis* (T.&G.) Barnh. Plants leafy below, terminating in slender naked peduncles 2-5 dm. long, spreading-hirsute below; leaves often crowded near the base, pinnatifid or more or less bipinnatifid, including the subpetiolar base 25-150 mm. long, strigose-hirsute on both surfaces often with microscopic resin-globules interspersed; heads solitary, columnar, 15-40 mm. long, 8-11 mm. thick; outer phyllaries linear, 6-10 mm. long, acute; inner phyllaries about 2 mm. long; rays 5-25 mm. long, yellow or yellow with a red-brown spot basally or even almost entirely red-brown with a narrow yellow margin; achenes flat, 4 mm. long including the toothlike projections, the edges winglike, conspicuously pectinate-fimbriate at least on the ventral edge and sometimes on both. Incl. var. *picta* (Gray) Sharp. Sandy (usually loose) soils, s.e., and e. Tex. and the extreme coastal part of the Rio Grande Plains, (spring-) summer-fall; also La.

Perhaps intergrading with *R. columnaris*. Some of the plants very near the coast have definite rosettes of leaves and the stem is subscapose, but away from the coast some of the populations have stems leafy nearly to the middle.

3. *Ratibida Tagetes* (James) Barnh. PRAIRIE CONE-FLOWER. Plants often bushy-branched, 15-40 cm. tall, leafy; basal and lower cauline leaves lanceolate, entire or more often pinnatifid or bipinnatifid, 5-13 cm. long including the subpetiolar base; upper cauline leaves usually 3- to 5-cleft into linear or linear-lanceolate segments 5-30 mm. long; heads on peduncles only 2-7 cm. long, numerous, often forming close clusters, globular to oblong, 8-15 mm. long, 8-10 mm. thick; rays 5 to 7, rotund-ovate to oblong-ovate, 4-6 mm. long, yellowish with red-brown bases or nearly all red-brown, varying; achenes winged on the ventral edge, the wing fimbriate-ciliate. Frequent in dry plains, Trans-Pecos and Plains Country, summer-fall; Kan., Okla., Colo., Tex., N.M. and Chih.

77. BORRICHIA ADANS.

A tropical genus of perhaps 5 species.

1. *Borrichia frutescens* (L.) DC. SEA OX-EYE DAISY. Rhizomatous subshrub (2-) 4-8 (-12) dm. tall, much-branched but the branches all rather stiffly ascending; leaves opposite, variable in size and shape, obovate to oblanceolate to spatulate, 2-6 cm. long, sessile or narrowed to a subpetiolar base, acutish or obtuse, entire or spinulose-dentate or even with small lobelike teeth on the sides near the base, thick and somewhat fleshy, gray-green, densely but minutely pubescent; heads terminating the branches on upwardly slightly expanded peduncles 1-3 cm. long; involucre hemispheric, about 5 mm. high; phyllaries rather indurate, in roughly 2 series; outer phyllaries about half to two thirds as long as the inner, acute, in texture and pubescence and color much like the leaves; inner phyllaries spinose-squarrose, nervate, less pubescent than the outer; receptacle flat or very slightly convex, chaffy throughout; pales firm or indurate, nearly linear but with a stout noxious spine-tip; ray flowers 15 to 30, pistillate, fertile; rays 5-10 mm. long, yellow or orangish, 3-toothed apically; disk flowers numerous, perfect, fertile, the corolla yellow and 5-toothed terminally; achenes prismatic, those of the ray flowers trigonous,

of the disk flowers tetragonous; pappus a low crown of persistent brown scales, one over each angle of the achene. Extremely abundant in coastal areas of Tex. and inland in local areas of poor drainage and salt accumulation to Gonzales and Webb cos., nearly all year; coastal areas, D.C. to Ver.; also S.L.P.; much of W.I.

78. VIGUIERA H.B.K. GOLDEN-EYE

Herbs or shrubs; leaves usually opposite at least in the lower part of the plant, in some species throughout the plant, sessile or with subpetiolar bases; heads singly terminating the stems or branches; involucre campanulate to hemispheric; phyllaries in 2 to 5 series, graduated or subequal, lanceolate or linear-lanceolate to ovate or oblong, with usually indurated (and ribbed) bases and narrowly abruptly herbaceous apices or in some species herbaceous throughout; receptacle flat to low-conic, paleaceous throughout; pales firm, scarious or apically subherbaceous, carinate, embracing the achenes and persistent after the achenes fall; *ray flowers* pistillate but infertile, the showy rays yellow; *disk flowers* numerous, perfect, fertile; corolla yellow, with tube, throat and 5-toothed limb; style branches recurved, hispid above, with acutish to acuminate appendages; disk achenes laterally compressed but not flat, usually narrowly rhombic in transection, usually appressed-pubescent, unmarginated, essentially unribbed, apically truncate or rounded; pappus present or absent, when present of 2 awns (one over each of the sharpest angles of the achene) and several free or united nearly always much shorter scarious scales, or of several subequal muticous-fimbriate scales. *Heliomeris* Nutt.; *Hymenostephium* Benth.

A genus of almost 200 species of North America and South America.

1. Pappus present (2)
1. Pappus absent (4)
- 2(1). Pappus of 6 to 8 muticous-fimbriate scales 3. *V. ludens*.
2. Pappus of awns over the angles of the achenes and of scales between (3)
- 3(2). Phyllaries with indurated ovate bases and abruptly narrowed linear herbaceous apices 1. *V. dentata*.
3. Phyllaries otherwise, the herbaceous apices not distinctly different in texture from the subherbaceous bases 2. *V. cordifolia*.
- 4(1). Shrub with deeply pinnatifid leaves 6. *V. stenoloba*.
4. Herbs; leaves not deeply pinnatifid (5)
- 5(4). Leaves 4-14 mm. broad 4. *V. longifolia*.
5. Leaves 1.5-3 mm. broad 5. *V. annua*.

1. *Viguiera dentata* (Cav.) Spreng. Perennial herb, paniculately branched, 1-2 m. tall; stems slender, usually sparsely strigillose or glabrate; leaves opposite below, alternate above, ovate to rhombic-ovate, basally cuneate to truncate, tapering into the subpetiolar base, serrulate or serrate, the teeth usually appressed, green and sparsely pubescent on both surfaces, 35-125 mm. long plus a subpetiolar base 6-55 mm. long, 9-80 mm. broad; heads usually numerous, 22-37 mm. broad, on naked or minutely bracteolate often sharply angled penduculiform branch-ends 3-14 cm. long; disk 7-10 mm. high, 10-14 mm. thick; involucre 3-seriate, 5-10 mm. high; phyllaries graduated or subequal, with ovate to ovate-oblong indurated costate and vittate body and shorter or often much-elongated linear or linear-oblong herbaceous apices, loose or appressed; rays 10 to 12, rarely styliiferous but sterile, ovate to oblong-ovate, 7-15 mm. long, 3-7.5 mm. broad; disk corollas hirtellous, 3-4 mm. long; pales scarious-margined, hispidulous dorsally, with ovate-oblong body abruptly narrowed into an acuminate stiff pungent tip, 6.5 mm. long; achenes obovate-oblong, black or mottled, appressed-pubescent, 3.5-3.8 mm. long, 2 mm. broad; awns of pappus slender, 2.2-2.8 mm. long; squamellae 4, quadrate, free, fimbriate, 0.7 mm. long. Extremely abundant in Edwards Plateau, less common on cuestas of chalky limestone in n.-cen. Tex. and the Trans-Pecos, Oct. (-Nov.); Ariz., N.M. and Tex. s.e. to Guat.

2. *Viguiera cordifolia* Gray. Perennial herb; main taproot napiform, as much as 3 dm. long and 3 cm. thick; stems several, hispid, about 1 m. high; leaves mostly opposite or sometimes mostly alternate, ovate to deltoid-ovate or the upper lanceolate, acute to acuminate, mucronate, basally rounded to cuneate-rounded or shallowly cordate, obscurely or rather sharply serrate or the upper ones entire, green and very rough on both sides, above tuberculate-hispidulous with incurved hairs and glandular-granular, beneath more or less hispid or hispidulous and glandular-granular, 3-nerved, rather veiny, 2-10 cm. long, 13-68 mm. broad, on petioles 1-8 mm. long; heads usually numerous, 25-45 mm. broad, on peduncles 13-143 mm. long; disk 11-15 mm. high, 11-18 mm. thick; involucre 3- or 4-seriate, graduated, 7.5-15 mm. high; phyllaries varying from lance-subulate and attenuate, usually mucronate, herbaceous or subherbaceous or usually strongly indurated and costate-vittate except at the herbaceous apex, tuberculate-hispid on margin and midline, sometimes also on dorsum and densely tuberculate-granulose; rays 6 to 8, oblong to ovate, 9-19 mm. long, 3.5-9 mm. broad; pales acuminate, cuspidate, 8-11 mm. long; achenes appressed-pilose, 6.5 mm. long; pappus awns 5.5 mm. long; squamellae 4 to 6, united below or free, 0.8-2 mm. long. Infrequent in limestone areas, near the Guadalupe Mts. in the Trans-Pecos, Oct.; Ariz., N.M., Tex., Son., Chih. and S.L.P.

3. *Viguiera ludens* (Shinners) M. C. Johnst. Taprooted annual 30-45 cm. tall, much-branched; branches ascending, all with stiff antrorse appressed white hairs; leaves opposite only in the lowest 4 cm. of the stem, alternate above, ascending; blades linear-lanceolate, (3-) 4-9 cm. long not including the petiole, (5-) 8-11 mm. broad, obscurely sinuate-dentate, 3-nerved, membranous, on both surfaces cinereous with stiff antrorsely appressed white hairs; the very narrowly winged petiole about 1 cm. long, sparsely ciliate with stiff spreading translucent pustule-based setae about 2 mm. long; peduncles few, terminal, (3-) 5-10 cm. long, slightly enlarged and fistulose just beneath the solitary head; involucre hemispheric or slightly shallower, 7-10 mm. high; phyllaries linear-lanceolate, 1-1.5 (-2) mm. broad, blunt or acutish, gray-green, appressed or slightly spreading near the tips, biseriate, subequal or the inner ones usually slightly shorter, dorsally in the lower half discolored, firm to indurate, with 2 or 3 pale ribs and sparse spreading pustule-based setae, marginally ciliate with such setae, dorsally on the distal half with the texture and pubescence of the leaf blades; receptacle slightly convex, chaffy throughout; pales folded over the disk achenes, erect, translucent except at the 2 firm strong ribs which converge to form the firm very acute glabrous larger central tooth of the 3-cuspidate apex; rays 11 to 14, about 5-11 mm. long, 2-4 mm. broad, yellow; disk about 12-14 mm. across, yellow except for the darker anthers; achenes about 3 mm. long, 1.5 mm. broad, grayish-mottled, antrorsely appressed-pubescent all over; pappus persistent, of about 6 to 8 low fimbriate scales, the 1 scale on the achene angle toward the center of the head longer (0.8-1 mm. long) and slightly acute, the remainder about 0.5 mm. long and muticous. *Helianthus ludens* Shinners. In the Trans-Pecos, Culberson Co., Lobo Flat, 19 mi. e. of Van Horn, ditch beside cotton field, 28 Aug., 1953; known only from the one locality.

4. *Viguiera longifolia* (Robins. & Greenm.) Blake. Annual with taproots, erect, subsimple or branched, about 8 dm. tall; stem strigillose with appressed or incurved hairs, sometimes subglabrate; leaves opposite below or nearly throughout, narrowly lanceolate to linear-lanceolate, acuminate to attenuate at each end, 1-nerved and feather-veined, glandular-tuberculate-strigillose above, tuberculate-strigillose and scarcely paler beneath, entire or obscurely repand-toothed, only slightly revolute, 45-110 mm. long, 4-11 (-14) mm. broad; petioles 5 mm. long or less; involucre 2-seriate, 4-7 mm. high; phyllaries lanceolate or linear-lanceolate, acuminate, herbaceous, strigose-hispid below, strigillose above; rays about 12, ovate to oblong, 7-17 mm. long; disk corollas puberulous below, 2.5-3 mm. long; pales firmly short-pointed, hispid-pilose above, 4 mm. long; achenes lucid, blackish, glabrous, 1.8 mm. long; pappus absent. *Heliomeris longifolia* (Robins. & Greenm.) Cockl. Rare, Trans-Pecos deserts, late summer-fall; Ariz., N.M. and Tex. s. to Dgo., S.L.P. and Zac.

5. *Viguiera annua* (M. E. Jones) Blake. Taprooted annual, erect, paniculate branched to subsimple, slender, about 7 dm. tall, the stem subtuberculate-strigillose or strigose; leaves opposite below, alternate above, linear or very narrowly linear-lanceolate, attenuate at each end, tuberculate-strigillose on both sides and gland-dotted beneath, equally green

on both sides, 1-nerved and feather-veined, very strongly revolute, 3-7 cm. long, 1.5-3 mm. broad, the upper smaller; petioles 4 mm. long or less; disk of heads 5-7 mm. high, 6-8 mm. thick; involucre 3-4 (-5) mm. high, 2-seriate; phyllaries lanceolate, acuminate, bluntish-tipped, callous-mucronulate, herbaceous, below strigose, above strigillose or subglabrous, appressed or loose; rays about 12, ovate, 5-12 (-15) mm. long; disk corollas with a few glandular hairs below, 2.5-2.8 mm. long; pales and achenes as in *V. longifolia*; pappus absent. *Helimeris annua* (M. E. Jones) Cockll. Rare, Trans-Pecos deserts, late summer-fall; Ariz., N.M., Tex., Son. and Chih.

Extremely closely related to *V. longifolia* and perhaps conspecific with it.

6. *Viguiera stenoloba* Blake. RESIN-BUSH. Much-branched shrub about 1 m. high; stem slender, glabrous or strigillose, sometimes subcanescent; leaves alternate or rarely opposite, ovate in outline or linear, divided nearly to midrib into 3 to 7 linear or linear-lanceolate entire or few-lobed or few-toothed lobes, or the upper leaves linear and entire or subentire (the lobes attenuate), 1-5 mm. broad, equaling the central part of the leaf in width, above dull-green and tuberculate-strigose, beneath canescently strigillose, 25-60 mm. long, 4 cm. or less broad across the basal pair of lobes; peduncular branch-ends 2 dm. long or less; disk 6-8 mm. high, 8-12 mm. thick; phyllaries in 3 series, with ovate-lanceolate pale strongly indurated and ribbed base, abruptly narrowed into a linear loose or spreading herbaceous tip, more or less strigose and strigillose or the hairs somewhat looser; rays about 12, 7-14 mm. long, 2-4 mm. broad; disk corollas puberulous, the recurved teeth 3.8 mm. long; pales abruptly acute, 5 mm. long; achenes glabrous, substriate, rather strongly compressed but subquadrangular in transection, 3.5 mm. long; pappus absent. Locally abundant in dry desertic or subdesertic areas in the Trans-Pecos and Rio Grande Plains, infrequent in w. part of Edwards Plateau, summer; N.M. and Tex., s.w. and s. to Dgo., Coah., N.L. and Tam.

79. HELIANTHUS L.²¹⁵

SUNFLOWER

Annual or perennial herbs; stems simple or branched; leaves always opposite at least at the base of the stems and usually alternate above (usually alternate for most of the length of the plant, but opposite nearly throughout in some species), usually coarse-textured, 3-nerved (this obscure in some species), at least the lower ones usually narrowed to a petiole or a subpetiolar base; heads usually borne singly at the ends of nearly naked terminal peduncles; involucre usually saucer-shaped to hemispheric; phyllaries in 2 to 4 series, either subequal or strongly graduated, often ciliate-margined; receptacle plane to convex, chaffy throughout; pales folded around the disk achenes; *ray flowers* uniseriate, usually pistillate but always infertile, the yellow rays 3-toothed apically; *disk flowers* very numerous, perfect, fertile; corolla tubular, mostly yellowish but with 5 equal teeth terminally which are yellow to brownish to reddish to purplish; disk achenes laterally compressed but not thin-edged, often subrhombic in transection, often emarginate apically as seen from the side; pappus usually of two elongated awns over the thinner shoulders of the achene and often with a smaller accessory palea on each side of each awn, sometimes with small intermediate scales between the 2 principal awns, all of these pappus members readily caducous.

An American genus of about 67 species, made difficult taxonomically by the tendency toward hybridization between many of its constituents or at least by the evidence of past genetic intercontamination. *Helianthus* is closely related to *Viguiera* and *Helimeris* and perhaps should be merged with them.

1. Glauous blue-green rhizomatous perennial with leaves nearly all opposite; stems rarely more than 7 dm. tall; phyllaries obtuse to acute, glabrous dorsally, white-ciliate, ovate to oblong, closely imbricated, shorter than the disk 10. *H. ciliaris*.
1. Plants not strongly glauous or blue-green and not with the combination of other characters given (2)

²¹⁵ Much of this treatment is adapted from various papers by Charles B. Heiser; the characterization of *H. Maximiliani* is by Robert Long and that of *H. ciliaris* by R. C. Jackson.

- 2(1). Perennial herbs usually with rhizomes or rhizomelike organs (doubtful cases should be keyed under both alternatives) (3)
2. Taprooted annuals (11)
- 3(2). Disk corollas with red-brown to purple-brown lobes (4)
3. Disk corollas with yellow lobes (6)
- 4(3). Principal leaves oblong-lanceolate to lance-ovate, serrate, mostly more than 10-15 mm. broad 3. *H. laetiflorus*.
4. Principal leaves linear to linear-oblong or elongate-lanceolate with entire or barely undulate mostly revolute margins, the broadest 10-15 mm. broad (5)
- 5(4). Leaves and stems smooth and glabrous or nearly so; leaves crowded, without axillary fascicles, all but the basal narrowly linear to nearly filiform, sub-membranaceous, 1-3 mm. broad, with scarcely narrowed sessile base; involucre smooth; achenes with rounded summit; rhizome elongate 9. *H. salicifolius*.
5. Leaves and at least the base of the stem scabrous; leaves numerous but not crowded, often with axillary fascicles, firm, mostly 3-15 mm. broad, commonly narrowed above the base; involucre scabrous; achenes truncate; rhizome a short erect crown 8. *H. angustifolius*.
- 6(3). Phyllaries firm, very unequal, tightly appressed, neither long-attenuate nor with foliaceous spreading or recurving tips; chief heads long-peduncled 7. *H. occidentalis*.
6. Phyllaries looser, the outer ones (at least) spreading and with long-attenuate or more or less foliaceous tips (7)
- 7(6). Principal leaves rounded to sessile or with very short-petioled bases, mostly opposite, their petioles when developed rarely 5 mm. long (8)
7. Principal leaves tapering to base, if strongly rounded then with petioles more than 5 mm. long (9)
- 8(7). Stem, lower leaf surfaces and backs of phyllaries densely whitish-villous; leaves mostly cordate-clasping 6. *H. mollis*.
8. Stems, lower leaf surfaces and backs of phyllaries greener, variously pubescent but not whitish-villous; leaves not cordate-clasping 5. *H. hirsutus*.
- 9(7). Main stem glabrous 1. *H. grosse-serratus*.
9. Main stem scabrous-hispidulous or at least hirtellous (10)
- 10(9). Leaves nearly all alternate, lanceolate; rhizomes stout but lacking tuberos thickening 4. *H. Maximiliani*.
10. Leaves on the lower quarter of the stem opposite, the rest usually alternate, mostly ovate 2. *H. tuberosus*.
- 11(2). Stems, leaves and involucre densely covered with whitish silky wool 11. *H. argophyllus*.
11. Stems, leaves and involucre pubescent but not densely white-woolly (12)
- 12(11). Phyllaries at least in the lower part conspicuously long-ciliate and 4-7 mm. broad, usually rather abruptly contracted proximal to the apex 12. *H. annuus*.
12. Phyllaries narrower and usually not conspicuously ciliate in the lower part, usually rather gently long-tapered to the apex (13)
- 13(12). Leaves lanceolate, much more than twice as long as broad; Trans-Pecos Texas 15. *H. paradoxus*.
13. Leaves proportionately shorter and broader (except in aberrant individuals of *H. debilis*) (14)
- 14(13). Leaves for the most part cordate; isolated populations in Trans-Pecos Texas .. 16. *H. neglectus*.
14. Leaves rarely cordate (15)

- 15(14). Leaf blades usually entire, generally twice as long as broad, bluish-green to canescent bluish-green; tips of pales in center of disk densely villous
13. *H. petiolaris*.
15. Leaf blades entire or more often serrate, generally less than twice as long as broad, not bluish-green; tips of pales villous to merely hispid
14. *H. debilis*.

1. *Helianthus grosse-serratus* Martens. Perennial herb; rhizomes often branched and elongate; stems stout, erect, 1-4 (-5) m. tall, normally simple for most of the length, glabrous, glaucous, very smooth; leaves alternate; blades lanceolate to oblong-ovate, acuminate very near the apex, grossly and saliently serrate, very near the base cuneate, shiny-dark-green, densely hispidulous beneath, at midstem about 20-25 cm. long, (2-) 5-6 (-9) cm. broad, the upper leaves reduced and less deeply serrate; petiole about 8 cm. long at midstem; upper branching paniculiform; involucre hemispheric; phyllaries narrowly lanceolate or linear-subulate, acuminate, attenuate to long subulate tips, very dark-green, mostly glabrous toward the base, finely appressed-pubescent toward the apex, softly appressed-ciliate marginally, very loose but not recurring, longer than the disk; pales linear, mostly entire or rarely 3-cuspidate; rays 25-40 mm. long, obovate; disk 1-2 cm. across, the corollas totally yellow; achenes slender, glabrous, pale brown, sometimes mottled, about 5 mm. long; pappus of 2 slender narrowly lanceolate awns without other scales. Rare and local, n.-cen. Tex. and near Gonzales, Gonzales Co. in s.-cen. Tex., summer-fall; O. to N.D. and s. to Tex.; sometimes cult.

2. *Helianthus tuberosus* L. JERUSALEM ARTICHOKE. Perennial herb with abundant coarse fibrous roots; rhizomes slender and distally with tuberous thickenings; stems stout, 15-25 dm. tall, branched, sulcate, scabrous-hispid, rarely subglabrous, sometimes glabrescent toward the base; leaves normally opposite at least on the lower fourth to third the total height, usually alternate above; blades ovate or broadly ovate-lanceolate, sometimes broadly oblong-lanceolate, always acuminate, dentate or serrate-dentate, usually large (about 1-2 dm. long by 7-15 cm. broad); petioles winged, 4-9 cm. long; involucre hemispheric to broadly campanulate; phyllaries linear-lanceolate, often attenuate, usually more or less short-appressed-pubescent, ciliate, variable in length but usually slightly to greatly longer than the disk, usually loose, the tips somewhat reflexed when they are only a little longer than the disk but loosely erect when much longer; pales 3-cuspidate; rays 25-40 mm. long; disk usually 10-15 mm. across, the corollas totally yellow; achenes turgid, usually dark; pappus of 2 narrowly lanceolate awns without other scales. Rare in n.-cen. Tex., Aug.-Oct.; Ont. and Sask. s. to Ga., Tenn. and Tex.; perhaps adv. with us.

The species elsewhere intergrades with *H. laetiflorus* var. *rigidus*, apparently because of past introgression. In Texas the two taxa do not overlap in distribution. The tubers of this plant are eaten, cooked, pickled and raw.

3. *Helianthus laetiflorus* Pers. Perennial herb with fibrous roots on stout rhizomes; stems stout, erect, 5-20 dm. tall, mostly simple below; leaves nearly all opposite, reduced and sparser upward, ovate to broadly lanceolate or less commonly linear, mostly broadly rhombic-lanceolate, acute, obscurely to conspicuously serrate, sessile (to a broad subpetiolar base), 5-28 cm. long, 4-7 cm. broad, very firm-textured, rough on both sides; peduncles few, long, stout, nearly naked; involucre short-cylindric-campanulate; phyllaries in 3 or 4 series, elliptic to oblong-ovate, obtuse or broadly acute, the outermost shorter, glabrous, conspicuously short-ciliate marginally the full length, deep-green, glabrous, usually shiny, shorter than the disk, erect and closely appressed; pales entire or obscurely 3-cuspidate, the middle cusp larger and dark; rays ovate, about 2-3 cm. long, often emarginate; disk 15-20 mm. across, the corollas with red-brown or reddish lobes; achenes turgid, dark, more or less pubescent apically; pappus of 2 broadly lanceolate, pubescent awns with accessory awns at each side of the principal awns.

We have two varieties in Texas.

Var. *rigidus* (Cass.) Fern. Stems harshly scabrous, 8-20 dm. tall, with 7 to 15 nodes; leaves oblong-lanceolate to lance-ovate, tapering to long acuminate tips, 8-27 cm. long; phyllaries narrowly ovate or lanceolate. *H. rigidus* (Cass.) Pers. Infrequent or rare in e. Tex., Aug.-Oct.; midwest. U.S. s. to Tex.

Var. *subrhomboideus* (Rydb.) Fern. Stems less harsh above, 5-10 dm. tall, with 6 to 9 nodes; leaves subrhombic-ovate to subrhombic-lanceolate, subacute, 5-12 cm. long; phyllaries nearly oblong-ovate. Rare in Trans-Pecos mts., late summer; s. Can. and n. U.S., s. in the mts. to Tex.

The var. *laetiflorus* occurs in n.e. U.S., s.w. to Mo. and Kan. Elsewhere these varieties intergrade, and the var. *laetiflorus* intergrades with *H. tuberosus*, making the taxonomy most perplexing.

4. *Helianthus Maximiliani* Schrad. MAXIMILIAN SUNFLOWER. Stout perennial, with usually several mostly simple stems 3-30 dm. tall from the woody crowns or short root-stocks, rarely with lateral branches near the top, scabrous or with abundant short white hairs; leaves alternate, lanceolate, gradually acuminate to both ends, mostly 14-30 cm. long, 20-55 mm. broad, marginally entire, sometimes obscurely serrate, surficially with many short hairs imparting a grayish-green color, sessile; phyllaries 10-15 mm. long, densely pubescent, marginally strongly ciliate, spreading; heads in a simple terminal racemose arrangement, less commonly in a paniculiform grouping, 50-75 mm. across; disk florets 10-12 mm. long, the base of the corolla puberulent; rays bright-yellow, 25-35 mm. long, concave; pales linear-acuminate, obscurely 3-cuspidate, apically pubescent. Frequent in seasonally moist ditches, depressions or prairies, n.-cen. and s.e. Tex. and Edwards Plateau, infrequent in Plains Country and rare in the Trans-Pecos, (late summer)-fall; most of s. Can., s. in cen. U.S. to Tex. and in Coastal States to N.C.

5. *Helianthus hirsutus* Raf. Perennial with coarse roots; rhizomes very stout, much-branched, 1-3 dm. long; stems erect, 5-17 dm. tall, usually simple most of the length, densely scabrous-hispid or scabrous-hirsute, often glabrescent below, rough; leaves opposite; blades ovate or ovate-lanceolate to narrowly lanceolate, often acuminate, marginally serrate to obscurely so and often revolute, rarely entire, rounded or abruptly contracted at the broad base, sometimes subcordate, densely hispid above, scabrous-hispid beneath, 6-15 cm. long, 7-70 mm. broad; petiole (sometimes winged) 5-20 mm. long; involucre hemispheric; phyllaries broadly linear-lanceolate, slightly to greatly longer than the disk, ciliate, hispid, very loose, recurved; pales 3-cuspidate, carinate; rays 15-25 mm. long, oval; disk 1-2 cm. across, the corollas totally yellow; achene broadly obovate, turgid, dark, glabrous; pappus of 2 broadly lanceolate rather short pubescent awns, without other scales. *H. leptocaulis* (Wats.) Blake var. *trachyphyllus* T.&G. and var. *stenophyllus* T.&G. Frequent in e., s.e. and n.-cen. Tex., infrequent to e. part of Edwards Plateau, summer-fall; most of e. U.S.

Reports of *H. leptocaulis* from Texas are based on specimens of *H. hirsutus*.

6. *Helianthus mollis* Lam. Perennial herb with many fine fibrous roots, the creeping rhizomes very stout and rarely more than 15 cm. long; stems often tufted, erect, 5-10 dm. tall, scabrous-hirsute, simple in medium or small plants, often branched above in large ones, the branches rather rigidly ascending; leaves mostly opposite, narrowly ovate to ovate-lanceolate, entire or serrulate, sessile, clasping, sometimes cordate-clasping, mostly about 9 cm. long, 2-6 (-9) cm. broad, variable in size, densely scabrous-hispid above, densely cinereous-pubescent beneath; involucre hemispheric; phyllaries broadly linear-lanceolate, acute, often abruptly acuminate, not much longer than the disk, erect, densely hispid or scabrous-tomentose; disk 2-3 cm. across, the corollas totally yellow; achenes slightly villous at the apex; pappus of 2 broadly lanceolate awns, without other scales. Frequent in sandy soil, e., s.e. and n.-cen. Tex., late summer-fall; most of e. U.S.

7. *Helianthus occidentalis* Ridd. Perennial herb with abundant fine fibrous roots, the rhizomes very slender; stems several, slender, erect, 8-15 dm. tall, finely appressed-pubescent; leaves strictly opposite (except the few and much-reduced bracteals above), crowded at or very near the base and persistent even at flowering time; bladelike portion ovate, obtuse, crenate-dentate, subcoriaceous, about 10 cm. long and 5 cm. broad, remotely appressed-pubescent with very short hairs; narrow petiolelike base about as long as the blade; heads in a small paniculiform group at the top of the nearly naked stem; involucre subcampanulate; phyllaries narrowly lanceolate, subulate-attenuate, very loose but not reflexed, longer than the disk, obscurely and very finely appressed-pubescent; pales lanceolate, subglabrous; disk about 1 cm. across, the corollas all yellow; achenes villous at the apex and on the angles; pappus of 2 broadly lanceolate awns. Incl. var. *plantagineus* T.&G. Infrequent in e. Tex., late summer-fall; most of e. U.S.

8. *Helianthus angustifolius* L. Perennial herb; roots fibrous; rhizomes few, very slender, 5-15 cm. long; stems 10-17 dm. tall, leafy, mostly simple, usually scabrous,

hispid; leaves mostly alternate, variable but mostly linear or narrowly lanceolate, 1-2 dm. long, 3-15 (-20) mm. broad, obtuse, sessile, very firm, very scabrous above, pubescent beneath, often with resin-dots; upper branching open-paniculiform; phyllaries narrowly lanceolate, slightly acuminate, usually shorter than the disk, very loose, setose or scabrous, scarcely ciliate; pales 3-cuspidate; disk about 1 cm. across; lobes of disk corolla purple, puberulent; achene slender, glabrous, about 4 mm. long; pappus of 2 lanceolate awns, without intermediate scales. Moist places, e. and s.e. Tex., late summer-fall; N.J. s. to Fla., w. to Ia. and Tex.

A very closely related form, but with an entirely yellow disk and reputed to be more robust with woodier rootstocks, is *H. simulans* E.E.Wats. It is rare in boggy areas in east Texas (Robertson Co. and probably elsewhere), and Louisiana. Its degree of distinctness needs further investigation.

9. *Helianthus salicifolius* Otto & Dietr. Perennial from stout rhizomes 2-3 dm. long with coarse roots; stems 4-8 dm. tall or occasionally to 2 m., erect, mostly glabrous, simple below the head-bearing region; leaves mostly alternate, crowded, narrowly linear-lanceolate to linear, marginally often revolute, 5-15 cm. long, 1-3 (-5) mm. broad; upper branching paniculiform; peduncles 5-6 cm. long; involucre campanulate; phyllaries narrowly lanceolate to linear-lanceolate (outermost shorter), acuminate, attenuate into subulate tips often longer than the disk, very loose but not reflexed, glabrous or nearly so, scarcely ciliate or ciliate toward the base; rays numerous, 1-2 cm. long; disk about 10-11 mm. across, the corollas with red-purple lobes; achenes slender, glabrous, dark-brown, apically rounded; pappus of 2 lanceolate short awns, without other members. *H. filiformis* Small. Rare in calcareous prairies, n.-cen. Tex., e. part of Plains Country and Edwards Plateau, late summer-fall; from cen. Plains States s. into Tex.

10. *Helianthus ciliaris* DC. BLUE-WEED. Perennial from slender rhizomes; stems 1 to several, 5-7 dm. tall, glabrous, glaucous; midstem leaves opposite, sessile or very short-petiolate, linear to broadly lanceolate, entire to somewhat pinnately lobed, glabrous and glaucous, conspicuously 3-nerved when lanceolate; heads 12-25 mm. across; phyllaries obtuse, ovate to broadly lanceolate, ciliate, glabrous or slightly puberulent dorsally, about 5-7 mm. long, about 3.5 mm. broad; rays 12 to 18, about 1 cm. long; disk corolla 5-6 mm. long, basally puberulent and yellow, the lobes reddish or sometimes the entire corolla red; pales entire to 3-cuspidate, the tips obtuse to acute and puberulent; achenes about 3 mm. long, black or grayish at maturity; pappus of the disk of 2 broadly ovate-acuminate scales; ray pappus absent or of 1 to 3 linear to lanceolate scales. Locally abundant near streams or canals, often in subalkaline desert soil in the Trans-Pecos and Plains Country, infrequent in Rio Grande Plains, summer-fall; Kan., Okla., Tex., N.M., Ariz., Chih., Coah., N.L., Tam. and S.L.P.

11. *Helianthus argophyllus* T.&G. SILVERLEAF SUNFLOWER. Taprooted short annual 1-2 m. tall, densely white-tomentose (especially the younger parts), profusely branched in the upper half; leaves mostly alternate, ovate, obtuse, entire or rarely serrate, more or less subcordate, petiolate (petiole about as long as blade in larger midstem leaves); blade normally almost 2 dm. long and broad, densely tomentose on both surfaces; peduncles 5-15 cm. long; involucre flattish; phyllaries broadly ovate-acuminate with subulate tips, about equaling the disk, loose but not reflexed, densely tomentose, more or less ciliate, the cilia usually obscured by the tomentum; pales 3-cuspidate, often red-purple; disk 2-3 cm. across, deep-purple; achene more or less pubescent toward the apex; pappus of 2 lanceolate ample awns, without any other scales. Locally abundant in deep loose sandy soils, s.e. Tex. and Rio Grande Plains, scattered and perhaps introd. in e. Tex., late summer-fall; perhaps endemic but now introd. widely as an ornamental and escaping in the Gulf States.

Hybridizes occasionally with *H. annuus* (and perhaps also with *H. debilis*), producing local hybrid swarms.

12. *Helianthus annuus* L. COMMON SUNFLOWER, MIRASOL. Taprooted annual; stems 5-25 dm. tall, less commonly taller, simple or branched, hispid, very rough, green, often mottled; leaves nearly all alternate; blades ovate (rarely ovate-lanceolate), obtuse or less commonly acute, basally truncate to cordate, dentate (rarely subentire), scabrous-setose above, hispid beneath, (5-) 10-30 cm. long and nearly as broad as long; petioles often as long as or longer than the blades; peduncles very variable; heads often numerous; involucre shallow; phyllaries broad, 4-10 mm. broad, in the proximal part marginally conspicuously ciliate and oblong in shape, rather abruptly contracted toward the tip

(thus acuminate), often attenuate, sparingly to densely hispid, about equaling the disk; pales ample, 3-cuspidate; disk 20-35 (-45) mm. across, the corolla lobes red or purple; achenes 3.3-5.5 (-7) mm. long, obovate, glabrous or obscurely pubescent apically, light gray, often mottled; pappus of 2 broadly lanceolate awns, without intermediate scales.

We have 3 intergrading races as follows:

Subsp. *annuus*. Plants usually very tall and branched; leaf blades ovate, cordate basally; phyllaries 7-10 mm. broad, sparingly to densely pubescent; disk 3-5 cm. across; rays 21 to 35, 3-5 cm. long, 10-15 mm. broad; disk corollas red or purple; achenes 4-7 mm. long. Rare in n.e. Tex., late summer-fall; e. and cen. U.S. and s. Can.

Subsp. *texanus* Heiser. Plants 15-25 dm. tall, usually much-branched; stem frequently conspicuously purple and green-mottled; lower leaves ovate, cordate at base, occasionally somewhat jaggedly serrate; phyllaries 4-6 mm. broad, generally sparingly pubescent; disk generally 21-30 mm. across; rays light yellow, 19 to 25, 24-32 mm. long, 8-12 mm. broad; disk corollas and anthers purplish; achenes 3.3-5 mm. long. *H. annuus* var. *texanus* (Heiser) Shinn. Widespread in e. and s. halves of Tex., late summer-fall; also in n.e. Mex.

Subsp. *lenticularis* (Dougl.) Cockl. Plants generally 5-25 dm. tall, branched; lower leaves lanceolate to ovate, truncate to cordate basally; phyllaries 4-7 mm. broad, sparingly to densely pubescent; disk generally 20-35 mm. across; rays 12 to 26, 25-39 mm. long, 9-13 mm. broad; disk corollas generally red or purple; anthers reddish or purplish, rarely yellow; achenes 4-5.5 mm. long. Infrequent in w. Tex., late summer-fall; most of w. N.A.

In Texas the common sunflower has apparently introgressed with *H. debilis*; the racial characters of the subsp. *texanus* can be explained as the result of introgressive genetic influence of *H. debilis* populations on *H. annuus* populations. The cultivated giant sunflower is a member of *H. annuus*, derived through artificial selection.

13. *Helianthus petiolaris* Nutt. PLAINS SUNFLOWER. Taprooted annual; stems erect, usually 5-20 dm. tall, often much-branched, variously pubescent (see remarks below); leaves alternate; blades narrowly lanceolate to deltoid or ovate, obtuse to acute, marginally entire to deeply serrate-dentate or dentate, at the extreme base cuneate, rarely cuneate-subcordate, 4-15 cm. long, 1-10 cm. broad (mostly about 8 × 3-4 cm.), variously pubescent; petiole slender, 1-15 cm. long, longest on the lowest leaves, about as long as the blade; branching above paniculiform, the heads solitary at the tips, the peduncles mostly about 1 dm. long; involucre hemispheric; phyllaries broadly lanceolate, about as long as the disk, erect, somewhat appressed, ciliate or not, densely short-hispidulous; pales 3-cuspidate; rays oval, about 2 cm. long; disk 10-25 mm. across, the corollas with red-purple lobes; achene turgid, oblong, apically rounded, evenly and conspicuously villous; pappus of 2 broadly lanceolate awns about half as long as the corolla. Local in usually sandy plains and prairies, w. half of Tex., sporadically waifed farther e., summer-fall; much of the Great Plains and s. to Chih.; waifed in a few areas of n.e. U.S.

The Trans-Pecos representatives of this species have gray-pubescent herbage; since they show some degree of reproductive isolation from the greener plains plants, they are considered by some authors to be a separate species, *H. canus* (Britt.) Woot. & Standl., or a separate variety, *H. petiolaris* var. *canescens* Gray; but there is complete intergradation of this sort with the true *H. petiolaris* of the plains. The var. *canescens* is distributed in Tex., N.M., Ariz., Calif., Baja Calif., Son. and Chih. It is one of the *Helianthus* taxa most similar to *Viguiera*, to which the entire genus *Helianthus* is most closely related.

14. *Helianthus debilis* Nutt. Taprooted annual 4-20 dm. tall, rather much-branched, subglabrous to canescent-pubescent, usually scabrous above, the upper stem and branches usually conspicuously mottled; leaves nearly all alternate; blades deltoid-ovate to deltoid-lanceolate, acute, more or less cordate basally, 3-8 cm. long, 2-5 cm. broad, irregularly serrate (rarely subentire), green (or rarely canescent-pubescent); petiole nearly as long as the blade; heads few, terminating the upper branches; involucre hemispheric; phyllaries narrowly lanceolate, attenuate to subulate apically, exceeding the disk, loose but not reflexed, not very ciliate; pales 3-cuspidate; rays 11 to 16 (rarely to 20), 15-27 mm. long; disk 14-17 mm. across; corolla lobes deep-red-purple; achene slender and pubescent at the summit; pappus of 2 short slender awns.

We have several races of this species all found in sandy soil and nearly all on the Coastal Plains, as follows:

Subsp. *silvestris* Heiser. Stems erect, dark-reddish-mottled, frequently glabrate branched above, the branches somewhat drooping; lower leaves deltoid-ovate, cordate, for the most part regularly serrate; blades 6-14 cm. long, 4-13 cm. broad; peduncles slender, 16-30 (-40) cm. long; disk for the most part 15 mm. across; phyllaries about 2 mm. broad; rays 12 to 14 (rarely to 20), 15-23 mm. long, 7-12 mm. broad; pales for the most part hispid. Sandy soils, e. Tex., late summer-fall; endemic.

Subsp. *cucumerifolius* (T.&G.) Heiser. Erect, much-branched, the branches ascending, hispid below, usually conspicuously purple-mottled, 55-65 dm. tall; lower leaves deltoid-ovate to deltoid or lanceolate, cuneate to truncate or cordate basally, fairly regularly serrate, slightly wavy-margined; blade 4-9 cm. long, 3-8 cm. broad; peduncles not conspicuously slender, 25-50 cm. long; disk 16-18 (-20) mm. across at anthesis; phyllaries 2-2.5 mm. broad; rays 12 to 18, about 2 cm. long, 7-12 mm. broad; central pales with hispid or slightly villous tips. *H. debilis* var. *cucumerifolius* (T.&G.) Gray, *H. cucumerifolius* T.&G. Sandy soils, Travis Co. s. to Victoria Co., w. to Bandera, Medina and Frio cos., late summer-fall; endemic.

Subsp. *praecox* (Engelm. & Gray) Heiser. Usually somewhat prostrate or erect with branches horizontal; stems greenish, not conspicuously mottled, hispid to hirsute, 4-5 dm. tall; lower leaves deltoid-ovate, usually cuneate to truncate basally, finely and fairly regularly serrate, 3-8 cm. long, 2-7 cm. broad; peduncles 15-30 cm. long; disk about 14 mm. across; phyllaries 3-4 mm. broad, short-attenuate; rays generally 14 to 15, 17-27 mm. long, 7-12 mm. broad; central pales hispid or occasionally slightly villous. *H. debilis* var. *praecox* (T.&G.) Gray, *H. praecox* T.&G. Coastal sands, Galveston and Chambers cos., late summer-fall; endemic.

Subsp. *Runyonii* Heiser. Erect, generally reddish, hispid to hirsute, 5-6 dm. tall; lower leaves deltoid-ovate, basally cuneate to truncate, generally with small acute teeth and regularly serrate; blades 30-75 mm. long, 2-6 cm. broad; peduncles 2-3 dm. long; disk about 14 mm. across; phyllaries 3-4 mm. broad, abruptly attenuate; rays generally 11 to 13, 22-24 mm. long, 10-11 mm. broad; central pales villous. Coastal areas, Aransas Co. to Cameron Co. and inland to Bee and Brooks cos., late summer-fall; endemic.

Subsp. *hirtus* Heiser. Similar to subsp. *Runyonii* but more hirsute; blades 3-9 cm. long, 2-7 cm. broad; peduncles 3-4 cm. long; disk 15-17 mm. across; rays 14 to 16, 21-27 mm. long, 7-13 mm. broad. Known only from sands in Dimmit Co., Rio Grande Plains; endemic.

H. debilis, especially as it is represented by its subspecies *praecox*, *Runyonii* and *hirtus*, is exceedingly closely related to *H. petiolaris*.

15. *Helianthus paradoxus* Heiser. Taprooted annual 15 dm. tall, the stem sparsely scabrous; leaves opposite below, alternate above; lower blades lanceolate, 10 cm. long, 25 mm. broad, 3-nerved, entire, rough; petioles 2 cm. long; peduncles 3 to 5, 12-18 cm. long; phyllaries 16 to 20, ovate-lanceolate or ovate, sparsely hispid, 10 mm. long, 3 mm. broad; disk about 18 mm. across; rays about 15, 17 mm. long, 7 mm. broad; disk corolla purple; pales apically glabrous. Rare, known from one population, 7 miles w. of Ft. Stockton, Pecos Co. in the Trans-Pecos (11 Sept., 1947). Also known from an old collection from Valencia Co., N.M. Very likely extinct in Texas.

Probably has hybridized to some extent with *H. annuus* subsp. *lenticularis*.

16. *Helianthus neglectus* Heiser. Taprooted annual, 8-15 dm. tall, densely hispid below, branched above; lower leaves ovate, for the most part cordate basally, subentire to remotely serrulate, sparsely hispid, the hairs somewhat appressed; blades 7-14 cm. long, 75-123 mm. broad; petioles 9-11 mm. long; peduncles 1-4 dm. long; phyllaries 25 to 35, lanceolate, attenuate, 15-24 mm. long, 25-40 mm. broad; rays 21 to 31, 30-39 mm. long, 10-14 mm. broad; disk about 23-28 mm. across; scales apically white-hirsute. Rare, known from scattered populations along U.S. highway 80, from 2 to 10 miles e. of Monahans, in the sandy "South Plains" (22 July 1955). Also known from Eddy Co., N.M. Closely related to *H. petiolaris*. Probably has hybridized to some extent with *H. annuus*.

80. FLOURENSIA DC.

A genus of about 2 dozen species of North America and South America.

1. *Flourensia cernua* DC. TARBUSS, HOJASÉ. Shrub 1-2 m. tall, densely leafy, glabrous, glutinous, aromatic with an odor of tar; leaves alternate, elliptic or nearly so, 17-25 mm.

long, 6.5-11.5 mm. broad, acute at both ends, deep-green; petioles 1-2.5 mm. long; heads nearly sessile in leafy clusters on the branchlets, nodding, about 1 cm. long and thick; involucre campanulate; phyllaries in roughly 3 series, strongly graduated, linear, firmly herbaceous, glutinous, the tips often spreading; involucre slightly convex, chaffy throughout, the pales nearly as long as the flowers and partially enfolding them; *ray flowers* absent; *disk flowers* perfect, fertile, the corollas dull-yellow and 5-toothed terminally; achenes laterally compressed and 2-edged but not winged nor very flat, silky-villous, narrowly cuneate, about 6 mm. long, 2 mm. wide; pappus of 2 ciliate awns, unequal, 2.5-3.2 mm. long; intermediate squamellae absent. Very abundant in Trans-Pecos deserts, rare e. to w. part of Plains Country, Sept.-Dec.; Tex., N.M., Ariz., Son., Chih., Coah., N.L., Dgo. and Zac.

81. ENCELIA ADANS.

An American genus of about 15 species, of which we have one.

1. *Encelia scaposa* (Gray) Gray. Strongly perennial herb from woody rootstocks 1-2 cm. thick; leaves mostly alternate but so densely crowded at the base that the phyllotaxy is obscure, narrowly oblanceolate to sublinear, 3-10 cm. long, 1-8 mm. broad; stems few, naked, scapelike, erect, 3-5 dm. tall, monocephalous; involucre about 1 cm. high, hemispheric or even broader; phyllaries linear, in about 2 or 3 series, the inner shorter than the outer; receptacle slightly convex, chaffy throughout, the pales folded and enveloping the flowers; *ray flowers* about 20 to 40, pistillate but infertile; rays about 15 mm. long, oblong, yellow, showy, 2-toothed terminally; *disk flowers* perfect, fertile, the yellow corolla 5-toothed terminally; achenes strongly laterally compressed, very pubescent especially on and near the 2 sharp edges; pappus of 2 hairs or awns, one over each shoulder of the achene, easily dislodged and often absent from the mature achenes. Incl. var. *stenophylla* Shinnery. Rare in deserts of the Trans-Pecos (Hudspeth and Terrell cos.), Mar.-Apr.; also N.M.

82. SIMSIA PERS.

BUSH SUNFLOWER

Annual or perennial herbs, usually harshly doubly pubescent with some longer bristly hairs intermixed with fine shorter ones; nearly all the leaves opposite, only a very few uppermost ones alternate, the petiole well-marked, the blade often deltoid or shallowly hastately lobed and marginally serrate; peduncles several cm. long, monocephalous; involucre 7-12 mm. high; phyllaries in about 3 unequal or subequal series, firm and finely bristly, basally often somewhat indurated and discolored and about 3-nerved; receptacle slightly convex, chaffy throughout; pales often discolored or stramineous, elliptic, acute, folded over and mostly enveloping the flower; *ray flowers* 8 to 30, pistillate but infertile; the yellow rays often also suffused or spotted (especially underneath) with purple, linear, terminally rounded; *disk flowers* numerous, perfect, fertile, the corollas mostly yellowish (often with purplish lines) and 5-toothed terminally; disk achenes laterally strongly compressed, nearly completely flat, obovate in outline, usually emarginate apically (the margins winglike but quite firm), blackish or mottled; pappus absent or of 2 awns, 1 over each shoulder of the developing achene and caducous, usually absent on the mature achene.

A genus of two dozen species of the warm-temperate and tropical parts of the Americas. It has been included in *Encelia* by some authors but it is as well-marked as various other genera closely related (*Verbesina*, *Helianthus*, *Viguiera*, *Flourensia*).

1. Phyllaries subequal; rays 15 to 30; perennial from thick fusiform or woody underground parts; petioles of some leaves auricled at the attachment to the stem and auricles of opposing leaves usually united at the side of the stem; corolla of disk flowers gibbous near the base on the side toward the periphery of the head 1. *S. calva*.
1. Phyllaries markedly graduated; rays about 8 to 10; annual from slender taproots; petioles not auricled; corolla not gibbous 2. *S. exaristata*.

1. *Simsia calva* (Engelm. & Gray) Gray. Perennial herb from woody or slightly fleshy fusiform underground organs often 1-2 cm. thick (these organs rarely extricated from crevices in Trans-Pecos and Edwards Plateau habitats), harshly pubescent, several-stemmed from the base and with the characters given in the key. *Encelia calva* (Engelm. & Gray) Gray, *Simsia subaristata* Gray. Abundant in Rio Grande Plains, frequent in the Trans-Pecos, n.-cen. and s.e. Tex., Edwards Plateau and Plains Country, spring-fall; Tex., Tam., N.L. and Coah.

The degree of development of the pappus awns and their degree of persistence is highly variable. Plants of the Trans-Pecos mts. are racially distinct in several subtle ways and probably deserve recognition as a variety.

2. *Simsia exaristata* Gray. Annual herb, erect, much-branched above and with the characters given in the key. Incl. var. *perplexa* Blake, *Encelia exaristata* (Gray) Gray. Very rare in deserts, w. part of the Trans-Pecos, late summer-fall; Tex., N.M., Ariz., Son., Chih. and southw.

Apparently intergrading with the central and southern Mexican *S. lagascaeformis* DC., and probably should be referred to by the latter name.

83. ZEXMENIA LA LLAVE & LEX.

Small shrubs; leaves mostly opposite, short-petiolate or nearly sessile, often rough-pubescent, the blades usually unlobed; peduncles remote, 1-2 cm. long, naked; heads solitary on the peduncles; involucre usually hemispheric or deep-campanulate; phyllaries in 2 or 3 series, graduated, usually ovate or oblong and with herbaceous tips; *ray flowers* usually 8, fertile; rays yellow or orange; *disk corollas* yellow or orange; disk achenes more or less compressed, mostly oblong or obovate, acute- or sharp-edged or sometimes winged; achene more or less markedly constricted near its summit, forming a sort of neck which separates the insertion of the pappus from the body of the achene; pappus of 2 or 3 awns and several usually more or less connate squamellae.

An American genus of several dozen species.

1. Stem leaves 5 cm. or more in length (sometimes shorter) 1. *Z. hispida*.
 1. Stem leaves 2-3 (rarely -4) cm. long; outer phyllaries squarrose, loose and enlarged or the heads subtended by 2 or 3 bractlike leaves 2. *Z. brevifolia*.

1. *Zexmenia hispida* (H.B.K.) Gray. Shrub 5-10 dm. tall, strigose-hispid; leaves rhombic-lanceolate or ovate-lanceolate, acute at the base, sessile or nearly so, sparingly dentate or subhastately lobed, generally strigose on both sides; peduncles terminal, solitary or occasionally in a cyme of 3, very long; heads about 1 cm. high; involucre 2-seriate, cylindraceous-campanulate, generally less than 1 cm. broad; outer phyllaries (or bractlike leaves) lanceolate, subfoliaceous; rays broad, conspicuous, yellowish-orange; achenes variable as to wing and size; achenes of the ray flowers commonly 3-angled, with 2 or occasionally 3 wings; achenes of the disk flowers broadly 2-winged or with the wings reduced to 2 upwardly directed auricles; pappus separated from the body of the achene by a strong constriction or neck bearing a somewhat expanded row of very short squamellae and 2 or 3 short awns. Abundant on Edwards Plateau (n.w. to Kent Co.), Rio Grande Plains and less frequent in the Trans-Pecos and s. part of s.e. and n.-cen. Tex., summer-fall; Tex. and much of upland and n.e. Mex. s.e. to Ver. and Hgo.

2. *Zexmenia brevifolia* Gray. Rounded shrub usually 5-10 dm. tall, rather harshly pubescent; leaves ovate to broadly elliptic-ovate, 2-3 (rarely -4) cm. long, entire, obtuse at apex; peduncles long, slender, terminal, solitary, densely strigose; heads 10-15 mm. high; involucre lax, roughly 3-seriate; outermost phyllaries ovate, foliaceous at apex, squarrose, loose and enlarged; rays 5 to 8, small, the achenes broadly winged; disk achenes 4-6 mm. long, slightly rugose, narrowly winged; pappus scales well-developed, usually united at base to form a short cup at achene summit, the neck evident in disk achenes; awns shorter than the body, rather rigid. Frequent in low scrubby vegetation on limestone, Rio Grande Plains and s. Trans-Pecos, summer-fall; Tex., Chih., Coah., N.L., Tam. and S.L.P.

84. VERBESINA L. CROWN-BEARD

Pubescent annual or perennial herbs; leaves opposite or alternate, mostly roughly ovate or deltoid in shape (less commonly elliptic) and basally narrowed either to a subpetiolar winged base or rarely a true petiole, marginally usually coarsely serrate, in some species basally decurrent as wings on the stem; heads solitary or clustered; receptacle low to high-conical to nearly globose; involucre usually hemispheric or campanulate; phyllaries imbricated in 2 to several series, ascending or spreading at maturity, usually not markedly unequal; each pale folded at one edge of the achene; *ray flowers* present, pistillate, fertile or infertile, yellow or white, 3-toothed or shortly 3-lobed terminally; *disk flowers* numerous, perfect, fertile, the corollas yellow or white and 5-toothed; style tips acute or attenuate; achenes strongly laterally compressed, with 2 thin edges each usually with a well-developed wing, the body glabrous or pubescent; pappus of 2 deciduous or persistent usually straight awns or in some species essentially absent. *Ximenesia* Cav.; *Actinomeris* Nutt.; *Ridan* Britt.; *Pterophyton* Cass.

A rather diverse genus, marked by the very thin and thin-margined or wing-margined achenes. *Zexmenia* has somewhat similar achenes but it comprises shrubs or subshrubs and its achenes tend to be slightly thicker, and the outer phyllaries are broad, almost foliaceous. About 150 species, native to America.

- 1. Rays deeply 3-toothed or shallowly 3-lobed terminally, the teeth or lobes 1.5-3 (-4) mm. long (2)
- 1. Rays more shallowly 3-toothed or with 3 scallops terminally (3)
- 2(1). Annual, usually bushy-branched; rays yellow2. *V. encelioides*.
- 2. Perennial, subrhizomatous, not bushy-branched; rays orange3. *V. nana*.
- 3(1). Rays white (4)
- 3. Rays yellow (5)
- 4(3). Wings of the stems commonly 6, usually present also in the upper head-bearing region; leaves mostly sinuate-dentate or deeply crenate; pubescence very short7. *V. microptera*.
- 4. Wings of the stem 4 or 5, narrow, seldom proceeding upward into the head-bearing region; leaves soft-pubescent8. *V. virginica*.
- 5(3). Phyllaries few, soon deflexed; achenes at maturity squarrosely spreading1. *V. alternifolia*.
- 5. Phyllaries numerous, imbricated; achenes at maturity ascending (6)
- 6(5). Leaves opposite, for the most part harshly scabrous-pubescent; Edwards Plateau4. *V. Lindheimeri*.
- 6. Leaves alternate for the most part; pubescence not harshly scabrous; not on Edwards Plateau (7)
- 7(6). Stems winged by the decurrent leaf bases; eastern half of state5. *V. helianthoides*.
- 7. Stems not winged; Trans-Pecos mountains6. *V. oreophila*.

1. *Verbesina alternifolia* (L.) Britt. WINGSTEM. Perennial herb usually 1-2 m. tall, erect, not much-branched except in the upper 1-4 dm.; leaves alternate (rarely opposite), elliptic, basally cuneate, apically acute, coarsely serrate, decurrent as narrow wings on the stem; *ray flowers* few, neutral, sterile; rays yellow, about 1 cm. long; disk only about 1 cm. thick, soon nearly globose on account of the high-conic receptacle and spreading phyllaries, pales and flowers; achenes with prominent wings; pappus of 2 persistent awns. *Actinomeris alternifolia* (L.) DC. Rare in n.-cen. Tex. (Dallas Co.), presumably adv.; Gulf States n. to Ont. and Ia.

2. *Verbesina encelioides* (Cav.) Gray. COWPEN DAISY. Much-branched grayish-green or canescent-pubescent taprooted annual 1-9 dm. tall; leaves chiefly opposite, with a roughly deltoid lamina portion (coarsely dentate) and narrowed below to a

broad subpetiolar base which usually clasps the stem, rarely the leaves with true, unwinged petioles (var. *exauriculata* Robins. & Greenm.); heads solitary on the pedunculiform ends of the branches or rarely 2 or 3 fairly closely aggregated, each 2-3 cm. across (incl. the expanded rays); outer phyllaries long, green, much-surpassing the disk or else subequal; rays about 1 cm. long; ray flowers fertile, yellow, showy, deeply 3-toothed terminally; wings of the achene rarely narrow or nearly vestigial, usually broad and acutish summitally. *Ximenesia encelioides* Cav. and var. *cana* DC., *X. australis* H. & A., *X. exauriculata* (Robins. & Greenm.) Rydb. Very frequent in disturbed soils essentially throughout although rare in extreme e. Tex., summer; Fla., Tex., s.e. through most of the warmer parts of Am., adv. in Old World.

3. *Verbesina nana* (Gray) Robins. & Greenm. Rhizomatous perennial, the aerial shoots only 1-2 (-3) dm. tall; leaves chiefly opposite, often canescent-pubescent, oval, obtusish, irregularly dentate (the teeth often blunt), often only 3-5 cm. long, nearly half as broad, narrowed basally to a linear subpetiolar base which is entire and bears 2 to 4 teeth near the stem; heads solitary at the pedunculiform ends of the branches, about 2 cm. across; phyllaries oblong to lance-linear, about 8 mm. long, subequal; ray flowers fertile; rays orangish, usually less than 1 cm. long, 3-toothed apically; pales narrow, nearly filiform; achenes suborbicular in outline, broadly winged, villous, the wings obtuse at the summit; pappus absent. *Ximenesia nana* (Gray) Shinn. Local in deserts in the Trans-Pecos, rare in Rio Grande Plains, summer; also Coah.

4. *Verbesina Lindheimeri* Robins. & Greenm. LINDHEIMER CROWN-BEARD. Perennial herb (2-) 4-6 (-10) dm. tall; stems not winged; herbage harshly scabrous; leaves opposite for the most part but alternate in the head-bearing region, with an ovate-deltoid lamina-portion but basally narrowly long-tapered to a cuneate base (not clasping); heads few; peduncles essentially naked; phyllaries broadly oblong; rays showy, yellow; pappus awns short. Locally abundant in limestone hills in e. part of Edwards Plateau, late summer-fall; endemic.

5. *Verbesina helianthoides* Michx. Perennial about 1 m. tall; most of the leaves alternate, all basally decurrent on the stem as wings, elliptic, basally cuneate, apically acute, marginally serrate; heads 3-5 cm. across when the rays are expanded and spreading; phyllaries lanceolate to linear-oblong; ray flowers usually infertile; rays long (18-30 mm.), yellow, showy; wings of the achene broad. Local in open areas of n.-cen. Tex., rare in e. Tex., May-Oct.; s.e. U.S. n. to O. and Ia. and w. to Okla. and Tex.

6. *Verbesina oreophila* Woot. & Standl. Perennial herb about 1 m. tall; stems erect, stout, not winged, minutely puberulent; leaves alternate; blades triangular-lanceolate to deltoid-ovate, 8-11 cm. long, 7 cm. broad or less, acute, narrowed basally to a very short linear subpetiolar base, marginally coarsely serrate, scaberulous on the upper surface, soft-pubescent on the lower; heads numerous, each on a slender naked peduncle in a loose cymelike arrangement, about 12 mm. across; phyllaries oblanceolate to linear-oblong or lanceolate, acute, 5 mm. long or less, appressed-pubescent; rays bright-yellow, conspicuous, obovate-spatulate; achenes 5 mm. long, cuneate-obovate, brown, glabrous, closely invested by the receptacular pales. Mts. of the Trans-Pecos, above 7,000 ft., (Aug.-) Sept.-Nov.; also N.M.

7. *Verbesina microptera* DC. CAPITANA. Perennial herb from knotty crowns and fibrous roots, 5-20 dm. tall; stems prominently winged with usually 6 wings, the wings progressing up well into the highly branched head-bearing region; leaves alternate with an elongate-deltoid or rarely elliptic lamina portion which is coarsely toothed or crenate and narrowed basally to a broadly winged subpetiolar base; rays and disk whitish. *V. texana* Buckl. Abundant in loamy soil, Rio Grande Plains, s. part of Edwards Plateau and s. part of s.e. and e. Tex., summer-fall; also n.e. Mex.

Intergrading on a broad scale with the next and probably conspecific with it.

8. *Verbesina virginica* L. FROSTWEED. Perennial herb usually 1-2 dm. tall, much resembling the last but the stem with only 4 or 5 wings and these usually absent from the highly branched head-bearing region; pubescence averaging softer and less harsh than in *V. microptera*; rays and disk whitish. Abundant in loamy soil, e., s.e., and n.-cen. Tex., late summer-fall; Gulf States n. to Pa., Ky., Mo. and Kan.

Probably to be enlarged to include *V. microptera*, with which it intergrades.

85. CALYPTOCARPUS LESS.

A monotypic genus.

1. *Calyptocarpus vialis* Less. HIERBA DEL CABALLO. Perennial herbs, with weak often sprawling stems (1-) 2-6 dm. long but only 2-9 cm. tall; leaves opposite, with deltoid marginally serrate strigose blades 1-3 (-4) cm. long and petioles (or subpetiolar winged bases) about a third as long; peduncles naked, axillary, 3-50 mm. long, topped by a solitary head; head less than 1 cm. long; involucre obconical; phyllaries about 5, slightly unequal (the inner ones shorter and narrower), leaflike in texture, obtuse and broadly overlapping; receptacle chaffy throughout, the scarious pales lance-subulate; ray flowers pistillate, fertile, the yellow rays spatulate; disk flowers perfect, fertile, the yellow corollas equally 5-toothed; achenes strongly dorsiventrally compressed, subulate; pappus of 2 awns, one over each corner of the achene. *Zexmenia hispidula* Buckl. Frequent in s.e. Tex. and Rio Grande Plains, infrequent n. to e. and n.-cen. Tex. and Edwards Plateau, nearly all year; Pan., C.R., Guat. and Mex., n. to Coah., Tex., La., Ala. and Fla.; Cuba.

A troublesome lawn weed.

86. COREOPSIS L.²¹⁶

COREOPSIS. TICK-SEED

Annual or perennial herbs, glabrous or pubescent; leaves opposite or more rarely (in the upper part of the plant) alternate, undivided and entire or dentate, or 1 to 3 times ternately or pinnately dissected; heads peduncled; phyllaries commonly in 2 or rarely in 3 or 4 series, more or less connate at the very base (but not high up); outer phyllaries commonly herbaceous or submembranous and appressed or often spreading; inner bracts commonly larger, brown or yellow, membranous; receptacle flat or slightly convex, chaffy throughout; pales flat or somewhat concave, membranous, striate; ray flowers present, neuter or pistillate, usually infertile; rays spreading, yellow (in some species with two shades of yellow, in others with a red-brown spot basally), 3-toothed terminally; disk florets numerous, perfect and fertile, the corolla yellowish (often with reddish veins) and equally 5-toothed terminally; achenes dorsiventrally flattened, orbiculate to oblong or more or less oblong-linear, often 2-winged (the wings membranous or indurate-thickened, entire or not, flat or incurved), glabrous or especially at the margin villous; pappus usually present, usually of 2 awns over the two shoulders of the achene and with or without intermediate scales, persistent.

A genus of probably 100 species widely distributed.

- 1. Style branches terminally cuspidate or acute-conic (2)
- 1. Style branches terminally truncate or obtuse-conic (6)
- 2(1). Style branches acute-conic terminally1. *C. tripteris*.
- 2. Style branches cuspidate (3)
- 3(2). Annual herb; 2 shades of yellow on each ray2. *C. nuecensis*.
- 3. Perennial herbs; rays unicolor (4)
- 4(3). Plants subcaulescent, the leaves crowded near the base, the branches subscapose3. *C. lanceolata*.
- 4. Plants leafy nearly to the top (5)
- 5(4). Blades pinnately parted into narrow segments ...4. *C. grandiflora*.
- 5. Blades broad, simple5. *C. intermedia*.
- 6(1). Achenes wingless (7)
- 6. Achenes winged (8)
- 7(6). Outer phyllaries not commonly shorter than the inner; achenes obovate6. *C. basalis*.
- 7. Outer phyllaries much shorter than the inner; achenes narrowly oblong, slender, flattish7. *C. tinctoria*.

²¹⁶ Adapted from E. E. Sherff in N. Am. Fl. II, 2:1-190. 1955.

- 8(6). Achenial wings entire 8. *C. cardaminaefolia*.
 8. Achenial wings dissectedly fimbriate-pectinate 9. *C. linifolia*.

1. *Coreopsis tripteris* L. Perennial herb, erect from a horizontal base, commonly glabrous, more rarely pubescent, more or less pallid, 1-3 m. tall, the stems branched toward the top; leaves opposite, the principal ones petiolate, 6-8 mm. long including petioles, 3-parted, the middle leaflet rhomboid-lanceolate, 17-23 mm. broad and often in turn 3-parted, the segments lanceolate, at the apex acute or subobtusely, marginally revolute, superficially glabrous, the uppermost leaves smaller, often simple and subsessile; heads smelling of anise when bruised, in subcorymbiform aggregations, on peduncles 3-8 cm. long, at anthesis about 3 cm. broad and 8 mm. high; style branches acute-conic terminally; achenes brownish-black, glabrous, cuneate-oblong or cuneate-obovate, 4-4.5 mm. long and including the wings about 3 mm. broad. Incl. var. *subrhomboidea* Sherff. Rare in extreme n.e. Tex. (Bowie Co.), summer; most of e. U.S.

2. *Coreopsis nucensis* Heller. Annual herb, sparsely hirsute or almost glabrous, 2-6 dm. tall; stems erect but weak, branched toward the base, the uppermost nude; leaves opposite in often remote pairs, the uppermost subsessile, the others petiolate (with wide or very narrow petioles hispid-ciliate with pluriloculate hairs and up to 5 or even 12 cm. long), including the petiole 4-10 (-20) cm. long, the blades now entire and widely ovate or oblong-spatulate, now pinnately cut with up to 5 segments (the terminal one much the largest, the lateral more often alternate segments rarely lobate and the lowermost often petiolulate); heads terminating the stem and often 2-3 dm. long branches, radiate, at anthesis about 35-48 mm. broad, about 1 cm. tall; outer phyllaries about 8, oblong-lanceolate to narrowly deltoid-ovate or subulate, dorsally glabrate, at the apex narrow and more often rounded, at the sides often scarios, at the edges ciliate with pluriloculate bristles, 5-8 mm. long; each ray yellow, toward the base with large dark brownish-red or brownish-yellow spots, apically 3-lobate with the median lobe much larger and commonly divided into 2 smaller often emarginate lobes; style branches cuspidate; achenes about 4 mm. long and broad, winged. Abundant in sandy soils, s.e. Tex. and coastal parts of Rio Grande Plains, less frequent in e. and n.-cen. Tex., spring; endemic.

3. *Coreopsis lanceolata* L. Perennial herb 2-6 dm. tall; stems erect or ascending, glabrous, branched, foliose toward the base, subscarescent and very greatly elongated above where they pass into peduncles; leaves opposite, glabrous or pubescent, commonly 5-15 cm. long, the upper ones sessile, the lower ones more often elongately and slenderly petiolate with petioles sometimes surpassing the blades in length, spatulate to linear or linear-lanceolate to linear-oblancheolate, commonly simple, rarely divided, with mostly 1 or 2 small lateral lobes; heads 3-6 cm. broad, 10-14 mm. high; outer phyllaries 8 to 10, lanceolate or oblong, ovate; rays 13-30 mm. long; style branches caudate-appendaged, cuspidate; achenes 2.3-3 mm. long, the body black, winged. Incl. var. *villosa* Michx. Infrequent to rare in e. and s.e. Tex., spring; most of cen., midwest. and s.e. U.S.; n. N.M.

4. *Coreopsis grandiflora* Sweet. Perennial or rarely annual herb, erect or ascending commonly not pubescent except at the ciliate petioles, 3-6 dm. tall, often branched, commonly foliose at least near the base; leaves opposite, more or less petiolate with petioles more often 5-40 mm. long, the lower ones simple or irregularly parted or pinnate, with the petiole included usually 5-10 cm. long, the other leaves (often reduced) commonly 3- to 5-parted or less commonly simple, the segments at times again 3- to 5-parted, the ultimate segments filiform to linear or lance-linear; heads often solitary, 3-6 cm. broad, 8-12 mm. high, moderately pedunculate with peduncles often 10-15 cm. long; outer phyllaries 7 to 10, often in 2 series, lance-subulate, near the base often subdilated; rays 13-25 mm. long, cuneate-obovate, 3-lobate apically; style branches cuspidate; achenes winged, about 2.5 mm. long, the body black. *C. longipes* Hook., *C. Harveyana* Gray. Sandy wooded areas, e. Tex., frequent, less frequent w. to n.-cen. Tex., spring; s.e. U.S. and inland to Ark., Mo., Okla., Kan. and N.M.

5. *Coreopsis intermedia* Sherff. Erect herb, more or less glabrous, probably perennial, scarcely branched above, about 6 dm. tall; leaves opposite, simple, the basal ones with elongate and very slender petioles to 45 mm. long; blade oblong-oblancheolate or narrowly and obtusely obovate, the principal cauline ones sessile, widely oblong-lanceolate, ciliate, thickish, apically subacute, 50-70 (-95) mm. long and 12-20 (-32) mm. broad; heads pedunculate (peduncles 15-25 cm. long), 35-40 mm. broad and about 12

mm. high; outer phyllaries 8 to 10, lanceolate to linear-lanceolate, apically acute and cartilaginous; rays about 8, about 15 mm. long, obovate or oblanceolate, apically 3-lobed and with the median lobe strongly emarginate; style branches caudate, cuspidate; achenes winged, the body 2-3 mm. long. Exceedingly rare in sandy woods, e. Tex. (near Mineola, Wood Co.), spring; endemic.

Probably only a geographic race of *C. pubescens* Ell., which is widespread in e. U.S. w. to La. and Okla.

6. *Coreopsis basalis* (Otto & Dietr.) Blake. Annual, erect, branched, variously pubescent, 2-4 dm. tall, the stems and branches angulate and sulcate; leaves opposite, with petioles 1-5 cm. long, up to 12 cm. long (with petioles included), the principal ones 1- to 3-pinnate, the segments linear (rarely almost filiform) or linear-lanceolate to elliptic-oblong or even orbiculate, membranous, undulate, entire, obtuse apically or rarely acute; peduncular branches nude, 5-15 cm. long; heads 30-45 mm. or less broad, about 8 mm. high, or less; outer phyllaries 8 to 10, often spreading, subulate or linear-lanceolate, apically commonly acute, at the margins more or less hispid-ciliate, usually as long as the inner phyllaries, 5-9 mm. long; rays 13-23 mm. long, cuneately and broadly obovate, 3-lobed apically, medial lobe in turn 2- (rarely 3-) lobate; style branches obtusely conic apically; achenes wingless, obovate, on the dorsal surface black and very papillate, 1.4-1.8 (-2) mm. long. *C. Drummondii* (D. Don) T. & G. Abundant over much of the e. half of the state and w. on to the Edwards Plateau and the lower parts of the Plains Country; showing 2 rather distinct races:

Var. *basalis* with ultimate leaf segments averaging toward the broader limits given in the description. Common on sandy soils.

Var. *Wrightii* (Gray) Blake. Leaf segments filiform or linear or rarely lance-linear. Common on limestone soils, especially in the Edwards Plateau area, spring; endemic, or perhaps venturing as far w. as N.M. infrequently.

7. *Coreopsis tinctoria* Nutt. Annual herb, erect, glabrous, 6-12 dm. tall; stems foliose, much-branched; leaves opposite, subsessile or short-petiolate, usually 5-10 cm. long, 1- or 2-pinnate or the uppermost ones undivided; segments (or blades) narrowly linear or linear-lanceolate; heads numerous, 2-3 cm. broad, 4-6 mm. high; outer phyllaries about 8, more or less biseriolate and imbricate, linear-oblong or more often triangulate, about 2 mm. long; rays about 7 or 8, 7-15 mm. long, obovate, commonly 3-lobate apically, often with a red-brown spot near the base; style branches apically obtuse; achenes wingless, black, 1.2-4 mm. long. Abundant in seasonally moist soils, e. half of Tex. and less frequent nearly throughout, spring-early summer; Minn., Sask. and Wash. s. to La., Tex., N.M. and Calif.

8. *Coreopsis cardaminaefolia* (DC.) Nutt. MANZANILLA SILVESTRE. Annual herb, glabrous, erect, slender, suberectly branched, 2-5 dm. tall; stems subterete, foliose; leaves opposite, remote, shorter than the internodes, all but the sessile topmost ones with petioles commonly 1-4 cm. long, the lower and midstem leaves 1- or 2-pinnate with elliptic-oblong or widely or narrowly linear segments, the upper ones sometimes pinnately few-lobed or sometimes simple; peduncles glabrous, 1-5 cm. long; heads often numerous, 16-24 mm. broad, 6-8 mm. high; outer phyllaries 6 to 9, more or less lanceolate and irregularly placed, often subacute, 1-2 mm. long; rays about 7 or 8, about 1 cm. long, with a red-brown spot near the base (or this absent and the rays all yellow in a rare form known as *C. stenophylla* Boynt.); style branches obtusely conic; achenes strongly winged, 2-3 mm. long or occasionally less, the body black; awns of the pappus (one over each of the two shoulders, between the wing and the body) minute or in a coastal race (*C. similis* Boynt.) to 0.5 mm. long. *C. stenophylla* and *C. similis* Boynt. Abundant in seasonally moist soil, essentially throughout, spring-early summer, occasionally again in fall; La., Neb., N.M. and Ariz., s. to Tam., Coah. and Chih.

9. *Coreopsis linifolia* Nutt. Perennial herb, glabrous, pale, erect, 5-7 dm. tall; stems slender, corymbosely branched above; leaves opposite or the lower alternate, marginally entire but indurate or calloused, the lower ones spatulate or oblanceolate, shorter than the internodes (or the basal ones at times twice as long), 4-10 (-14) mm. broad, apically rounded, basally petiolate (petioles usually 1-4 cm. long) or the other ones sessile, linear, often truncate or exceedingly obtuse at the apex, much smaller; peduncles usually 3-7 cm. long; heads few, 2-3 cm. broad, about 6-7 mm. high; outer phyllaries about 6 to 11, glabrate, often irregularly placed, ovate to lanceolate-deltoid, lengthwise pluristriate, coriaceous, scarious at the margins, subacute or rounded apically, 1-3 mm. long; rays

7 or 8, 10-15 mm. long, obovate, apically 3-lobed with the median lobe emarginate; style branches obtusely conic; achenes winged, the wings lacerate or dissected-fimbriate-pectinate. Rare in wet soil, e. Tex., spring-early summer; Va. to Fla. and w. to Tex.

87. BIDENS L. BEGGAR-TICKS. BUR-MARIGOLD

Annual taprooted herbs or less commonly perennial herbs with taproots or fibrous roots; leaves opposite, entire or dentate or incised, or 1-, 2- or 3-ternately or -pinnately dissected; upper leaves sometimes alternate; involucre usually campanulate or subhemispheric; phyllaries commonly biseriata, at the base often very shortly connate; outer phyllaries usually herbaceous in texture, sometimes short, sometimes expanded into leaf-like members; inner phyllaries usually membranous, usually hyaline- or yellow-margined; receptacle flat or convex, chaffy throughout, the pales narrow and flattish; ray flowers present or absent, when present neuter or less commonly pistillate but infertile; rays when present whitish or yellow or less commonly rosy or a shade of red, usually shallowly 3-lobed apically; disk flowers numerous or less commonly few, perfect, fertile; corolla equally 5-toothed, usually yellow; style branches bearded above, tipped with short and acute or longer and subulate appendages; achenes dorsiventrally compressed or less commonly triangular or rhombic in transection; pappus awns absent or 1 to 8 in number and commonly persistent, usually more or less antrorsely or retrorsely barbed.

A genus of possibly 150 species in the warmer parts of the world, often separated on the most technical sort of characters, thus difficult to key out unless with patience and a good lens; heads both in anthesis and in fruit. The kinds with retrorsely barbed pappus awns are efficiently dispersed, becoming attached easily in fur and clothing.

- 1. Rays yellow (2)
- 1. Rays white or rosaceous to red or absent (5)
- 2(1). Pappus of 2 to 4 retrorsely barbed awns 6. *B. laevis*.
- 2. Pappus awns smooth, antrorsely setose, or absent (3)
- 3(2). Achenes black, the body 2.5-4.5 mm. long; outer phyllaries 7 to 10 3. *B. mitis*.
- 3. Achenes brown or blackish, the body 5-7.5 mm. long (4)
- 4(3). Outer phyllaries mostly 8 to 12, glabrous or moderately ciliate, usually shorter than the inner ones 1. *B. aristosa*.
- 4. Outer phyllaries 12 to 20, very ciliate or coarsely hispid, commonly longer than the inner ones 2. *B. polylepis*.
- 5(1). Achenes broadly or narrowly cuneate, not narrowed below the apex (6)
- 5. Achenes linear or clavate but never manifestly cuneate, often attenuate above (8)
- 6(5). Achene bodies striate; leaves simple or deeply incised (cf. remarks under *B. frondosa*) 6. *B. laevis*.
- 6. Achene bodies not striate; leaves at least 1- or 2-pinnate, the terminal leaflet commonly petiolulate (7)
- 7(6). Outer phyllaries 3 to 5 (commonly 4), not manifestly ciliate; pappus awns erect-hispid or smooth 4. *B. discoidea*.
- 7. Outer phyllaries 5 to 8, regularly and copiously ciliate; pappus awns retrorsely barbed 5. *B. frondosa*.
- 8(5). Achenes 5 to 9 (rarely 13) 8. *B. leptcephala*.
- 8. Achenes 14 to 50 (9)
- 9(8). Leaves simply pinnate 10. *B. pilosa*.
- 9. Leaves (at least the lower ones) 1- or 2-pinnate (10)
- 10(9). Achenes dimorphic, a few peripheral ones clavate with a body only 4-7 mm. long; body of the inner achenes 8-13 mm. long after anthesis 7. *B. Bigelovii*.
- 10. Achenes nearly all alike, the body often longer than 12 mm. 9. *B. bipinnata*.

1. *Bidens aristosa* (Michx.) Britt. TICKSEED SUNFLOWER. Annual or biennial herb, glabrate or scarcely pubescent, 3-10 (-15) dm. tall; leaves petiolate [petioles 10-15 (-30) mm. long], including the petiole 5-15 cm. long, pinnate or bipinnate; blade segments lanceolate or linear-lanceolate, acuminate, incised-serrate or pinnatifid, membranous, ciliate, scarcely pubescent on the lower surface; heads 2-5 cm. broad, 7-9 mm. high; involucre often hispid; phyllaries subequal, the outer ones 8 to 10, linear, sometimes scarcely ciliate, sometimes very ciliate, 5-12 mm. long; rays 6 to 10, golden, 10-25 mm. long, oblong-ob lanceolate, apically obtuse and entire or subdenticulate; achenes to 6.5 mm. long, flat or flattish, blackish or yellowish-black; pappus awns rarely absent (var. *mutica* Gray), usually present and smooth or antrorsely ciliate. In moist or seasonally moist soil, e. and s.e. Tex., infrequent, spring-early summer; most of the e. U.S.

2. *Bidens polylepis* Blake. Annual or biennial herb, glabrous, 3-10 dm. tall; leaves petiolate (petioles to 25 mm. long), including the petiole 8-15 cm. long, commonly bipinnate; leaflets lanceolate or linear-lanceolate, acuminate, sharply serrate, membranous, ciliate; heads 2-5 cm. broad, 7-9 mm. high; outer phyllaries numerous, commonly 15 to 20, usually spreading or reflexed, linear-elongate, conspicuously hispid-ciliate, dorsally hispid or glabrate, 10-27 mm. long; inner phyllaries lanceolate, shorter; rays about 8, golden-yellow, 10-25 mm. long, oblong-ob lanceolate, apically entire or obscurely denticulate; achenes flat, brown or blackish-brown, 5.5-7.5 mm. long; pappus awns nearly obsolete or slightly developed and with erect-hispid teeth. Frequent in e. and s.e. Tex., spring-early summer; Midwest U.S. and s. to Tex.

3. *Bidens mitis* (Michx.) Sherff. Annual herb, more or less glabrous, 3-10 dm. tall; leaves petiolate (petioles 3-30 mm. long), including the petioles 4-12 cm. long, membranous, variable, lanceolate or ovate, serrate, acute or acuminate, sometimes entire or more often pinnately 3- to 7-parted, the terminal leaflet commonly very elongate, the blade or segments linear and commonly entire or broader and incised-serrate, very rarely decomposed; peduncles 2-12 cm. long; heads 2-5 cm. broad; involucre glabrous or sparsely hispid at the base; outer phyllaries 7 to 10, linear or linear-spatulate, usually ciliate, acute or obtuse, 5-10 mm. long, the inner phyllaries often shorter; rays about 8, golden-yellow, 12-27 mm. long, ob lanceolate or elliptic-obovate, entire or very minutely denticulate; achenes flattish or scarcely trigonal in transection, broadly cuneate, black, the body 2.5-4.5 mm. long; pappus awns 0.6-1 mm. long, antrorsely setose. Rare in s.e. Tex., in moist soil, spring-early summer; s.e. U.S.

4. *Bidens discoidea* (T.&G.) Britt. Annual herb, 3-18 dm. tall; leaves petiolate (petioles 1-4 cm. long), including the petiole 5-12 cm. long, membranous, tripartite; leaflets lanceolate or ovate-lanceolate, acuminate, serrate, all commonly petiolulate, sometimes obscurely ciliate; heads numerous, the disk finally 7-9 mm. broad and 6-7 mm. high; involucre glabrous; outer phyllaries 3 to 5 (usually 4), foliaceous, linear-spatulate, membranous, not distinctly ciliate, commonly surpassing the disk, 7-25 mm. long; inner phyllaries oblong-lanceolate, membranous, subequal to the disk; ray flowers absent; achenes blackish, flattish, linear-cuneate, often tuberculate, pilose-hispid, the body 3-6.2 mm. long; pappus awns 0.2-2.2 mm. long, erect, hispid. Frequent in e. and s.e. Tex., spring and early summer; s.e. Can. and e. U.S.

5. *Bidens frondosa* L. BEGGAR-TICKS, STICK-TIGHTS. Annual herb, more or less glabrous, paniculate-branched, 5-12 dm. tall; leaves petiolate (petioles 1-6 cm. long), including the petiole 5-15 (-20) cm. long, pinnately 3- or 5-divided, membranous, ciliate, on the upper surface commonly glabrate, on the lower surface glabrate or obscurely and sparsely or even rather densely clothed with minute setae; leaflets lanceolate, acuminate, serrate, the terminal one slenderly petiolulate; heads about 1 cm. broad, 6 mm. high; involucre basally hispid; outer phyllaries 5 to 8 or occasionally as many as 10, conspicuously ciliate, often very long (even 3-5 cm. long) and foliaceous, linear-spatulate; inner phyllaries ovate or ovate-lanceolate, shorter (finally 5-7 mm. long); ray flowers absent or if present minute, the golden-yellow rays 2-3.5 mm. long, cuneate-obovate, commonly 2- or 3-denticulate; achenes flat, narrowly cuneate, blackish, subglabrous or pilose-hispid, on each face strongly 1-nerved, the body 6-10 mm. long; pappus awns 2, retrorsely barbed, 3-4.5 mm. long. Frequent near moist places, e. half of Tex., recently reported from Hemphill Co. in the Panhandle, spring-early summer; e. Can., most of the U.S.

Bidens tripartita L. has recently been reported to occur in Hemphill Co. in the Panhandle of Tex. (we have not seen specimens). It has heads and achenes rather similar to

those of *B. frondosa*, but the primary leaves are simple, incised-serrate, or 3- to 5-lobed; it is otherwise known from Eur. and adv. in Que. and N.H.

6. *Bidens laevis* (L.) B.S.P. Annual or perennial herb, erect or procumbent at base, 3-10 dm. tall; leaves sessile, undivided, linear-lanceolate to lanceolate or rarely ovate-lanceolate, narrowed at each end or at the base sometimes broad and connate, apically often acuminate, regularly serrate with the teeth often slender and almost subulate, glabrate or on the margin often sparsely ciliate, 5-15 cm. long; heads commonly few, 3-7 cm. broad, 8-11 mm. high; involucre commonly hispid at base; outer phyllaries 6 to 8, scarcely foliaceous, linear-lanceolate, apically obtuse or acute, marginally subsparingly aciculate-ciliate, very rarely longer than the head; ray flowers rarely absent, usually 7 or 8; rays golden-yellow, 15-30 mm. long, obovate-lanceolate, apically rounded and often minutely 2- or 3-denticulate; achenes narrowly cuneate, flat or 3- or 4-angulate, on the angles retrorsely barbed, the body 6-9 mm. long; pappus awns 2 to 4, 3-5 mm. long, retrorsely barbed. *B. Nashii* Small. Scattered near water in e., s.e., n.-cen. Tex. and Edwards Plateau, rare in the Trans-Pecos, summer; most of U.S. except higher mt. areas.

7. *Bidens Bigelovii* Gray. Annual herb, erect, almost glabrous, 4-10 dm. tall; leaves petiolate (petioles 10-25 mm. long), including the petiole to 8 cm. long, tripartite, the segments 3- to 5-partite, their lobes oblong or cuneate and pinnatifidly incised (with the rather few teeth mucronate), membranous, more or less ciliate; peduncles to 15 cm. long; heads subsolitary, at anthesis about 6-9 mm. broad and equally tall; involucre basally hispid; outer phyllaries 6 to 9, linear, dorsally glabrous, marginally ciliate, terminally sharp-apiculate, 5-7.5 mm. long; inner phyllaries lanceolate, often shorter; rays absent or 3 to 5 in number, whitish, 5-7 mm. long, oblong-obovate; achenes subquadrangulate, dimorphic, the 1 to 4 exterior ones linear-cuneate, truncate, papillose-hispidulous and very scabrous, often castaneous, the body 5-7 mm. long, the apex either essentially awnless or with 2 or 3 short retrorsely barbed pappus awns; inner achenes narrowly linear, black, glabrate below but commonly erect-hispid above, the body 8-12 mm. long; pappus awns 2 or 3, retrorsely barbed, 1.5-3 mm. long. Rather frequent in moist canyons, Trans-Pecos mts., summer; Colo. N.M., Tex., Ariz. and Son.

8. *Bidens leptcephala* Sherff. Annual herb, 1-5 dm. tall, branched; leaves petiolate (petioles 3-40 mm. long), including the petioles 2-10 cm. long, 15-55 mm. broad, bipinnate, minutely ciliate, hispid or glabrate, the segments sometimes linear or sometimes ovate; peduncles 2-8 cm. long; heads 4-8 mm. broad, 3-5 mm. high (in fruit to 15 mm. high); involucre subglabrous at the base; outer phyllaries 4 to 6, linear, ciliate, 10-25 mm. long, inner ones half again as long, lanceolate, glabrous or at the apex pubescent; rays occasionally absent, usually 3, only 2.5 mm. long and 1.2 mm. broad, whitish, entire or bidentate; achenes 5 to 9, rarely to 13, subquadrangulate, linear, the inner ones blackish, 9-14 mm. long, some of the outer ones sometimes shorter and browner; pappus awns 1-3 mm. long, retrorsely barbed. Frequent in moist canyons, Trans-Pecos mts., summer; Chih., Tex., N.M., Ariz. and Baja Calif.

9. *Bidens bipinnata* L. SPANISH-NEEDLES. Annual herb, erect, commonly glabrous but rarely minutely setose-hispid, branched, 3-12 (-17) dm. tall; leaves petiolate (petioles 2-5 cm. long), including the petioles 4-20 cm. long, normally 2- or 3-pinnate, membranous, ciliate, the ultimate segments often deltoid- (or rhombic-) lanceolate, toward the base cuneate; peduncles to 1 dm. long; heads 5-7 mm. high, 4-6 mm. broad; involucre pubescent at base; outer phyllaries 7 to 10, linear, apically acute (var. *bipinnata*) or distally dilate (var. *biternatoides* Sherff), 3-5 mm. long; inner phyllaries linear-lanceolate, half again as long; rays inconspicuous, yellowish-white, not exceeding the disk florets, lanceolate or obovate-lanceolate, apically entire or 2- or 3-lobulate; achenes linear, tetragonal, the body commonly black, distally attenuated and often sparsely setulose, glabrate below, 10-18 mm. long (the outer shorter and often castaneous); pappus awns usually 3 or 4, yellowish, retrorsely barbed, 2-4 mm. long. Infrequent in moist places, e. Tex., rare (var. *biternatoides*) in moist canyons of Trans-Pecos mts., summer; most of e. U.S.; Mex.; Braz., Arg., Chile, etc.; widely adv. in Old World.

10. *Bidens pilosa* L. Annual herb, erect, branched, 3-18 dm. tall; petioles 10-65 mm. long; leaves including petioles 5-20 cm. long, membranous, on the margins ciliate and serrate, on each surface subglabrous or scatteringly pilose with unequal and appressed hairs or sometimes densely tomentose-pilose, the lowermost often simple, ovate, apically acute, the midstem leaves 3- to 5- (or even 7-) partite, the uppermost leaves simple and

lanceolate; heads 7-8 mm. broad, 5-7 mm. high (at anthesis); peduncles 1-9 cm. long; involucre basally hispid; outer phyllaries 7 to 9, linear or linear-spatulate, indurate-apiculate, ciliate, 4-5 mm. long, shorter than the lanceolate inner phyllaries; rays commonly absent or when present minute (2-3 mm. long) or well-developed (to 15 mm. long), white or pale-yellowish-white; achenes linear, straight or the marginal ones incurved, obcompressed-quadrangulate or flattish, glabrous below, tuberculate-strigose above, 4-16 mm. long, the inner ones longer than the outer; pappus awns 2 or 3 (rarely to 5), yellowish, retrorsely barbed. Infrequently (probably repeatedly) waived in extreme s.e. and Trans-Pecos Tex., summer-fall; an exceedingly common weed of disturbed moist soil in all the warmer parts of the world, not hardy in the temp. parts but repeatedly introd.

88. COSMOS CAV. COSMOS

Annual herbs, taprooted; leaves opposite, undivided to lobed or 1- to 3-pinnatisect; peduncles long; heads usually solitary; involucre subhemispheric; phyllaries biseriata, connate basally, membranous, striate, scarcely unequal or less commonly the outer shorter; receptacle flat or flattish, chaffy throughout, the pales flat or somewhat concave; *ray flowers* in one series, infertile; rays spreading, entire or subdentate, rosy-white or orange; *disk flowers* numerous, perfect, fertile, the corolla equally 5-toothed terminally; style branches slender, thickened above, hirtellous, tipped with short and acute appendages; achenes linear, more or less fusiform, more or less tetragonal or more rarely obcompressed or even alate, toward the apex usually attenuate into a beak, attenuate toward the base, at the base itself more or less enlarged; pappus awns 2 to 8, usually persistent, commonly retrorsely (rarely antrorsely) barbellate or hispid.

A genus of perhaps 50 species of the warmer parts of America.

1. Rays rosy-white or whitish 1. *C. parviflorus*.
 1. Rays orange 2. *C. sulphureus*.

1. *Cosmos parviflorus* (Jacq.) Pers. Annual herb, erect, slender, often branched above, 3-9 dm. tall; leaves scarcely petioled or with petioles wing-margined and to about 5 mm. long, with total length of about 3-7 cm., bipinnate; segments very narrowly linear, only 0.1-0.6 mm. broad, glabrous above and below, often strongly spinulose-ciliate, apically acute or subobtuse, the rachis and its branches somewhat winged; heads singly terminating peduncles 1-3 dm. long, 15-25 mm. broad, 6-9 mm. high; outer phyllaries commonly 8, lance-acuminate or linear-elongate, often spreading or even reflexed, on the outer surface green and marked with 3 to 5 black nerves, 6-9 mm. long; inner phyllaries oblong, acute, a little shorter than the outer; rays about 8, whitish to roseate, 5-9 mm. long, cuneate-obovate, apically 2- or 3-dentate; disk corollas yellow; achenes subfusiform, linear, 9-16 mm. long; pappus awns 2 to 4, erect, retrorsely barbed, about 2 mm. long. Infrequent in moist meadows, Trans-Pecos mts., summer-early fall; Tex., Colo., N.M., Ariz., s. and s.e. to Pue. and Michoac.

2. *Cosmos sulphureus* Cav. Annual herb 6-21 dm. tall; leaves 1-20 cm. long including the petiole, bi- or tripinnatisect; heads 35-55 mm. broad, 12-18 mm. high; outer phyllaries commonly 8; rays about 8, intensely orange or yellowish-red, 18-28 mm. long, 10-17 mm. broad, obovate, often 1- to 5-denticulate apically; achene linear-fusiform, black, 16-28 mm. long including the setulose-coronate rostrum; pappus awns very slender, here and there weakly retrorsely barbed, 4.5-7 mm. long. Rare and local, escaped from cult., s. Tex., especially near Laredo, summer-fall; widespread at moderate elev. in the Am. trop., adv. elsewhere; probably originally nat. of Mex.

This is the commonly cultivated *Cosmos*; it occasionally escapes, but probably persists nowhere in Texas.

89. HETEROSPERMA CAV.

A genus of about 10 species from the United States to Argentina.

1. *Heterosperma pinnatum* Cav. Taprooted annual, nearly glabrous, 1-8 dm. tall, usually with a single stem 1-2 (-7) mm. thick basally, much-branched, stem and branches rather rigidly ascending and leafy throughout; leaves opposite, the upper ones with a

linear subpetiolar portion 8-20 mm. long and subamplexicaul basally and 3 longer linear palmate lobes, or some of the larger leaves in some plants pinnatifid with a terminal linear portion and on each side 2 linear lobes; peduncles absent; heads solitary, terminating the erect branches, closely subtended by the uppermost pair of leaves whose lobes are closely appressed to the involucre (almost like accessory bracts) and fimbriate-ciliate marginally; involucre 4-5 mm. high, slightly urceolate, of about 4 equal separate erect obovate broadly overlapping membranous colorless phyllaries each with 8 or 10 dark-brown broad nerves; *ray flowers* about 4, fertile, with no pappus, the minute ray yellow; *disk flowers* few, fertile, perfect; corolla minute, 5-toothed, regular, yellow, the pappus of the peripheral ones absent, of the central ones 2 minute spreading awns; pales of the disk similar to the phyllaries subtending the ray flowers but progressively slightly longer and narrower toward the center; achenes of the ray and outer disk flowers dorsiventrally flattened, narrowly wing-margined, apically blunt; achenes of the central disk flowers not winged but subulate-beaked, much-surpassing the involucre and surmounted by the spreading pappus awns. Local in moist canyons, Davis Mts. in the Trans-Pecos, 4,500-8,000 ft. elev., Sept.-Oct.; Mex. highlands n. to Ariz. and Tex.

90. DICRANOCARPUS GRAY

A monotypic genus.

1. *Dicranocarpus parviflorus* Gray. PITCHFORK. Taprooted annual, 1-5(-7) dm. tall, with a single stem basally but divaricately bushy-branched above, essentially all glabrous and very brittle; leaves all opposite, once or twice ternately divided into filiform lobes or the uppermost nearly simple; heads on short branches, only 3 mm. high in flower; involucre obconic; phyllaries 3 or 4, linear, membranous, at length loose, deciduous in age (occasionally 1 or 2 short calyculate outer phyllaries also present); receptacle slightly convex, chaffy throughout, the pales membranous and subulate; *ray flowers* 3 or 4, pistillate, fertile; ray corolla only 1 mm. long, yellowish, obscurely 3-toothed apically, deciduous; *disk flowers* 3 or 4, seemingly perfect but infertile; corolla 1.5 mm. long, abruptly flaring, equally 5-toothed, yellow; ray achenes markedly unequal, flattened, linear, the longer ones to 1 cm. long, warty-roughened on the flat sides; ray pappus of 2 widely divergent persistent stout awns. Infrequent in gypseous soil in the Trans-Pecos, Sept.-Oct.; Tex., N.L., Coah. and S.L.P.

91. THELESERMA CHAM. & SCHLECHT.²¹⁷

GREEN-THREAD

Erect annual or perennial herbs, sometimes suffrutescent below, 1-18 dm. tall, glabrous except for the ciliate leaf bases; stems 1 to several near the base, usually rebranching above; leaves all opposite, evenly distributed throughout or crowded toward the base, ternately or 1- to 3-pinnatisect, trifold or simple, the ultimate segments narrowly oblanceolate or linear to filiform; heads on short to elongate naked peduncles; phyllaries of 2 distinct size-classes; outer phyllaries herbaceous, short and obtuse to long and lance-linear, spreading to appressed, often with narrow scarious margins; inner longer phyllaries membranous with broad transparent scarious margins, basally connate for a fifth to a half or more their length, the free portion lanceolate to ovate, often subapiculate and pubescent at the tip; receptacle flat, chaffy; *ray florets* present or absent, when present neutral, sterile; ligule yellow or yellow with a red-brown base to purple-brown spot at base or rarely red-brown to purple-brown nearly throughout; *disk flowers* perfect, fertile, the corollas yellow with red-brown veins or red-brown tube, the limbs narrowly campanulate to cylindrical, equally or unequally lobed for a fifth to nine-tenths the length, when unevenly lobed one lobe longer than the other 4; pales scarious with 2 red-brown medial nerves, oblong to ovate-lanceolate, smooth or dentately erose, in fruit usually tightly enclosing and falling with the achene; achenes linear to linear-oblong, erect to slightly curved or cucullate, 2-7 mm. long, terete, dorsally or dorsiventrally flattened, verrucose to smooth, subtruncate; pappus of 2 rarely 3 ciliate awns or teeth, or essentially absent.

About a dozen species in warm regions in America.

²¹⁷ Many of the characters are adapted from a dissertation by Thomas E. Melchert.

1. Limb of the disk corolla usually shallowly lobed for a third its length or less, rarely up to half its length; pappus of small toothlike awns or essentially absent (2)
1. Limb of the disk corolla unequally lobed, the deepest lobe half as long as the limb or longer; pappus of well-developed awns (3)
- 2(1). Leaves crowded near the base of the plant; most of the stems essentially naked2. *T. longipes*.
2. Leaves sparse and evenly distributed on the stems1. *T. simplicifolium*.
- 3(1). Plants perennial; rays present or absent (4)
3. Plants annual; rays present (6)
- 4(3). Outer phyllaries lance-linear, usually at least half as long as the inner phyllaries; rays present; involucre suburceolate7. *T. filifolium*.
4. Outer phyllaries minute, mostly 1-2 mm. long, obtuse to rounded at the apex; rays present or absent; involucre hemispheric to campanulate (5)
- 5(4). Rays present or rarely absent; disk corollas red-brown4. *T. ambiguum*.
5. Rays absent or rarely present; disk corollas yellow3. *T. megapotamicum*.
- 6(3). Disk corollas red-brown (7)
6. Disk corollas yellow (9)
- 7(6). Outer phyllaries with hispid-ciliate margins; at least some of the achenes cream-colored with scalloped wings; rays purple-brown, only a very narrow zone at the apex yellow-orange5. *T. Burridgeanum*.
7. Outer phyllaries completely smooth; achenes wingless or essentially so; rays either completely yellow, yellow with a small red-brown basal spot or with diffuse red-brown color throughout most of the area (8)
- 8(7). Each ray with a small well-defined red-brown spot at the base or with diffuse red-brown pigmentation over half or nearly all the length; outer phyllaries appressed to the inner series; basal leaves when present with linear ultimate segments6. *T. nuecense*.
8. Rays either all golden-yellow or with a small amount of diffuse red-brown pigment at the base but this pigment never forming a well-defined basal spot; outer phyllaries spreading; plants usually densely and evenly leafy for three-fourths the height; leaves often with narrowly oblanceolate ultimate segments7. *T. filifolium*.
- 9(6). Peripheral achenes cucullate, winged, 2.5-3 mm. broad; pappus of 2 minute teeth; involucre usually glandular-punctate.8. *T. curvicaipum*.
9. Achenes erect to somewhat curved, terete to dorsally flattened, wingless, 1.5 mm. broad or less; pappus of well-developed awns; involucre never glandular-punctate (10)
- 10(9). Plants 2-3 (-4) dm. tall, the internodes relatively short, the stems densely leafy7. *T. filifolium* var. *intermedium*.
10. Plants 7-18 dm. tall, the internodes elongate, the stems remotely leafy9. *T. flavodiscum*.

1. *Thelesperma simplicifolium* Gray. Slender perennial from vertical or horizontal rhizomes; stems 1 to several, simple or branching above, 3-7 dm. tall; leaves few, 35-80 mm. long, much shorter than the internodes giving the plant a somewhat naked appearance; lowermost stem leaves pinnatifid to trifid or simple, mid- and upper-stem leaves trifid or simple; heads 1 to many on relatively short peduncles, the peduncles 3-17 cm. long; involucre hemispheric, 6-13 mm. thick; outer phyllaries 8 to 10, sublinear, obtuse to subulate, herbaceous, 1.5-4 mm. long, mostly less than half as long as the inner phyllaries; inner phyllaries 8, brownish to greenish-black, ovate, scarious-margined, mostly 4.5-8.5 mm. long, basally connate for two-fifths to three-fifths their length, often subapiculate with a pubescent tip; ray flowers 8; rays yellow, cuneate, usually 10-22 mm. long, 6-10 mm. broad; disk corolla yellow with reddish-brown veins, 3-5.5 mm. long, the red-brown tube 1-2 mm. long, the cylindrical limb 2-3 mm. long, shallowly and evenly lobed to a fifth the length; pales curved, 3-5 mm. long; outer achenes incurved, robust,

3-5 mm. long, 1-2.2 mm. broad, completely smooth or dorsally wrinkled, occasionally also ventrally wrinkled; pappus of 2 minute smooth or slightly ciliate cusplike awns, or obsolete. Often abundant on open and well-drained limestone uplands, Edwards Plateau, less common on calcareous cuestas e. to n.-cen. Tex. and w. into the Trans-Pecos, summer and fall; N.L., Coah. and Tex.

2. *Thelesperma longipes* Gray. Suffrutescent perennial herb from thick woody rootstocks, these forming dense multiscaped globular clumps or irregular mats; stems many, irregularly branched, 20-38 cm. tall; leaves filiform, crowded toward the base, pinnatifid to trifid or simple, mostly 3-5 cm. long; heads numerous, solitary on elongate peduncles 12-32 cm. long; involucre 5-8 mm. thick; outer phyllaries 5, minute, obtuse, 1-2.5 mm. long; inner phyllaries 8, striate, reddish-brown, scarious, 4-5.5 mm. long, basally connate for half their length, often reflexed; ray flowers absent; disk corolla yellow, cylindrical, 3-4.2 mm. long, the limb equally or subequally lobed for a fifth to two-fifths its length; pales narrowly oblong, often curved and enclosing the achenes, 3-4 mm. long; achenes curved, 2-2.5 mm. long, smooth or slightly dorsally verrucose, usually with a small apical disk; pappus absent or of 2 minute toothlike awns. Abundant, often on calcareous soil or almost naked limestone ledges in the Trans-Pecos and w. part of the Edwards Plateau, n. into the n. part of the Plains Country, summer to fall; Ariz., N.M. and Tex., s. and s.e. to S.L.P.

3. *Thelesperma megapotamicum* (Spreng.) O. Ktze. Perennial herb from horizontal rhizomes, mostly 30-75 cm. tall; stems erect, one or several from the base, each usually branching once or twice toward the midstem; leaves either evenly and distantly distributed throughout the stem by elongate internodes or crowded toward the lower half of the stem; basal and cauline leaves usually once-, rarely twice-pinnate, often trifid or simple, rarely ternately pinnatisect, 40-95 mm. long, their ultimate segments elongate and linear-lanceolate to subfiliform; involucre campanulate to subhemispheric, smooth, 7-14 mm. thick; outer phyllaries 4 to 6, minute, oblong to oblong-ovate, obtuse or rounded, 1-2 (-3) mm. long, narrowly white-margined, usually appressed to the inner ones; inner phyllaries 8, ovate-lanceolate, red-brown to green-black, scarious-margined, mostly 6-8 mm. long, basally connate two-fifths to two-thirds their length; ray flowers rarely present; disk corolla yellow with red-brown veins, 5-7.4 mm. long, the limb deeply and irregularly lobed for half to five-sixths its length; pales oblong to ovate-lanceolate, 7-11 mm. long, often erose; achenes erect to slightly incurved, subterete, with the dorsal side somewhat flattened or both dorsally and ventrally flattened, black to brownish, with conspicuous tubercles or more or less smooth; pappus of 2 triangular retrorsely barbed awns 1.5-3 mm. long. Widespread and usually common in calcareous or alkaline uplands and lowlands in the Trans-Pecos and Plains Country, rare e. to n.-cen. Tex. and on much of the Edwards Plateau, summer and fall; Neb., Wyo., Ut., Ariz., s. and e. to Zac.; also Braz., Urug., Parag. and Arg.

4. *Thelesperma ambiguum* Gray. Perennial from slender horizontal rhizomes, 22-50 cm. tall; stems 1 to many from the base, erect, simple or branched above; leaves extremely variable as to shape and arrangement, usually with a basal rosette and stem leaves distributed over a half to a third the length of the stem; rosette leaves 6-16 cm. long, compactly twice- or thrice-pinnatisect to loosely once- or twice-pinnatisect, occasionally trifid or sometimes simple, their petioles 3-8 cm. long; mid- and upper cauline leaves when present once pinnate to trifid or simple, their ultimate segments revolute; heads 10 to 50, on short or elongate peduncles 8-22 cm. long; involucre 7-15 mm. thick; outer phyllaries 4 to 6, minute, oblong to oblong-ovate, obtuse, 1-2 (-3.5) mm. long, smooth; inner phyllaries 8, ovate-lanceolate, scarious-margined 6.5-10 mm. long, basally connate for two-fifths to two-thirds their length, often with a pubescent tip; rays usually present, rarely absent, yellow; disk corolla irregularly lobed for a half to five-sixths its length; pales oblong to ovate-lanceolate, 6-9 mm. long, erose, usually clasping the dorsal half of the achene; achenes erect or slightly incurved, 4-6.5 (-7) mm. long, subterete, with the dorsal side somewhat flattened or both dorsally and ventrally flattened; pappus of 2 deltoid retrorsely barbed awns 1-2 (-2.7) mm. long. *T. fraternum* Shinn. Locally abundant on calcareous cuestas and well-drained open areas, Rio Grande Plains and the s.w. extreme of the Edwards Plateau, rare w. into the Trans-Pecos and n. to the s. part of the Plains Country, summer and fall; Tex., Tam. and N.L.

5. *Thelesperma Burridgeanum* (Regel) Blake. Annual herb 3-7 dm. tall; stems 1 to several from the base, branching above; leaves crowded on the basal half of the plant, deeply pinnately dissected, the ultimate segments linear to linear-lanceolate; basal leaves numerous, simply or ternately twice- or thrice-pinnatisect, 5-15 cm. long, never forming a definite basal rosette; midstem leaves once- or twice-pinnatisect; upper leaves once-pinnatisect, trifid or simple; heads usually many or few on elongate peduncles 8-24 cm. long; involucre urceolate, 9-13 mm. thick; outer phyllaries 8, subulate, herbaceous, 3-4.5 mm. long, sparsely to densely hispid-ciliate, the extreme basal portion often with larger tuberculate projections and/or purple punctate glands; inner phyllaries usually 8, red-brown to green-black, ovate-oblong to ovate-lanceolate, scarious-margined, 6-8 mm. long, basally connate a third to two-fifths the length, usually reflexed at anthesis and with a subapiculate pubescent tip; ray corollas purple-brown with a narrow yellow-orange apical margin, 10-15 mm. long, 6-12 mm. broad; disk corollas purple-brown, the limb subequally or strongly unequally lobed three-fifths to three-fourths its length; pales narrowly oblong, not erose; achenes somewhat dorsally compressed with 3 conspicuous scalloped wings at the lateral or ventral edges, these especially noticeable near the base; inner achenes elongate and narrow, covered with tubercles; peripheral achenes shorter and stouter, 4-4.5 mm. long, to 2.5 mm. broad, smooth except for the dorsal verrucose surface; pappus of 2 awnlike retrorsely barbed awns 0.5-1 mm. long, divergent from the main axis of the achene. Local in sandy soil, n. part of the Rio Grande Plains (Atascosa, Bexar, Dimmit, Frio, Karnes, LaSalle and Wilson cos.), Apr.-May, rarely to June; endemic.

These are attractive plants and have been taken into cultivation.

6. *Thelesperma nuecense* B. L. Turner. Annual 45-100 cm. tall; stems one to several from the base, weakly rebranching above, unequally leafy for about half the length; lower stem leaves ternately or merely once- or twice-pinnatisect, 75-190 mm. long, often but not always forming a basal rosette, the ultimate segments narrowly linear; leaves of midstem mostly once-pinnatifid, 7-13 cm. long; uppermost leaves trifid or simple; peduncles 135-400 mm. long; involucre suburceolate, 1-2 cm. thick; outer phyllaries 8, subulate, herbaceous, 2-6.5 mm. long, usually half or less as long as the inner phyllaries, completely smooth, the extreme basal portion sometimes roughened but never tuberculate; inner phyllaries 8, oblong or ovate to ovate-lanceolate, 6-9 mm. long, basally connate for a third to two-fifths their length, red-brown above, often reflexed at anthesis, subapiculate with pubescent tips; rays 8, broadly cuneate, 15-25 mm. long, 8-18 mm. broad, gold-yellow with a small well-defined red-brown spot at the base or with diffuse or conspicuous red-brown coloring for approximately half the length or completely red-brown except for a yellow terminal margin; disk corolla 4-6.5 mm. long, the limb subequally or decidedly unequally lobed for three-fifths to three-fourths the length; pales narrowly oblong, 5-8 mm. long, mostly smooth; achenes erect or slightly incurved, terete to somewhat dorsally flattened, 4.5-7 mm. long, completely smooth or with evenly distributed roughening, wings obsolete or merely minute, entire, lateral flanges toward the base of the achene; pappus of 2 erect triangular retrorsely barbed awns 0.5-1 mm. long. Deep sandy soil, s. part of s.e. Tex. and n.e. part of Rio Grande Plains (Aransas, Brooks, Duval, Hidalgo, Jim Hogg, Kenedy, Kleberg, Live Oak, Nueces and Willacy cos.), spring-fall; endemic.

7. *Thelesperma filifolium* (Hook.) Gray. Taprooted annual or weak perennial, leafy, 2-7 dm. tall; stems simple to multibranching at the base, usually rebranching above to form dense sub-bushy clumps; leaves regularly distributed throughout; basal and lower cauline leaves mostly 5-12 cm. long, ternate or occasionally simple or thrice-pinnatisect; ultimate segments usually flattened, 1 mm. broad, narrowly oblanceolate to linear; upper cauline leaves becoming less segmented and the segments narrower, mostly simply pinnatisect and filiform, the uppermost occasionally trifid or simple; heads several to many on peduncles 6-25 cm. long, drooping in bud but totally erect at anthesis; involucre urceolate, 8-14 mm. thick; outer phyllaries 7 to 12, narrowly linear-lanceolate, herbaceous, 3-12 mm. long, spreading, variable in length; inner phyllaries 8, lanceolate to ovate-lanceolate, scarious-margined, 7.5-10 mm. long, basally connate for a fourth to two-fifths the length, greenish and glaucous at the base, reddish-brown above; rays 8, yellow or golden-yellow throughout or with a small amount of diffuse red-brown coloring at the base but this never in a definite spot, broadly cuneate, 3-lobed, 9-22 mm. long, 9-17 mm. broad; disk corolla yellow or red-brown, 4-7 mm. long, the limb variously lobed; pales narrowly oblong to ovate-lanceolate, 5-7.5 mm. long, clasping the achene; achenes polymorphic, 3.5-6.5 mm.

long, green to brownish or black, smooth to dorsally or completely verrucose, the outer ones curved, mostly short and thick, the inner ones elongate and slender, subterete to dorsiventrally flattened; pappus of 2 erect retrorsely barbed yellow awns 0.5-2 mm. long.

Our plants fall into two varieties of this species.

Var. *filifolium*. Robust habit, usually 25-70 cm. tall; limb of the disk corollas deeply and unequally lobed, the shorter lobes half or slightly less than half the length of the limb, the longer ones two-thirds to four-fifths or more the length of the limb; outer phyllaries normally more than half as long as the inner phyllaries; rays of golden-yellow. *T. intermedium* var. *rubrodiscum* Shinners. Widespread and abundant in n.-cen. Tex., e. part of the Plains Country, the extreme s. portion of e. and s.e. Tex. and infrequent in Rio Grande Plains and the Trans-Pecos, mostly late spring and early summer; Ark., Okla., La. and Tex.

Var. *intermedium* (Rydb.) Shinners. Smaller size, usually 2-3, rarely to 4 dm. tall; disk corolla yellow, the limb of which is subequally lobed for half or slightly less than half the length of the limb or decidedly irregularly lobed, the shorter lobes being half or less than half the length of the limb, the longer lobes two-thirds to three-fourths the length of the limb; outer phyllaries usually half or less than half as long as the inner phyllaries; rays yellow instead of golden-yellow. Abundant in the Plains Country, rare in the Trans-Pecos, spring-summer; Mo., Neb., Colo., Kan., Okla., N.M., Tex. and N.L.

8. *Thelesperma curvicaupum* T. E. Melchert. Taprooted annual 25-50 cm. tall, glabrous except for the ciliate leaf bases; stems single or multibranched from the base, rebranching above to form a paniculate head-bearing region; internodes more or less equidistant throughout, giving a kind of loose open aspect; basal leaves ternately twice- or thrice-pinnatisect, 3-12 cm. long, their ultimate segments to 2 mm. broad, narrowly oblanceolate to sublinear; lower and middle cauline leaves once- or twice-pinnatisect, usually as long as or only slightly shorter than the basal leaves, their linear segments 1 mm. wide, the uppermost leaves becoming palmately three-divided or simple; heads 2 to many; peduncles 4-15 cm. long; involucre 8-14 mm. thick, often dotted with black glands; outer phyllaries usually 8, linear-lanceolate, herbaceous, half to three fourths as long as the inner phyllaries; inner phyllaries 8, oblong, apiculate, scarious-margined, 6.5-8.5 mm. long, 2.5-4 mm. broad, basally palmate for a fifth to three-tenths the length; ray flowers 8, sterile; rays pale yellow, mostly 10-17 mm. long, 7-10 mm. broad, slightly 3-notched; disk flowers yellow with red-brown veins, 5-6 mm. long; limb 2.5-3.5 mm. long, irregularly lobed to three-fifths its length; pales scarious, with 2 medial nerves; peripheral achenes conspicuously cucullate, 3 mm. long, 2.5-3 mm. thick, purple-brown at maturity with conspicuous warts and corky flanges, these often tightly clasped by the pale; central achenes longer, narrower and decidedly less curved than the peripheral series; pappus of 2 minute teeth-like awns often protruding from a small crown formed by the corky wings, the awns retrorsely ciliate, the crown antrorsely ciliate. Locally abundant in open areas of the Edwards Plateau and in calcareous cuestas of the s. part of the Plains Country (Crockett, Taylor, Coleman, San Saba and Burnet cos.), spring to early summer; endemic.

9. *Thelesperma flavodiscum* (Shinners) B. L. Turner. Taprooted annual; stems slender with elongate internodes, erect, 1 to 3 (to 5) from the base, 7-8 dm. tall, usually branching toward the summit; leaves ternately or once- or twice- (rarely thrice-) pinnatisect, to 95 mm. long, of more or less equal length throughout, only the uppermost trifid, their ultimate segments filiform, elongate and to 8 cm. long, usually in a loose arrangement; peduncles 1-2 dm. long; involucre suburceolate, 8-13 mm. thick; outer phyllaries 7 to 9, filiform to subulate, herbaceous, 3-6 (-10) mm. long; inner phyllaries 8, lanceolate, red-brown, scarious, 6-9 mm. long, basally connate for two-fifths to three-fifths the length, often reflexed at the tip; rays 8, yellow, cuneate, 3-notched, 12-15 mm. long, to 8 mm. broad; disk corolla yellow with red-brown vein; tube 2-3 mm. long; limb 2.5-3 mm. long, deeply and unequally lobed, the shorter lobes half the length of the limb, the longer lobe four-fifths to nine-tenths the length of the limb; pales clasping the achene, 5-8 mm. long; achenes polymorphic, 4-6.2 mm. long, terete to somewhat dorsally flattened, smooth to dorsally or completely verrucose, usually with scattered antrorse hispid hairs toward the apex; outer achenes incurved; inner achenes erect; pappus of 2 short retrorsely hispid awns 0.8-1 mm. long. Deep fine sandy soils in oak woods, s. and s.e. portion of e. Tex., late spring-summer; endemic.

92. MARSHALLIA SCHREB.²¹⁸

BARBARA'S-BUTTONS

Perennial erect herbs from caudexes or rhizomes with fibrous roots; leaves alternate, simple, entire, 1- to 3-nerved, glabrous, sessile or contracted into subpetiolar bases, the stem leaves somewhat clasping when present; heads solitary at the end of the stems or branches; involucre hemispherical or campanulate; phyllaries herbaceous, often with hyaline margins, subequal, in 1 or 2 series, imbricated or merely approximate and not at all imbricate; receptacle convex or conical, chaffy throughout; pales herbaceous, often hyaline-margined below, narrowly linear in outline, longer than the achenes, semirigid; *ray flowers* absent; *disk flowers* perfect, fertile; corollas white, cream-colored, pale-lavender or purplish, never yellow, longer than the pales, externally pubescent, the tubes slender, the 5 equal lobes of the limb long and linear-obtuse; achenes turbinate or clavate, truncate, somewhat 5-angled, 10-ribbed, the achene-surface between the ribs concave and usually beset with minute resin-dots, these rarely absent; pappus scales 5 (sometimes 6), erect or spreading, forming a crown at the summit of the achene, membranous-scarious, white-hyaline or ferruginous, ovate to ovate-lanceolate or triangular-lanceolate, sessile, the apex acuminate or acute, the margins regularly or irregularly serrulate or lacerate.

About 10 species, in southern United States.

1. Phyllaries and pales merely acute or obtuse, not subulate-tipped, glabrous; phyllaries not winged; flowering in the spring and early summer 1. *M. caespitosa*.
1. Phyllaries and pales strongly acuminate or subulate-tipped, pubescent; phyllaries usually winged below the middle; flowering late summer and early fall 2. *M. tenuifolia*.

1. *Marshallia caespitosa* DC. Perennial herb (1-) 2-4 (-6) dm. tall with a short rhizome; leaves entire, gradually tapering below the middle into a winged subpetiolar base; lowermost leaves when present 2-8 (-18) cm. long and (3-) 5-10 (-20) mm. broad, with obovate to spatulate or oblanceolate obtuse blades; leaves of midstem when present (4-) 5-15 (-16) cm. long and 2-10 (-12) mm. broad, linear or linear-lanceolate with obtuse rarely acutish apices; heads solitary on the stems; involucre (5-) 6-12 (-15) mm. high; phyllaries herbaceous, green except for the white-hyaline margins below, glabrous, entire, subequal in 1 or 2 series, the outer usually but scarcely imbricate, 5-12 (-15) mm. long, 1-2 (-3) mm. broad, linear-oblong or linear-lanceolate with obtuse or merely acutish apices; pales 5-8 mm. long, linear with merely acute apices, slightly dilated at the summit; corollas usually white or cream-colored, only occasionally pale-lavender; pappus scales (1.5-) 2-3 (-4) mm. long; achene (2-) 3-4 (-4.5) mm. long. E. half of Tex. w. to Taylor, Val Verde and DeWitt cos., Apr.-May (-June); Miss., Ark., Okla., Tex. and La.

We have two varieties.

Var. *caespitosa*. Leaves all crowded near the base of the plant. E., s.e. and n.-cen. Tex., s. to Refugio and w. to Navarro and Bastrop cos.; Miss., Ark., Okla. and Tex.

Var. *signata* Beadle & Boynt. Stems leafy nearly throughout except for the uppermost peduncular flowering portion. Abundant on the Edwards Plateau and in limy cuestas of n.-cen. Tex., the Rio Grande Plains and the e. part of the Plains Country, s. to DeWitt Co. and w. to Val Verde and Taylor cos.; endemic.

2. *Marshallia tenuifolia* Raf. Leafy-stemmed perennial (2-) 4-10 (-12) dm. tall from a caudex; stem usually branched near the middle, the branches strictly erect; radical leaves spreading, thin-textured, obovate or spatulate, obtuse; stem leaves numerous, gradually reduced upward, glabrous, entire, the lowermost ones (2-) 3-4 cm. long and (4-) 5-10 (-13) mm. broad, mostly 3-nerved, spatulate to obovate or oblong-obovate in outline, with obtuse sometimes emarginate bladlike portion gradually narrowed basally into broad-winged subpetiolar bases shorter than the blades; lower stem leaves elongate, linear to linear-oblong or linear-lanceolate, attenuate, (2-) 4-20 (-22) cm. long, (1-) 2-13 (-14) mm. wide, broadest near the middle, gradually tapering to obtuse or acutish apices and more or less sessile somewhat clasping bases, prominently 1- to 3-nerved; upper stem leaves narrowly linear, attenuate, acute, gradually reduced in size upwards to the linear-subulate bracts of the peduncles; heads singly terminating the pedunculiform upper portion of the branches; involucre (5-) 10-15 (-20) mm. high; phyllaries herbaceous, sub-

²¹⁸ Adapted from R. B. Channell in Contr. Gray Herb. n. s. 181:41-132. 1957.

equal in about 2 series, linear-lanceolate to lanceolate or somewhat rhomboidal in outline, with strongly subulate apices, (2-)4-5(-6) mm. long; pales linear-attenuate, strongly subulate-tipped, 4-7 mm. long, longer than the phyllaries; corolla purple or pale-lavender, 6-14 mm. long; pappus scales (0.7-)1-2(-2.5) mm. long, achenes 1.5-3 mm. long. Infrequent in sandy usually moist soil, forests of e. and s.e. Tex., late summer-Oct.; Coastal States, Ga. to Tex.

93. GALINSOGA R. & P.

QUICK-WEED

Annual herbs, rather freely branched, about 1-4 dm. tall; leaves opposite, petiolate, ovate to narrowly ovate, entire or usually finely serrate; blades 1-3 cm. long; heads small, compressed-hemispherical, very short-pedunculate, borne solitary at the ends of branches; bracts imbricated in 2 series, thin, the inner sometimes longer than the outer; receptacle conic or sometimes elongate; chaff present; *ray flowers* present, inconspicuous, few, pistillate, fertile; rays white, about 1 mm. long; *disk flowers* several, perfect, fertile, the corolla yellow; achenes 4- or 5-angled or the outer ones slightly flattened; pappus of ray either absent or of several bristles, that of the disk of 15 to 20 minutely fimbriate scales.

A very small tropical American group.

1. Pappus of disk flowers linear-lanceolate, conspicuously fimbriate, equaling or even exceeding the corollas, that of the ray flowers absent; achenes glabrous or somewhat pilose; plants freely branched; leaves slender-petioled, ovate-lanceolate, coarsely or bluntly serrate; peduncles and stems near the nodes clothed with a fine rarely glandular pilosity1. *G. parviflora*.
1. Pappus of disk flowers linear, fimbriate, two-thirds the length of the corolla tube; pappus of ray flowers of a few short white bristles or absent; achenes minutely hispidulous at the summit or glabrate; plants rather strictly ascending, rarely branched from the base; internodes elongate; leaves short, petioled, linear-lanceolate or narrowly deltoid-lanceolate, bluntly serrate to subentire; pedicels and nodes of the stem with a coarse partly appressed puberulence2. *G. semicalva*.

1. *Galinsoga parviflora* Cav. Characters as in the key. Infrequent or rare in Davis Mts. in the Trans-Pecos at elev. of 5,000-7,500 ft., fall; nat. of S.A., now widely distributed in N. A.

2. *Galinsoga semicalva* (Gray) St. John & White. Infrequent or rare at elev. of 6,000-8,000 ft., Davis and Chisos mts. in the Trans-Pecos, Aug.-Oct.; Ariz., N.M., Tex., Chih., Dgo. and S.L.P.

94. BEBBIA GREENE

A genus of 2 species in southwestern United States.

1. *Bebbia juncea* (Benth.) Greene. Perennial, much-branched at base and in the head-bearing region; stems to 10 dm. high, with long internodes, often canescent-pubescent; leaves mostly opposite, few, linear or uncommonly with a few linear lobes, to 5 cm. long and 7 mm. wide, canescent; heads about 1 cm. long and thick; receptacle chaffy throughout, the pales longer than the achenes; phyllaries about 20, in about 3 series, canescent-green and with the texture of leaves except for the narrow hyaline margins; *ray flowers* absent; *disk flowers* about 20 to 30, perfect, fertile; corolla pale-yellow, 5-lobed terminally; achenes compressed, with 2 sharp angles and one blunt one; pappus a single series of about 15 or 20 plumose bristles. Rare in crevices, Franklin Mts., near El Paso, El Paso Co. in the Trans-Pecos, spring; Tex. to Nev. and Calif. s. to n. Mex.

95. GAILLARDIA Foug.²¹⁹

INDIAN BLANKET. BLANKET FLOWER

Annual or perennial herbs, rarely suffruticose basally, either scapose or caulescent; leaves alternate or basal, entire, toothed or pinnatifid, with long petioles or somewhat clasping; heads solitary, terminating the peduncles; involucre rotate; phyllaries herbaceous in texture (or indurated and discolored basally), ovate or lanceolate, 2- or 3-seriate,

²¹⁹ Adapted from Susan Fry Biddulph in Res. Stud. St. Coll. Wash. 12:195-256. 1944.

strongly reflexed in fruit; receptacle convex, alveolate with long setiform or in some species small dentiform fimbriae; *ray flowers* present, pistillate or not, infertile, rarely absent; rays usually yellow or yellow with red or red-purple spots basally, trifold apically; *disk flowers* perfect, fertile; corollas yellow to red or red-purple at least on the teeth, with 5 equal teeth terminally covered with moniliform hairs; style branch appendages usually long and hispidulous but sometimes short and glabrous; achenes broadly obpyramidal, wholly or partly covered with long hairs; pappus of several separate members, each thin and bractlike, lanceolate to ovate with an awn almost as long as the body.

An American genus of perhaps 15 or 20 species.

1. Receptacle with small dentiform setae (representing pales); lobes of the disk corollas caudate-acuminate (2)
 1. Receptacle with long stiff setae; lobes of the disk corollas triangular (4)
 - 2(1). Disk yellow7. *G. aestivalis*.
 2. Disk brown or red-brown (3)
 - 3(2). Heads long-pedunculate; branches slender; rays often absent
.....7. *G. aestivalis*.
 3. Heads short-pedunculate; branches stout and somewhat stiff; rays present
.....8. *G. fastigiata*.
 - 4(1). Style branches short and glabrous6. *G. suavis*.
 4. Style branches long and hispidulous (5)
 - 5(4). Annuals (doubtful cases should be keyed under both alternatives) (6)
 5. Perennials (7)
 - 6(5). Phyllaries only shortly chartaceous basally; rays red, tipped with yellow
.....1. *G. pulchella*.
 6. Phyllaries chartaceous with herbaceous tips; rays totally dark-reddish
.....2. *G. Amblyodon*.
 - 7(5). Achenes glabrate above3. *G. mexicana*.
 7. Achenes hairy all over (8)
 - 8(7). Plants densely villous; woody caudex absent4. *G. pinnatifida*.
 8. Plants minutely puberulent; caudex thick and woody ..5. *G. multiceps*.

1. *Gaillardia pulchella* Foug. INDIAN BLANKET, FIREWHEEL. Taprooted annual; stems becoming ligneous basally toward the end of the growth season, 3-6 dm. tall, usually branched, striate with short moniliform hairs; leaves 2-8 cm. long, oblong to oblanceolate, coarsely toothed to lobed or entire, acute or rounded apically, sessile and somewhat clasping or tapering into a short petiole, both surfaces with some moniliform hairs, the margins somewhat ciliate; peduncles 5-15 cm. long; phyllaries lanceolate, acute, chartaceous basally, herbaceous distally, ciliate marginally with moniliform hairs, reflexed at anthesis; receptacular setae subulate, twice as long as the achene; rays 6 to 10, 12-20 mm. long, red tipped with yellow; disk 15-20 mm. across; corollas 6-7 mm. long, yellow below and purple-red above by reason of the long moniliform hairs or occasionally with yellow hairs, the lobes triangular-acuminate; pappus scales 5-6 mm. long, lanceolate and gradually attenuate into an awn; achenes about 2 mm. long, hirsute from the base only, the hairs scarcely equaling the body. Incl. var. *picta* (Sweet) Gray, *G. Drummondii* (Hook.) DC., *G. villosa* Rydb., *G. neomexicana* A. Nels. Prairies, often sandy areas, common throughout the state but rare in the densely forested e. areas, late spring-early summer; Neb., Colo. and Ariz., s. to Tam., N.L., Coah. and Chih., rare e. to Ark. and along the coastal sandy areas to Va.; exceedingly close to *G. Amblyodon* below.

One of our most characteristic and plentiful spring flowers.

2. *Gaillardia Amblyodon* Gay. Taprooted annual; stems 3-5 dm. tall, simple or branched above, with crisp moniliform hairs; leaves 3-7 cm. long, long-lanceolate, sessile and slightly auricled basally, with short moniliform hairs; peduncles 3-10 cm. long; phyllaries 10-15 mm. long, lanceolate, the base chartaceous and appressed, only the tip herbaceous; setae of the receptacle subulate, 5-6 mm. long; rays 15-20 mm. long, dark-red to brownish-purple, the tip *not* yellow; disk 10-15 mm. across, lobes of disk corollas triangular, ciliate with moniliform hairs; style with long hispidulous appendages; achenes

about 3 mm. long, densely villous basally; pappus scales lanceolate, produced into an awn about half as long as the body. Sandy prairies and open woods in s.e. Tex. but most common in the s.w. extreme of e. Tex. and n. Rio Grande Plains, late spring-early summer; endemic.

Exceedingly closely related to *G. pulchella* above and probably not deserving separate recognition.

3. *Gaillardia mexicana* Gray. Perennial herb; stems 3-5 dm. tall, branched from the base, often with a reddish-tinge and pubescent with short moniliform hairs; rosette leaves 6-7 cm. long, oblanceolate with long subpetiolar bases, the margins coarsely lobed or entire; cauline leaves 25-35 mm. long, oblong or ovate-lanceolate, sessile, marginally entire or toothed; peduncle 15-20 cm. long; phyllaries 7-10 mm. long, lance-acuminate, herbaceous in texture, pubescent with short moniliform hairs; setae of the receptacle subulate, 3-4 mm. long; rays yellowish-red or purple, 7-9 mm. long; disk 12-15 mm. across, the triangular corolla lobes pubescent with brownish-purple moniliform hairs; pappus scales ovate-lanceolate, about 5 mm. long including the awn; achenes 2.5 mm. long, hairy from the base only, the hairs about as long as the body of the achene. Infrequent to rare in the vic. of Del Rio, Val Verde Co., spring; Tex., Chih., Coah., N.L. and S.L.P.

4. *Gaillardia pinnatifida* Torr. Perennial herb; stems 3-4 dm. tall, striate; leaves confined to lower half, lower leaves long-petioled, upper ones sessile or short-petioled; blades pinnatifid, oblanceolate in outline, covered with moniliform hairs; peduncles 8-18 cm. long; setae of the receptacle stiff, almost equaling the body of the achenes; rays yellow (the base sometimes pale-reddish), strongly purple-veined beneath; disk 2 cm. across; lobes of disk corollas triangular, covered with purple moniliform hairs; achenes 3 mm. long, covered with silky hairs; pappus scales lanceolate, each with an awn a third to half as long as the body. Abundant in grasslands of the Trans-Pecos and Plains Country, infrequent s.e. to n.e. part of Rio Grande Plains, late spring-fall; Okla., Colo. and Ut., s. to N.L., Coah. and Dgo.

5. *Gaillardia multiceps* Greene. Suffruticose perennial growing in bunches; stems 15-30 cm. tall, leafy in the lower half to two-thirds; leaves obtuse to acute, linear-oblanceolate, sessile, 2-8 cm. long, punctate and covered with moniliform hairs on both sides; peduncles 3-10 cm. long; phyllaries linear-lanceolate, acute, woolly with moniliform hairs; setae of the receptacle shorter than the body of the achene; disk 15-25 mm. across; lobes of disk corollas triangular, covered with purple-brown moniliform hairs; rays yellow with brown silky hairs; pappus scales 4-5 mm. long, lanceolate and often notched at the apex, the midrib extending into an awn a third the length of the body. Infrequent or rare in gypseous sands of Hudspeth Co. in the Trans-Pecos, summer; Ariz., N.M., Tex. and Coah.

6. *Gaillardia suavis* (Gray & Engelm.) Britt. & Rusby. Perennial herb; stems scapiform, 3-8 dm. tall; leaves basal, 5-15 cm. long, variable in shape from spatulate or oblanceolate-entire to only slightly toothed or lyrate pinnatifid, if entire strongly 3-nerved; leaf surfaces with a few scattered moniliform hairs; heads single; peduncles 3-8 dm. high; phyllaries ovate-lanceolate, acute, herbaceous in texture, with a few long moniliform hairs; setae of the receptacle subulate; rays often absent, if present short and usually orange-brown, inconspicuous; disk 15-20 (-30) mm. across, nearly spherical; corollas about 6 mm. long, exceeded by the awns of the pappus, reddish-brown; style branches with short glabrous appendages; achenes about 2.5 mm. long, the body covered with long white hairs; pappus scales including the awn 7-9 mm. long, ovate-lanceolate. *G. trinervata* Small. Widespread in calcareous and sandy-calcareous prairies in the w. two-thirds of the state, spring-early summer; Kan., Okla., Tex., Coah. and N. L.

7. *Gaillardia aestivalis* (Walt.) Rock. Perennial herb; branches slender and spreading, 3-7 dm. long or tall, the stems reddish-striate; upper leaves 2-8 cm. long, sessile, linear or oblanceolate; lower leaves 5-10 cm. long, oblanceolate, petioled; leaves glandular-punctate with short moniliform hairs on both surfaces and short cilia on the margins; peduncles 4-20 cm. long; phyllaries 8-10 mm. long, lanceolate, acute, covered with very short moniliform hairs but not ciliate; setae of the receptacle short and weak; rays 12 to 18, red or yellow; disk about 2 cm. broad; lobes of the disk corollas caudate-acuminate with long purple moniliform hairs; achenes 2 mm. long, the hairs covering the body; pappus scales lanceolate, tapering into an awn twice the length of the body. *G. lanceolata* Michx., *G. chrysantha* Small, *G. lutea* Greene, *G. serotina* (Walt.) Rock. Widespread in sandy soils, open woodlands and prairies, e. part of Tex. s. to Willacy Co. and w. to Medina Co., spring-summer, less commonly in fall; Coastal States, S. C. to Tex., inland to Ill., Mo., Ark. and Okla.

8. *Gaillardia fastigiata* Greene. Perennial herb; stems usually rigid, branching toward the top with the branches erect, 3-6 dm. tall; leaves sessile, linear-oblong or oblanceolate, acute, entire or coarsely dentate, glandular-punctate and covered with short moniliform hairs; peduncles 4-8 cm. long; phyllaries acute or acuminate, 8-12 mm. long, covered with short moniliform hairs; setae of the receptacle short, weak, flattened; rays yellow or occasionally reddish basally, 10-15 mm. long; disk 18-25 mm. broad; lobes of the disk corollas caudate-acuminate, covered with moniliform hairs, brown or dark-purple; achenes 2 mm. long, hairy from the base only but the hairs almost covering the body; pappus scales lanceolate, tapering into an awn longer than the body, body plus awn 5-6 mm. long. *G. rigida* Small. Open woods and prairies, sandy soil, e. half of Tex., spring-summer (less commonly in fall); Kan., Okla., Ark. and Tex.

Exceedingly closely related to *G. aestivalis* and probably not really separable therefrom except as an inland race.

96. AMBLYOLEPIS DC.

There is only one species; referred by some authors to *Helenium*.

1. *Amblyolepis setigera* DC. HUISACHE-DAISY. Slenderly taprooted annual with a pleasant odor like new-mown (*Medicago* or *Melilotus*) hay, sparingly branched, 1-5 dm. tall, glabrous or sparingly long-pilose; leaves alternate, sessile, thin-membranous, entire, the lower ones 2-5 (-8) cm. long, oblanceolate and narrowed to the base, the ones of midstem ovate, usually acutish and often somewhat clasping; upper 3-15 cm. of branches essentially naked, pedunculiform, each with a single head; involucre hemispheric, 7-11 mm. high; phyllaries in 2 series, the outer ones 8, longer, green, narrowly elliptic, the inner ones shorter, very inconspicuous, hyaline, mucicous, much-resembling pappus scales; receptacle strongly convex, naked except for persistent projections about 0.5 mm. long subtending the central flowers; ray flowers about 8 or 10, pistillate, fertile; rays yellow, 1-2 cm. long, deeply 3-(4-) toothed terminally; disk flowers numerous, perfect, fertile, the yellow corollas equally 5-toothed; achenes narrowly obconic, almost equally 10-ribbed, about 4 mm. long, densely covered with antrorse silky brownish hair; pappus of about 5 scarious scales 2.5-3 mm. long. *Helenium setigerum* (DC.) Britt. & Rusby. Abundant in Rio Grande Plains and the Edwards Plateau, infrequent in n.-cen. and s.e. Tex. and Plains Country, rare in the Trans-Pecos, spring; also Coah.

97. HELENIUM L.

SNEEZEWEED

Annual or perennial caulescent herbs usually with taproots; stems 1-20 dm. tall, usually simple below, ascendingly branched above; leaves alternate, usually ascending, in some species decurrent, essentially sessile, the lowest ones often pinnately lobed, the upper usually not, all beset with microscopic droplets of resinlike exudate; peduncles moncephalous, terminal; receptacle usually globose or prolate (or globose but basally truncate), naked or rarely with a few short bristles in the peripheral zone; involucre usually flat or even inverted-saucer-shaped; phyllaries about 16, in 2 series of about 8, lanceolate to subulate, herbaceous in texture, usually pubescent and resin-atomiferous, the outer somewhat longer than the inner, usually reflexed at maturity; ray flowers absent or present, about 8, pistillate or not, fertile or infertile; rays yellow (or red-brown with a yellow tip), apically 3-lobed, often reflexed, dorsally often hairy and resin-atomiferous; disk usually globose or prolate; disk flowers numerous, perfect, fertile; corollas yellow mostly, with 5 moniliform-pubescent triangular lobes which are either yellow or red-brown; style branches unappendaged, truncate, penicillate; achenes obpyramidal, 4- or 5-angled, short and squatty, usually antrorsely hairy at least in the basal part; pappus of 5 translucent scales each of which usually is prolonged into an awnlike tip, occasionally the whole scale narrow and awnlike.

About 40 species, mostly in western America.

1. Cauline leaf bases not decurrent along the stem, the stem thus not winged (2).

1. Cauline leaf bases (at least those of the midstem leaves) decurrent along the stem to form wings on the stem (3)

- 2(1). Lobes of disk corollas yellow5. *H. amarum*.
 2. Lobes of disk corollas red-brown6. *H. badium*.
- 3(1). Rays absent (4)
 3. Rays present (5)
- 4(3). Perennial with short fibrous-rooted caudex; perennation by leafy offsets; disk red-brown7. *H. flexuosum*.
 4. Annual or biennial with a coarse taproot; leafy offsets usually absent; disk reddish to yellowish (8)
- 5(3). Ray flowers neutral, sterile (6)
 5. Ray flowers styliiferous, fertile (tardily so in some) (7)
- 6(5). Disk yellow; stem nearly simple8. *H. Drummondii*.
 6. Disk red-brown; stem branched7. *H. flexuosum*.
- 7(5). Perennial1. *H. autumnale*.
 7. Annual or biennial with a coarse taproot, usually with numerous heads on shortish peduncles and the heads relatively small (8)
- 8(4,7). Pappus scales ovate, with a long awn tip, altogether fully three fourths as long as the disk corolla4. *H. linifolium*.
 8. Pappus scales obtuse, pointless, without conspicuous midrib (9)
- 9(8). Leaves narrowly elliptic and often undulate-dentate; plants usually leafy even up to the top among the heads; achenes mostly 0.8-1 mm. long and pappus 0.2-0.4 (0.5) mm. long; "disk" usually slightly higher than thick; rays (1-) 2-3 (-5) mm. long2. *H. microcephalum*.
 9. Leaves lanceolate to linear, rarely undulate, much-reduced upward so the heads are definitely peduncled and emergent above the foliage; achenes 0.5-0.7 (-0.8) mm. long and pappus 0.1-0.2 (rarely to 0.3) mm. long; disk usually slightly thicker than high; rays 3-15 mm. long3. *H. quadridentatum*.

1. *Helenium autumnale* L. Perennial herb from a fibrous-rooted subrhizomatous base; stems erect, 3-10 dm. tall, branched above, winged; leaves mostly linear-elliptic, usually serrate, 3-15 cm. long, 3-18 mm. broad, acute, decurrent; peduncles 3-6 cm. long; receptacle roughly globose; ray flowers pistillate, tardily fertile, the rays yellow; disk globose, 8-13 (-20) mm. thick, yellow, the corollas 5-merous; achenes about 1.5 mm. long, hairy on the ribs; pappus scales lanceolate, erose-fimbriate, acuminate, about a fourth as long as the tube. *H. canaliculatum* Lam., *H. edwardsianum* Cory. Infrequent in moist usually calcareous places, n.-cen. and e. Tex., Edwards Plateau and Plains Country, (Aug.-) Sept.-Oct.; widespread in temp. N. A.

2. *Helenium microcephalum* DC. SNEEZEWEED. Taprooted annual (2-) 3-6 (-8) dm. tall, usually simple-stemmed basally, bushy-branched above, the stems winged; leaves narrowly elliptic or narrowly oblong-elliptic, usually serrate or undulate-serrate-margined, blunt, ascending, decurrent; peduncles short so that the heads usually just barely emerge above the foliage mass; receptacle usually short conic-globular; rays entirely yellow, (1-) 2-3 (-5) mm. long; disk pale-red-brown, usually slightly higher than thick; achenes mostly 0.8-1 mm. long; pappus scales 0.2-0.4 (-0.5) mm. long, ascending. *H. ooclinium* Gray. Abundant in overgrazed areas, especially in low seasonally moist areas of clay soil, w. half of Tex., infrequently e. to Brazos and San Patricio cos., summer- (fall); Tex., Tamp., N.L. and Coah.

3. *Helenium quadridentatum* Labill. ROSILLA. Taprooted annual (2-) 3-6 (-8) dm. tall, usually single-stemmed basally, bushy-branched above, the stems winged; leaves lanceolate to linear, those of midstem and above entire-margined, acute, ascending, decurrent; peduncles long enough to elevate the heads distinctly above the foliage; receptacle usually globose; rays yellow or often partly red-brown basally, 3-15 mm. long; disk red-brown, usually slightly thicker than high; achenes mostly 0.5-0.7 mm. long; pappus scales 0.1-0.2 (rarely 0.3) mm. long, usually slightly spreading. *H. elegans* DC., *H. amphibolum* Gray. Frequent or local in the Trans-Pecos and n.-cen. Tex., Edwards Plateau and Rio Grande Plains, (May-) summer; Tex., La., Miss., Okla., Tam., N.L., Coah., s.e. to Hgo., perhaps even to C. A.

The allegations that this species has 4-merous disk corollas seem unfounded, at least in Texas material. The species may have introgressed to a small extent with *H. microcephalum*.

4. *Helenium linifolium* Rydb. Taprooted annual (2-) 3-6 (-8) dm. tall, simple basally, with few ascending branches, the stems and branches narrowly winged; lowermost leaves (often withered before flowering) oblanceolate, pinnatifid; stem leaves linear, narrowly decurrent, (2-) 3-5 cm. long, ascending; peduncles (3-) 4-6 cm. long; receptacle conic-globose; ray flowers about 8, pistillate, tardily fertile; rays about 1 cm. long, 3-fid, yellow or yellow with red-brown spot basally or nearly all red-brown with yellow lobes; disk 5-10 mm. thick, globose; corollas 5-lobed, the lobes yellow to red-brown; achene about 1 mm. long, hispid on the angles; pappus scales ovate, each with a long awn-tip, altogether fully three fourths as long as the corolla. Infrequent in Rio Grande Plains in sandy loam soil, spring; endemic.

Closely related to the *H. amarum*-*H. badium* alliance, but with stems very narrowly winged.

5. *Helenium amarum* (Raf.) Rock. BITTERWEED. Taprooted annual (5-) 10-50 (-80) cm. tall, bushy-branched above or rarely subsimple; leaves not decurrent on the stem, mostly linear but the lowermost (usually withered prior to anthesis) pinnately lobed, oblanceolate in outline and long-tapered to the base; heads numerous; rays about 8; disk corollas 5-lobed, entirely yellow. *H. tenuifolium* Nutt. Very widespread in (usually disturbed) sandy or loamy soil in the e. two thirds of the state, spring-summer (rarely again in the fall); s.e. U.S.

The stems are striate or ribbed, each rib leading downward from the side of a leaf base, but the stem is definitely not winged. The whole plant is odoriferous and bitter; the milk of cows which have eaten even a small quantity of this plant is distasteful. The plant is very weedy and increases enormously under the usual regime of abusive overgrazing.

6. *Helenium badium* (Gray) Greene. Identical to the last but the lobes of the disk corolla red-brown so that the disk appears dark. *H. amarum* var. *badium* (Gray) Waterfall. This can easily be considered merely a variety of *H. amarum* but it is more restricted geographically to calcareous disturbed soils of the Edwards Plateau, Plains Country and Trans-Pecos, infrequently farther e., spring-summer (rarely again in fall); also Okla.

7. *Helenium flexuosum* Raf. Perennial herb perennating by rosetted offshoots at the crown; stems 3-10 dm. tall, simple basally, profusely branched, winged below; radical leaves usually withered by flowering time, linear-lanceolate to elliptic-lanceolate or oblanceolate to spatulate, entire to pinnatifid-incised, 3-21 cm. long, 4-30 mm. broad; stem leaves mostly entire, linear-lanceolate, decurrent, much-reduced upward; heads usually many, globose; receptacle subglobose to conical-subglobose; ray flowers when present infertile (style usually absent); rays yellow, umber or suffused with red or purple, 10-21 mm. long; disk red-brown to red-purple, 7-20 mm. thick, 5-15 mm. high, the corollas predominantly 4-merous; achenes 1-1.5 mm. long, columnar to truncate-turbinate; pappus scales usually 5, lanceolate, acute and awned apically. *H. nudiflorum* Nutt. Infrequent in moist sandy places, s.e. Tex. (s. to Calhoun Co.), rare in e. Tex., spring (to first week in June); e. U. S., w to Mo., Okla. and Tex.

8. *Helenium Drummondii* Rock. Perennial herb perennating from rosette-leaved offshoots of the crown; stems (19-) 47-54 (-60) cm. tall, solitary, simple, subscapose, monocephalous, winged below; radical leaves usually present at flowering time, linear-lanceolate to elliptic-lanceolate or less commonly spatulate or oblanceolate, marginally entire to repand, dentate to pinnatifid; stem leaves narrower, nearly linear, very strongly reduced upward, the uppermost (near the middle of the stems) being mere bracts; receptacle convex to hemispherical; ray flowers astylous, infertile, the yellow rays 12-22 mm. long; disk yellow, 9-14 (-18) mm. high, 12-22 mm. thick, the corollas 5-lobed; achenes columnar to truncate-turbinate, 1-1.5 mm. long, hairy on the ribs; pappus scales 5 to 10, 2-3.5 mm. long, deeply divided into capillary segments. Infrequent in poorly drained areas, s.e. Tex., rare in e. Tex., spring; Tex., La. and Fla.

98. HYMENOXYSS CASS.²²⁰

BITTERWEED

Annual or perennial herbs from a taproot, sometimes also with a caudex (persistent old exposed stem bases); herbage granulate, dotted with microscopic globules of resinlike

²²⁰ Contributed by Kittie F. Parker.

exudate, pilose to glabrate; stems sulcate; leaves alternate, both rosulate and cauline or all basal, simple, entire, few-toothed or lobed to pinnatisect, impressed-glandular-punctate on both surfaces; heads solitary on each peduncle, cymosely or corymbosely arranged; involucre hemispherical to nearly cylindrical; outer phyllaries rigid, united from near base to half their length and strongly thickened below or distinct to base and not strongly thickened; inner phyllaries distinct to base, either in 1 definite series and coriaceous throughout or in 2 indefinite series and more or less herbaceous and membranous-margined; receptacle high-conical, naked, pitted; ray flowers pistillate, fertile; rays yellow, sharply reflexed at maturity, persistent, becoming almost whitish; disk flowers numerous, perfect, fertile; disk corollas yellow; style branches dilated-truncate, at tip penicillate; anther appendages broadly triangular to ovate; achenes of ray and disk similar, obturbinate, indistinctly 4-angled, coarsely sericeous, 1.5-3.5 mm. long; pappus of 5 to 8 hyaline scales. *Tetraneris* Greene.

An American genus of about 27 species, confined to limestone soil or derivatives of limestone or of basic igneous rocks (basalt, andesite, etc.). Some species are poisonous to sheep.

1. Phyllaries dissimilar, rigid; outer phyllaries keeled or strongly thickened below, herbaceous above, united from near base to half their length; inner phyllaries separate, coriaceous throughout, in 1 series, slightly longer than outer and convergent in fruit (2)
1. Phyllaries similar, separate, erect but not rigid nor strongly thickened, subequal; inner phyllaries more or less herbaceous and membranous-margined, in 2 indistinct series, not convergent (4)
- 2(1). Perennial with a branched woody caudex, the base conspicuously long-villous-woolly among the persistent petiole bases; Culberson Co1. *H. Richardsonii*
var. *floribunda*.
2. Annual from a slender taproot, the base not conspicuously long-villous or woolly, lacking persistent petiole bases (3)
- 3(2). Leaves all pinnately divided into 3 to 13 linear-filiform segments; ray flowers obvious, longer than phyllaries; common in Texas ...2. *H. odorata*.
3. Leaves of rosette spatulate with short lobelike teeth; cauline leaves few, becoming linear, entire; ray flowers not obvious, shorter than phyllaries; Harris Co.3. *H. texana*.
- 4(1). Annual with basal rosette and cauline leaves; stems simple to few- or many-branched from base to near top, sometimes flowering before branching; phyllaries 2.5-4.5 mm. high; disk flowers 1.5-2.5 mm. long ...4. *H. linearifolia*.
4. Perennial with or without a caudex; plants acaulescent or flowering stems sparingly branched near base; leaves all basal or ascending the stem a third or more its length; phyllaries 4.5-8.5 mm. high; disk flowers 2.5-4.5 mm. long (5)
- 5(4). Leaves densely sericeous, all entire, clearly basal, not imbricated along basal part of stem nor ascending stem; plants strictly acaulescent, the scapes arising from a short thick woody multicapital caudex5. *H. acaulis* var. *acaulis*.
5. Leaves not sericeous, densely to thinly pilose-villous to glabrate, entire or some with 1 to 5 short toothlike lobes, closely imbricated along basal part of stem or ascending a third or more the length of the stem; plants rarely strictly acaulescent, the stems often branched below; caudex lacking to well-developed (6)
- 6(5). Petioles 2-6 mm. broad, the clasping base scarcely broader than rest of petiole, not coriaceous, sometimes membranous; leaves 6-15 mm. broad, not linear, lanceolate to spatulate; phyllaries 5.5-8.5 mm. high6. *H. Turneri*.
6. Petioles 0.5-1.5 mm. broad, the clasping base expanded and much broader than rest of petiole, pale to whitish, coriaceous, often pearly, shiny; leaves (1-) 14 mm. broad, linear to oblanceolate; phyllaries 4.5-6 mm. high (7)
- 7(6). New leaves closely imbricated around base of stem, not ascending stem; stem not visible between leaf bases (8)
7. New leaves ascending stem a third or more its length; stem clearly visible between leaf bases, sparingly branched below (10)

- 8(7). Caudex forming a woody fastigiately branched mound to 1 dm. or more high; leaves mostly entire, 1.5-4 mm. broad, thinly pilose to glabrate 7. *H. scaposa* var. *glabra*.
8. Caudex none to short, the new growth often arising by scapelike branches or well-developed, few-branched and spreading; commonly some leaves short-lobed, 1.5-14 mm. broad (9)
- 9(8). Leaves moderately pilose to glabrate, 1.5-9 mm. broad; widespread 7. *H. scaposa* var. *scaposa*.
9. Leaves densely long-villous-pilose, 4-14 mm. broad; southeast Trans-Pecos Texas and western Edwards Plateau 7. *H. scaposa* var. *villosa*.
- 10(7). Leafy part of flowering stem conspicuously and densely whitish-villous-woolly-tomentose; leaves 1-3 (-4) mm. broad 7. *H. scaposa* var. *argyrocaulon*.
10. Leafy part of flowering stem appressed-puberulent, not densely villous-woolly; leaves 1.5-9 (-11) mm. broad 7. *H. scaposa* var. *scaposa*.

1. *Hymenoxys Richardsonii* (Hook.) Cockll. var. *floribunda* (Gray) Parker. PINGUE. Cespitose perennial 15-45 cm. high, from a well-developed multicapital woody caudex, the base conspicuously long-villous-woolly in axils of persistent petiole bases; stems many, well-branched; leaves entire to mostly pinnatisect into 2 to 15 long narrow segments, densely cauline and forming a tuft at base of each stem; heads many per stem, in flat-topped corymbs, the peduncles 2-6 cm. long; phyllaries 4-5.5 mm. high; outer phyllaries united about half their length, thickened, dorsally keeled, gland-dotted; inner phyllaries slightly longer, mucronate; rays 6 to 9, 8-11 mm. long; disk flowers 3-4 mm. long; pappus scales 1.5-3 mm. long. Locally abundant in overgrazed limestone or dolomite mt. meadows, Guadalupe Mts., Culberson Co., 5,700 to 8,751 ft. elev., July-Aug. (-Sept.); Colo., Ut., Ariz. and Tex.

The species as a whole is more widely distributed in the Rocky Mts. Poisonous to sheep.

2. *Hymenoxys odorata* DC. BITTERWEED. Bushy annual, much-branched, 7-45 (-60) cm. high, aromatic when crushed, sparingly canescent to glabrate; leaves pinnatisect into 3 to 15 very narrow to filiform divisions; heads many, small, solitary on terminal or axillary peduncles 3-7 (-14) cm. long; phyllaries 4-6.5 mm. high; outer phyllaries united near (noticeably thickened) base; inner phyllaries 1-3 mm. longer, strongly convergent in fruit; rays 6 to 13, 5-11 mm. long; disk flowers 2.5-4.2 mm. high; pappus scales acuminate or awn-tipped, 1-1.8 (-2.3) mm. long. A weed of overgrazed plains, roadsides and wasteplaces in limestone soils, abundant in Edwards Plateau and the Trans-Pecos, frequent in n.w. Tex., e. and s. to Wilbarger, Robertson and Starr cos., Feb.-June (-Nov); Kan., Colo., N.M., Ariz., Calif., Tex., Okla., Son., Chih., Coah., N.L. and Tam.

Poisonous to sheep.

3. *Hymenoxys texana* (Coul. & Rose) Cockll. Delicate annual 5-15 cm. high, with several divergent branches from base, sparingly short-villous to glabrate; rosette leaves spatulate with short marginal teeth or lobes, 4-5 mm. broad; cauline leaves few, becoming narrowly linear and entire; heads few, small, on peduncles 4-15 mm. long; phyllaries 5 mm. long; outer phyllaries strongly thickened and united near base; inner phyllaries longer, convergent in fruit; rays only 2-3 mm. long, shorter than and hidden by phyllaries; disk flowers 2 mm. long; pappus scales 5, acuminate to short-awned, 1.5-2.4 mm. long. Rare in sandy soils near Hockley and Houston, Harris Co., probably extinct (no known collections after 1900), Mar.-Sept.; endemic.

4. *Hymenoxys linearifolia* Hook. Annual; first stem from basal rosette commonly flowering before it branches or other stems are fully developed, the branches often greatly rebranched in age and the plant bushy, or stem rarely solitary, simple below, sparingly branched above, 3-40 (-60) cm. high, densely to sparingly long-pilose below; rosette leaves caducous, oblanceolate, entire or with 1 to 5 short lobes, glabrate to densely pilose, 4-8 (-13) mm. broad; cauline leaves becoming narrowly linear; heads solitary on naked peduncles 3-20 cm. long, disk of first flowering to 14 mm. across, later heads smaller, as narrow as 3.5 mm.; phyllaries 2.5-4 (-4.5) mm. long; rays 6 to 22; disk flowers 1.5-2.5 (-2.8) mm. long. *Tetranneuris linearifolia* (Hook.) Greene. Locally abundant in prairies,

floodplains, weedy places and mts. to 7,000 ft. elev., in limestone soil throughout except rare in Plains Country and forested parts of e. Tex., Mar.-May (-July); reflowering to July (-Nov.), heads progressively smaller; Okla., N.M., Tex., Coah., N.L. and Tam.

5. *Hymenoxys acaulis* (Pursh) Parker var. *acaulis*. Cespitose scapose perennial from a short thick woody multicapital caudex, covered by persistent leaf bases with woolly axils, strictly acaulescent; scapes 6-35 cm. high; leaves strictly basal, entire, linear-oblongate, 2-6 mm. broad, densely sericeous; heads solitary on each scape; phyllaries 4.5-6 mm. high, densely silky-villous; rays 8 to 16, 6-14 mm. long; disk corollas 2.5-3.5 mm. long; pappus scales 5 to 6 (or 7), 2-2.8 mm. long. *Tetaneuris acaulis* (Pursh) Greene var. *acaulis*. Frequent on limestone bluffs, slopes and roadsides, Plains Country s. to Randall and Donley cos., May-June, spasmodically to Aug.-Sept.; Alta. and Sask. s. to N.M. and Tex.

6. *Hymenoxys Turneri* Parker. Perennial with a branched decumbent caudex, weak and spreading, not cespitose; leafy part of flowering stems densely long-pilose-woolly, the hairs often whitish; stems unbranched to sparingly branched near base; leaves basal and often ascending a third or more the stem length, 6-15 mm. broad when mature, entire to trifid or with 4 or 5 short lobes, mostly densely long-pilose, lanceolate or oblanceolate to spatulate; petioles 2.5-6 mm. broad, the clasping bases inconspicuous, scarcely broader than petioles, not coriaceous, sometimes membranous; heads large, the disks 14-22 mm. across; phyllaries 5.5-8.5 mm. long; rays 14 to 27; disk flowers 3-4.5 mm. long; pappus scales 2.6-4.1 mm. long; chromosome number: $n = 45$. Frequent locally in dry limestone plains and roadsides in the s. tip of the Blackland Prairies and s.-cen. Rio Grande Plains from Karnes and Goliad cos. s. through Live Oak and s. San Patricio to Jim Wells Co., Feb.-Apr.; endemic.

7. *Hymenoxys scaposa* (DC.) Parker. Perennial from a slender taproot to cespitose with a well-developed caudex; leaves closely imbricated along basal part of stem to ascending a third or more of the stem length, entire or with 1 to 5 short lobes, linear or linear-lanceolate or oblanceolate to rarely spatulate, densely pilose-villous to glabrate, attenuate below into a petiole 0.5-1.5 mm. broad, the clasping bases expanded, whitish, coriaceous, often pearly, shiny, the axils densely long-pilose-villous; heads solitary on long naked peduncles; phyllaries 4.5-6 mm. high; rays variable in number and length; disk corollas 3-3.6 mm. long; pappus of 5 to 8 scales 1.5-3.3 mm. long; achenes 2.2-3.3 mm. long. *Tetaneuris scaposa* (DC.) Greene. Late Mar.-June (-Aug.), often reflowering Sept.-Oct.; widespread over Tex. except extreme e. part, with several intergrading forms or races, 4 of which are recognized here as varieties:

Var. *scaposa*. Caudex lacking to sparse, often with scapelike branches to well-developed and few-branched, spreading; leaves 1.5-9 (-11) mm. broad, entire to few-lobed; scapes 7-36 cm. high, sometimes sparingly branched among the leaves; rays 12 to 31; corollas 8-22 mm. long, the veins sometimes purplish-brown beneath. *Tetaneuris scaposa* var. *scaposa*, *H. scaposa* var. *linearis* (Nutt.) Parker. Locally abundant in limestone soil in the Plains Country, Blackland Prairies to Dallas Co., Edwards Plateau, n. Rio Grande Plains and Trans-Pecos to Hueco Mts., El Paso Co., up to 6,500 ft. elev.; Kan., Okla., N.M., Tex., Chih., Coah., Dgo., N.L., Tam. and S.L.P.

Var. *glabra* (Nutt.) Parker. Caudex forming a fastigiately branched woody mound to 1 dm. or more high; leaves 1.5-4 mm. broad, usually entire, occasionally short-lobed, thinly pilose to glabrate, in closely imbricated tufts at stem base, rarely ascending above base; scapes 5-20 (-25) cm. high; rays 8 to 13, 6-13 mm. long. *H. glabra* (Nutt.) Shinners, *Tetaneuris glabra* (Nutt.) Greene. Locally common in dry rocky limestone soil in the Plains Country to Tom Green Co., infrequent in the Trans-Pecos from Guadalupe Mts. to Glass Mts.; Neb., Kan., Okla., Colo., Ut., N.M., Tex., Coah., N.L. and S.L.P.

Var. *villosa* Shinners. Leaves densely long-villous-pilose, 4-14 mm. broad, often some only sparingly punctate; rays as in var. *scaposa*, the veins usually purplish-brown beneath; caudex none to sparse. *Tetaneuris scaposa* var. *villosa* (Shinners) Shinners. Frequent on rocky limestone mesas and disturbed areas in s.e. Trans-Pecos and w. Edwards Plateau; Tex., N.M. and Coah.

Var. *argyrocaulon* Parker. Mostly with a many-branched spreading caudex; lower part of new stems clearly visible between leaf bases, frequently branched, densely pilose-woolly, the hairs conspicuously whitish (ferruginous in old specimens); leaves ascending a third or more up the stem, linear to linear-lanceolate, 1-3 (-4) mm. broad, entire to trifid, moderately to thinly silky-pilose, often silvery. Fairly common in sandy calcareous

soil in s.w. Rio Grande Plains in Webb, Duval, Jim Hogg and Zapata cos., rare in Edwards Plateau (Edwards Co.), Feb.-Apr.; Tex., Coah., N.L. and Tam.

99. DYSSODIA CAV.²²¹

DOGWEED. FETID MARIGOLD

Strongly scented annual or perennial herbs, or shrubs, glabrous to densely tomentose; foliage and phyllaries dotted with translucent usually orange or dark-brown oil glands; capitula usually pedunculate, sometimes sessile or subsessile, in cymose clusters in *D. tagetoides*; calyculum (short bracts subtending the phyllaries proper) usually present; involucre hemispheric to narrowly turbinate or cylindric, 4-12 mm. high; phyllaries in 2 series, free or variously connate from the base, the upper portions gland-dotted; receptacle flat to convex, minutely fimbriate, puberulent or naked; ray florets usually present (mostly 8 to 13), pistillate; corollas light-yellow to orange; pappus and achene similar to those of the disk; disk florets 12 to 100 per head, perfect; corollas usually dull-yellow, the tube and throat about equal, the short lobes deltoid; style branches in the disk florets long, slender, abruptly tipped with a short papillate cone; pappus of 5 to 22 squamellae, muticous, awned or dissected into several bristles; frequently both muticous and awned scales on the same achene; achenes stout, obpyramidal and sericeous to slender, cylindric and glabrous.

An American genus of about 32 species; most common in the more arid regions of southwestern United States and northern Mexico.

- 1. Phyllaries free nearly to the base of the involucre; rays inconspicuous, barely exerted beyond the phyllaries 1. *D. papposa*.
- 1. Phyllaries connate half their length or more; rays (when present) conspicuous (2)
- 2(1). Ephemeral annual; leaves alternate, pinnatisect; calyculum absent; plants of Trans-Pecos Texas 9. *D. aurea*.
- 2. Perennials (sometimes flowering the first year and behaving as annuals), usually with calyculate heads; leaves opposite or alternate, simple to pinnatisect (3)
- 3(2). Leaves simple, entire or toothed but not pinnatisect into linear lobes; calyculum more than half as long as the involucre (4)
- 3. Leaves pinnately parted into 3 to 15 linear lobes (entire in *D. tenuiloba* var. *Wrightii*); calyculum less than half as long as the involucre (7)
- 4(3). Plants woolly-tomentose, ashy-white; leaves mostly alternate (5)
- 4. Plants glabrescent, green; leaves opposite or alternate (6)
- 5(4). Plants depressed, spreading, less than 1 dm. high; leaves spatulate 2. *D. micropoides*.
- 5. Plants erect, mostly 1-3 dm. high; leaves linear-filiform .. 3. *D. tephroleuca*.
- 6(4). Plants mostly less than 3 dm. high; leaves opposite, acerose, 1-2 cm. long 4. *D. acerosa*.
- 6. Plants 3-9 dm. high; leaves becoming alternate, toothed, 4-9 cm. long 5. *D. tagetoides*.
- 7(3). Leaves opposite, the divisions rather stiff to the touch; margins of the outer phyllaries usually free for half or more of their length (8)
- 7. Leaves alternate, rather soft to the touch; margins of the outer phyllaries united up to the short deltoid tips 8. *D. tenuiloba*.
- 8(7). Plants ashy-white, tomentose; tips of the phyllaries attenuate 6. *D. setifolia* var. *radiata*.
- 8. Plants green, glabrous to puberulent but not tomentose; tips of the phyllaries short, deltoid 7. *D. pentachaeta*.

1. *Dyssodia papposa* (Vent.) Hitchc. Erect to spreading annual, 1-7 dm. high; leaves mostly opposite, becoming alternate, 15-50 mm. long, pinnately parted into 11 to 15 narrow lobes (sometimes secondarily divided), glabrous to sparsely pubescent, irregularly

²²¹ Contributed by John L. Strother.

dotted with numerous small ovate glands; heads subsessile or on short peduncles; calyculum of 4 to 9 linear bracts, usually bearing 1 to 3 elongate glands; involucre turbinate to campanulate, 6-10 mm. high; phyllaries 6 to 12, free, oval-oblongate, tips acute to rounded-obtuse, scarious, fimbriate, bearing 1 to 7 elongate to ovate glands inset slightly from the upper margin; *ray florets* 8 or fewer, inconspicuous, yellow-orange; tube 3-3.5 mm. long, sparsely puberulent, constricted just below the lamina, the latter 1.5-2 mm. long and about 1 mm. wide, 2- or 3-denticulate at the apex; *disk florets* 12 to 50; corollas dull-yellow, about 3 mm. long; pappus of about 20 squamellae, each dissected into 5 to 10 fine bristles with the longest about equaling the disk corollas; achenes stout, 3-3.5 mm. long, subsericeous. Trans-Pecos and High Plains (Panhandle), Aug.-Oct.; Me. to Mont. s. through Mex. Highlands to Chis.

2. *Dyssodia micropoides* (DC.) Loes. Depressed spreading short-lived perennial, 5-10 cm. high, with a slender taproot or woody caudex, densely arachnose-floccose throughout; leaves alternate, spatulate, 10-25 mm. long, 3-5 mm. wide, mostly entire, sometimes with a few subtle teeth toward the apex, lower surface dotted with tiny glands hidden in the dense wool; heads sessile or terminating short branches; calyculum of 3 to 5 linear bracts hidden in the wool; involucre a turbinate cup, 6-7 mm. high, 5-6 mm. wide; phyllaries 12 to 14, united to the short scarious triangular tips, dotted in the upper fourth with tiny glands hidden in the wool; *ray florets* 10 to 15; corollas bright-yellow, turning greenish, the tube about 3 mm. long, the obovate lamina about 5 mm. long and 3 mm. wide; *disk florets* about 60; corollas yellow, about 3 mm. long; pappus of 5 mucicous scales less than 1 mm. long alternating with 5 lanceolate aristate ones, about equaling the disk corollas; achenes clavate or nearly cylindrical, 2.3-3 mm. long, sparsely pubescent. Trans-Pecos, throughout the year with favorable conditions; Tex., Coah. and N.L.

3. *Dyssodia tephroleuca* Blake. ASHY DOGWEEED. Erect perennial to 3 dm. high, lanate-tomentose, the upper stems white with dense wool; leaves alternate, linear, entire or weakly trifid at the tip, 10-15 mm. long, 0.3-0.8 mm. wide; peduncles also white-tomentose, 1-3 cm. long, bearing 0 to 3 foliaceous bracts; calyculum of 3 to 4 linear bracts about half as long as the phyllaries; involucre a campanulate cup, 5-7 mm. high, lanate; phyllaries 12 to 13, connate about three-fourths their length, the tips acutely triangular, 1.5-2 mm. long, each bract glandular in the upper half or third; *ray florets* 12 to 13; corollas golden-yellow; tube about 2 mm. long; lamina oblong-oval, 6-8 mm. long, 3-4 mm. wide, 2- or 3-denticulate at the tip; *disk florets* about 30; corollas yellow, 4.5-5 mm. long; pappus of 10 to 11 subequal squamellae about equaling the disk corollas, each scale bearing a central awn and 2 to 4 shorter lateral ones; achenes 3-4 mm. long. Very rare in grassland-brush in Starr and Zapata cos. in Rio Grande Plains, Feb.-Mar., Aug.; endemic.

4. *Dyssodia acerosa* DC. Compact much-branched erect or spreading suffruticose perennial, 10-25 cm. high; stems and leaves glabrous or minutely pubescent; leaves acerose, mostly opposite but sometimes becoming alternate, 10-18 mm. long, 0.5-2 mm. wide, bearing numerous small swollen glands; heads sessile or borne on very short peduncles; calyculum of about 5 linear-lanceolate bracts; involucre turbinate-cylindric, 5-7 mm. high, 3-4 mm. wide; phyllaries about 13, connate nearly to the tips, conspicuously dotted with glands in the upper half or third; *ray florets* 7 to 8; corollas bright lemon-yellow; tube about 2.5 mm. long; lamina elliptic, 5-6 mm. long, 2-3 mm. wide, retuse or entire; *disk florets* 18 to 25, the light-yellow corollas 3-4 mm. long; pappus of about 20 squamellae, each dissected into 3 to 5 bristles, about equaling the disk corollas; achene 3-3.5 mm. long. Arid calcareous soils w.-cen. and Trans-Pecos Tex., mostly July-Nov.; Tex., Ut. and Nev. to Hgo. and Zac.

5. *Dyssodia tagetoides* T.&G. Annual or short-lived perennial 4-9 dm. high, becoming corymbosely branched above, glabrous; leaves mostly alternate, linear, 4-9 cm. long, 2-6 mm. wide, the margins with coarse subopposite teeth, conspicuously dotted with orange glands; peduncles about 5 cm. long, bearing 4 to 6 linear more or less foliaceous bracts; calyculum conspicuous, of 5 to 8 pinnatisect bracts; involucre turbinate-cylindric, 9-12 cm. high, 5-8 mm. wide; phyllaries 10 to 12, united nearly to the apex but the margins of the outer ones free quite to the base, each with several laterally disposed glands (occasionally the inner ones glandless); *ray florets* 7 to 12; corollas bright-yellow, the tube about 3 mm. long, the linear-elliptic lamina about 13 mm. long and 5 mm. wide; *disk florets* 20 to 40; corollas brownish-yellow and about 4 mm. long; pappus of 10 to 12 unequal lanceolate

scales, 1-2.5 mm. long, each scale with 1 to 3 awns; achenes 3-3.5 mm. long. N.-cen. Tex. s. to Bexar and Fayette cos., June-Aug.; cen. Okla. s. to s.-cen. Tex.

6. *Dyssodia setifolia* (Lag.) Robins. var. *radiata* (Gray) Strother. Diffusely branched white-tomentose perennial, forming dense caespitose clumps 10-15 cm. high; leaves opposite, 6-12 mm. long, stiff, the lower ones 3 to 5 parted near the base, the upper entire, acerose, dotted with glands hidden in the dense indumentum; peduncles very slender, 3-4 cm. long, glabrous or nearly so, bearing 3 to 8 subulate bracts; calyculum of 1 to 3 short subulate bracts; involucre turbinate to narrowly campanulate, 3.5-4 mm. high, nearly glabrous; phyllaries 9 to 15, united about three-fourths their length, each with 2 or 3 swollen glands at the apex; *ray florets* 7 to 10; corollas bright-yellow, the tube about 1 mm. long, the elliptic lamina 2-3 mm. long and 0.8-1.2 mm. wide; *disk florets* 20 to 40; corollas dull-yellow and 2-2.5 mm. long; pappus a mere crown 0.3-0.5 mm. high, the squamellae united into a cup; achenes 1.5-2.2 mm. long. Rocky calcareous soils, w. Tex., mostly July-Sept.; Guadalupe Mts. in N. M. s. into Coah. and N.L.

7. *Dyssodia pentachaeta* (DC.) Robins. PARRALENA. Short-lived perennial 1-2 dm. high, glabrescent to puberulous or villous; leaves opposite, pinnately parted into 5 to 11 linear lobes, rather stiff to the touch; peduncles slender, bracteate, 2-10 cm. long; calyculum (when present) usually of 3 to 6 triangular to subulate bracts; involucre 4-6 mm. high, narrowly turbinate to broadly campanulate; phyllaries 12 to 17, united high up but the margins of the outer ones more or less free, glandular; *ray florets* mostly 8 to 13; corollas yellow to yellow-orange, the tube 1.5-2 mm. long, the lamina 2-8 mm. long and 1-3 mm. wide; *disk florets* 16 to 70; corollas dull-yellow and 2-4 mm. long; pappus of about 10 awned scales or 5 awned scales alternating with 5 muticous ones; achenes slender, 2-3 mm. long, glabrous.

Four varieties are distinguished as follows:

Var. *pentachaeta*. Leaves mostly 9- to 11-parted, all lobes about equal; peduncles 5-10 cm. long; calyculum of 3 to 5 triangular bracts; involucre turbinate, usually glabrous; phyllaries with the outer margins free half their length or less. N.-cen. Tex. w. to the Pecos River, and e. to the Rio Grande Valley and Gulf Coast, Apr.-May and Sept.-Nov.; Tex. s. to Coah., N.L., Tam. and S.L.P.

Var. *Belenidium* (DC.) Strother. Leaves with the distal lobe somewhat longer than the lateral ones; peduncles 2-5 cm. long; heads calyculate; margins of the outer phyllaries free nearly to the base, bearing 3 to 6 pairs of marginal glands; *disk florets* usually more than 50. Trans-Pecos, mostly Apr.-Aug., throughout the year with favorable conditions; Tex., s. Ut., Nev. and Calif. s. to Zac. and S.L.P.

Var. *puberula* (Rydb.) Strother. Leaves mostly 5- to 7-parted; peduncles 5-10 cm. long; calyculum absent or represented by 1 to 3 slender usually glandless bracts; involucre campanulate, puberulous; margins of the outer phyllaries free only a third their length. Cen. and Trans-Pecos Tex., summer-fall; Tex. to S.L.P. and Hgo.

Var. *Hartwegii* (Gray) Strother. Leaves with the distal lobes longer than the lateral ones; involucre nearly cylindrical, usually less than 3.5 mm. wide, glabrescent to puberulous; margins of the outer phyllaries connate almost to the tips; *disk florets* 40 or fewer. Rare in the Trans-Pecos, May and Aug.; Ariz. and N.M. s. to Ags., Zac. and S.L.P.

8. *Dyssodia tenuiloba* (DC.) Robins. Annual or short-lived perennial, erect or spreading, sometimes forming dense clumps 15-50 cm. across, 1-3 dm. high, glabrous to sparsely hirtellous; leaves mostly alternate, 1-3 cm. long, dissected into 7 to 15 linear-filiform lobes or entire (var. *Wrightii*); peduncles slender, 3-8 cm. long, bracteate; calyculum of 3 to 8 subulate-triangular glandular bracts; involucre turbinate-campanulate, 5-7 mm. high, glabrous; phyllaries 12 to 22, completely united up to the short triangular tips, scarious and glandular in the upper half or third; *ray florets* mostly 13 (10 to 21); corollas golden-yellow to yellow-orange, the tube 2-3 mm. long, the lamina 4-10 mm. long and 1.3-3 mm. wide; *disk florets* 50 to 100; corollas yellow-orange, usually darker than the rays, 2.8-4.5 mm. long, sometimes tending to zygomorphy; pappus of 5 to 12 squamellae, variously awned or erose; achene slender, 2-3.2 mm. long, glabrous.

Four varieties are distinguished as follows:

Var. *tenuiloba*. Leaves dissected into 7 to 15 linear lobes; pappus of 10 to 12 similar squamellae 2-3.4 mm. long, each bearing 3 to 5 awns. Cen. Tex. s. to the Rio Grande and e. to the Gulf Coast, Mar.-June, Sept.-Nov.; Tex. and adj. Mex.; adv. in s. Fla., Cuba and Bah. I.; Afr. and Asia.

Var. *Treculii* (Gray) Strother. Leaves as in var. *tenuiloba*; pappus of 5 oblanceolate

or truncate scales alternating with 5 longer squamellae awned from a bifid apex. *D. Treculii* (Gray) Robins. S. Tex. near the Rio Grande, Feb.-Apr. and Nov.-Dec.; Tex., Coah., N.L. and Tam.

Var. *texana* (Cory) Strother. Foliage as in var. *tenuiloba*; pappus of 5 to 10 lanceolate or truncate scales 0.7-1.2 mm. long, either all erose or 1 to 3 with a single delicate awn about equaling the squamellae proper. *D. texana* Cory. W. Tex. (Tom Green Co., etc.), Mar.-June and Oct.; additional populations in e.-cen. Coah. and adj. N.L.

Var. *Wrightii* (Gray) Strother. Leaves mostly spatulate, entire, sometimes with a few lateral lobes; pappus of 10 to 12 squamellae, about 3 mm. long including the 3 to 5 awns, *D. Wrightii* (Gray) Robins. Confined to sandy soils of the Coastal Plain, mostly Feb.-June; endemic.

9. *Dyssodia aurea* (Gray) A. Nels. Erect or spreading annual 1-2 dm. high, diffusely branched from the base; leaves alternate, 15-40 mm. long, pinnately parted into 5 to 13 linear lobes 5-12 mm. long, glabrous, conspicuously gland-dotted; peduncles 1-3 cm. long, 1- to 5-bracteate; calyculum absent or represented by but 1 or 2 short subulate bracts; involucre turbinate to campanulate, 5-6 mm. high; phyllaries 12 to 15, connate about two-thirds to three-fourths their length, margins of the outer ones free nearly to the base, the scarious tips in both series deltoid to attenuate, glandular; ray florets 8 to 12; corollas bright-yellow, the tube about 1.5 mm. long, the ovate lamina 4-6 mm. long and 2-3 mm. wide; disk florets 30 to 45; corollas yellow and about 3 mm. long; pappus of 8 to 10 muticous scales 0.3-0.6 mm. long (var. *aurea*) or of about 20 squamellae each dissected into 3 to 5 awns or bristles [var. *polychaeta* (Gray) M. C. Johnst.]. The two varieties are both found in the Trans-Pecos, frequently in the same populations; var. *aurea* flowers in July-Aug. and extends n. through N.M. into Colo. and Kan.; var. *polychaeta* flowers Aug.-Oct. and extends s. through Chih. into Dgo.

100. CHRYSACTINIA GRAY

A genus of about 4 species, mostly Mexican.

1. *Chrysactinia mexicana* Gray. DAMIANITA. Low spreading taprooted shrub (1-) 2-3 (-4) dm. tall, aromatic, nearly glabrous or minutely hispidulous, densely leafy except for the nearly naked ascending peduncles 3-8 cm. long; first pair of leaves of each branchlet of the season opposite, all the rest alternate, somewhat fleshy, linear, about 1 cm. long, very crowded and dark-green, with oil glands visible under a lens; heads solitary on the peduncles, usually numerous on the shrub, showy; involucre hemispheric, about 4-5 mm. high; phyllaries about 12 in a single series, linear, round-keeled dorsally, green, with oil glands; receptacle convex, naked, pitted; ray flowers usually 12, pistillate, fertile; rays oblong or linear, bright-yellow, 3-toothed terminally; disk flowers about 20 to 25, perfect, fertile, the yellow corollas 5-toothed; achenes narrowly columnar or very slightly fusiform-columnar, 3-4 mm. long, blackish, striate, hispidulous; pappus persistent, of a number of stiffish unequal buffy-white bristles. Local on limestone, Edwards Plateau and Trans-Pecos, Apr.-Sept.; N.M., Tex., Coah., N.L., Tam., Chih. and reputedly also s. to Ver. and Mex. State.

101. NICOLLETIA GRAY

A genus of 3 species of desert herbs; 2 in the California-Baja California area.

1. *Nicolletia Edwardsii* Gray. Annual from slender taproots, 1-3 dm. tall, rather freely bushy-branched, essentially glabrous, strongly aromatic; lowermost leaves opposite but most of them alternate, mostly 2-6 cm. long, deeply pinnately dissected into linear-filiform axis and lobes, beset with reddish oil glands; peduncles 1-3 cm. long; heads numerous; involucre occasionally calyculate with deltoid bracts about 1 mm. long at the extreme base equal, erect, 8 in a double row (4 in, 4 out), green, thin, with a few elongate oil glands; involucre slenderly conical, 11-14 mm. high, 5-9 mm. thick, occasionally calyculate with deltoid bracts about 1 mm. long at the extreme base outside; phyllaries free, oblanceolate, equal, erect, 8 in a double row of 4 each, green, thin, with a few elongate oil glands; receptacle slightly convex, naked; ray flowers about 8, pistillate, fertile; ray pink or lavender-pink or nearly white with red-purple nerves, 8-16 mm. long, 3-toothed terminally; disk flowers about 25 or 30, perfect, fertile, the yellowish corolla 5-toothed; achenes

gently tapered to the base, 5-7 mm. long, antrorsely hispidulous, blackish; pappus double, the internal pappus of 5 lanceolate awn-tipped scales, the external pappus of 5 groups of numerous bristles (these 5 groups alternate with the inner scales and interpretable as 5 deeply dissected units). Rare in Trans-Pecos deserts, late summer-fall; Tex., Coah., Chih., Dgo. and Zac.

The odor, often described by collectors as unpleasant, is like that of *Porophyllum scoparium*.

102. PECTIS L.

Herbs usually not more than 2 dm. tall, branching at least in the upper part and sometimes from the base, with strong-scented (occasionally disagreeable) essential oils mostly residing in reddish oil glands; leaves opposite (at least most of them), gland-dotted, mostly entire, usually with several pairs of marginal bristles near the base or in the lower half; heads usually solitary on nearly naked peduncles but these sometimes so numerous the heads seem crowded, occasionally the heads in rounded subcorymbose aggregations; involucre cylindric to turbinata; phyllaries 3 to 12, free from each other, uniseriate, subequal or equal (calyculate outer phyllaries absent), usually gland-dotted, rounded-carinate at least near the base; receptacle essentially flat, naked; ray flowers few, pistillate, fertile, the yellow rays usually of the same number as the phyllaries; disk flowers few, perfect, fertile, the corollas yellow; style hispidulous, the short branches obtuse, exappendiculate; achenes linear, terete or somewhat angled, pubescent or glabrate; pappus various, of few or many scales, awns or bristles or a mere scaly crown with or without bristles.

An American genus of perhaps 100 species, much in need of a comprehensive revision.

1. Pappus of well-developed scales (2)
 1. Pappus (at least in the ray flowers) at least in part of bristles or slender awns or rarely a mere scaly crown (3)
 - 2(1). Phyllaries 5 1. *P. prostrata*.
 2. Phyllaries 3 2. *P. cylindrica*.
 - 3(1). Pappus bristles at least in the disk flowers 10 or more (4)
 3. Pappus bristles 0 to 6 usually (5)
 - 4(3). Perennial with a caudex or rootstock 3. *P. longipes*.
 4. Taprooted annual 4. *P. papposa*.
 - 5(3). Phyllaries 3 to 5 7. *P. filipes*.
 5. Phyllaries about 8 (6)
 - 6(5). Pappus merely of 2 to 6 bristles without a scaly crown 6. *P. tenella*.
 6. Pappus of a shallow scaly crown with or without 1 or 2 bristles (7)
 - 7(6). Leaves not dilated, merely ciliate basally 4. *P. papposa*.
 7. Leaves dilated and lobed basally 5. *P. angustifolia*.

1. *Pectis prostrata* Cav. Depressed taprooted annual, branched from the base and the branches spreading, 4-20 cm. long; leaves oblance-linear, entire, 1-3 cm. long, 2-4.5 mm. broad, acute, often mucronate, ciliate with 5 to 9 pairs of bristles below; peduncles 0-5 mm. long; involucre oblong, 5-6 mm. high, 2.5-3 mm. thick; phyllaries 5, oblong or linear-oblong, rounded or truncate apically; rays 5; achenes 3-4 mm. long; pappus of the ray flowers of 2 narrowly lanceolate scales and 1 to 3 bristles. Frequent in Trans-Pecos deserts, usually in arroyos and washes, summer-fall; widespread in warmer drier parts of Am. n. to N.M. and Ariz.

2. *Pectis cylindrica* (Fern.) Rydb. Very similar to *P. prostrata* but phyllaries only 3 in number. *P. prostrata* var. *cylindrica* Fern. Known from one station in Starr Co., in extreme s. Tex., probably not a persistent member of our flora, fall; also N.M., Ariz. and Son.

3. *Pectis longipes* Gray. Perennial with cespitose slender caudexes; stems densely leafy below, 1-2 dm. tall, glabrous, ascending; leaves linear, mucronate, thickish, 2-4 cm. long, 1.5-3 mm. broad, with 2 or 3 pairs of bristles near the base; heads solitary at the ends of

the branches or in the upper axils; peduncles 6-14 cm. long, slender; involucre 6-8 mm. high, 8-10 mm. broad; phyllaries 12 to 15, linear, flat above, keeled below, acute, each with a large apical oil gland; rays 12 to 15; disk flowers 40 to 75; achenes 4-5 mm. long; pappus bristles of the disk flowers 20 to 40, very unequal, capillary, the longest 4-6 mm. long; pappus bristles of the ray flowers 2, slender, 3-5 mm. long, rarely with a few additional shorter ones. Infrequent in the Trans-Pecos, summer-fall; Tex., N.M. and Ariz., s. to Son., Dgo. and Chih.

4. *Pectis papposa* Gray. Slender taprooted annual; stems pseudodichotomous with spreading branches, 1-3 dm. tall; leaves slightly fleshy, filiform, 1-6 cm. long, 1-2 mm. broad, with 2 to 5 pairs of bristles near the base; heads in leafy cymose aggregations; peduncles 1-3 cm. long; involucre turbinate, 4-6 mm. high, 3-5 mm. thick; phyllaries 7 to 9, narrowly linear, strongly involute, strongly round-keeled and basally gibbous, obtuse, with 3 to 7 conspicuous glands; rays 7 to 9; disk flowers 10 to 15; achenes 4-5 mm. long; pappus of the disk flowers of 12 to 20 short-plumose bristles about 4 mm. long or rarely reduced to a crown; pappus of the ray flowers a short oblique crown of united scales, 1 or 2 of which are rarely produced into awns. Infrequent in Trans-Pecos desert washes, summer-fall; Tex., N.M., w. to Calif., Baja Calif. and Son.

5. *Pectis angustifolia* Torr. Annual, diffusely and pseudodichotomously branched, 1-2 dm. tall, essentially glabrous; leaves 1-4 cm. long, 1-2 mm. broad, slightly fleshy, with more or less dilated scarious-margined bases which are lobed into 3 to 5 pairs of lanceolate or subulate bristle-tipped lobes; heads in bundles at the ends of the branches; involucre turbinate, 4-5 mm. high, almost as broad; phyllaries 8 to 10, narrowly linear, strongly involute and round-ribbed, gibbous basally, each with a conspicuous apical gland; rays 8 to 10; disk flowers 10 to 15; achenes 4 mm. long; pappus of a crown of 4 or 5 short scales or rarely with 1 or 2 additional short awns in the ray flowers. *P. texana* Cory. Locally abundant in calcareous dry uplands, Edwards Plateau, s. part of Plains Country and Trans-Pecos, summer-fall; Neb., Colo. and Ariz. s. and s.e. to S.L.P.

6. *Pectis tenella* DC. LIMONCILLO. Low annual; stem usually less than 1 dm. tall, pseudodichotomously branched near the base, with ascending or spreading branches; leaves 1-4 cm. long, 1-2 mm. broad, linear, broadened at the base, pectinately divided (especially the lower) into 1 to 4 narrow lobes ending in bristles; heads in bundles, sessile or short-pedunculate; peduncles rarely as much as 5 mm. long; involucre turbinate, 4-5 mm. high, 3-4 mm. thick; phyllaries 7 to 9, linear, prominently round-keeled, strongly involute, basally gibbous, each with a single conspicuous apical gland and sometimes 1 or 2 below; rays 7 to 9; disk flowers 10 to 15; achenes about 3 mm. long; pappus of 2 to 6 unequal minutely scabrous awns. Locally abundant in Rio Grande Plains, spring-fall; Tex., Chih., Coah., N.L. and Tam.

7. *Pectis filipes* Gray. Slender taprooted annual; stems 1-5 dm. tall, diffusely branched, glabrous or scabrous; leaves glabrous or slightly scabrous, 3-6 cm. long, 1-3 mm. broad, with 1 to 5 pairs of basal bristles; heads in leafy cymose arrangements; peduncles 2-8 cm. long; involucre turbinate, 4-6 mm. high, 3-5 mm. broad; phyllaries oblanceolate, obtuse, slightly keeled below, often glandless; rays 5 or 6; disk flowers about 5; achenes 4-5 mm. long; pappus of 1 to 4 awns 2.5-4 mm. long with sometimes a few blunt squamellae at their base. Local in the Trans-Pecos, summer-fall; Tex., N.M., Ariz., Son. and Chih.

103. POROPHYLLUM GUETT.²²²

Aromatic annual or perennial herbs, subshrubs or shrubs, glabrous, often glaucous; leaves alternate, opposite or both, simple; blades from broad and sinuate with slender petioles to filiform, entire and sessile, with translucent oil glands along the margins or sometimes also scattered on the surfaces, occasionally absent; heads discoid, solitary or 2 to several at the ends of branches; involucre cylindrical or campanulate, uniseriate; phyllaries 5 to 9, linear or oblong to ovate or obovate, free or connate only at the base with linear to oblong dorsal translucent oil glands in 2 rows; receptacle small, naked; flowers perfect, fertile; corollas whitish, purplish or yellow, actinomorphic to slightly bilabiate, throat funnelliform and several times shorter than the slender tube to cylindrical and longer than the tube;

²²² Contributed by R. Roy Johnson.

anthers rounded to obscurely sagittate at the base, acute at the apex; style branches elongated, subulate, hirtellous; pappus of numerous free bristles, hispidulous or scabrescent; achenes slender, linear to long-triangular, striate, often tapering at the apex, puberulent, usually hispidulous.

An American genus of approximately 30 species occurring from southern Nevada to central South America; of little economic value but some eaten green in Mexico, used for medicinal purposes by natives of several countries and others (such as *P. gracile* and *P. Greggii*) browsed by cattle and wildlife.

1. Annual; leaves petiolate, thin, elliptical or oblong to ovate or obovate, occasionally widely lanceolate or oblanceolate 4. *P. ruderale* subsp.
macrocephalum.
1. Perennials; leaves sessile or subsessile, filiform to lanceolate; shrubs or subshrubs (2)
- 2(1). Phyllaries 7 to 9; erect shrub or subshrub; corolla yellow
..... 1. *P. scoparium*.
2. Phyllaries 5; plant or corolla otherwise (3)
- 3(2). Plant flexuous, weak; corolla yellow 2. *P. Greggii*.
3. Shrub or subshrub; corolla white to purplish 3. *P. gracile*.

1. *Porophyllum scoparium* Gray. Perennial, suffruticose, odoriferous, glabrous; stems much-branched, 2-6 dm. high or more, erect, green, becoming brownish with age, terete, scarcely striate; leaves sessile, opposite in seedlings, mostly alternate in mature plants, sessile, filiform, somewhat fleshy, to 4 cm. long, with numerous small dark glands, apex acute to acuminate; heads solitary at the ends of branches; peduncles 1-2 cm. long or shorter, greatly enlarged at base of involucre; phyllaries 7 to 9, green to yellowish, 6-9.3 mm. long, 1.5-2.3 mm. wide, linear to oblanceolate, usually with 2 rows of long linear glands on the rounded back, apices acute; flowers more than 45; corolla 5.3-8 mm. long, yellow, the tube shorter than the cylindrical throat; pappus 5.4-7.5 mm. long, yellowish, bristles hispidulous; achenes 3.7-5.5 mm. long, hispidulous. Locally abundant in desert arroyos and on limestone slopes, often forming almost pure stands, in the Trans-Pecos from El Paso and Culberson cos., s. through Brewster and Val Verde cos., throughout year, depending on rain and temperature; Tex., N.M., Chih., Coah. and N.L.

2. *Porophyllum Greggii* Gray. Perennial glabrous herb; stems green, 15-30 cm. high, flexuous, weak, semi-erect, terete, striate; leaves alternate, sessile, to 6 cm. long, filiform with many small glands; heads solitary at the ends of branches; peduncles 2-4 cm. long; phyllaries 5, pale-green, scarious-margined, 8.9-12 mm. long, 3.4-5.5 mm. wide, elliptical to obovate-oblong, with 2 rows of linear or oblong yellowish glands, apex rounded; flowers more than 50; corolla yellow, 7.6-9.8 mm. long, the tube slightly shorter than the cylindrical throat; pappus 8-9 mm. long, straw-colored, bristles hispidulous; achenes 6.8-8 mm. long, densely puberulous with tawny hairs. Rare in mts. and desert grasslands in (?) Trans-Pecos, May-Oct.; endemic.

3. *Porophyllum gracile* Benth. Perennial, suffruticose, glabrous, often glaucous; stems little- to much-branched, 2-6 dm. high, suberect to erect, green to purplish, becoming brownish to purplish with age, terete, striate; leaves opposite in seedlings, mostly alternate in mature plants, sessile, filiform to linear, to 5 mm. wide, apex acute to obtuse; heads solitary at the ends of branches; peduncles 4-25 mm. long, moderately enlarged at base of involucre; phyllaries 5, green to purple, 9.3-14.6 mm. long, 1.4-3.5 mm. wide, linear to oblong, apex obtuse or seldom acute, rounded on the back with round to linear glands in 2 rows or rarely scattered; flowers 12 to 30, rarely as few as 5; corolla 6-9.1 mm. long, white to pale-purple with dark-purple streaks, the tube shorter to longer than the funnel-form throat; pappus 5.3-8.6 mm. long, white to purplish, bristles hispidulous; achenes 5.7-10.3 mm. long, hispidulous. Rare in desert grassland, Franklin Mts., El Paso Co. in the Trans-Pecos, throughout year, depending on rain and temperature; s. Nev. and s. Calif., s. through Baja Calif., Son. and Tex.

4. *Porophyllum ruderale* (Jacq.) Cass. subsp. *macrocephalum* (DC.) R. R. Johnson. Annual, erect, glabrous, somewhat glaucous; stems branching above, 1.5-10 dm. high, green to purplish, terete, striate; leaves opposite or alternate; blades 1-3.5 cm. long, to 25 mm. wide, thin, broadly ovate to obovate, rarely widely lanceolate or oblanceolate,

sinuate with one gland in each sinus and one at the apex, surfaces of the blades with or without glands, apex rounded, base usually rounded or sometimes attenuate; petioles 0.5-2 cm. long; heads solitary at the ends of branches; peduncles erect, clavate, 15-64 mm. long; phyllaries 5, green, purple-tinged, 17-23 mm. long, 2.5-3.7 mm. wide, linear with 2 rows of linear glands, apex obtuse or acute to rarely acuminate; flowers 30 or more; corolla 9.2-12.4 mm. long, puberulent, purple to olive-green, the slender tube several times longer than the funnellform throat; pappus 6.7-9.7 mm. long, straw-colored to brown, bristles scabrescent; achenes 9.5-12.4 mm. long, hispidulous. Rare in higher parts of Chisos Mts. in the Trans-Pecos, Aug.-Oct.; s. Ariz., N.M. and Tex. s. to cen. S. A.

104. TAGETES L. MARIGOLD

A large genus of the Mexican and Central American highlands, with a few species in the Andes.

1. *Tagetes micrantha* Cav. LICORICE-MARIGOLD. Delicate taprooted aromatic annual, usually only 1-2 dm. tall; leaves opposite, mostly linear to linear-filiform and 1-3 cm. long, beset with numerous microscopic oil glands; heads terminal on the leafy branches, not peduncled; involucre fluted, cylindric, 9-11 mm. long, about 1.5 mm. broad, of 5 linear phyllaries united marginally for essentially their full length and beset with microscopic oil glands; receptacle essentially flat, quite naked; flowers usually 7; *ray flowers* solitary, pistillate, fertile; ray barely protruding from the involucre, yellowish-white, oblong, 2- or 3-toothed apically; *disk flowers* usually 6, perfect, fertile, with included yellowish-white 5-toothed corolla; achene elongate-linear, about 7 mm. long, black, fine-striate or costellate, slightly flattened; pappus of 2 awns over the shoulders of the achene and on each broader side between the awns a scale, one shorter than the other, all persistent. Local in high moist canyons, Davis and Chisos mts. in the Trans-Pecos, late summer; Ariz., N.M. and Tex., s. to Qro.

105. CLAPPIA GRAY

A monotypic genus.

1. *Clappia suaedaefolia* Gray. Subshrub from taproots, only slightly woody below, much-branched, the upper third or fourth of the height being nearly naked fistulose peduncles; leaves opposite on the lowest part of the stem but mostly alternate, crowded, confined to the lower two-thirds or three-fourths of the plant, fleshy and almost terete, linear, rarely with a lateral lobe or trifid in the distal half, often having lines of black (glandular?) dots visible under a lens, grayish-green when fresh; heads solitary, on the ends of the enlarged peduncles; involucre hemispheric, about 8-10 mm. high; phyllaries in about 4 or 5 series, strongly graduated, linear-oblong, definitely rounded apically, rather firm-membranous with an exceedingly narrow scarious margin, often with parallel dark or subglandular longitudinal striae; receptacle convex, decidedly fimbriate-setose around the sockets but not chaffy; *ray flowers* about 12, pistillate, fertile; rays yellow, linear, terminally 2- or 3-toothed; *disk flowers* numerous, perfect, fertile, the corolla yellow and 5-toothed; style-branches hispidulous, with ovate tips; achenes about 3.5 mm. long, columnar or slightly tapered to the base, black, about 10-ribbed, the ribs hispidulous; pappus of 15 to 25 unequal coarse stiff slightly tawny dorsiventrally flattened persistent bristles about as long as the achene. Locally abundant in subsaline poorly drained clay flats, Rio Grande Plains, spring-fall, less commonly summer and winter; also N. L. and Tam.

106. PSEUDOCLAPPIA RYDB.

The genus, closely related to and probably congeneric with *Clappia*, is monotypic.

1. *Pseudoclappia arenaria* Rydb. Weak shrub or strong subshrub from woody taproots, the branches very numerous, the whole plant usually 2-4 dm. tall; leaves opposite at the very lowest nodes of the branches but mostly alternate, crowded, fleshy, nearly

terete, 1-2 cm. long, essentially glabrous; leaves on the upper 2-3 cm. reduced to setaceous bracts on the slightly swollen pedunculiform branch endings; heads solitary on the erect peduncles; involucre broadly obconic, 8-10 mm. high; phyllaries linear or slightly oblanceolate, slightly fleshy, appressed, in about 3 crude series of diverse lengths but not well-organized, glabrous; receptacle convex, not chaffy but bristly around the sockets; *ray flowers* few, 2 to 4 per head, pistillate, fertile; rays linear, 5-9 mm. long, dirty-yellow, terminally 2- or 3-toothed; *disk flowers* 20 to 30, perfect, fertile, the corollas dirty-yellow and 5-toothed; achenes about 3 mm. long, slightly tapering to the base, dark-brown to black, irregularly 10-ribbed with less prominent intermediate ribs, some of the larger ribs antrorsely hispid; pappus persistent, of numerous unequal dorsiventrally flattened stramineous bristles mostly much longer than the achene. Restricted to gypseous deserts near Pecos, Reeves Co. in the Trans-Pecos, summer-fall, following rains; also N.M.

107. SARTWELLIA GRAY

A genus of 2 species of Mexico, Texas and New Mexico; one occurs in the United States.

1. *Sartwellia Flaveriae* Gray. Taprooted herb, apparently perennial but flowering first year, essentially glabrous or slightly puberulent, 1-3 dm. tall, with several ascending stems from the base and these subsimple except in the uppermost parts; leaves opposite, essentially sessile, linear to linear-filiform, (1-) 2-6 cm. long, 1-2 mm. broad; heads in dense subcorymbiform aggregations at the top, about 3 mm. high; involucre campanulate-cylindric, about 2 mm. high and wide; phyllaries about 5, subequal, oval or elliptic, often yellowish; receptacle flat, naked; *ray flowers* 3 to 5, pistillate, fertile; rays ovate, about 1.5 mm. long, yellow; *disk flowers* 6 to 15, perfect, fertile; corollas 2-2.5 mm. long, yellow, 5-toothed terminally; achenes columnar, black, 10-ribbed, about 2 mm. long; pappus stramineous, of 5 erose broad scales and 5 narrow bristlelike ones about as long as the broad ones or a little longer, all 10 united for a third to five-sixths the length (when united high up, appearing as a mere cup). *S. puberula* Rydb. Infrequent in gypseous-saline deserts in the Trans-Pecos and w. extreme of Edwards Plateau, late summer-fall; Coah., Tex. and N.M.

108. FLAVERIA Juss.

Glabrous or puberulent herbs, usually annual; leaves opposite, narrow, entire to dentate, sessile, often more or less connate; heads numerous, sessile or short-pedunculate, in dense glomerules or cymelike clusters; involucre usually narrowly campanulate to nearly cylindric; phyllaries 1 to 8 subequal and often 1 or 2 smaller outer ones; receptacle small, naked or setose; *ray flowers* solitary, pistillate and fertile or absent; rays entire, emarginate or 3-dentate terminally, yellow, inconspicuous; *disk flowers* 1 to 15, perfect, fertile; corolla yellow, 5-toothed terminally; style 2-parted, reflexed, obtuse; achenes oblong, somewhat compressed, 10-ribbed; pappus absent or in *F. chloraefolia* present and of 2 to 4 distinct irregular scales.

A genus of about 20 species in the warmer parts of America, with no known economic importance.

- 1. Pappus of 2 to 4 scales; leaves connate-perfoliate, broad; throat of the disk corollas elongate, funnellform4. *F. chloraefolia*.
- 1. Pappus absent; leaves barely connate (2)
- 2(1). Receptacle setose; phyllaries 1 or 2; heads 1-flowered; throat of the disk corollas campanulate1. *F. trinervia*.
- 2. Receptacle naked; phyllaries more than 2; flowers 2 to 20 per head; throat of disk corollas funnellform (3)
- 3(2). Phyllaries 3, rarely 42. *F. campestris*.
- 3. Phyllaries 5 to 73. *F. oppositifolia*.

1. *Flaveria trinervia* (Spreng.) Mohr. Taprooted annual 1-5 (-12) dm. tall, glabrate, widely branched; leaves slightly connate, lanceolate, 3-nerved, serrate, 3-9 cm. long, the

lower short-petioled; heads so closely crowded that each aggregation of them appears like a single head 20-25 mm. broad and each such aggregation closely subtended by 3 pairs of leaves simulating phyllaries; heads small, usually 1-flowered; flowers either subligulate and pistillate or regular and perfect; phyllaries concave, 1 or 2 (if 2, the outer shorter); receptacle setose; achene about 2 mm. long; pappus absent. Infrequent in low waste places in the Trans-Pecos, late summer-fall; S.A. n. to s. U.S.

2. *Flaveria campestris* J. R. Johnst. Taprooted annual, the erect stems glabrous or pubescent only at the nodes; leaves linear or linear-lanceolate, serrulate, 3-ribbed, narrowed basally, slightly connate, 25-70 mm. long, 10-25 mm. broad; heads 4- or 5-flowered; phyllaries 3, nearly equal, 5 mm. long, the outer shorter ones 2 and unequal, 1-3 mm. long, linear-lanceolate; receptacle naked; ray oval, reflexed, 2.5 mm. long; disk flowers 3 or 4; corollas 3 mm. long; achene 2.5-3 mm. long, that of the ray slightly larger than the rest; pappus absent. Frequent in low waste ground or disturbed ground, Plains Country, late summer-fall; Mo. to Colo., N.M. and Tex.

3. *Flaveria oppositifolia* (DC.) Rydb. Taprooted annual 3-10 dm. tall, simple below; leaves glabrous, broadest at the sessile base, nearly linear, entire or rarely spinulose-denticulate; heads of 10 to 15 flowers in ample rather open cymose clusters; phyllaries 5 to 7, oblong, 4 mm. long; receptacle naked; ray flower absent; disk corolla 3 mm. long, glabrous; achenes 1.5 mm. long; pappus absent. Locally abundant in poorly drained coastal areas, Rio Grande Plains and s. part of s.e. Tex., late summer-fall; Tex., Tam., N.L., Coah., Ver. and perhaps elsewhere in Mex.

4. *Flaveria chloraefolia* Gray. Herb to 2 m. tall, the herbage glaucous; leaves ovate-oblong to lanceolate, 25-100 mm. long, 10-35 mm. broad, glabrous, connate-perfoliate; heads in open cymose clusters, 11- to 13-flowered; phyllaries 5, oblong, 6-7 mm. long, the outer calyculate ones 2, lanceolate; receptacle naked; ray flower absent; disk corolla 6 mm. long, glabrous; achenes 3 mm. long; pappus of 2 to 4 hyaline unequal incurved scales, the larger about 0.5 mm. long. Infrequent to rare in mud along creeks in calcareous areas in the Trans-Pecos, rare to w. part of Edwards Plateau, late summer-fall; Tex. to Dgo. and N.L.

109. PERICOME GRAY

A monotypic genus.

1. *Pericome caudata* Gray. Rather tall widely branching perennial herb, strong-scented, minutely puberulent; leaves opposite, long-petioled, green, membranous, minutely somewhat resin-dotted; blades triangular-hastate, 5-15 cm. long, marginally sparingly crenate-dentate or entire, caudately long-acuminate as also to a lesser degree are the basal angles; heads numerous in roughly corymbiform aggregations, each about 1 cm. high; involucre hemispheric, about 5-6 mm. high; phyllaries in a single series, linear, 16 to 20 in number, each with a rounded keel (which is actually composed of 3 very close nerves) and scarious margins; receptacle flat, naked; *ray flowers* absent; *disk flowers* numerous, perfect, fertile; corolla yellow, the 5-lobed limb abruptly much wider than the short glandular tube; achenes flattened, black, about 5 mm. long, shiny, nearly linear or gradually tapered below, the 2 sharp thin edges with a conspicuous antrorse whitish ciliate fringe; pappus of a few fimbriate scales. Infrequent in moist canyons of the higher Trans-Pecos mts., late Aug.-Oct.; Colo., N.M., Ariz., Tex., Nev. and Chih.

110. PERITYLE BENTH.²²³

ROCK DAISY

Annuals or herbaceous to suffruticose perennials from fleshy or woody bases, most species growing from crevices in bare rock exposures; leaves opposite or alternate, glabrous to tomentose-canescens, notably viscid and bitter-tasting, widely variable in shape and size, from finely dissected to merely lobed, serrate or entire; heads solitary to densely aggregated and cymose; peduncles short so that heads are partially obscured by leaves or long and heads borne well-above leaves; involucre subcylindric, narrowly to broadly campanulate or hemispheric; phyllaries of 2 equal or subequal series, the inner ones

²²³ Contributed by A. Michael Powell.

somewhat membranous or with broader scarious margins than the outer; receptacles slightly convex but typically flattened and alveolate; *rays* when present white or yellow, pistillate and fertile; *disk flowers* 4-lobed, white or yellow, infrequently purple-tinged; achenes black, the peripheral ones typically partially clasped by the phyllaries and incurved, oblong to narrowly obconical, typically distinctly laterally flattened with conspicuous or inconspicuous callous margins, the margins glabrous, minutely pubescent or densely ciliate, in some species rounded or angled on one or both surfaces, the surfaces glabrous to minutely pubescent; pappus absent or of 1, 2 or numerous bristles, or of a conspicuous to inconspicuous crown of laciniate hyaline squamellae with (rarely zero or) 1 to 2 naked or short-ciliate bristles. *Closia* Remy; *Laphamia* Gray; *Monothrix* Torr.; *Galinsogeopsis* Sch. Bip.; *Nesothamnus* Rydb.; *Leptopharynx* Rydb.; *Pappothrix* Rydb.

At least 25 species, native to southwestern United States and Mexico.

1. Pappus of a crown of laciniate hyaline squamellae and 1 or 2 (rarely no) bristles; achene margins densely ciliate (2)
1. Pappus absent, a callous crown or 1, 2 or numerous (10 to 30) bristles; achene margins glabrous or merely short-pubescent (6)
- 2(1). Rays yellow (3)
2. Rays white or absent (4)
- 3(2). Leaves palmately divided into 3 lobes or subcruciform 1. *P. Vaseyi*.
3. Leaves not deeply 3-lobed, cordate to subreniform 2. *P. Parryi*.
- 4(2). Rays white; disks yellow; pappus of 2 delicate bristles 0.7-1 mm. long; achenes 1.5-2 mm. long 5. *P. microglossa*.
4. Rays absent or both rays and disks white; pappus of 1 to 12 bristles 3.5-5.5 mm. long; achenes 2.5-3.2 mm. long (5)
- 5(4). Rays absent; disks yellow; pappus bristles 1 (rarely 2) 4. *P. aglossa*.
5. Rays and disks white; pappus bristles (1 to) 8 to 12 ... 3. *P. Parryi* (hybrid)
- 6(1). Pappus bristles 1 or 2 or none (7)
6. Pappus bristles 10 to 30 (14)
- 7(6). Leaves extremely dissected 6. *P. dissecta*.
7. Leaves otherwise (8)
- 8(7). Inflorescence of loose or dense corymbs; plants (8-) 15-45 (-60) cm. high (9)
8. Inflorescence of solitary heads or small clusters; plants 2 10 (-12) cm. high (11)
- 9(8). Heads radiate; rays and disks yellow (10)
9. Heads discoid; disks yellow 8. *P. angustifolia*.
- 10(9). Pappus of a single bristle 7a. *P. Lindheimeri* var. *Lindheimeri*.
10. Pappus absent 7b. *P. Lindheimeri* var. *halimifolia*.
- 11(8). Pappus absent 9. *P. Warnockii*.
11. Pappus of 2 bristles (12)
- 12(11). Plants 2-7 cm. high; leaves opposite below, rarely alternate above, essentially glabrous, the margins entire, subsessile to short-petiolate (1-2 mm. long) 10a. *P. bisetosa* var. *bisetosa*.
12. Plants 4-12 cm. high; leaves opposite below, alternate above or distinctly alternate, scabrous-hispidulous or glabrous, the margins serrate or serrate-sinuate; petioles 20-70 mm. long (13)
- 13(12). Leaves opposite below, alternate above, ovate to suborbicular, serrate, scabrous-hispidulous; petioles 2-4 mm. long 10b. *P. bisetosa* var. *scalaris*.
13. Leaves distinctly alternate, ovate, serrate or serrate-sinuate, glabrous; petioles 3-7 mm. long 10c. *P. bisetosa* var. *appressa*.

- 14(6). Disk florets 5 (rarely 6 or 7); disk corollas yellow . . 11. *P. quinqueflora*.
 14. Disk florets more than 5 (8 to 16); disk corollas white or yellow (15)
 15(14). Pubescence tomentose-canescens; disk corollas white12. *P. cinerea*.
 15. Pubescence otherwise; disk corollas yellow or white (16)
 16(15). Pappus reduced to 2 to 6 main bristles, rarely with 10 to 12 vestigial ones;
 leaves strongly veined; plants 3-10 cm. high; disk corollas white13. *P. vitreomontana*.
 16. Pappus always of 25 to 30 unequal bristles; leaves not so strongly veined; plants
 6-20 cm. high; disk corollas yellow or white (17)
 17(16). Disk corollas yellow14a. *P. rupestris* var.
rupestris.
 17. Disk corollas white14b. *P. rupestris* var.
albiflora.

1. Perityle Vaseyi Coult. Large herbaceous to suffruticose perennial with fleshy tap-roots; stems erect to somewhat spreading; leaves opposite or alternate, 25-65 mm. long, 2-5 cm. wide, typically palmately divided into 3 lobes or subcruciform, with the lobes further dissected, cleft or parted, less often the leaves are strongly 3-lobed, cleft or parted; petioles 14-35 mm. long; inflorescence of solitary heads or small subcymose clusters; heads borne on long peduncles 1-7 (-13) cm. long, radiate, campanulate (broadly so) or hemispheric, 8-15 mm. high; phyllaries numerous, oblanceolate to linear-lanceolate, typically acute at the apex, rarely somewhat attenuated; ray flowers numerous (about 20), the rays yellow; disk flowers numerous (about 200); disk corollas yellow, 3.2-5 (-6) mm. long; achenes 3.2-3.7 (-4.3) mm. long, 0.5-1 mm. wide, linear-elliptic to obconical-elliptic, tapering to the base, rounded at the apex, with thin to conspicuous callous margins, the margins short-pubescent to dense-pilose, 0.1-0.9 mm. long; pappus of a crown of squamellae 0.2-0.9 mm. long and 1 (rarely 0 or 2) bristle, (1.2-1.8) 2.8-3 (-5) mm. long, the cilia flaring toward the tip or becoming lateral or retrorse in some. *Leptopharynx trisecta* Rydb. Common in soil, s. Brewster, Presidio and Terrell cos., spring-fall; also Chih. and Coah.

Notable for tremendous variation in leaf shape and pappus bristle structure throughout its range. Possibly intergrades or hybridizes with *P. Parryi*.

2. Perityle Parryi Gray. Low suffruticose perennial from a woody base in crevices of rocks or tall spreading semiherbaceous to suffruticose perennial in soil; leaves opposite or alternate, 30-95 mm. long, 2-6 cm. wide, cordate to subreniform, the margins irregularly lobed, dentate or lacinate but typically shallowly to deeply 3-lobed; petioles 18-40 mm. long; heads same as or slightly smaller than in *P. Vaseyi*; other floral features about the same as *P. Vaseyi* except achenes are slightly smaller (2.5-3.8 mm. long). *Laphamia Parryi* (Gray) Hemsl., *Leptopharynx Parryi* (Gray) Rydb. Common in crevices of limestone and igneous bluffs and rocks, or soil, Brewster Co. and s.w. Presidio Co., spring-fall; also Chih. and Coah.

Notable for variation in leaf shape, approaching the degree of lobing characteristic of *P. Vaseyi*, and possibly intergrading or hybridizing with the latter taxon.

3. Perityle Parryi (hybrid). Low perennial from a woody base; leaves opposite or alternate, ovate-deltoid, shallowly 3-lobed or lacinate-dentate; heads radiate, campanulate, 7-10 mm. high, 4-8 mm. wide, on short peduncles; ligules white; disk corollas cream-white, 4.5-5.5 mm. long; achenes 3-3.2 (-3.8) mm. long, about 0.7 mm. wide, narrowly obconical with thin callous margins, the margins not strongly ciliate but merely short-pubescent to sparsely short-pilose; pappus of 1 or numerous (8 to 12) bristles of unequal length, 3.5-4 mm. long, if one main bristle then numerous vestigial bristles resembling hyaline squamellae or actual squamellae present, or squamellae may be absent and pappus only of numerous bristles from 1-3.5 mm. long, the shortest very delicate. Extremely rare in crevices of igneous rock bluffs, lower Window Trail, Chisos Mts. Basin, Brewster Co.; endemic.

Derived from hybridization between *P. Parryi* and *P. rupestris* var. *albiflora*.

4. Perityle aglossa Gray. Suffruticose perennial 15-40 cm. high; leaves opposite or alternate, 22-34 mm. long, 6-22 mm. wide, ovate to subcordate or subdeltoid, irregularly

lobed to lacinate or serrate-dentate, often shallowly 3-lobed; petioles 8-23 mm. long; inflorescence same as *P. Vaseyi* and *P. Parryi* but peduncles typically shorter (10-25 mm. long); heads discoid, campanulate, 4-7 mm. wide, 8-11 mm. high; phyllaries linear-lanceolate, attenuated at the apex; disk corollas yellow, typically pinkish- or purplish-tinged, 4.2-6 mm. long; achenes (2-) 2.5-3.2 mm. long, oblong-obconical and truncate at the base, the margins distinctly calloused and ciliate; pappus a crown of squamellae and a single bristle (rarely 2), 4.5-5.5 mm. long. *Laphamia aglossa* (Gray) Hemsl., *Leptopharynx aglossa* (Gray) Rydb. Infrequent in crevices of limestone bluffs, s. Brewster Co., late summer-fall; also Chih.

5. *Perityle microglossa* Benth. MAZANILLA BRONCA. Herbaceous annual, 10-55 cm. high; leaves opposite below, alternate above, 22-56 mm. long, 12-31 mm. wide, 3-lobed or -cleft to subhastate, infrequently pinnately lobed; petioles 5-16 mm. long; heads radiate, 4-7 mm. wide, 4-5 mm. high; rays white; disk corollas yellow, 1.6-2 (-2.2) mm. long; achenes 1.5-2 mm. long, obconical, with conspicuous whitish callous margins, the margins hirsute-ciliate; pappus of a short crown of squamellae and 2 (rarely 1) delicate unequal bristles, 0.7-1 mm. long. Incl. var. *effusa* Gray, *Perityle acmella* Harv. & Gray, *P. effusa* (Gray) Rose, *P. urticifolia* Rydb. Uncommon in Cameron and Willacy cos. in extreme s. Tex., in sandy loam soil, perhaps introd., spring-fall; typical of s. Ariz., w. coast of Mex. to Nic. and s. tip of Baja Calif.

6. *Perityle dissecta* (Torr.) Gray. Perennial from a woody base, 7-18 cm. high; leaves opposite or alternate, usually alternate above, 9-20 mm. long, 5-10 mm. wide, hirsute-pilose, irregularly dissected, once- to twice- or thrice-pinnately divided, less often pinnately parted or cleft, the lobes irregular and rounded; petioles 4-8 mm. long; inflorescence of solitary heads or small clusters, borne on rather stout peduncles 2-8 (-17) mm. long; heads discoid, campanulate, 8-10 mm. high, 4-5 mm. wide, typically partly obscured by leaves; phyllaries 11-13 mm. long, 0.7-0.9 mm. wide, linear-lanceolate, attenuate at the apex; disk corollas yellow, (4.5-) 5-5.5 mm. long; achenes (2.8-) 3-3.8 mm. long, slender-oblong to narrowly obconical, with rather conspicuous callous margins, short-pubescent on the margins and both surfaces; pappus 1 (rarely 0 or 2) rather stout bristle(s) 2.2-2.5 mm. long and a vestigial crown of squamellae. *Laphamia dissecta* Torr., *Leptopharynx dissecta* (Torr.) Rydb. Rare in crevices of limestone bluffs near Shafter in Presidio Co., and Santa Elena Canyon, Brewster Co., spring-fall; also Chih.

Has been confused with *P. Lemmonii* (Gray) Macbr. of Ariz. because of similarities in habit, but both are distinct species. Related to *P. Castillonii* I. M. Johnst. of Coah. and Chih.

7a. *Perityle Lindheimeri* (Gray) Shinnery var. *Lindheimeri*. Perennial from a woody base, (10-) 18-45 (-60) cm. high; leaves opposite below, alternate above, 2-5 cm. long, 10-35 mm. wide, punctate, essentially glabrous, broadly ovate-lanceolate, with 3 to 5 serrate lobes on anterior margins; petioles 4-10 mm. long; inflorescence cymose with numerous heads loosely to densely aggregated at the tips of slender often dichotomously branched peduncles; heads radiate, narrowly campanulate, 6-7 mm. high, 4-5 mm. wide; ray flowers 3 to 5; rays yellow, 2.5-3 mm. long, 1.5-2 mm. wide, oblong to suborbicular; disk corollas yellow, 3-3.5 mm. long; achenes 2-2.8 mm. long, linear-oblong to narrowly obconical, with thin callous-margins, minutely pubescent on margins and surfaces; pappus of a single bristle, 0.5-1.5 mm. long, arising at the apex of one margin, often with a vestigial nub at the other, and a callous crown with minute squamellae. *Laphamia Lindheimeri* Gray, *L. rotundata* Rydb., *Perityle rotundata* (Rydb.) Shinnery. Common in crevices of limestone rock exposures, Edwards Plateau, spring-fall; endemic.

7b. *Perityle Lindheimeri* var. *halimifolia* (Gray) Powell. Pappus bristle absent except in a few individuals. Restricted and isolated in distribution, rare on Cretaceous limestone exposures s. of Loma Alta in s.w. Val Verde Co., Apr.-May and early June; endemic.

After further study it may prove necessary to submerge var. *halimifolia* completely with *P. Lindheimeri*. As it stands now this essentially nonpappous population serves to link the related species, *P. angustifolia*.

8. *Perityle angustifolia* (Gray) Shinnery. Perennial from a woody base, 8-25 cm. high; leaves opposite below, alternate above, 15-30 mm. long, (1.5-) 3-10 mm. wide, punctate, essentially glabrous, often coriaceous, linear to oblanceolate or lanceolate to broadly so, typically 3- to 5-lobed or -cleft, less often subentire or lacinate, the lobes acute to attenuate, subsessile to short-petiolate; petioles when present 4-10 mm. long;

inflorescence subcymose, typically with several heads loosely aggregated at tips of dichotomously branched peduncles; heads discoid, campanulate to narrowly so, 5.5-7 mm. high, 3.5-5 (-6) mm. wide; disk corollas yellow, 2.2-2.8 (-4.5) mm. long; achenes 2-2.5 (-2.8) mm. long, narrowly obconical, with thin callous-margins, minutely pubescent on margins and surfaces; pappus absent. *Laphamia angustifolia* Gray, *L. angustifolia* var. *laciniata* Torr., *L. laciniata* (Torr.) Rydb. Common in crevices of Cretaceous limestone exposures, w. Val Verde, Crockett, Terrell and Pecos cos., spring-fall; endemic.

Easily distinguished from *P. Lindheimeri* by narrower leaves, discoid heads and non-pappous achenes.

9. *Perityle Warnockii* Powell. Small perennial, 2-10 cm. high; leaves opposite below, alternate above, 8-15 mm. long, 4-8 (-10) mm. wide, scabrous-pubescent, suborbicular to ovate-lanceolate, the margins conspicuously serrate; petioles 2-5 (-8) mm. long; inflorescence of solitary heads on short peduncles; heads discoid, campanulate, 0.7-1 cm. high, 4-7 mm. wide, sometimes partly obscured by subtending leaves; disk corollas bright-white, 5-6 (-6.5) mm. long, the tube glandular-pilose, the throat subfunneliform, sparsely glandular-pilose, the lobes attenuate-acute, (1-) 1.2-1.6 mm. long; achenes 2.2-2.5 (-2.8) mm. long, oblong to oblong-obconical, truncate at the base and apex, with conspicuous callous-margins, the margins glabrous, minutely pubescent on the surfaces; pappus absent. Known only from a single population, about 1 mile e. of the Pecos River in n.w. corner of Val Verde Co., fall; endemic.

Related to *P. bisetosa* but differs in several important characters.

10a. *Perityle bisetosa* (Gray) Shinnars var. *bisetosa*. Small perennial 2-7 cm. high; leaves opposite or alternate, 5-10 mm. long, 2-6 mm. wide, essentially glabrous, glandular-punctate, coriaceous, ovate to ovate-lanceolate or lanceolate, the margins entire to subserrate, subsessile or short-petiolate; petioles when present 1-2 mm. long; heads discoid, solitary, narrowly campanulate, 7-8 (-10) mm. high, 3.5-7 mm. wide, subtended and mostly obscured by leaves; disk corollas white, (4-) 4.2-5.5 mm. long, the throat tubular to subfunneliform; achenes 1.8-2.2 (-3) mm. long, narrowly obconical, with conspicuous callous-margins, the margins glabrous, minutely pubescent on the surfaces; pappus of 2 bristles 1.5-2.3 mm. long, the bristles rather flattened, linear; chromosome number: $n = 17$. *Laphamia bisetosa* Gray. Rare, growing in pockets and crevices of limestone rock, s.e. Brewster Co., July-Oct.; endemic.

10b. *Perityle bisetosa* var. *scalaris* Powell. Perennial, in small erect or pendulous clumps, 6-12 cm. high; leaves opposite below, alternate above, 8-12 mm. long, 5-8 mm. wide, scabrous-hispidulous, ovate or broadly so to suborbicular, with one or two shallow lobes per margin or serrate, lobes and serrations acute; petioles 2-4 mm. long; floral features mostly slightly larger than in var. *bisetosa* but otherwise similar except pappus in some heads composed of 3(4) bristles equal in length or the 3rd and 4th shorter; chromosome number of several individuals determined to be $n =$ about 102. Single population growing on lower limestone cliffs of Stairstep Mt. in Black Gap Game Refuge, Brewster Co., Aug.-Oct.; endemic.

10c. *Perityle bisetosa* var. *appressa* Powell. Perennial growing in dense leafy clumps closely appressed to rocks, 4-8 cm. high, 12-20 cm. broad; leaves distinctly alternate (rarely opposite below), 10-15 mm. long, 4-8 mm. wide, glabrous, ovate, serrate or serrate-sinuate to shallow-lobed, typically with 2 or 3 serrations or lobes per margin (less often 4), the serrations obtuse to subacute; petioles 3-7 mm. long; chromosome number: $n = 17$. Single population growing on the e. face of the limestone caprock of a small mt. peak on the n. rim of San Francisco Creek Canyon, Brewster Co., May-June (Aug.-Sept.); endemic.

11. *Perityle quinqueflora* (Steyerm.) Shinnars. Perennial from a woody base, 7-30 cm. high; leaves opposite, often becoming alternate above, 15-25 (-38) mm. long, 8-20 (-35) mm. wide, glabrous to puberulent, fleshy-succulent or coriaceous, typically reniform to subreniform, sometimes short-cordate, the margins obtuse-dentate or shallow-lobed; petioles 5-8 (-12) mm. long; inflorescence typically of several to many heads in a cluster, borne on rather slender peduncles 2-10 (-15) mm. long; heads discoid or cylindrical to very narrowly campanulate, 7-8 (9) mm. high, 2-3 mm. wide, often partially obscured by leaves; phyllaries 5 or 6, essentially 1-seriate, 5-6 mm. long, (1-) 1.3-1.7 mm. wide; disk flowers typically 5, rarely 6 or 7 per head; disk corollas yellow, 3.8-4.3 (-5) mm. long; achenes 1.9-2 (rarely 2.5-2.9) mm. long, oblong-obconical with rather in-

conspicuous callous-margins, the margins, angles and surfaces short-pubescent; pappus of 25 to 30 slender unequal bristles. *Laphamia quinqueflora* Steyerem., *Pappothrix quinqueflora* (Steyerem.) Everly. Crevices of limestone bluffs, Guadalupe and Diablo mts. of Culberson Co. and Quitman and perhaps Eagle mts. of Hudspeth Co., perhaps Vieja Mts. of Presidio Co., spring-fall; also Guadalupe Mts. in N.M.

12. *Perityle cinerea* (Gray) Powell. Suffrutescent to suffruticose perennial 8-25 (-45) cm. high, cinereous; leaves opposite below, alternate above, 12-25 mm. long, 10-18 mm. wide, tomentose-canescens, broadly ovate to subdeltoid, rarely subreniform, the margins deeply serrate with lobelets obtuse to acute; petioles 6-10 mm. long; inflorescence of solitary heads or clusters of heads borne on rather stout peduncles 3-10 mm. long; heads discoid, campanulate, 8-10 mm. high, 4-7 mm. wide, sometimes partially obscured by subtending leaves; phyllaries 8 to 10, 2-seriate, subequal, 5-7 mm. long, 1.1-2 mm. wide, tomentose; disk flowers 10 to 15; disk corollas white, 5.3-6 mm. long; achenes 2.6-3 (-3.5) mm. long, oblong to narrowly obconical, with rather inconspicuous callous-margins, the margins, angles and surfaces short-pubescent; pappus of 14 to 20 slender unequal to subequal bristles. *Laphamia cinerea* Gray, *Pappothrix cinerea* (Gray) Rydb. Rare in crevices of limestone caprock, mesas in Pecos and Upton cos., spring-fall; endemic.

13. *Perityle vitreomontana* Warnock. Small perennial from a woody base, 3-10 cm. high; leaves opposite, becoming alternate above, 7-10 (-13) mm. long, 5-8 (-12) mm. wide, pilose, ovate to ovate-deltoid, the margins obtuse-serrate to incised-lobed, rarely lacinate, strongly veined; petioles 2-4 mm. long; inflorescence typically of loosely clustered heads, rarely solitary, borne on short rather stout peduncles (1-) 2-3 (-8) mm. long; heads discoid, subcampanulate, 6-7 mm. high, 3-4 mm. wide, often mostly obscured by leaves; phyllaries (9 or) 10 to 12, 2-seriate, equal, 4-5 mm. long, 0.8-1 mm. wide; disk flowers 11 to 16; disk corollas white, 4.2-4.5 mm. long; achenes 1.9-2 mm. long, narrowly obconical, typically truncate at the base and apex, with rather inconspicuous callous-margins, angles and surfaces short-pubescent, margins essentially glabrous; pappus typically of 2(3) very slender bristles 1.2-2 mm. long, often with 3 to 6 bristles shorter than the main 2, rarely with 10 to 20 short to vestigial bristles and nubs. Known only from a single population, growing in crevices of limestone exposures, n. side of Glass Mts., Brewster Co., June-Oct.; endemic.

14a. *Perityle rupestris* (Gray) Shinnars var. *rupestris*. Suffrutescent perennial 6-20 (-35) cm. high; leaves opposite or alternate, usually alternate, 10-32 mm. long, 8-35 mm. wide, sparsely to densely pilose to short-pilose or pilose-hirsute, ovate to broadly so to cordate or subdeltoid, less often subreniform, margins irregularly serrate to serrate-lobed, the serrations or lobes acute; petioles 4-13 mm. long; inflorescence of solitary heads or small clusters; heads discoid, often partially obscured by leaves, subcampanulate or subfunnel-form to subcylindric, 2.5-8 mm. high, 3-4 mm. wide; phyllaries 8 to 10, 2-seriate, equal, 4.5-5.5 (-6) mm. long, 1-2 mm. wide; disk flowers 8 to 12; disk corollas yellow, 4-4.5 mm. long; achenes 1.8-2.5 mm. long, oblong-obconical, subtruncate or rounded at the base, with rather conspicuous to inconspicuous callous-margins; angles, surfaces and margins short-pubescent; pappus of 25 to 30 unequal bristles, 2-3 mm. long; chromosome numbers: $n = 17$, $n = 34$, $n = 68$. *Laphamia rupestris* Gray, *Pappothrix rupestris* (Gray) Rydb. Common in crevices of igneous bluffs and boulders from about 10 miles n. of Alpine throughout Jeff Davis Co. and probably n. Presidio Co., spring-fall; endemic.

14b. *Perityle rupestris* var. *albiflora* Powell. Disk corollas white; leaves of some populations smaller; tendency for more florets per head; pappus bristles tend to be shorter than achenes in most populations; chromosome numbers: $n = 17$, $n = 34$, $n = 85$. Common in crevices of igneous-rock bluffs and limestone bluffs and boulders, from about 10 miles n. of Alpine, s. throughout Brewster Co., extreme s. Jeff Davis Co., and e. Presidio Co.

Both varieties of *P. rupestris* include isolated populations of diploid and polyploid individuals which increase the range of variability in each taxon. No infravarietal population seems to exhibit characteristics of sufficient distinction to warrant its recognition as a separate taxon. Included in the variety *albiflora* are isolated and rather distinct populations growing on Caballos novaculite limestone exposed in the Marathon Basin, and on igneous bluffs below San Estaban Dam south of Marfa. Plants growing on the novaculite limestone have mostly opposite leaves, but these rarely tend to be alternate above. While plants of this type are recognizable in the field, there seems to be no consistent feature which allows formal, separate recognition of the population. Below San Estaban Dam is

a tetraploid population with large leaves and heads. Future study may provide additional characters which can be used for another disposition of these populations.

111. PALAFOXIA LAG.²²⁴

Taprooted annuals, rarely overwintering in the southern areas; stems ascending, often nearly simple for most of the length; leaves alternate (except in seedlings the lowermost pairs above the cotyledons may be opposite), firm-membranous, petiolate; blades usually lanceolate or broadly so, entire; heads borne in irregularly corymbiform masses at the top of the plant, 5-20 mm. high; involucre turbinate to hemispheric or cylindrical; receptacle essentially flat, naked; phyllaries 2- or 3-seriate, subequal, thickish, green, often with a slightly discolored (reddish) tip; *ray flowers* present or absent, when present pistillate, fertile; rays pink to mauve or roseate, conspicuously 3-toothed terminally; *disk flowers* perfect, fertile; corollas equally (in one species unequally) 5-lobed or 5-toothed terminally; style branches linear, spreading or revolute, hispidulous; achenes 4-angled, obpyramidal; pappus of 7 to 10 scales, varying from a minute callosity to a long acuminate hyaline-margined callose midrib. *Othake* Raf.; *Polypteris* Nutt.

About 10 species, in southwestern United States and northern Mexico.

1. Heads with conspicuous rays (2)
1. Heads without rays (peripheral flowers inconspicuously zygomorphic in *P. riograndensis*) (4)
- 2(1). Leaves linear-lanceolate, 2-4 mm. broad; stems not glandular except in the upper branched head-bearing region; achenes 5-6 mm. long; phyllaries 6-7 mm. long 1. *P. Reverchonii*.
2. Leaves lanceolate to ovate-lanceolate, 3-20 mm. broad; stems usually glandular for some distance below the head-bearing region, often conspicuously so; achenes 6-9 mm. long; phyllaries 7-20 (-25) mm. long (3)
- 3(2). Species of western Texas; heads narrowly turbinate to cylindrical; phyllaries 2-2.5 (-3) mm. broad; rays mostly 10 mm. long or shorter; stems not robust, branching at or below the middle (except in immature or depauperate plants) 2. *P. sphaelata*.
3. Species of eastern Texas; heads broadly turbinate to campanulate; phyllaries 2-5 mm. broad; rays mostly 10 mm. long or longer; stems robust, branched at or below the middle (except in mowed or injured plants) 3. *P. Hookeriana*.
- 4(1). Involucre cylindrical; corolla of outermost flowers zygomorphic; achenes (7-) 8-11 mm. long 4. *P. riograndensis*.
4. Involucre turbinate; corollas regular; achenes 4-7 mm. long (5)
- 5(4). Leaves mostly broadly lanceolate, 6-15 mm. broad; chromosome number $n = 11$; plants of south-central Texas and southward 7. *P. texana*.
5. Leaves mostly narrowly lanceolate, 2-6 mm. broad; chromosome number $n = 10$; plants of south-central to western Texas and northward (6)
- 6(5). Phyllaries narrowly linear, 0.6-1.3 mm. broad; pappus 0.5-2 mm. long; plants predominantly found on limestone areas 5. *P. callosa*.
6. Phyllaries linear to obovate, mostly 1.2-2.5 mm. broad; pappus 2-8 mm. long; plants predominantly found on sandy soils 6. *P. rosea*.

1. *Palafoxia Reverchonii* (Bush) Cory. Annual herb 3-5 (-8) dm. tall; stems not glandular except in the upper branches of the head cluster; leaves linear-lanceolate, 4-6 cm. long, 2-4 mm. broad (rarely broader); phyllaries 7 to 9, about 6-7 mm. long; ray flowers 4 to 6, the rays deeply 3-lobed; achenes 5-6 mm. long. Infrequent in sandy forested areas, e. Tex., summer-fall; endemic.

2. *Palafoxia sphaelata* (Torr.) Cory. Stems 3-6 dm. tall, branching at or below the middle (except in immature or depauperate plants), usually glandular for some distance below the peduncles; leaves lanceolate to ovate-lanceolate, 4-7 cm. long, 3-20 mm. broad; phyllaries 7-20 (-25) mm. long, 2-2.5 (-3) mm. broad, glandular; ray flowers

²²⁴ Many of the characters were supplied by B. L. Turner from his unpublished manuscript on this genus.

present, the rays mostly 10 mm. long or shorter but still conspicuous; achenes 6-9 mm. long. Frequent in sandy plains and dune areas, Plains Country and Trans-Pecos, May-Oct.; Kan., Okla., Tex., Colo., N.M. and Chih.

3. *Palafoxia Hookeriana* T.&G. Stems branched at or below the middle, usually glandular for some distance below the head-bearing region, often conspicuously viscid-glandular; heads broadly turbinate to usually campanulate or hemispheric; phyllaries (7-) 10-15 mm. long, 2-5 mm. broad, with glandular as well as nonglandular pubescence; ray flowers present, mostly 10 mm. long or longer; achenes 6-9 mm. long. Incl. var. *minor* Shinnars. Frequent in sandy soil, s.e. Tex., s.w. part of e. Tex., and coastal parts of Rio Grande Plains, Sept.-Oct.; endemic.

The plants in full flower are quite showy; well worthy of cultivation.

4. *Palafoxia riograndensis* Cory. Stems 4-7 dm. long, only the uppermost peduncles with glandular hairs; involucre cylindrical; phyllaries 1.3-1.7 mm. broad, 1.3 to 1.7 times as long as broad, rather densely hispid with appressed or spreading trichomes, mostly with prominent swollen bases; ray flowers absent; outermost disk corollas slightly zygomorphic; achenes (7-) 8-11 mm. long. Rare in sandy vegas of the Rio Grande in the Trans-Pecos, Aug.-Nov.; also Chih.

5. *Palafoxia callosa* (Nutt.) T.&G. Annual; peduncles 5-33 mm. long; leaves mostly narrowly lanceolate, 2-6 mm. broad; involucre turbinate; phyllaries narrowly linear, 0.6-1.3 mm. broad; ray flowers absent; all corollas regular; achenes 4-7 mm. long; pappus 0.5-2 mm. long; chromosome number: $n = 10$. *P. bella* Cory. Abundant on limestone areas, Edwards Plateau and n.-cen. Tex., rare w. to Terrell Co., (later summer-) fall; Mo., Ark., Okla. and Tex.

6. *Palafoxia rosea* (Bush) Cory. Annual; leaves mostly narrowly lanceolate, 2-6 mm. broad; involucre turbinate; phyllaries linear to obovate, mostly 1.2-2.5 mm. broad; ray flowers absent; achenes 4-7 mm. long; pappus 2-8 mm. long; chromosome number: $n = 10$. In sandy soil.

We have 2 varieties:

Var. *rosea*. Pappus 2-5 mm. long. E. and s.e. Tex., rare w. to n.cen. Tex., June-Nov.; endemic.

Var. *macrolepis* Rydb. Pappus 6-8 mm. long. Plains Country, rarely s.e. as far as the Llano-Burnet cos. region or even the Bexar-Wilson cos. area, May-Sept.; Tex. and N.M. n.w. to Wyo.

7. *Palafoxia texana* DC. Annual; leaves mostly broadly lanceolate, 6-15 mm. broad; involucre turbinate; phyllaries narrowly linear, 0.6-1.3 mm. broad; ray flowers absent; corollas all equally 5-toothed; achenes 4-7 mm. long; pappus very variable in length (see below); chromosome number: $n = 11$.

We have 2 varieties as follows:

Var. *texana*. Pappus 3-5 mm. long. *P. rosea* var. *papposa* Shinnars, *Othake canescens* Rydb. W. part of Rio Grande Plains, spring-fall; Tex., Coah., N.L. and Tam.

Var. *ambigua* (Shinnars) B. L. Turner. Pappus usually 2-3 mm. long. *P. rosea* var. *ambigua* Shinnars. In the sandy and more coastward parts of the Rio Grande Plains and the s.w. portion of s.e. Tex., May-Nov.; also Tam.

112. HYMENOTHRIX GRAY²²⁵

Erect annual (or perhaps longer enduring) herbs, 3-7 dm. tall; stems usually single from a taproot; leaves alternate, biternately or triternately divided into linear divisions; heads in some species crowded near the top in a roughly corymbiform arrangement; involucre turbinate to hemispheric; phyllaries scarious, 1- or 2-seriate; receptacle nearly flat, naked; ray flowers present or absent, when present pistillate, fertile; rays 3-4 mm. long, creamy; disk flowers numerous, perfect, fertile; corollas white to lavender-pink or pale-yellow, 5-lobed terminally, the lobes either subequal or in some species distinctly unequal and the corollas zygomorphic; style branches flattened to nearly terete, with distinct marginal stigmatic lines, apically with rather small conic or swollen obtuse appendages; achenes obpyramidal, 4-sided, the faces conspicuously nerved to smooth; pappus of 12 to 18 scales, the midnerves of the scales conspicuous and extending to the apex and often beyond.

²²⁵ Adapted from B. L. Turner in *Brittonia* 14:101-120. 1962.

A genus of about 5 species of Mexico and southwestern United States. Only one has been definitely found in Texas.

1. Ray flowers present 1. *H. Wislizenii*.
 1. Ray flowers absent 2. *H. Wrightii*.

1. *Hymenothrix Wislizenii* Gray. Plant annual or biennial, 3-7 dm. tall; lower leaves pinnately 1- or 2-dissected, the upper less so, the earliest ones forming a rosette but subsequent ones conspicuously alternate; midstem leaves glabrous (rarely minutely puberulent), dissected, the ultimate divisions linear or spatulate-linear, 5-40 mm. long, 1.5-4 mm. broad; petioles 15-50 mm. long; disk corollas creamy-white or pale-yellow; ray flowers small, creamy-white to yellowish, 4-5 mm. long, 1.5-2 mm. broad. Not definitely known to occur in Texas, but occurring very close in Chih. and N.M. and to be expected in the El Paso area, late summer-fall; Ariz.; N.M., Son. and Chih.

2. *Hymenothrix Wrightii* Gray. Plant 3-6 dm. tall; stems erect, 1 to several from the crown of a taproot, the lower portion pubescent with long spreading hairs, the upper portions glabrous or nearly so (rarely pubescent throughout); leaves alternate, the lower ones pinnately twice or thrice ternately dissected, the upper ones less dissected, the lowermost forming a rosette but the later ones conspicuously alternate; midstem leaves glabrous (rarely pubescent), with petioles 0.6-2 mm. long, dissected, the ultimate divisions 5-40 mm. long and 0.5-1.5 mm. broad; heads turbinate, 9-12 mm. high, 7-10 mm. broad, with 15 to 30 white to lavender-pink or purplish disk flowers (ray flowers absent!). Exceedingly rare in the Trans-Pecos, collected once in 1889 in the "Chenates region," late summer-early fall; otherwise known in Calif., Baja Calif., Ariz., Son., Chih. and N.M.

113. FLORESTINA CASS.²²⁶

A Mexican and Central American genus of 8 species.

1. *Florestina tripteris* DC. Erect taprooted annual herb 1-6 dm. tall; stems single, not developing a rosette; first leaves opposite, the later ones alternate, simple to 3-parted; head-bearing region open, a dichotomously branched or subcorymbose cyme of 5 to numerous heads; involucre broadly to narrowly turbinate; phyllaries mostly in a single series, usually with scarios margins and often suffused with purple; rays absent; corollas hermaphroditic with well-defined tubes and throats, distinctly irregular, white; style branches flattened, with well-developed marginal stigmatic lines, abruptly terminated by a penicillate cuspidate appendage, otherwise glabrous; achenes obpyramidal, 4-sided, the faces smooth or distinctly 3-ribbed; pappus of 8 to 10 ovate to obovate or truncate scales, the midnerve only rarely extending to the apex or beyond. *Palafoxia tripteris* (DC.) Shinnery and var. *brevis* Shinnery. Frequent in Rio Grande Plains and s. and w. parts of Edwards Plateau (Crockett, Sutton and Terrell cos.), summer-fall; Tex., Chih., Coah., Dgo., N.L. and Tam.

114. SCHKUHRIA ROTH²²⁷

THREAD-LEAF

Taprooted annuals, ascending, 5-50 cm. tall; stems short-glandular-hairy to glabrate; leaves mostly opposite, those on the upper part alternate, pinnately or bipinnately divided into linear-filiform lobes, rarely simple, often impressed-punctate; involucre obconic to turbinate; phyllaries 4 to 9, obovate to oblanceolate, rather narrow, scarios and frequently colored at the margins, occasionally 1 or more smaller phyllaries present; ray flowers absent or solitary, minute, when present pistillate and fertile, the ray pale yellow; disk flowers few to several (up to 30); corolla yellow, equally 5-toothed terminally, the tube glandular; achenes elongate, obpyramidal, generally 4-sided, villous or hispid on the angles (particularly near the base); pappus of 8 (rarely more) scarios squamellae, callused at the base or with prominent midrib becoming an awn in some of the species.

An American genus of 6 or 8 species, of which we have two. The genus is exceedingly closely related to *Bahia*, with which it should probably be united.

²²⁶ Adapted from B. L. Turner in *Brittonia* 15:27-46. 1963.

²²⁷ Adapted from C. B. Heiser, Jr. in *Ann. Missouri Bot. Gard.* 32:265-278. 1945.

1. Ray flowers absent; disk flowers 15 to 30 1. *S. multiflora*.
 1. Solitary ray flower present; disk flowers 5 or fewer 2. *S. anthemoidea*.

1. *Schkuhria multiflora* H. & A. Branching annual, the branches widely spreading and then ascending, 5-25 cm. tall; stems short-glandular-hairy to glabrate; leaves pinnately dissected into lobes 0.5-1 mm. broad, to 3 cm. long; petioles 2-10 mm. long; peduncles glandular-pubescent, 5-30 mm. long; involucre turbinate to obconic, 5-6 mm. high, 5-10 mm. broad; phyllaries 7 to 9, scarious-tipped, frequently reddish or yellowish on the margins, 1-2 mm. broad and narrowing gradually; ray flowers absent; disk corollas 15 to 30; achenes 3-4 mm. long; scales of the pappus 1-2 mm. long, obtuse to acutish, rarely several or all of them awned, usually strongly calloused at the base. Higher parts of the Trans-Pecos mts. in grasslands on igneous rocks, summer-early fall; Ariz., Colo., N.M., Tex., Chih.; Bol., Peru, Arg. and Chile.

2. *Schkuhria anthemoidea* (DC.) Coult. Erect annual 2-5 dm. tall; leaves glabrate, pinnately or bipinnately dissected into linear-filiform segments 1-4 cm. long and 0.5-2 mm. broad or the upper and lower entire, conspicuously glandular-punctate; involucre 5-7 mm. high, narrower than high; phyllaries 4 or 5, obovate, obtuse, glabrous, punctate, green with scarious colored margins, deep-purple to red; ray flower solitary, the ray about 1 mm. long; disk flowers 5 or fewer; achenes 3-4 mm. long, about twice as long as thick, striate, densely villous on the 4 angles, the hairs 0.4 mm. long or longer; pappus scales subequal, obovate, rounded apically, denticulate. *S. Hopkirkia* Gray. Our plants are of the var. *Wrightii* (Gray) Heiser. Infrequent in the higher parts of the Davis and Vieja mts. in the Trans-Pecos, fall; the species occurs from Ariz. and N.M., s.e. to Guat. and Salv.

115. BAHIA LAG.²²⁸

Annual, biennial and perennial herbs, when perennial with rootstocks; leaves alternate at least over a portion of the stem, the lower leaves opposite, mostly ternately dissected into linear or ovate segments (often simple or merely lobed in *B. absinthifolia*), impressed-punctate or punctulate in each pit with a minute resin-globule; heads few to many, in a cymose paniculiform aggregation; involucre hemispheric-campanulate; phyllaries 8 to 24, subequal in 1 to 3 series, membranous marginally, usually reflexed with age; receptacle slightly convex or flat, naked; ray flowers 5 to 20, pistillate and fertile, the rays yellow; disk flowers 25 to 140, the yellow corollas 5-toothed terminally; achenes 4-sided, narrowly obpyramidal, hispid to essentially glabrous; pappus absent or of 8 to 15 scarious obovate or oblanceolate scales, the midrib percurrent, excurrent or absent.

A genus of about 11 species of Mexico and southwestern United States (one in Chile). Rather closely related to *Schkuhria*, differing in the extent to which the phyllotaxy is opposite and in the tendency toward coloring of the external bracts. *Schkuhria multiflora* is by some authors included in *Bahia*, and in some ways it connects the two genera. Another closely related taxon is *Picradeniopsis*, which is often included in *Bahia*.

1. Leaves opposite over at least half the length of the plant, only those on the upper branches alternate (2)
 1. Leaves opposite only very near the base, alternate over more than half the total length (3)
 2(1). Taprooted annual; leaves sparingly pubescent 4. *B. Bigelovii*.
 2. Subrhizomatous perennial; leaves white-pubescent 3. *B. absinthifolia*.
 3(1). Pappus absent; achenes essentially glabrous 2. *B. dissecta*.
 3. Pappus of scales present; achenes hispid 1. *B. pedata*.

1. *Bahia pedata* Gray. Taprooted annual 3-10 (-12) dm. tall; stems single (rarely 2 following injury) and erect, paniculately branched above, each terminal branch culminating in 1 to 4 1-headed peduncles, variously pubescent and glandular with resin-globules and/or numerous stipitate glands; leaves alternate, often crowded near the base, pedately divided into 3 segments, each lateral segment 2-parted, the middle segment of

²²⁸ Adapted from William L. Ellison in *Rhodora* 66:67-86, 177-215, 281-311. 1964.

3 to 7 lobes, the ultimate lobes obovate or broadly oblong and 2-5 mm. broad; uppermost leaves simple and entire or ternately divided into entire linear segments 4-11 cm. long, pubescent; heads 5-8 mm. high, 15-20 mm. broad; involucre broadly campanulate; phyllaries short stipitate-glandular, 13 to 17 in 2 series with 1 or more outer bractlets, scattered-pubescent, 4-6 mm. long, 1.5-2.5 mm. broad, oblong-oblancheolate; ray flowers 10 to 15, the rays 5-6 (-7) mm. long and 2.5-5 mm. broad; achenes 2.4-4 (-4.5) mm. long; pappus of 10 to 15 scarious oblancheolate or spatulate scales. Frequent in Trans-Pecos desert grasslands, recently reported from Dallam Co. in the Tex. Panhandle, late summer-fall; Tex., N.M., Coah. and Chih.

The closely related *B. biternata* Gray with leaf segments averaging narrower and the pappus scales (of inner achenes) with a prominent excurrent midrib, has been collected close to the Texas border north of El Paso and may eventually be found in the state.

2. *Bahia dissecta* (Gray) Britt. Taprooted annual 2-8 (-12) dm. tall; stems single (rarely 2 or 3 following injury) and erect, paniculate-branched above, each terminal branch culminating in numerous 1-headed peduncles, more or less pubescent with numerous stipitate glands on the upper stems and branches; leaves alternate, often crowded near the base, ternately divided, each segment compoundly subdivided into linear or oblong-ovate segments 1-3 mm. broad; upper leaves reduced and ternately divided into entire linear-lanceolate segments, 2-13 cm. long, more or less pubescent; heads 5-10 mm. high, 1-2 cm. broad; involucre hemispheric or broadly campanulate; phyllaries 12 to 24 in 2 or 3 series, 4.5-6 mm. long, 1-3 mm. broad, oblancheolate to lanceolate; ray flowers 10 to 20, the rays 5-7.5 mm. long and 2-3.5 mm. broad; achenes 3-4.5 (-5) mm. long; pappus absent. Infrequent in the higher parts of the Chisos and Davis mts. in the Trans-Pecos, late summer-fall; Tex., N.M., Ariz., Calif., Nev., Wyo., Colo., Baja Calif., Son., Chih. and Coah.

3. *Bahia absinthifolia* Benth. Subrhizomatous perennial 1-4 dm. tall, branching from the base, each terminal branch culminating in 1 to 5 1-headed peduncles, canescent or only partially clothed with short appressed hairs; leaves opposite (becoming alternate only on the upper stems), highly variable in form, some being narrowly to broadly lanceolate and entire or toothed with others ternately divided into narrow-to-broad linear segments which may themselves be divided, 1-5 cm. long, (1-) 2-15 mm. broad at the point of maximum breadth, tomentulose-canescent; heads 5-15 mm. high, 10-25 mm. broad; involucre hemispheric or broadly campanulate; phyllaries tomentose and farinose with few resin-globules beneath the tomentum, 12 to 16 in 2 series with 1 or more outer phyllaries, 5-9 mm. long, 1-4 mm. broad, lanceolate with acute to ovate or frequently acuminate apices; ray flowers 10 to 13, the rays 5-12 mm. long and 2-3.5 mm. broad; achenes 2.5-5.5 mm. long; pappus of 6 to 9 scarious obovate scales. *B. dealbata* Gray. Abundant in the Trans-Pecos and s.w. parts of Rio Grande Plains, infrequent in extreme s.w. part of Edwards Plateau, spring-fall; Ariz., N.M., Tex., s.e. to Jal. and Gto.

4. *Bahia Bigelovii* Gray. Taprooted annual 15-35 cm. tall; stem erect, branched, each terminal branch culminating in 1 to 4 1-headed peduncles; leaves opposite (becoming alternate only on the uppermost branches), 3-parted into linear entire segments or secondarily divided, the segments 15-50 mm. long and 1 (-2) mm. broad, sparingly pubescent, impressed-punctate (each depression with a resin-globule); heads 4-7 mm. high, 8-16 mm. broad; involucre broadly campanulate; phyllaries more or less pubescent and resin-globule-dotted, 10 to 14 (to 18) in 2 series, 3.5-4.5 mm. long, 1-1.6 mm. broad, obovate, the apex acute to acuminate or obtuse and the midrib weakly discernible or absent; ray flowers 5 to 9, the rays 3.5-4.5 mm. long and 1.5-3 mm. broad; achenes 2-2.5 (-4.3) mm. long; pappus of 8 (or 9) broadly ovate scarious scales. Moist canyons, higher parts of Trans-Pecos mts., late summer-fall; endemic.

116. PICRADENIOPSIS Rydb.

A genus closely related to *Bahia* and containing 2 species, of which we have one.

1. *Picradeniopsis Woodhousii* (Gray) Rydb. Rhizomatous perennial forming extensive colonies, 5-15 cm. tall, oppositely branched, ultimate branching terminating in 1 to 6 1-headed peduncles, cinereous, sparingly pubescent and farinose with few to numerous resin-globules; peduncles 1-2 cm. long; leaves opposite, ternately divided into linear segments 1-2 mm. broad, the latter entire or again divided, 1-3 cm. long, sparingly pubescent,

cinereous, impressed-punctate (each depression with a resin-globule); heads 4-8 mm. high, 8-12 mm. broad; involucre campanulate, puberulent and somewhat farinose with numerous resin-globules; phyllaries 8 to 10 in 1 or 2 series, 2.5-7 mm. long, 1.5-3 mm. broad, oblong or obovate with the apex obtuse, more or less keeled with the midrib prominent, marginally membranous; receptacle flat or slightly convex, naked, about 2 mm. broad; *ray flowers* 5 to 9, pistillate, fertile; rays yellow, 2.2-4 mm. long, 1-1.4 mm. broad, oblong or somewhat spatulate with a notched or 2- or 3-lobed apex; *disk flowers* 25 to 40, perfect, fertile; corolla yellow to orange-yellow, 2.5-5 mm. long, equally 5-toothed terminally; achenes 3-4 mm. long, narrowly obpyramidal, 4-sided, brown to black, hispid on the angles at the base, otherwise hispidulous; pappus of 8 or 9 scarious lanceolate scales 0.6-2 mm. long (subequal or conspicuously unequal), 0.2-0.5 mm. broad, basally thickened, the midrib prominent and extending to the apex (occasionally slightly excurrent). *Bahia Woodhousii* (Gray) Gray. Abundant in disturbed soil, especially road shoulders, higher parts of Plains Country and rare in the Trans-Pecos (Culberson Co.), spring-fall; Colo., Kan., Okla., N.M., Ariz. and Tex.

The other species, *P. oppositifolia* (Nutt.) Rydb., with glandular achenes and broader pappus-scales, has been found within a few miles of the Texas border in N.M. and Okla.

117. PSILOSTROPHE DC.²²⁹

PAPER-FLOWER

Taprooted herb, reputed to be "biennial" or less commonly perennial, growing in clumps, 5-60 cm. tall; branching, pannose, densely villous or glabrate; lower leaves petioled, obovate to oblanceolate, entire or occasionally lobed, villous to glabrate; upper leaves alternate, smaller and sessile, spatulate to linear, rarely lobed; involucre campanulate-cylindric; phyllaries roughly of 3 sorts, the principal ones 4 to 12, linear-oblong to lanceolate, villous, connivent; inner phyllaries 1 to 7, smaller, scarious; solitary outer phyllary a much smaller bract or this commonly absent; receptacle nearly flat, naked; heads crowded usually in subcorymbiform masses; peduncles present or absent; *ray flowers* present, pistillate, fertile, in a single series, 3 to 7; rays yellow, persistent, papery, 3-16 mm. long, roughly 3-toothed apically; *disk flowers* perfect, fertile; corolla equally 5-toothed or -lobed, glandular; achenes small, linear, striate, obtusely angled or terete, glabrous or long-villous; pappus of 4 to 6 nerveless hyaline scales which are lanceolate to ovate, acute to obtuse, equal or unequal. *Riddellia* Nutt.

An American genus of about 6 species, rather closely related to *Baileya*.

1. Achenes and pappus long-villous; heads subsessile or with peduncles mostly less than 5 mm. long; rays about 6 mm. long 1. *P. gnaphalodes*.
1. Achenes and pappus glabrous or essentially so; heads long-peduncled (or subsessile in *P. villosa*) (2)
- 2(1). Heads densely clustered, on peduncles mostly less than 5 mm. long; rays 3-5 mm. long, deeply lobed 2. *P. villosa*.
2. Heads loosely clustered, on peduncles mostly longer than 5 mm.; rays 5 mm. or more long, shallowly lobed 3. *P. tagetina*.

1. *Psilostrophe gnaphalodes* DC. Herb 1-5 dm. tall; basal leaves spatulate to oblanceolate, occasionally lobed, loosely long-villous to pannose, to 8 cm. long and 2 cm. broad, upper leaves smaller and oblanceolate to linear; heads several in a congested corymbiform cluster, on peduncles less than 5 mm. long or subsessile; involucre densely woolly, 5-6 mm. high, 3 mm. broad; rays 3 or 4, 5-7 mm. long, slightly 3-lobed; disk flowers 8 to 12; achenes and pappus scales densely long-villous; pappus scales subulate to lanceolate, acute, about half as long as the corolla. Frequent, Trans-Pecos, Rio Grande Plains and extreme w. end of Edwards Plateau, waifed farther e., spring-fall; Tex., Chih., Coah., Dgo., N.L., S.L.P., Son., Tam. and Zac.

Reputed to be poisonous to livestock.

2. *Psilostrophe villosa* Rydb. Herb loosely to densely long-villous, 1-6 dm. tall; basal leaves spatulate to oblanceolate, entire or some 3- to 5-lobed, short-petioled, 5-10 cm. long; upper leaves smaller and sessile, rarely lobed; heads several in small congested cor-

²²⁹ Adapted from C. B. Heiser, Jr. in Ann. Missouri Bot. Gard. 31:279-301. 1944.

ymbiform clusters, on peduncles less than 5 mm. long or sessile; involucre densely woolly, 5 mm. long, 3 mm. broad; rays 3 or 4, 3-5 mm. long, 3-lobed about half their length or rarely 4-lobed; disk flowers 5 to 12, usually 6 to 8; achenes glabrous or essentially so; pappus scales linear-lanceolate, acute, half as long as the disk corolla or more. Frequent in Plains Country, infrequent in the Trans-Pecos and Rio Grande Plains, waived farther e., spring-fall; Kan., Okla., Tex. and N.M.

Closely related to *P. gnaphalodes* and replacing it to the north.

3. *Psilostrophe tagetina* (Nutt.) Greene. Perennial herb; stems densely to slightly villos, occasionally glabrate, 1-5 dm. tall; basal leaves ovate to oblanceolate or usually spatulate, entire or pinnately lobed, densely to slightly villous, 2-10 (-15) cm. long, less than half as broad; upper leaves linear to oblanceolate or spatulate, occasionally lobed, smaller and greener than the basal leaves, 1-7 cm. long; heads generally numerous in dense to loose corymbiform clusters; peduncles usually 5-20 (-30) mm. long; involucre usually densely woolly, 5-7 mm. long, 3-4 mm. broad; rays 3 to 5, 5-12 mm. long, shallowly 3-lobed; disk flowers 6 to 12; achenes glabrous or with a few short and scattered hairs; pappus scales various, lanceolate or lance-elliptic to oblong, obtuse to acute, entire to erose, from half to two-thirds the length of the disk corolla. Incl. var. *lanata* A. Nels. Frequent in the Trans-Pecos, infrequent in s. part of Plains Country and rare in w. part of Edwards Plateau, spring-fall; Ariz., N.M., Tex., Chih., Coah. and Ut.

118. BAILEYA HARV. & GRAY

A North American desert genus of about 3 species.

1. *Baileya multiradiata* Harv. & Gray. Annual or weak perennial herb, flowering the first year, (1-) 2-3 dm. tall, with 1 to several stems from the base; stems ascending for most of the length, sparingly branched, leafy except in the upper 5-15 cm. of the length which is naked and pedunculiform, whitish or grayish floccose-woolly throughout; heads solitary on the peduncles; involucre of 2 or 3 subequal series of woolly phyllaries 5-6 mm. long; receptacle flat or slightly convex, naked; *ray flowers* about 30 or 40, pistillate, fertile; rays about 1 cm. long, broadly linear, bright-yellow, distinctly 3-toothed terminally, persistent and becoming papery in texture; *disk flowers* numerous, perfect, fertile; corolla yellow, 5-toothed; achenes somewhat dorsiventrally flattened or somewhat prismatic, pale, many-striate, truncate; pappus absent. *B. pleniradiata* Harv. & Gray and var. *perennis* A. Nels., *B. Thurberi* Rydb. Very abundant in Trans-Pecos deserts, rare in Edwards Plateau, almost any month; Calif., Ut., Nev., N.M., Ariz., Tex., Chih. and Coah.

Reputed to be highly toxic to livestock.

119. HYMENOPAPPUS L'HÉR.²³⁰

WOOLLY-WHITE

Biennial and perennial subscapose to leafy-stemmed herbs from a single unbranched obconical taproot (in biennial species) or from a woody much-branched taproot bearing several crowns (in perennials); stems erect; leaves alternate, forming a basal rosette, mostly bipinnately dissected to rarely simple or merely lobed, reduced up the stem, minutely impressed-punctate, with usually inrolled margins; heads in a few- to many-headed cymose aggregation, on slender peduncles; involucre subturbinate to broadly campanulate, of 6 to 14 subequal phyllaries in 2 or 3 series (these membranous at the apex or rarely throughout); receptacle dome-shaped to nearly flat, naked; *ray florets* when present (in *H. biennis* only) pistillate and fertile, with conspicuous white ligules; *disk florets* with regular corollas (at least the throat), yellow to white or less often reddish-purple, narrowed below into a slender mostly glandular tube and above this (after anthesis) an abruptly flaring campanulate to funnelform throat, the equal lobes ovate and reflexed after anthesis; achenes with 4 faces, obpyramidal to rarely incurved and diagonally compressed, the narrow base often shortly stipitate (in biennial species), faces 0- to 3-nerved, glabrous to densely pubescent with ascending or spreading hairs; pappus when present of 12 to 22 linear-oblong or broadly ovate obtuse hyaline scales, usually with an included medial nerve.

About 10 species, in the United States and Mexico.

²³⁰ Adapted from B. L. Turner in *Rhodora* 58:163-186, 208-242, 251-269, 295-308. 1956.

1. Perennial with roots bearing several to many crowns; stem leaves few to none or 1 to 4 per stem; heads 1 to 6 per stem; corolla throat 2.5 to 4 times as long as the lobes 1. *H. filifolius* var. *cinereus*.
1. Biennials or less commonly robust winter annuals with roots usually bearing a single crown; stem leaves usually more than 10; corolla throat 1 or 2 (to 3) times as long as the lobes (2)
 - 2(1). Heads with white rays 2. *H. biennis*.
 2. Ray flowers absent (3)
 - 3(2). Corolla tube 1.5-2 (-2.2) mm. long; basal rosette leaves bipinnately dissected, the ultimate segments mostly linear and 0.5-6 mm. broad; flowers yellow or white; corolla throat campanulate (very rarely funnelform) (4)
 3. Corolla tube 2-3 mm. long; basal rosette leaves simple to bipinnate with ultimate segments 5-20 mm. broad; flowers white or vinaceous, never yellow; corolla throat funnelform (rarely campanulate) (5)
 - 4(3). Flowers white; ultimate leaf segments narrowly linear, 0.5-1.5 mm. broad 3. *H. tenuifolius*.
 4. Flowers yellow; ultimate leaf segments short, 1-6 mm. broad 4. *H. flavescens*.
 - 5(3). Basal rosette leaves pinnately to bipinnately parted; flowers white; pappus 0.2-0.8 (-1) mm. long; plants of clayey soils 5. *H. scabiosaeus* var. *corymbosus*.
 5. Basal rosette leaves simple to pinnately parted; flowers vinaceous or reddish-tinged (rarely completely white); pappus 0.5-2 mm. long; plants of sandy soils 6. *H. artemisiaefolius*.

1. *Hymenopappus filifolius* Hook. var. *cinereus* (Rydb.) I. M. Johnst. Perennial 15-40 cm. high, sparsely grayish-green tomentose; principal rosette leaves 5-14 cm. long, bipinnately dissected with linear filiform divisions 0.5-1 mm. wide, conspicuously impressed-punctate; stem leaves none or usually 2 to 4, much-reduced upwards; heads 1 to 6 per stem, subturbinate to campanulate, 25- to 40-flowered, on ultimate peduncles 1-6 cm. long; principal phyllaries 6-9 mm. long, 2-4 mm. wide, glabrous to densely tomentose, yellow or rarely white-membranous for 1-2 (-3) mm. from the acute to obtuse tip; corolla yellow or rarely white (ochroleucous), 3-4.5 mm. long, the tube moderately glandular and 1.5-2.5 mm. long, the throat campanulate and 1.5-2.5 mm. long with lobes reflexed, 2.5 to 4 times longer than the lobes; achenes 4-6 mm. long, evenly pubescent with conspicuous hairs 1-3 mm. long; pappus of 14 to 18 linear-oblong scales 1.5-2 mm. long. Frequent in higher parts of Plains Country, May-Sept.; Ut., Ariz., Colo., N. M. and Tex.; with 13 varieties, this species as a whole is distributed from Alta., Sask. and Wash., s. to Baja Calif., Ariz., N.M. and Tex.

2. *Hymenopappus biennis* B. L. Turner. Biennial 6-10 dm. tall; stems single from each taproot, much-branched and leafy, tomentose to nearly glabrate; basal rosette leaves 6-16 cm. long, 3-6 cm. broad, bipinnately dissected into linear mostly flattened ultimate segments 6-20 mm. long and 1-3 mm. wide, sparsely tomentose to nearly glabrate, conspicuously impressed-punctate; stem leaves 10 to 40, gradually reduced upward; heads in a large much-branched cymose aggregation, 20 to 40 per stem, 40- to 60-flowered, on ultimate peduncles 1-6 cm. long; principal phyllaries 5-8 mm. long, 3-5 mm. wide, sparsely tomentose to nearly glabrate, yellow-membranous for 1-2 mm. from the acute to obtuse tip; *ray flowers* 8, pistillate and fertile, tubular at the base for about 2 mm., extending into a conspicuous white ray 14-16 mm. long and 6-8 mm. wide, not cleft at the apex or obscurely so; *disk flowers* yellow, 3-3.5 mm. long, the tube densely glandular and 1.5 mm. long, the throat campanulate and 1.5-2 mm. long with lobes reflexed, 2 to 3 times as long as the acute lobes; achenes black, glabrous (or with a few sessile glands near the apex), 4 mm. long, obpyramidal, 4-sided, becoming incurved near the periphery of the head; pappus obsolete or nearly so (0-0.2 mm. long). Calcareous soils at elev. above 6,000 ft., Guadalupe Mts. in the Trans-Pecos, July-Oct.; also N.M.

3. *Hymenopappus tenuifolius* Pursh. Biennial 4-15 dm. tall; stems from a single taproot (rarely 2 crowns forming on a root, especially on injured plants), erect, much-branched, sparsely white-tomentose to more frequently nearly glabrous; leaves alternate,

forming the first year a basal rosette, the larger basal leaves 8-15 cm. long and 4-5 cm. wide, bipinnately dissected with linear or filiform ultimate segments 0.5-1.5 mm. wide, conspicuously impressed-punctate; stem leaves 8 to 30, becoming reduced upwards; heads numerous (20 to 200), 25- to 50-flowered, on pubescent to glabrate ultimate peduncles 1-5 cm. long, in a flat-topped cymose aggregation; involucre campanulate; principal phyllaries mostly glabrate (rarely tomentose) or densely glandular, 5-8 mm. long, 2-4 mm. wide, yellowish-membranous for 1-2 mm. from the acute to obtuse tip; ray flowers absent; disk corollas white, 2.5-3 mm. long, the glandular tube 1.5-2.2 mm. long, the campanulate throat 0.8-1.5 mm. long with lobes reflexed, 1.5 to 2 times longer than the lobes; achenes 3.5-4.5 mm. long, 4-sided, the faces 2- or 3-nerved, pubescent principally on the corners with hairs 0.5-1 mm. long; pappus of 16 to 18 linear oblong scales 1-1.5 (-2) mm. long. Calcareous loamy soils, Plains Country and n.-cen. Tex., s. to the n. edge of the Rio Grande Plains, May-Aug.; S.D. and Colo., s. to Tex. and N.M.

4. *Hymenopappus flavescens* Gray var. *flavescens*. Biennial 45-90 cm. high, the stems single from each taproot; larger rosette leaves 6-14 cm. long, sparsely canescent to glabrate above, densely tomentose below (rarely tomentose on both surfaces), bipinnately parted (except for the first 1 to 4 leaves) with broad ultimate segments mostly 2-6 mm. wide; stem leaves 15 to 40, becoming reduced upward; heads 30 to 100 per stem, campanulate, 30- to 70-flowered, on short ultimate peduncles 0.5-3 cm. long, in a many-headed mostly congested cymose arrangement; principal phyllaries pubescent to glabrate, 4-5 (-6) mm. long, 2-4 mm. wide, yellow-membranous for about 1 mm. from the acute or narrowly obtuse tip; ray flowers absent; disk corollas bright-yellow, 2.5-3.5 mm. long, the tube densely to sparsely glandular and 1.5-2 mm. long, the throat abruptly campanulate to campanulate-funnelform and 0.8-1.5 mm. long with lobes reflexed, as long as the lobes (rarely shorter); achenes obpyramidal, 4-sided, 3.5-4 mm. long, pubescent principally on the corners with hairs 0.3-1 mm. long; pappus of 18 to 20 linear oblong scales 0.5-1 (-1.2) mm. long. Distinguished from the other variety below by the following combination of characteristics: leaf segments 2-6 mm. broad; leaves generally glabrous or less pubescent above, pappus 0.5-1 (-1.2) mm. long. Plains Country, May-Sept.; Kan. and Colo., s. to Tex. and N.M.

Var. *cano-tomentosus* Gray. Biennial 3-9 dm. tall, the stems typically densely tomentose and single from each taproot (rarely 2 crowns forming on injury); larger rosette leaves 6-15 cm. long, 2-4 cm. wide, evenly pubescent on both surfaces, usually densely tomentose but often merely canescent, bipinnately dissected with the small narrow ultimate segments 1-2 mm. wide; stem leaves 10 to 50, becoming reduced upwards; heads 15 to 100 per stem, campanulate, 30- to 90-flowered, on ultimate peduncles 1-6 cm. long; principal phyllaries (4-) 5-8 mm. long, 2-4 mm. wide, densely tomentose to nearly glabrate, yellow-membranous for about 1 mm. from the acute to rarely obtuse tip; ray flowers absent; corollas yellow, 2.5-3.5 mm. long, the tube glandular and 1.5-2 mm. long, the throat abruptly campanulate and 1-1.5 mm. long with lobes reflexed, 1 to 1.5 times longer than the lobes; achenes obpyramidal, 4-sided, 3-4.5 mm. long, evenly pubescent with hairs 0.5-1.5 mm. long; pappus of 16 to 22 linear oblong scales, 1-1.5 mm. long (very rarely less). Distinguished from the var. *flavescens* by the following characters: leaf segments 1-2 mm. broad; leaves usually evenly pubescent on both surfaces; pappus 1-1.5 mm. long, rarely less. Locally abundant in sandy soils in the Trans-Pecos, Apr.-Aug.; N.M., Ariz., Tex. and Chih.

5. *Hymenopappus scabiosaeus* L'Hér. var. *corymbosus* (T.&G.) B. L. Turner. OLD PLAINSMAN. Biennial 4-10 dm. tall; stems single from each taproot (rarely two crowns forming, especially on injured plants), erect, usually much-branched, tomentose to nearly glabrate; leaves forming the first year a basal rosette, the primary leaves entire to variously lobed, the later-formed rosette leaves becoming pinnately dissected, 5-15 cm. long, 5-7 cm. wide, mostly glabrate or sparsely canescent above, more tomentose below, the ultimate divisions linear, acute and 2-8 mm. wide; stem leaves (on well-developed plants) 15 to 30, becoming reduced upward; heads campanulate, numerous (40 to 100), 20- to 60-flowered, on densely strigose ultimate peduncles 5-30 mm. long, these without conspicuous petaloid bracts at their bases; involucre campanulate; principal phyllaries 5-9 mm. long, 2-4 mm. wide, glabrate above, pubescent below, yellowish-white or white membranous for 2-4 mm. from the acute to narrowly obtuse tip; ray flowers absent; disk corollas white or creamy white, 3-4 mm. long, sweet-scented, the tube sparsely glandular

and 2-3 mm. long, the funnellform throat 1-1.5 mm. long, with lobes reflexed, the lobes equal to or nearly as long as the throat; achenes obpyramidal, 4-sided, 3-4 mm. long, short-pubescent (especially on the corners) with hairs 0.1-0.5 mm. long, the faces 2- or 3-nerved; pappus of 14 to 18 obtuse or spatulate scales, 0.2-0.8 (-1) mm. long. Frequent in calcareous often tight clay prairie soils, lower parts of Plains Country, n.-cen. Tex., s.w. part of e. Tex., s.e. Tex., Rio Grande Plains, Edwards Plateau and s.e. part of the Trans-Pecos, Mar.-July; Neb., s. to Coah. and Tex. The var. *scabiosaeus* occurs in Fla., Ga., S.C., Miss., Ind., Ill. Mo, Ark. and Okla.

6. *Hymenopappus artemisiaefolius* DC. var. *artemisiaefolius*. Biennial 4-9 dm. tall, tomentose to nearly glabrate; larger rosette leaves 8-18 cm. long, simple to once-pinnate with broad primary divisions, 6-30 mm. wide, mostly densely tomentose on the lower surface, becoming glabrate above; stem leaves (6 to) 8 to 16, not much-reduced upward; heads 30 to 60 per stem, campanulate, on ultimate peduncles 1-4 (-6) cm. long; principal phyllaries broadly elliptic to ovate, 6-12 mm. long, 3-7 mm. wide, snowy-white-membranous for about half their length or more (often tinged with red); corollas rosy-vinaceous to rarely completely white, 3.5-5 mm. long, the tube moderately glandular and 2.5-3 mm. long, the funnellform throat 1-1.5 mm. long, with lobes reflexed, 1.5 times as long as the lobes; achenes obpyramidal, 4-sided, 3.5-4 mm. long, principally pubescent on the corners with short white hairs 0.3-0.6 mm. long, the faces 2- or 3-nerved; pappus of 16 to 18 oblong scales 0.5-1 (-1.5) mm. long. Frequent in sandy soils, e., s.e. and n.-cen. Tex., Mar.-May; also La.

Var. *riograndensis* B. L. Turner. Biennial 45-100 cm. high; principal rosette leaves 1-2 dm. long, 2-5 cm. wide, tomentose on both surfaces, simple to once-pinnate with broad coarsely toothed divisions; stem leaves 2 to 8, much-reduced upward; heads 20 to 60 per stem, campanulate, 40- to 60-flowered, on slender bractless ultimate peduncles 2-5 cm. long, in a large open cymose-paniculate aggregation often comprising two thirds of the plant height; principal phyllaries 5-7 mm. long, 2-4 mm. wide, the apex narrowly obtuse or acute with an inconspicuous yellow-membranous tip 1-(2) mm. long or less; corollas "yellow-reddish," 3-3.5 mm. long, the tube sparsely glandular and 2 mm. long, the campanulate-funnelform throat 1.5 mm. long with lobes reflexed, 1 to 1.2 times longer than the acute lobes; achenes 4-5 mm. long, pubescent principally on the corners with white hairs (0.8-) 1-1.2 mm. long; pappus of 16 to 18 linear oblong scales 1.5-2 mm. long. Frequent in deep loose pure sandy soil, Rio Grande Plains (specimens intermediate between the 2 varieties are found as far north as Refugio Co.), Mar.-May; endemic.

120. ANTHEMIS L. CAMOMILE

A genus of several species, mostly European; one is adventive with us. *A. nobilis* L. is the usual source of "camomile," a useful stomach drug. *Maruta* Cass.

1. *Anthemis Cotula* L. MAYWEED, DOG-FENNEL. Ill-scented taprooted annual 2-5 dm. tall, usually with several stems from the base; leaves alternate, bipinnatifid, the divisions linear; heads terminal and solitary on the branches which are naked for the upper 1-3 cm.; involucre saucer-shaped, about 3 mm. high, 6-8 mm. broad; phyllaries in 2 series, subequal, mostly scarious, elliptic, obtuse or acutish, pubescent; receptacle high-conic, chaffy toward the apex, the subulate pales stiff; ray flowers 10 to 15, infertile; rays white, 6-8 mm. long, about 2 mm. broad; disk flowers numerous, perfect, fertile; corolla greenish-yellow, glandular-granuliferous, 2 mm. long, with 5 teeth; achenes cylindric, 1-1.5 mm. long, nearly ribless or very weakly 10-ribbed; pappus absent. Scattered in waste places in the e. two thirds of Tex., escaped from cult., Mar.-June; a Eur. herb now widely adv. in the world.

121. ACHILLEA L.

A large genus of north-temperate areas.

1. *Achillea millefolium* L. COMMON YARROW, MILFOIL. Perennial herb with 1 to several stems from the base, 2-10 dm. tall; leaves alternate, bi- or tripinnatifid, variably pubescent, rather fernlike; heads with about 10 to 20 flowers, in terminal corymbose rather dense clusters; involucre turbo-cylindric, 4-5 mm. high, 2.5-4 mm. thick; phyllaries in about 4 series, graduated, mostly scarious; receptacle chaffy, the stiffish pales oblong; ray flowers

present, 5 to 12; rays white; tube of disk corolla more or less flattened; corolla whitish or yellowish-white, 5-toothed; achenes more or less obcompressed, subrhombic to obliquely triquetrous in transection, oblong or obovate in outline, callous-margined, glabrous; pappus absent. Frequent in disturbed soil, n. half of Tex., spring-summer; nat. of Eur. and Asia, with varieties nat. to nearly all of N. A.

Ours are mostly of the var. *occidentalis* DC. with rays about 2 mm. long, but the Trans-Pecos plants tend toward the var. *lanulosa* (Nutt.) Piper with rays 2.5 mm. long or longer.

122. ARTEMISIA L.* WORMWOOD. SAGEBRUSH

Perennial herbs or less commonly subshrubs or rarely shrubs, with several virgate stems from the base that are somewhat branched upward, the entire plant often (2-) 5-10 dm. tall, glabrous to tomentose, usually aromatic; leaves alternate; heads small, urceolate at anthesis (except in *A. frigida*), narrowly campanulate in fruit, usually nodding and aggregated in rather many-headed sometimes leafy panicles, often with hundreds of heads per stem; involucre only 3-6 mm. high; phyllaries with very broad scarious margins (the scarious texture sometimes obscured by the dense pubescence), in 2 distinct size-classes and three rather definite series; outer phyllaries about a fourth to a half as long as those of the inner 2 series, usually lanceolate and acute, forming a calyculum; middle and inner phyllaries nearly equal in length but the middle ones very broad, nearly as broad as long and blunt, the inner ones elliptic and blunt to acutish; receptacle convex or often conical, naked or rarely hairy; flowers few; ray flowers present, 1 to few, pistillate, fertile or infertile; corolla 1 mm. long or less, yellowish-white, mostly in the form of a cylinder with a V-shaped gap down most of the side toward the disk; disk flowers 3 to 20, about equaling the longer phyllaries, perfect, infertile or fertile, with minute yellowish-white equally 5-toothed corollas; achenes about 1 mm. long or less, usually plump-elliptic in transection, rarely nearly cylindrical, in outline obovate-oblong or oblong, very faintly or weakly 10-costellate, translucent-brown; pappus absent.

A genus of a few hundred species in the cooler, drier parts of the world. The plants are wind-pollinated and have toxic, allergenic pollen. The beverage absinthe is made by steeping the leaves of *A. absinthium* L. in alcohol. Tarragon, an herb used in cooking, is the herbage of *A. Dracuncululus* L., a species fairly closely related to our species *A. glauca*. The over-abundant "sagebrush" of the western plains is *A. tridentata* Nutt. Most of our species afford some low-quality forage for livestock.

- 1. Receptacle hairy; rare in Trans-Pecos mts. 1. *A. frigida*.
- 1. Receptacle naked (2)
- 2(1). Shrubs; leaves sordidly-tomentose, 15-25 mm. long and 2-4 mm. broad, at the extreme tip cuneate-dilated and 3-toothed with each tooth 1-2 mm. long; rare in west Texas 2. *A. Bigelovii*.
- 2. Herbs or subshrubs, if approaching a shrubby habit (in *A. filifolia*) the foliage quite different from that above (3)
- 3(2). Leaves linear-filiform or very deeply dissected into linear-filiform segments, only 1 or 2 (or 3) times as broad as thick or if several times as broad as thick then of the same color and pubescence on both sides; disk flowers infertile; ray flowers fertile but maturation long-delayed (4)
- 3. Leaves either broader or with broader segments or if these fairly narrow then often somewhat revolute with slightly to much-contrasting color and vesture on the 2 surfaces; disk flowers fertile; ray flowers rarely fertile (6)
- 4(3). Definitely subshrubby; leaves canescent-pubescent, usually densely so 5. *A. filifolia*.
- 4. Usually mostly herbaceous; leaves not canescent (5)
- 5(4). Leaves of the upper stems and head-bearing region dissected to the base, usually with a main axis and near the base on each side with 1 or 2 segments 6. *A. caudata*.
- 5. Leaves of the upper stems and head-bearing region entire or rarely a few of them with a few lobes 7. *A. glauca*.

* See also *Cotula* in Appendix.

- 6(3). Leaves 5-20 mm. long, either entire and linear or pinnately dissected into few linear lobes 1 mm. broad or narrower4. *A. Carruthii*.
 6. Leaves usually 10-60 mm. long, if dissected the lobes broader than 1 mm.
3. *A. ludoviciana*.

1. *Artemisia frigida* Willd. PRAIRIE-SAGEWORT. Woody at the extreme base; leaves only about 1 cm. long and much-dissected into narrow segments, canescent-pubescent; heads in a loosely spikelike arrangement on the upper 5-10 cm. of the stems, many-flowered; receptacle hairy. Very rare in Trans-Pecos mts. if still extant, collected once near the Eagle Mts. in 1881, late summer; Sask. to Minn., s. to Tex., Ariz.; also Sib.

2. *Artemisia Bigelovii* Gray. Shrub 2-4 dm. tall; stems many from the base, spreading; twigs densely sordid- or canescent-pubescent; leaves 15-25 mm. long, 2-4 mm. broad, tip cuneate-dilated and 3-toothed with each tooth 1-2 mm. long; ray flowers 1 (or 2) per head; disk flowers 3 to 5, fertile. Rare in the Trans-Pecos and Plains Country, (Sept.-) Oct.; Colo., Ut., Tex., N.M. and Ariz.

Exceedingly similar to and closely related to the true sagebrush, *A. tridentata*, differing only in the technical detail of presence of a ray flower in each head. Probably *A. Bigelovii* should be considered merely a race of *A. tridentata*.

3. *Artemisia ludoviciana* Nutt. WESTERN MUGWORT, WHITE SAGE. Perennial herb, rarely slightly subshrubby below, often subrhizomatous, several- to many-stemmed from the base, (2-) 3-9 (-15) dm. tall, all the herbage grayish- or whitish-pubescent except in some plants the upper surface of the leaves nearly glabrous; leaves entire or dissected, the main axis and lobes usually 3-10 mm. broad, exceedingly variable in shape; involucre usually closely grayish- or whitish-woolly; ray flowers present, occasionally fertile, usually infertile. *A. mexicana* Willd., *A. gnaphalodes* Nutt., *A. vulgaris* var. *americana* Bess., *A. Lindheimeriana* Scheele, *A. redolens* Gray, *A. rhizomata* A. Nels., *A. texana* Rydb., *A. albula* Woot. & Standl. Frequent to infrequent over much of Tex. except the extreme s., summer-fall; widespread in temp. N. A.

The exceedingly variable habit and herbage have led to attempts to recognize numerous variations but these show so little geographic or morphic discreteness that nothing is gained by these attempts. The species has been considered, perhaps correctly, to be conspecific with the Eurasian *A. vulgaris* L.

4. *Artemisia Carruthii* Carruth. Rhizomatous perennial herb 1-3 (-5) dm. tall; stems several from the base, about 1 mm. thick; herbage closely canescent-woolly; leaves slightly darker on the upper surface than the lower, 5-20 mm. long, entire and linear or pinnately dissected into few linear lobes 1 mm. broad or narrower and often slightly revolute-margined; disk flowers fertile; ray flowers rarely fertile; involucre closely canescent-woolly. *A. Wrightii* Gray, *A. kansana* Britt. Locally abundant in Davis Mts. of the Trans-Pecos, rare in higher parts of Plains Country, July-Sept.; Kan. to Chih., Ariz., Ut. and Colo.

Perhaps intergrading to a limited extent with *A. ludoviciana*.

5. *Artemisia filifolia* Torr. SAND SAGE. Suffrutex; leaves or their lobes decidedly filiform, as thick as broad and grayish or canescent all over; heads only about 2 mm. long and exceedingly numerous in leafy panicles; ray flowers belatedly maturing achenes (long after the infertile disk flowers, which have nearly entire styles, have shed their pollen). Very abundant locally in areas of dunes or other deep loose sand, in the Trans-Pecos and higher parts of the Plains Country, Apr.-May; Sept.-Oct.; Wyo. and Neb. to Chih., Ariz. and Nev.

6. *Artemisia caudata* Michx. Biennial or weakly perennial herb with taproots and 1 to few stems from the base, 3 to 9 dm. tall; leaves 2-5 cm. long, very deeply (most of them) pinnately or pedately dissected, the divisions linear-filiform, nearly glabrous, drying dark-olive-green; heads about 3 mm. long, very numerous in elongate leafy paniculiform aggregations, not woolly, essentially glabrous; ray flowers belatedly maturing achenes; disk flowers infertile. *A. campestris* L. subsp. *caudata* (Michx.) Hall & Clem. Local in the Trans-Pecos and Plains Country, Sept.-Oct.; scattered over much of the U.S.

Intergrading with *A. glauca* and differing from it in the denser aggregations of heads, the tendency toward dissection of the foliage and the darkness of the color upon drying, all differences of degree. The superficially slightly similar *A. annua* L. has been found in sandy soil very near our limits north of Perryton, and no doubt will eventually be found in Texas; it has fertile disk flowers and a definitely annual taproot.

7. *Artemisia glauca* Pall. Perennial herb with woody crown; stems several, nearly simple, slender, usually purplish, nearly glabrous, to 13 dm. tall; leaves (at least those of the upper 1 to 4 dm.) linear, entire, 1-5 cm. long, rarely with 1 or 2 lateral lobes; heads about 3 mm. long, usually not crowded, not woolly, essentially glabrous; ray flowers belatedly maturing fruit; disk flowers infertile. *A. dracunculoides* Pursh, *A. dracunculina* Wats. Frequent in Plains Country and Trans-Pecos, infrequent to rare in Edwards Plateau, Aug.-Oct.; widespread in w. N. A.; also widespread in dry-temp. parts of Sib. and other areas of the Old World. (See remarks under *A. caudata*.)

123. SOLIVA R. & P. BURWEED

Low-growing taprooted annuals, usually only 2-10 cm. high, rosettelike and essentially acaulescent or else slightly proliferous with numerous short spreading stems; leaves alternate but the phyllotaxy often very obscure because of approximation of nodes just below the heads, the petioles slender; blades usually deeply tripinnately dissected or in some merely bipinnatifid, the divisions lance-linear or linear-deltoid; heads terminal but sessile in clusters of leaves (in the proliferous species the branches several, emerging from the axils just below the heads); involucre hemispheric, 3-5 mm. high; phyllaries numerous, lanceolate, in 2 subequal series, with broad scarious margins; receptacle low-conical, hairy around the sockets; flowers numerous; peripheral flowers corresponding to ray flowers, pistillate and fertile, the corollas absent; central flowers seemingly perfect but infertile, with a minute whitish 4-toothed corolla; achene dorsiventrally flattened, with lateral wings or somewhat winglike appendages, crowned by the persistent noxious spinelike erect style about as long as the achene; pappus absent. *Gymnostyles* Juss.

A genus of about 9 species centered in South America, with weedy tendencies and now widely distributed by man. These are noxious weeds because of the persistent styles, which are more injurious even than *Cenchrus* burs when the unwary hand or bared foot comes in sudden contact with the mature fruit head.

- 1. Achenes with broad lateral wings which are indented toward the lower half with a lobe below, glabrous apically3. *S. pterosperma*.
- 1. Achenes with thick lateral appendages that are only vaguely winglike and not lobed, hairy apically (2)
- 2(1). Lateral appendages of the achenes with divergent acute projections or shoulders at the top, one on each side of the achene at the level of the base of the style ..
.....2. *S. stolonifera*.
- 2. Lateral appendages of the achenes not having any acute projections
.....1. *S. Mutistii*.

1. *Soliva Mutisii* H.B.K. BUTTON BURWEED. Annual herb essentially acaulescent, with a number of heads clustered in the basal rosette; leaves several cm. long, much-dissected and sordid-villous all over, especially at the base; achenes with thick lateral appendages, the width about constant or very slightly wider toward the hairy apex, often with irregular transverse corrugations. Locally abundant in disturbed ground, s.e. and e. Tex. and Rio Grande Plains, (Feb.-) Mar.-Apr.; Col., Ecu.; adv. in Tex.

Our plants have been mistaken for the closely related and perhaps conspecific *S. anthemifolia* (Juss.) R. Br. of Brazil, Paraguay and Argentina; plants of the latter species are nearly glabrous.

2. *Soliva stolonifera* (Brot.) Loud. Annual, much-proliferous and rooting under the scattered head-bearing rosettes; leaves usually merely pinnatifid to bipinnatifid; achenes with thick lateral appendages (with prominent transverse rugae) becoming noticeably wider upward and (at the level of the juncture of achene and style) with a pointed lateral projection; achene hairy terminally. Rare and local in e. and s.e. Tex. (Bastrop, Hardin, Leon and Nueces cos.), Mar.-Apr.; Urug. and Arg.; now widely adv.

3. *Soliva pterosperma* (Juss.) Less. Annual herb, proliferous, rooting at the lower nodes, the heads scattered and never clustered near the base; leaves tripinnatifid, small, the bases of the petioles much-dilated beneath the heads; achenes with broad very firm wings which on each side are divided by an indentation into a smaller lower lobe and a larger upper lobe, the upper lobe on each side in some plants with an erect spinose

projection very near the side of the style, apex of achene glabrous. Local in e. and s.e. Tex., Apr.-May; Braz., Parag., Urug., Arg., Chile; widely adv. elsewhere.

124. BARTLETTIA GRAY

There is but a single species.

1. *Bartlettia scaposa* Gray. Taprooted annual herb 1-3 dm. tall, sparsely hirsute to nearly glabrous; leaves alternate, 1-2 cm. long, 7-17 mm. broad, clustered at the base or cauline, ovate with deeply and widely serrate margins or those at midstem pinnately lobed, the basal lobes usually large with acute apices; petioles usually about 25 mm. long but often to 35 mm.; heads solitary on peduncles 9-15 cm. long, naked except sometimes for 1 or 2 minute bracts; phyllaries linear-lanceolate, about 18 to 20 in 2 series, sparsely hirsute to hirsute dorsally, thin, indistinctly 2- or 3-nerved; inner (principal) phyllaries 7-10 mm. long, 2-4 mm. broad, with scarious margins; outer phyllaries successively shorter and narrower, 5-7 mm. long, 1.5-2 mm. broad; receptacle convex-conical, tuberculate-alveolate; pales linear-lanceolate, membranous, ciliate, about as long as the achenes, deciduous with and adnate to at least the inner achenes; *ray flowers* 10 to 12, pistillate, fertile, the corollas tubular for 3.5-4 mm. from the top of the achene; rays 4-7 mm. long, oblong, 3-toothed terminally, yellow; *disk corolla* 5-7 mm. long, with a cylindrical tube 2.5-4.5 mm. long gradually merging into the funnellform throat 2-2.8 mm. long, the 5 erect lobes 1 mm. long and acute; achenes compressed, about 3 mm. long and 1 mm. broad, ciliate on the margins, 1- or 2-nerved on each face; pappus bristles 18 to 20, 4.5-6 mm. long, in a single series, slightly unequal, fuscous. Very rare in Trans-Pecos deserts (10 miles s.e. of McNary, Hudspeth Co.), Oct.; Dgo., Chih., Tex. and N.M.

125. PSATHYROTES GRAY

BRITTLE-STEM

A western American genus of about 4 species.

1. *Psathyrotes scaposa* Gray. Taprooted annual or weak perennial, 1- to several-stemmed from the base, ascendingly rebranched above, 1-2 (-3) dm. tall; leaves crowded at or near the base, with subrhomboid blades (1-) 2-4 cm. long, scurfy-pubescent to tomentose, serrate or irregularly undulate on the distal margin; petioles about as long as the blades; stems often essentially naked and subscapose but somewhat branched, heads (1 or) 2 to 10 per main stem; involucre hemispheric (rarely obconic); principal phyllaries about 21, 5-7 mm. long, equal, in a double row, dorsally glandular- or scurfy-pubescent, thin-marginal; receptacle naked, essentially flat or with a minute umbo centrally; *ray flowers* absent; flowers all alike, perfect, fertile, the corollas yellowish-white to creamy-white and equally 5-toothed; achenes narrowly obpyramidal, 3- or 4-faceted, pubescent; pappus of many coarse tawny or buffy bristles, these united below into 5 scales. *Pseudobartlettia scaposa* (Gray) Rydb. Frequent in Trans-Pecos deserts, Feb.-May (June) and Sept.-Nov.; Tex., N.M. and Chih.

126. SENECIO L.

GROUNDSEL. RAGWORT. SQUAW-WEED

Herbs or subshrubs; leaves alternate, often pinnatifid; involucre usually campanulate or obconic-campanulate (or urceolate at anthesis); phyllaries usually in 2 size-classes; longer (inner) phyllaries 12 to 25, equal in length, in a double row, linear, often acute, with a herbaceous median area and usually thin margins; outer phyllaries much shorter, subulate-setaceous, forming a calyculum or in many species entirely absent; receptacle slightly convex, essentially naked; *ray flowers* present, pistillate, fertile; rays linear or elliptic-linear, yellow, terminally 3-toothed; *disk flowers* numerous, perfect, fertile; corolla equally 5-toothed, yellow; achenes columnar, nearly terete, several-nerved, alike in ray and disk; pappus of numerous capillary bristles.

An enormous world-wide genus of between 2,000 and 3,000 species, reputed to be among the several largest seed-plant genera.

1. Subshrubby perennials of southern and western Texas with leafy ligneous stems; leaves linear or usually with linear axis plus linear lobes (2)
1. Annual or perennial herbs; leaves not linear and the lobes very rarely so (4)

- 2(1). Involucres campanulate or broadly obconic, with about 19 to 23 principal phyllaries14. *S. longilobus*.
2. Involucres narrowly obconic-campanulate, with about 12 to 14 principal phyllaries (3)
- 3(2). Leaves linear, rarely lobed13. *S. Warnockii*.
3. Leaves regularly pinnately lobed12. *S. spartioides*.
- 4(1). Leaves merely serrate, not lobed, usually only gradually reduced upward along the stem, in the lower half of the stem longer than the internodes (5)
4. Leaves usually lobed or if some of them unlobed then most of them crowded near the base and the stem leaves much reduced and remote (6)
- 5(4). With a floccose tomentum or nearly glabrous but not glandular-pubescent; east of Trans-Pecos Texas 2. *S. ampullaceus*.
5. Glandular- and usually somewhat viscid-pubescent; Trans-Pecos Texas 1. *S. Parryi*.
- 6(4). Annuals, usually with slender taproots; leaves well-distributed along the stem and only gradually reduced upward and very deeply pinnately lobed (7)
6. Perennials, usually rhizomatous or subrhizomatous; often with most of the leaves crowded near the base, usually becoming much-reduced and remote toward the middle of the stem (9)
- 7(6). Terminal lobe subreniform and incised-dentate; lateral lobes of the upper leaves usually cuneate, strongly contracted toward the axis into a linear basal portion 9. *S. imparipinnatus*.
7. Terminal lobe and lateral lobes irregularly shaped, often not dentate; lateral lobes only slightly if at all narrowed, the basal portions about half as wide as the terminal portions (8)
- 8(7). East Texas10. *S. glabellus*.
8. Trans-Pecos Texas and perhaps rarely Rio Grande Plains . 11. *S. Greggii*.
- 9(6). Leaves unlobed, all crowded at the base (except for 1 or 2 minute triangular bracts high on the scape), serrate, lance-obovate; plants glaucous and essentially glabrous 3. *S. Wootonii*.
9. At least some leaves of the plant pinnately lobed or if approaching unlobed then the plant not all glabrous (10)
- 10(9). Even the basal leaves pinnately lobed, those of midstem 3-10 cm. long, glabrous and with about 10 cuneate linear-based lobes on each side; Trans-Pecos mountains 8. *S. millelobatus*.
10. Basal leaves usually unlobed or if slightly lobed then those of midstem with fewer than 10 lobes on each side and the lobes oblong (11)
- 11(10). Plants persistently floccose-woolly at least in patches near the nodes (12)
11. Plants glabrous at maturity or with very small spots of wool near the base of each leaf (13)
- 12(11). Leaves of midstem usually deeply pinnately lobed; involucre glabrate 5. *S. plattensis*.
12. Leaves of midstem shallowly pinnately lobed or unlobed; involucre persistently pubescent 4. *S. tomentosus*.
- 13(11). Basal leaves thickish, firm, usually with a weakly lobed oblong portion distally and proximally narrowed to a petiole about the same length 6. *S. tridenticulatus*.
13. Basal leaves thin, weak, membranous, usually with an unlobed blade about as broad as long and a very thin petiole longer than the blade .. 7. *S. obovatus*.

1. *Senecio Parryi* Gray. MOUNTAIN GROUNDSEL. Annual (?) herb to 4 dm. tall; stems striate, densely glutinous-pubescent with crisped subglandular hairs; leaves pubescent like the stems, sharply and unequally dentate; stem leaves 5-10 cm. long, obovate, basally attenuate, at the very base dilated and auriculate-clasping; uppermost stem and branch leaves deltoid-lanceolate, also truncate-clasping; heads few, short-pedunculate; involucre 10-13 mm. high, at the base with a few acuminate calyculate bractlets; principal phyllaries

about 21; rays 12 to 15, oblong, yellow, 10-13 mm. long; achenes silky-gray. Rare in wooded canyons in the Trans-Pecos (Chisos Mts. at about 4-5,000 ft. elev.), Sept.-Nov.; Tex., Coah. and the Mogollon Mts. of N.M.

2. *Senecio ampullaceus* Hook. TEXAS GROUNDSEL. Taprooted annual 3-8 dm. tall; herbage either persistently whitish floccose-tomentose or nearly glabrate; leaves gradually reduced upward, well-distributed over at least three-fourths the length, dentate, unlobed; lowermost leaves lanceolate or lance-obovate, narrowed to a linear subpetiolar base and at the extreme base auriculate-clasping, those higher lance-deltoid and often truncate-clasping, mostly longer than the internodes which they subtend; involucre 7-11 mm. high, often urceolate at early anthesis but soon campanulate; principal phyllaries about 21. Abundant in sandy soils, Rio Grande Plains, n.-cen., e. and s.e. Tex., infrequent w. to Llano Region and the e. part of the Plains Country, spring; endemic.

3. *Senecio Wootonii* Greene. Perennial from a stubby crown about 1 cm. thick; stems nearly naked, glaucous, glabrous, 25-50 cm. tall, nearly simple except at the very top; leaves crowded at the base, glaucous, unlobed, serrate, oblanceolate or lance-obovate, 8-30 cm. long, acutish, basally narrowed to a long linear subpetiolar base; branches few, stiffly spreading or ascending 5-12 cm. long, naked-pedunculiform, each terminated by a head; principal phyllaries about 21, 8-13 mm. long. Rare in high moist canyons, Mt. Livermore, Davis Mts. in the Trans-Pecos, late spring-early summer; also s. N.M.

This is possibly a form of the New Mexican *S. microdontus* (Gray) Heller.

4. *Senecio tomentosus* Michx. Weakly perennial herb; stems 25-50 cm. long, mostly erect, floccose-woolly or less commonly mostly glabrate; leaves mostly crowded near the base, serrate; basal leaves with an oblong to lance-ovate blade (3-) 5-10 cm. long and a linear petiole (4-) 6-16 cm. long (upper portion of petiole sometimes with a few lobes), floccose or often glabrate; leaves of lower stem much-reduced as compared to the basal ones, lanceolate, incised-serrate, petiolate or sessile; the few remote bracts higher on the stem lance-deltoid to subulate, 1-3 cm. long, truncate-clasping; involucre 6-7 mm. high, campanulate; phyllaries about 21, usually persistently pubescent. Rare in sandy soil, e. Tex., Apr.; s.e. U.S., n. to N.J. and w. to Okla. and Tex.

Intergrading with *S. plattensis* in Ark., La. and Tex. (See remarks under *S. tridenticulatus*.)

5. *Senecio plattensis* Nutt. PRAIRIE GROUNDSEL. Perennial rhizomatous herb (1-) 2-5 (-7) dm. tall, persistently floccose-woolly at least over boundaries of the herbage near the nodes; many leaves crowded near the base, with oblong to elliptic or ovate-elliptic and serrate blades (1-) 2-6 (-10) cm. long and (5-) 10-30 (-40) mm. broad, 1 to 3 times as long as broad, usually unlobed but less commonly pinnately lobed and petioles usually longer than the blades; stem leaves rather reduced and remote upward, usually rather deeply pinnatifid with 3 to 8 (to 10) lobes on each side and basally truncate-clasping; involucre campanulate; principal phyllaries usually 21, 5-7 mm. long, dorsally quickly glabrate. Frequent in Plains Country and n.-cen. Tex., rare in e. Tex., spring; Va. and Tenn. w. to Mont., Wyo. and Colo., n. to cen. Can. and s. to Tex.

Intergrading to a degree with *S. obovatus* and with *S. tomentosus*.

6. *Senecio tridenticulatus* Rydb. Perennial from woody vertical sparingly-branched caudexes 4-10 mm. thick; stems 1-3 dm. tall, glabrous to lightly floccose in a few small spots near the nodes; leaves crowded near the base, firm and almost 0.5 mm. thick in life, petiolate; blades rarely unlobed, usually with 2 to 8 lobes on each side (and these again incised-dentate near their apices), oblanceolate or oblong in outline, 2-5 cm. long, 5-15 mm. broad, usually about 3 times as long as broad; stem leaves few, remote and much-reduced (or absent), linear-oblong in outline, usually pinnatifid, clasping; involucre campanulate; phyllaries usually 21, 5-9 mm. long. Infrequent or rare in Davis Mts. in the Trans-Pecos, in the Llano Region and the Plains Country, spring; cen. Can. and Plains States s. to N.M. and Tex.

Probably has introgressed with *S. plattensis*. The closely related *S. neomexicanus* Gray has been reported to occur in the Guadalupe Mts.; it would key to the east Texas *S. tomentosus* in this treatment.

7. *Senecio obovatus* Muhl. GOLDEN GROUNDSEL. Perennial herb from slender branching rhizomes 2-3 mm. thick; stems 2-5 (-7) dm. tall, essentially glabrous except in genetically contaminated plants; basal leaves crowded; blades thin-membranous, unlobed, serrate, 2-8 cm. long, usually about as broad as long, truncate or slightly angled at the base;

petioles (1.5) 2 to 4 times as long as the blade; *stem leaves* few, remote and much-reduced (occasionally nearly absent), clasping, usually pinnately lobed; involucre campanulate; phyllaries about 20, 3-7 mm. long. Incl. var. *rotundus* Britt., *S. aureus* of Tex. reports. Frequent in Edwards Plateau and n.-cen. Tex., usually in calcareous soil, less common in e. Tex., spring; most of e. and s.e. U.S., w. to Ill., Kan., Okla. and Tex.

Shows evidence of introgression with *S. plattensis*.

8. *Senecio millelobatus* Rydb. Rhizomatous perennial herb; aerial shoots 10-25 (-40) cm. tall, rather leafy throughout; lowest (basal) leaves few and occasionally only weakly lobed but in most plants the leaves rather similar all up and down the stem except for slightly reduced size and reduction of petiole upward, all linear or linear-oblongate and very deeply pinnatifid (or even nearly pinnately compound), the lobes much-constricted basally and upwards of 10 in number on each side; principal phyllaries usually about 21, 5-6 mm. long. Locally frequent in Trans-Pecos mts. (Chisos and Davis), Apr.-Sept.; Ariz., Chih. and Tex.

9. *Senecio imparipinnatus* Klatt. Slenderly taprooted annual; stems solitary or few, sparingly branched, erect, (1-) 2-4 (-6) dm. tall; leaves usually well-distributed over the stem, only very gradually reduced upward, 2-10 cm. long, very deeply pinnatifid, the terminal lobe subreniform and incised-dentate, the lateral lobes of the upper leaves usually cuneate and strongly contracted toward the axis into a linear basal portion (the cuneate portion of the lobe itself often incised); involucre campanulate; principal phyllaries 3-6 mm. long, usually about 21 in number. Abundant over e. half of the state, infrequent w. in the Plains Country and Edwards Plateau, spring; Tam., Tex., Okla. and La.

Intergrades with *S. glabellus* and *S. Greggii*, these three species being poorly defined from each other. In Dallas and Grayson counties occurs a form in which the lateral lobes are again deeply incised-lobed, the ultimate divisions being short-linear. This race has not been given a separate botanical name.

10. *Senecio glabellus* Poir. BUTTERWEED. Annual 1-4 (-10) dm. tall; leaves pinnately lobed, lateral lobes oblong, undulate-margined, basally (toward the axis) not or only slightly constricted, the terminal lobe irregularly undulate. Rare in sandy soil, e. Tex. (Gregg and San Augustine cos.), spring; s.e. U.S., n. to N.C., Ill. and Mo., w. to Kan., Okla. and Tex.

11. *Senecio Greggii* Rydb. Annual 1-3 dm. tall, 1 to several-stemmed from the base; stems rather stiffly erect, about 2-3 mm. thick; leaves pinnately lobed, the terminal lobe irregularly incised-serrate or again lobed, the lateral lobes only slightly narrowed basally (toward the axis), the base about half as broad as the distal portion. Rare in sandy soil along the Rio Grande in the Trans-Pecos (rare farther down the river), Apr.-May; also Chih.

12. *Senecio spartioides* T.&G.* Subshrubby perennial (3-) 5-10 (-13) dm. tall, freely branched from the base and again near the upper end, essentially glabrous; leaves numerous, well-distributed over the stem, not reduced upward, often slightly succulent or fleshy, (2-) 3-6 cm. long, pinnatifid with linear lobes, the lateral lobes 2 to 5 on each side and rather well-distributed along the axis, the terminal lobe less than a third the total length of the leaf; involucre usually obconic; principal phyllaries about 12 to 14, about 1 cm. long. Locally abundant, usually in rather loose sandy soil, w. half of state and also in coastal part of Rio Grande Plains, July-Oct.

We have two varieties:

Var. *Fremontii* (T.&G.) Greenm. Rather close-branching above so that the entire plant is densely subcorymbose; leaves not succulent but merely a little fleshy. *S. Riddellii* T. & G. Western half of state; widespread in w. U. S. and n. Mex.

Var. *Parksii* (Cory) Shinnars. With widely spreading branches above, the whole plant loosely corymbose; leaves rather succulent. Locally abundant in loose sandy soils of Brooks, Jim Hogg, Kenedy, Kleberg, and Nueces cos., s. Tex.; endemic.

Both varieties comprise very showy plants that are reputed to be toxic to livestock. A few specimens in western Texas seem to show intermediacy in character between *S. spartioides* and *S. longilobus*.

13. *Senecio Warnockii* Shinnars. Subshrubby perennial; stems several from the base and with ascending branches above, 2-4 dm. tall, essentially glabrous or minutely whitish-

* Recent studies by Robert I. Ediger indicate that this should be *S. Riddellii* T.&G.

floccose and then glabrate; leaves very numerous, crowded, linear-filiform, rarely lobed, (2-) 3-6 cm. long, somewhat fleshy; heads not crowded; involucre obconic; principal phyllaries about 13 or 14, 8-9 mm. long. Restricted to gypseous sands of the Culberson-Hudspeth county area where locally abundant, Sept.-Oct.; also N.M.

14. *Senecio longilobus* Benth.* Subshrubby perennial; stems several from the base and freely ascending-branched above, closely whitish-floccose on all herbage or eventually glabrate; leaves numerous, crowded-ascending, 3-10 (-12) cm. long, usually pinnately lobed at least in the lower half, the lateral and terminal lobes filiform-linear, the terminal lobe often comprising as much as half the total length or more; involucre campanulate; principal phyllaries usually 21. *S. filifolius* Nutt. Abundant in w. half of Tex., e. rarely to Rio Grande Plains, spring-fall; widespread in driest parts of w. U. S. and n. Mex.

These are very showy plants increasing enormously in abundance under the prevalent abusive overstocking of ranges; reputed to be toxic to livestock. Some plants seem to combine characters of this species and of *S. spartioides*.

127. CACALIA L. INDIAN PLANTAIN

Strongly perennial essentially glabrous herbs; stems stout, 5-20 dm. tall, mostly simple and erect except at the extreme top; leaves alternate, the blades lanceolate or elliptic to rhombic-ovate or rhombic-oblongate, the lower ones usually long-petioled, the distal margin often undulate or remotely dentate; unlobed heads in a close corymbose arrangement at the tip of the plant; involucre short-urceolate, 5-10 mm. long; phyllaries about 5, broad, yellow-green; receptacle slightly convex, naked; *ray flowers* absent; *disk flowers* few, perfect, fertile, the corolla pale-yellowish or nearly white with its limb equally 5-toothed; achene columnar, smoothish; pappus persistent, of numerous very slender white bristles.

About 50 species, mostly in eastern Asia.

1. Phyllaries wing-keeled; basal and lower stem leaves ovate or rhombic-ovate, usually broadly so; plant usually flowering April-June1. *C. plantaginea*.
1. Phyllaries not wing-keeled; basal and lower stem leaves lanceolate; plant flowering July-October2. *C. lanceolata*.

1. *Cacalia plantaginea* (Raf.) Shinn. Lower stem leaves ovate to rhombic, usually broadly so; each phyllary at least by anthesis with a narrow median dorsal keel. *C. tuberosa* of auth. Frequent in open areas, e., s.e. and n.-cen. Tex., Apr.-June and less commonly again in late Sept.-Nov.; widespread in e. U. S.

2. *Cacalia lanceolata* Nutt. Lower stem leaves narrower than in *C. plantaginea*, usually lanceolate; phyllaries not wing-keeled even after anthesis. Infrequent in e. and s.e. Tex., July-Oct.; coastal s.e. states. *C. plantaginea* and *C. lanceolata* intergrade to some extent.

128. ERECHTITES RAF. FIREWEED. BURNWEED

A genus of about 15 species in America, Australia and New Zealand.

1. *Erechtites hieracifolia* (L.) Raf. var. *intermedia* Fern. Annual herb with stubby taproots and numerous adventitious roots, the lower parts of the stem occasionally propped in the mud by adventitious roots at the lower nodes, leafy, usually with one stem and few branches, to 1 m. tall; leaves alternate, irregularly and often doubly serrate, the lower ones narrowed to a subpetiolar base and broadly oblanceolate, the higher ones semiamplexicaul and the teeth tending to be incised very deeply almost forming shallow lobes; heads on slender peduncles 2-18 cm. long; receptacle essentially flat, naked; involucre cylindrical or slightly urceolate at anthesis, becoming narrowly campanulate in fruit; principal phyllaries equal, linear, about 13 or 14 in number, in a double row, 9-13 mm. long; outer phyllaries few, setaceous, 1-3 mm. long, forming a weak calyculum; flowers of 2 kinds; *peripheral flowers* pistillate, fertile, with a yellowish-white filiform-tubular corolla which at the tip is microscopically unequally toothed with 3 of the teeth much longer than the other 2 (the 3 longer teeth corresponding to the 3 teeth at the end of a

* Recent studies by Robert I. Ediger indicate that this should be *S. Douglasii* DC. var. *Jamesii* (T.&G.) Ediger.

ray and oriented to the outside of the head); *central flowers* numerous, perfect, fertile, the corollas with basal tube and a flaring equally 5-toothed limb; achenes all alike, columnar; pappus of copious soft white capillary bristles. Infrequent in muddy places, s.e. Tex. and s. part of e. Tex., Aug.-Nov.; e. U.S.

129. HAPLOESTHES GRAY

A genus of 2 species of which one is represented with us; the other species occurs in Coahuila.

1. *Haploesthes Greggii* Gray var. *texana* (Coulst.) I. M. Johnst. FALSE BROOMWEED. Subshrub from very tough woody taproots; stems several to numerous from the base, (2-) 3-5 (-8) dm. tall, much-fastigiately-branched, nearly glabrous; leaves numerous, opposite, linear-filiform, never lobed, 2-5 cm. long; heads numerous, in dense corymbose terminal clusters; involucre campanulate or somewhat urceolate; phyllaries constantly 5 in number, 3-4 mm. long, plumbeous to blue or green when dry, 1 to 1.5 times as long as broad, in one series, subequal, free, broadly overlapping; receptacle slightly convex, naked; *ray flowers* 3 to 5, pistillate, fertile; rays 1-2 mm. long, yellow to yellowish-white; *disk flowers* perfect, fertile, the corollas yellow to yellowish-white and equally 5-toothed; achenes irregularly columnar to falcate-columnar, about 1.5 mm. long, usually 10-ribbed, ripening blackish; pappus persistent, of a number of tawny or buffy unequal stiff bristles. Local apparently in gypseous areas, Plains Country, Edwards Plateau, Trans-Pecos and Rio Grande Plains, known to flower in all months except Nov. and Dec.; Coah., Chih. and Tex.

130. CENTAUREA L. STAR-THISTLE

Herbs; leaves alternate; heads solitary, terminal or axillary; phyllaries in several to many series, strongly imbricated; receptacle flat, covered with whitish bristles; ray flowers absent; marginal or peripheral disk flowers usually larger than the central ones especially as to corolla-size; corollas very deeply 4- or 5-lobed with the lobes linear; anthers with an elongate appendage apically; style thickened below the fork, the 2 branches papillate to the obtuse tips; achenes usually attached at an obliquely beveled surface just above the base or at a lateral notch slightly removed from the base.

A large and relatively diverse genus related to the thistles but not really thistlelike except for the spinose involucre of some species; most of our representatives are introduced.

- 1. Heads including corollas (3-) 4-8 (-10) cm. across; corollas pink (rarely white in albinos)1. *C. americana*.
- 1. Heads smaller or if nearly 3 cm. across then corolla not pink (2)
- 2(1). Phyllaries not spinose, at most with denticulate margins; corolla blue, pink or white (3)
- 2. Phyllaries with spines; corollas yellowish (4)
- 3(2). Plants thinly arachnose; leaves decurrent on the stem as narrow wings; annual ..
.....2. *C. Cyanus*.
- 3. Plants nearly glabrous; leaves not decurrent; rhizomatous perennial
.....3. *C. repens*.
- 4(2). Spinose tip of phyllary darker than the body of the phyllary, 3-9 mm. long
.....4. *C. melitensis*.
- 4. Spinose tip stramineous, those of the upper-middle phyllaries 10-17 mm. long
.....5. *C. solstitialis*.

1. *Centaurea americana* Nutt. BASKET-FLOWER, THORNLESS THISTLE, CARDO DEL VALLE. Erect annual (3-) 10-15 (-20) dm. tall; stems (1-) 2-4 (-6) mm. thick, leafy, simple below, branched above; leaves sessile and essentially entire; lowermost leaves sessile, narrowly obovate, scabrous; middle and upper leaves lanceolate, 2-6 cm. long, nearly glabrous; heads solitary at the ends of the upper branches, (3-) 4-8 (-10) cm. across (including the corollas); involucre broadly and shallowly campanulate; phyllaries appressed, in many series, strongly imbricate, each firm and stramineous and articulated into 2

portions, the lower portion linear and entire, the upper portion shorter and lance-deltoid with a flat subulate tip and on each side with 4 or 5 toothlike cusps or lobes; corollas pink or white in albinos, the peripheral ones much larger than the central ones; achenes fuscous, attached at an obliquely beveled surface just above the base; pappus of long barbellate bristles in 1 or 2 series, attached separately or only very weakly coalescent basally. Locally abundant over much of the state except the sandy forested areas of e. Tex., late spring-summer; Mo. to Ariz. and s. to La., N. L. and Coah.

Very showy and sometimes cultivated.

2. *Centaurea Cyanus* L. BACHELOR'S BUTTON, CORNFLOWER. Annual 3-6 dm. tall; stems usually 1-2 (-3) mm. thick and solitary from the base, branched above, the branches ascending, the herbage thinly tomentose; basal and lower stem leaves oblanceolate, shallowly pinnately lobed or merely toothed; upper stem leaves 1-5 cm. long, narrowly oblanceolate, sometimes toothed but not spiny, decurrent as extremely narrow stem wings; heads solitary, terminating the short leafy branchlets (the whole plant subcorymbiform); involucre campanulate, 15-25 mm. broad, of about 5 series of strongly imbricated phyllaries; outer phyllaries appressed, thinly arachnose and narrowly deltoid, with a well-defined thinner white margin that is either lacerate-fimbriate or usually divided into a number of short toothlike lobes, grading to the upper middle phyllaries that are more pointed and in which the denticulate margins are dark-purplish or brownish-purple to form a dark margin; longest innermost series of phyllaries strongly spreading, lanceolate, purple-tipped, not denticulate marginally but each with a blunt cusplike top which has a few toothlike laciniae; corollas purplish-blue to pink or white, the peripheral ones larger than the central ones; achenes attached at a notch on one side just above the base; pappus of a number of series of strongly unequal nonbarbellate bristles, shiny-white, 0.2-3.5 mm. long. Locally escaped along roadsides, widely cult. as an ornamental, Apr.-June; nat. of Eur., widely cult. and escaped.

3. *Centaurea repens* L. RUSSIAN KNAWEED. Perennial with slender rhizomes; stems 3-6 (-10) dm. tall, only 1-3 mm. thick, much-branched above, the branches spreading and then terminally ascending; leaves entire, not spiny, mostly oblanceolate, narrowed basally but not petiolate, the lowermost ones 4-10 cm. long, those of midstem (15-) 20-30 mm. long, reduced on the head-bearing branchlets to minute bracts; heads solitary on the branches, about 1 cm. thick; involucre stramineous or whitish; phyllaries not at all spinose, in about 4 series, most of the outer ones as broad as long, very blunt, mostly firm but with a narrow margin which is thin and minutely lacerate-fimbriate terminally, grading to the innermost phyllaries that are not firm but are lanceolate and toward the acute weak tip are densely pilosulous or hirsutulous; corollas blue, pink or white, the peripheral ones larger than the central ones; achenes not oblique basally; pappus of a number of separate barbellate units about 5-7 mm. long. *C. Picris* Pall. Rare and local in the Trans-Pecos (near Balmorra), perhaps not a persistent member of our flora, summer; nat. of Eur., now widely adv.

4. *Centaurea melitensis* L. TICALOTE, MALTA STAR-THISTLE. Winter annual or rarely biennial; stems several from the base, usually ascending, 1-5 (-8) dm. long, branched above; basal leaves and lower stem leaves oblanceolate in outline, 5-10 cm. long, pinnately lobed, the lobes rounded, not at all spinose; upper leaves nearly linear, 1-3 cm. long, not much-reduced upwards on the stem, decurrent, forming narrow wings on the stem; heads in the axils of the upper leaves; peduncles absent or 1-3 mm. long; involucre nearly globose, about 1 cm. thick (not including the spines), burlike; phyllaries in about 5 series, very firm, often thinly arachnose near the tip when young, the body stramineous, nearly as broad as long and strongly tapered or rounded upward, abruptly giving way apically to the even more indurate and noxiously spreading spinose-tip which is subulate (3-9 mm. long), darker than the body and often near its base on each side bears a couple of very short spine-lobes; corolla yellow; achenes attached at a lateral notch slightly removed from the base on one edge; pappus bristles shining, white, 2-6 mm. long, in several series, separate, not barbellate. Abundant in disturbed calcareous soil especially along roads over much of Edwards Plateau, n.-cen. Tex., s. part of e. Tex. and n. part of Rio Grande Plains, spring; nat. of Eur., now widely adv.

5. *Centaurea solstitialis* L. BARNABY STAR-THISTLE. Annual 3-7 dm. tall, usually with a single stem from the base, thinly arachnose over most of the herbage, widely branched above; basal leaves 5-8 cm. long, deeply pinnatifid, usually withered before anthesis; stem leaves 1-3 cm. long, essentially linear, long-decurrent as pronounced stem wings;

heads terminating the branchlets, erect; involucre globose, about 1 cm. thick (not including spines), burlike; phyllaries in about 4 to 5 series, very firm, often thinly arachnose near the tip when young, the body greenish-stramineous and about as broad as long, rounded upward abruptly giving way to the even more indurate and noxiously spreading spinose tip which is subulate and stramineous (those of the upper-middle phyllaries 10-17 mm. long) and often near its base bears on each side a couple of very short spine lobes; corolla yellow; achenes attached at a lateral notch slightly removed from the base on one edge; pappus bristles shining-white, 2-4 mm. long, in several series, separate, not barbellate, present only on the central (abortive?) achenes, the peripheral plump white achenes being epappose. Rare in disturbed soil especially along roadsides, n.-cen. Tex., spring-early summer; nat. of Eur., now widely adv.

131. CARDUUS L. PLUMELESS THISTLE

Annual or biennial herb 5-20 dm. tall, with few stems from the base; leaves alternate, decurrent, pinnatifid, with spiny-serrate margins; heads solitary or clustered at the ends of branches; involucre nearly cylindrical to campanulate, 5 to 7 series of lanceolate acute spine-tipped phyllaries, strongly imbricate; receptacle covered with soft hairlike bristles; ray flowers absent; disk flowers numerous, perfect, fertile; corolla pink, deep-pink or rarely purple, deeply subequally 5-lobed; filaments separate; achenes attached basally to the receptacle; pappus bristles not plumose, sometimes barbellate in the lower part but the lateral projections only about as long as the breadth of the central axis or shorter; pappus deciduous as a unit because of the joining of the bristles into a ring basally.

An Old World Temperate Zone genus of almost 100 species. The genus probably should be re-enlarged to include *Cirsium* which was originally excluded on the basis of the single technicality of pappus plumosity.

1. Heads 30-50 (-60) mm. thick, usually essentially solitary at the ends of branches; some of the outer phyllaries spreading or even sharply reflexed 1. *C. nutans*.
1. Heads 10-15 (-20) mm. thick, usually in close clusters of 5 to 10 heads at the ends of branches; phyllaries mostly ascending 2. *C. tenuiflorus*.

1. *Carduus nutans* L. MUSK-THISTLE. Considered to be biennial, 4-20 dm. tall; leaves pinnatifid, the lobes coarsely spiny-toothed; heads solitary at the ends of ascending branches that are usually naked and pedunculiform several cm. below the heads; involucre campanulate, usually 25-50 mm. thick, squarrose. Local on Edwards Plateau and to be expected elsewhere, May-July; nat. of Eur., now widely adv. in temp. areas.

2. *Carduus tenuiflorus* Curt. Considered to be annual, 3-10 dm. tall; leaves pinnatifid, the lobes coarsely spiny-toothed; heads in close clusters of 5 to 10 heads at the ends of ascending leafy branches; involucre 10-15 (-20) mm. thick, the phyllaries ascending. Local on Edwards Plateau, Apr.-May; nat. of s. Eur., now widely adv. in dry temp. areas.

132. CIRSIUM MILL. THISTLE. PLUMED THISTLE

Winter annual, biennial or perennial herbs; leaves alternate, entire or often lobed, usually also irregularly serrate, the whole blade plus each lobe plus each tooth usually ending in a spine-tip, sessile, often narrowed to a subpetiolar base, often slightly decurrent on the stem, often with a thin floccose wool beneath or on both surfaces; heads singly terminating the pedunculiform upper parts of the branches; involucre ovoid or subcylindrical to urceolate or nearly globose, usually much broader and more saucer-shaped after anthesis and when the achenes are mature; receptacle covered with soft hairlike bristles; phyllaries in many series, strongly imbricated, mostly lanceolate and nearly always each one ending in a spine-tip (not in *C. muticum*); ray flowers absent; disk flowers numerous, perfect, fertile; corolla usually mauve, reddish-purple, purple or pink, rarely white or yellowish (in *C. horridulum*), deeply and subequally 5-lobed; filaments separate; achenes mostly oblong or elliptic-oblong, flattish, unribbed, attached basally to the receptacle; pappus of numerous bristles united in a ring at the base, the lower part of each bristle plumose, the entire pappus deciduous as a unit.

A north-temperate genus of about 150 species. Differing from *Carduus* only in that

each unit of the pappus is decidedly plumose in the lower part; probably should be sub-merged in *Carduus*.

1. Flowers pinkish or yellowish; phyllaries of the true involucre all with weak flat tips but the large heads (4-8 cm. broad) subtended and often equalled or surpassed by a false involucre of large very spinescent appressed bracteal leaves 2. *C. horridulum*.
1. Flowers pinkish or purplish, rarely white and *never yellow*; at least the outer phyllaries prickly-tipped or with firm points; heads either naked at base or with only a few narrow or linear bracteal leaves at the base shorter than the involucre (2)
- 2(1). Outer phyllaries barely pointed, scarcely prickly-tipped; tips of inner phyllaries broadly lanceolate 7. *C. muticum*.
2. Outer phyllaries prickly-tipped (3)
- 3(2). Involucre 10-22 mm. high, nearly as broad as high or broader in flower, much broader in age (4)
3. Involucre 25-50 mm. high, higher than broad in flower, broader in age (5)
- 4(3). Taproot well-developed, much-surpassing the ring of secondary roots near the base of the stem 8. *C. texanum*.
4. Taproot poorly developed, stubby, shorter than the other roots so that the root system is fibrous 9. *C. carolinianum*.
- 5(3). Rare in crevices of cliffs in mts. in the Trans-Pecos; phyllary tips straight in line with the body of the rigid phyllary and not differing much from it in texture; most of the phyllaries largely reddish-purple or purple-tinged 1. *C. Turneri*.
5. Collectively widespread in sandy or rocky soils; phyllary tips (prickles) at least those of the middle phyllaries of a different (paler, more indurated) texture than the body of the phyllary and often slightly more spreading than the body, or even reflexed; most of the phyllaries largely stramineous or blackish, only the innermost (if any) purple-tinged (6)
- 6(5). Upper stem leaves with broad bases, subamplexicaul; plants strongly perennial, sometimes with creeping rhizomes, forming loose clumps or colonies; heads usually quite naked basally, about 1 cm. remote from the nearest bracteal leaf or if leaves closely subtending the head then these not differing substantially from those slightly farther down the peduncle (7)
6. Upper stem leaves basally narrowed to a subpetiolar base; biennials or weak perennials; heads often with a few small narrow bracteal leaves at the base differing in their narrowness and crowded condition from the bracteal leaves slightly farther down the peduncle (8)
- 7(6). Leaves shallowly pinnatifid (lobes usually less than a third the total breadth) or rarely unlobed, upper and lower surfaces almost the same shade of gray, not decurrent or only decurrent as much as 5 mm. below the departure of the midrib from the stem 4. *C. undulatum*.
7. Leaves pinnatifid with lobes often more than a third the total breadth, upper surfaces often strikingly darker (less canescent) than the lower, decurrent at the base often as much as 10 mm. below the point of divergence of the midrib from the stem ... 3. *C. ochrocentrum*.
- 8(6). Stem leaves entire to shallowly pinnatifid (the lobes up to a third the total breadth); roots coarsely fibrous, not tuberous-thickened; flowering mainly from mid-June to September 5. *C. iowense*.
8. Stem leaves (except the uppermost) more deeply pinnatifid on the average; usually some roots with tuberous enlargements; flowering mainly late May to July 6. *C. terraenigrae*.

1. *Cirsium Turneri* Warnock. CLIFF THISTLE. Roots perennial, rupicolous, not dislodged from their crevices; crowns fibrous, woody, 8-30 mm. thick; stems annual, herbaceous, 5 to 30 from each crown, 15-45 cm. long, simple except just beneath the head clusters, usually horizontal or drooping from cliff overhangs, 3 mm. thick, greenish-brown with

paler striae (excurrent midveins of leaves), thinly arachnose with flat jointed translucent hairs; internodes much shorter than the leaves; leaves pale-green, crowded, oblanceolate, pinnately lobed, 10-15 cm. long at midstem or much longer at base of stem and reduced beneath the heads, glabrous except thinly arachnose along the midveins, superficially microscopically pustular, basally narrowly clasping, apically and marginally spinose with principal slender spines stramineous and 4-7 mm. long; heads essentially sessile, not calyculately bracteate, 60- to 80-flowered, disposed in subcorymbose terminal clusters of (1 to) 3 to 5 per stem; involucre campanulate, 2-3 cm. broad; phyllaries strongly graduated in 3 or 4 series, linear-lanceolate, rose-purple to royal-purple or magenta, the outermost only a fourth as long as the innermost, marginally thinly arachnose, spine-tipped and with distinct midribs, the innermost round-keeled and long-acuminate into flattened stramineous tips; receptacles flat, 5-7 mm. wide, alveolate, thickly beset around the alveolae with white hairs about 1 cm. long; corollas slightly exceeding pappus, rose-purple to magenta, very slender, divided more than halfway into 5 very narrow lobes; achenes linear-oblong, about 5 mm. long. Rare in crevices of limestone or basalt bluffs and cliffs in the Trans-Pecos at elev. of 3,000-5,000 ft., July-Dec.; endemic.

2. *Cirsium horridulum* Michx. BULL THISTLE, YELLOW THISTLE. Winter annual or biennial, 1-10 dm. tall, rarely taller; stems commonly 5-10 mm. thick basally; flowering stem commonly solitary at the base, rarely much-branched above, usually with a solitary terminal head; leaves in over-all outline often broadly linear to lanceolate or oblanceolate, pinnatifid with shallow, spiny lobes; heads subtended closely by a false involucre or calyculum of large very spiny appressed bracteal leaves as long as or longer than the true involucre; involucre 4-8 cm. broad; phyllaries of the true involucre all with weak flat tips; corolla pinkish or yellowish. *Carduus spinosissimus* Walt. Common in open sandy places, e. and s.e. Tex. and coastal part of Rio Grande Plains, Mar.-May; mostly on the Coastal Plain, Me. to Tex.

Some of the populations of rather small plants near the Texas coast seem to show some similarities to the Floridan taxon called *C. vittatum* Small, but it is extremely doubtful that they are specifically distinct from *C. horridulum*.

3. *Cirsium ochrocentrum* Gray. YELLOW-SPINE THISTLE. Subrhizomatous perennials (2-) 3-8 (-12) dm. tall; leaves often with upper surfaces much less canescent than the lower, in over-all outline mostly lanceolate or oblanceolate but pinnatifid with extremely spiny lobes often more than a third the total breadth of the leaves, those of midstem narrowly decurrent basally often as much as 1 cm. below the point of departure of the midvein from the stem; upper stem leaves with broad bases, subamplexicaul, long-tapered to the apex; uppermost parts of the stems naked or if some of the smallest upper leaves closely subtend the head they are not differentiated into linear calyculate bracts but resemble the other bracteal leaves just below; heads at flowering time longer than thick, broader in age; involucre 25-50 mm. high; phyllaries often with a medial glandular black or vernicose strip, often (at least when young) tomentose thinly at the base and also along the margins, the lower middle phyllaries (2.2-) 2.5-3 mm. broad and long-tapered to the very acute apexes, each phyllary provided with a straight spreading spine-tip differing in texture from the body of the phyllary; flowers purplish, rosy-lavender or rarely whitish. Frequent or local in open areas, often disturbed soil, Trans-Pecos and Plains Country, infrequent or rare e. to n.-cen. Tex. and Edwards Plateau, summer; Neb. s. to Tex. and w. to Ariz.

Apparently some populations show genetic contamination of *C. ochrocentrum* by *C. undulatum* and vice versa.

4. *Cirsium undulatum* (Nutt.) Spreng. Subrhizomatous perennial (2-) 3-10 (-20) dm. tall; leaves often with the upper surfaces nearly or quite as canescent as the lower, in over-all outline mostly broadly linear to lanceolate or oblanceolate but pinnatifid with somewhat or weakly spiny lobes usually less than a third the total breadth; leaves of midstem not at all decurrent or else decurrent for less than 5 mm. below the point of departure of the midvein from the stem; upper stem leaves with broad bases, subamplexicaul, long-tapered to the apex; uppermost parts of the stems naked or if some of the smallest upper leaves closely subtend the head they are not differentiated into linear calyculate bracts but resemble the other bracteal leaves just below; heads at flowering time longer than thick, broader in age; involucre 25-50 mm. high; phyllaries often with a

medial glandular black and/or vernicose strip, often (at least when young) tomentose thinly at the base and also along the margins, the lower-middle phyllaries 2.5-3.5 (-4) mm. broad and long-tapered to the very acute apexes, each phyllary provided with a straight spreading spine tip differing in texture from the body of the phyllary; flowers lavender, purplish or white. *C. megacephalum* (Gray) Cockll. Frequent locally in Plains Country and n.-cen. Tex., infrequent s. to Edwards Plateau and the Trans-Pecos, May-June (-July); B.C. and most of w. U.S. e. to Man., Mich., Mo., Okla. and Tex.

Some Trans-Pecos plants which have been called *C. perennans* (Greene) Woot. & Standl. by some authors are referred here. Notes under *C. ochrocentrum* and *C. undulatum* indicate the probability of past hybridization with those taxa.

5. *Cirsium iowense* (Pammel) Fern. Winter annual or biennial (or rarely perennial by slender rhizomes?), usually with slender fibrous roots crowded at the crown, no definite taproot in evidence; stems few, 5-15 dm. tall; leaves mostly oblanceolate, with a number of short spines along the margin, either nearly entire or with a few shallow lobes up to a third the total breadth; upper stem leaves narrowed to a linear subpetiolar base; heads in flower usually distinctly longer than thick, immediately subtended by a few linear calyculate bracteal leaves much shorter than the involucre; involucre urceolate or usually short-cylindric to cylindric-campanulate, 3-5 cm. high; phyllaries mostly stramineous marginally, usually with a darker subglandular subrhombic medial patch, usually nearly glabrous except on the margins, each with a spine-tip of a slightly different texture and slightly more spreading than the body of the phyllary, the lower-middle phyllaries 2.2-2.5 (-2.9) mm. broad; flowers lavender. Locally abundant in disturbed usually calcareous open soil, n.-cen. Tex., rare in e. and s.e. Tex., June-Sept.; Plains States, Minn. and Ia. s. to Tex.

Reports of *C. altissimum* (L.) Spreng. in Texas are based on incorrectly determined specimens of this species.

6. *Cirsium terraenigrae* Shinn. Biennial or weak perennial with crowded slender fibrous roots near ground level, some of these often tuberous-thickened well below ground (rarely preserved in prepared specimens); stems few, mostly 5-15 dm. tall; leaves mostly broadly linear or oblanceolate in over-all outline but deeply pinnately lobed, the lobes usually a third to nearly half the total breadth and rather spiny, often the upper surface distinctly less canescent-tomentose than the lower and nearly dark green; upper stem leaves narrowed to a linear subpetiolar base; heads in flower usually distinctly longer than thick, immediately subtended by a few linear calyculate bracteal leaves much shorter than the involucre; involucre urceolate to usually short-cylindric or cylindric-campanulate, 25-50 mm. high; phyllaries mostly stramineous marginally, with a darker subglandular subrhombic medial patch, nearly glabrous, each (except sometimes the outermost) with a spine tip of a slightly different texture and slightly more spreading than the body of the phyllary, the lower-middle phyllaries (1.9-) 2.1-2.8 mm. broad; flowers deep-rosy-lavender. Locally abundant in open calcareous prairies, n.-cen. Tex., rare and local in restricted areas of calcareous soils in e. Tex., May-July; endemic or perhaps also in Okla.

Reports of *C. discolor* (Muhl.) Spreng. in Texas are based on incorrectly determined specimens of this species. According to some researchers the name *C. Engelmannii* Rybd. may apply to this species.

7. *Cirsium muticum* Michx. SWAMP-THISTLE. Biennial supposedly; stems thick and hollow, 4-30 dm. tall; leaves thinnish, very deeply pinnatifid, the lobes almost half the total breadth; involucre ovoid-cylindric, 20-35 mm. high; outer phyllaries blunt and merely subulate-mucronate, not spiny-tipped; flowers purple or rarely whitish. Very rare in moist sand, usually acid areas, e. Tex., July-Aug.; s.w. Can. and n.e. U.S. s. to N.C., Tenn., La. and Tex.

8. *Cirsium texanum* Buckl. Biennial (?) or weak perennial from a slender napiform or irregularly tuberous-enlarged deep taproot, often with a ring of fibrous secondary roots near the top of the taproot; stems usually solitary at the base, (2-) 10-15 (-20) dm. tall, often much-branched, the long branches erect or ascending; leaves slightly auriculate-clasping, those of midstem in outline usually narrowly obovate to lance-obovate, long-tapered basally, on each side with 3 to 9 triangular or rounded lobes which are in turn irregularly spiny-denticulate, above dark-green and glabrous or less commonly deciduous-floccose, beneath thinly grayish or whitish floccose-woolly; upper leaves reduced, broadest at the clasping base and tapering to the acute apex; upper (1-) 2-25 cm. of the flowering

branch essentially naked; involucre 14-22 mm. high, as broad as high or broader in flower, much broader in age, not subtended by any narrow bracteal leaves immediately at the base of the involucre; phyllaries often very thinly floccose in early head-condition, the innermost long-subulate and often purplish-tinged, the middle and outer ones not purplish-tinged, each with a prickle-tip usually spreading more than the body of the phyllary, the lower middle phyllaries at the base about 1 mm. broad (0.8-1.3, rarely to 1.5); disk pink, pink-purple, lavender-purple or rose-purple. Incl. var. *stenolepis* Shinnars, *Carduus austrinus* Small. Locally extremely abundant especially in disturbed soils, along roadsides and in fields, nearly throughout except in extreme e. Tex., extreme w. part of the Trans-Pecos and the higher parts of the Plains Country, late spring-summer, rarely again in fall; Okla. to Tam., N.L. and Coah.

In parts of the Edwards Plateau and the eastern part of the Trans-Pecos occur populations showing some of the characters of *C. undulatum* and probably representing the result of genetic contamination of *C. texanum* by *C. undulatum*. Such plants served as the basis of *Carduus Helleri* Small and *Cirsium Wrightii* Gray. Possibly the present species should be called *C. Wrightii* Gray even though the original collections of it were of genetically mixed plants.

9. *Cirsium carolinianum* (Walt.) Fern. & Schub. Biennial (?) or weak perennial, with fibrous root-systems on a stubby taproot about 1 cm. long and only a little less thick; stems usually solitary at the base, moderately branched above, in all usually about 1 m. tall (3-15 dm); leaves relatively thin and pliable, above green and nearly glabrous or promptly glabrate or merely hirtellous, beneath with a dense white tomentum of close felt, not decurrent or decurrent for not more than 5 mm. below the point of departure of the midvein from the stem; peduncles naked or with only 1 or 2 remote bracteform leaves, at the summit not bearing any calyculum of spinescent bracts below the heads; involucre 15-20 mm. high, usually as broad as high or broader even as early in development as anthesis; phyllaries spine-tipped (except the innermost), not purplish (except the innermost in some populations), the spine-tips spreading more than the body of the phyllary, basal portions of the lower-middle phyllaries about 1 mm. broad, the inner phyllaries very long-subulate; disk purple, pink-purple or lavender-purple, only 2-3 (-4) cm. across. *C. flaccidum* Small. Locally abundant in openings in sandy, forested areas, e. Tex., late spring-summer; Ga. to Tex., n. to N.C., O., Ind., Ill. and Mo.

133. SILYBUM ADANS. MILK THISTLE

There are 2 species, both native to the Mediterranean region.

1. *Silybum Marianum* (L.) Gaertn. Annual or biennial 1-2 m. tall; leaves alternate, to 8 dm. long and 3 dm. broad, mottled white especially in the vicinity of the veins, with clasping bases and wavy or lobed margins with many yellow spines; heads 25-50 mm. thick, solitary at the ends of ascending branches, often nodding; involucre oblate; phyllaries in many series, leathery, each with a spine-tip 1-2 cm. long or the outer ones merely mucronate; receptacle fleshy and covered with hairlike bristles; ray flowers absent; disk corolla purple; filaments united into a short tube slightly above the level of their insertion on the corolla tube, free only just below the attachment to the anthers; achenes glabrous, about 6 mm. long, basifixed; pappus shining white, in several series, the bristles not plumose. Rare and local, Edwards Plateau, perhaps not a persistent member of our flora, late spring-summer; nat. of Medit. region, widely adv.

134. CARTHAMUS L.

An Old World genus of 13 species; we have a single species. Another species, *C. tinctorius* L. (Safflower) is cultivated for oil (from the achenes) and orange dye (from the corollas).

1. *Carthamus lanatus* L. DISTAFF-THISTLE. Annual (allegedly), 4-12 dm. tall; leaves alternate, firm, pinnatifid, the lobes coarsely spiny-toothed, basally subamplexicaul; heads solitary, terminal on the branches, broadly ovoid; outer phyllaries ending in leaflike appendages, the inner rigid ones appressed and spine-tipped; receptacle with scaly chaff; ray flowers absent; disk corollas yellow with red veins; achenes obpyramidal, 5-6 mm.

long, stramineous; pappus of several short scales in several series (or in some species absent), the outer shorter, the inner to 1 cm. long and rigid. Rare in disturbed roadsides, n. part of Edwards Plateau (McCulloch Co.), June; nat. of Medit. region, now widely adv.

135. ONOPORDUM L. COTTON THISTLE

An Old World genus of about 40 species.

1. *Onopordum Acanthium* L. Biennial (allegedly), usually (1-) 2-3 m. tall, with a canescent cottony pubescence all over the aerial parts except the flowers; leaves alternate, mostly elliptic to elliptic-oblong in over-all outline, coarsely doubly spiny-serrate or shallowly spiny-lobed; heads often in a roughly corymbiform aggregation at the top of the plant, on short leafy-winged ascending branches, several cm. thick; phyllaries ascending to spreading, each nearly subulate, tapering only very slightly from near the base all the way to the spine-tip; receptacle neither setose nor scaly but deeply alveolate, fleshy or spongy in texture; ray flowers absent; disk corollas purple; filaments separate; achenes basifixed; pappus of slender barbellate bristles. Rare and local in n.-cen. Tex. (Tarrant Co.) near stockyards, May-July; nat. of Eur., adv. in N.A.

136. GOCHNATIA H.B.K.

With about 40 species in the warmer parts of the Americas; we have a single species.

1. *Gochnatia hypoleuca* DC. Much-branched shrub 1-2 (-3) m. tall; leaves alternate, sessile, elliptic to lance-elliptic, 2-5 cm. long, unlobed, marginally entire and often slightly revolute, strikingly bicolored, the dark upper surface almost blackish-green, the lower surface grayish or whitish with a very close fine dense tomentum; heads about 1 cm. high, 7- to 12-flowered, in terminal subcorymbose clusters on the branches; involucre cylindrical-obconic; phyllaries firm; in 3 or 4 series, strongly imbricated, narrowly obovate, acute, green, turning brownish; receptacle essentially flat and naked; flowers all perfect and fertile; corollas apparently pinkish, bilabiate, the upper lip long-linear and ascending with 2 minute teeth apically, the lower lip deeply cut into 3 linear lobes; each of the 5 whitish anthers with 2 subulate appendages basally; achenes narrowly obpyramidal, with about 3 or 4 angles, yellow-brown, shiny, antrorsely puberulent; pappus of a number of rather stiff dirty-white bristles. Infrequent on gravel and caliche cuestas in extreme s. Tex. (Duval, Hidalgo, Jim Hogg, Starr and Zapata cos.), late Oct.-Feb.; Tex., N.L. and Coah. s. to Qro. and Hgo.

137. TRIXIS P. BR.

Weak shrubs to 1 or 2 m. tall, often semiscandent; leaves alternate, lanceolate or lance-elliptic, entire or marginally serrate, sessile, disposed under the heads almost in the manner of calyculate outer phyllaries; heads in irregular clusters toward the ends of the branches, 1-2 cm. high and wide, with about 12 to 14 flowers; involucre campanulate or obconic; phyllaries firm, 8, linear, terminally rounded, dorsally round-keeled in age; receptacle flat, alveolate, densely short-bristly around the sockets but not paleaceous; flowers perfect, fertile; corolla yellow, bilaterally symmetrical, the longer raylike portion with 3 teeth terminally, the other 2 shorter portions lance-subulate; each of the 2 cells of each anther each with a long subulate white appendage proximally; achenes linear-columnar, minutely glandular-pubescent, 4-7 mm. long, flared apically to a pappus pedestal; pappus of very numerous buffy or ochraceous-white rather stiff bristles, persistent.

About three dozen species of warmer parts of the New World.

- 1. Leaves thin-membranous, the fine nerve reticulum conspicuous under a lens, drying dark-green or blackish, beneath nearly glabrous and not punctate or if so the dots sparse 1. *T. radialis*.
- 1. Leaves firm-membranous, the nerve reticulum obscure, drying ochraceous or olivaceous-green, beneath puberulent and microscopically densely gland- or resin-dotted 2. *T. californica*.

1. *Trixis radialis* (L.) O. Ktze. Shrub 1-2 m. tall; leaves thin and with a fine nerve-net conspicuous under a lens, nearly glabrous beneath and rarely with a few sparse resin-dots, the whole drying dark-green; flowers bright-yellow. Frequent in extreme s. Tex. (Cameron, Hidalgo, Jim Hogg, Kenedy, Starr and Willacy cos.) in brush on well-drained clay loam, July-Mar.; Tex. and N.L. s.e. to Pan.; W.I.

2. *Trixis californica* Kell. Shrub about 1 m. tall; leaves thin but firm, the fine nerve-net obscure, drying buffy or olivaceous-green, beneath with pubescence and densely beset with resin-dots; flowers bright-yellow. frequent in canyons, parts of the Trans-Pecos, May-Oct. (following rains); Calif., Ariz., N.M., Tex., Baja Calif., Son., Chih., Coah. and S. L. P.

138. PEREZIA LAG.

Perennial often somewhat rhizomatous herbs from strongly ligneous underground crowns, often rusty-floccose at the upper nodes of the crowns and lowest node(s) of the aerial stem; leaves alternate, the phyllotaxy obscure in one acaulescent species, essentially sessile and marginally usually spinose-dentate; heads mostly 1-3 cm. high; involucre broadly obconical; phyllaries in 3 to 5 series, strongly imbricated, linear-subulate or lanceolate and acute or acuminate; receptacle essentially flat, not paleaceous but often areolate and slightly short-hairy around the sockets; flowers all perfect and fertile; corollas bilabiate, the lower lip raylike and 3-toothed terminally, the upper lip more or less deeply cleft into 2 teeth or lobes, purple, pink, rose-red or lavender, or so pale as to be nearly white; each of the 5 anthers with 2 subulate appendages basally; achenes linear-columnar, sometimes with a few obscure ribs, sometimes more or less attenuate upwards, often glandular-pubescent, at the summit flared into a pappus pedestal; pappus persistent, of many separate bristles.

About 75 species in the warmer parts of the Americas.

1. Essentially acaulescent herbs; leaves basal, pinnatifid; heads (usually solitary) on elongate scapose peduncles1. *P. runcinata*.

1. Stems leafy; leaves not pinnatifid; peduncles not scapose (2)

2(1). Plants usually taller; most leaves appreciably longer than broad
.....2. *P. Wrightii*.

2. Plants 1-2 dm. tall; leaves about as broad as long
.....3. *P. nana*.

1. *Perezia runcinata* (D. Don) Gray. PEONÍA. Leaves pinnatifid, crowded in a basal rosette; scapes 8-33 cm. long, with 1 or 2 heads terminally; heads 2-3 cm. high, with about 40 or 50 flowers. *Clarionea runcinata* D. Don. Frequent in brush on calcareous soil, Rio Grande Plains, less frequent in e. parts of the Trans-Pecos and Edwards Plateau, Mar.-Nov.; Tex., N.L. and Coah., s. to Hgo.

2. *Perezia Wrightii* Gray. BROWNFOOT. Erect leafy herb 6-13 dm. tall; leaves obovate-elliptic to oblong-elliptic, 2-7 cm. long, not lobed; heads crowded in small subcorymbose terminal groups, about 10-15 mm. high, with 8 to 11 usually pinkish flowers. Frequent or local in the Trans-Pecos, less frequent in Edwards Plateau and with an outpost in Cameron Co. in extreme s. Tex., June-Nov.; Ut., Ariz., N.M., Tex., Son., Chih., Coah., Dgo., N.L., S.L.P. and Zac.

3. *Perezia nana* Gray. DESERT HOLLY. Colonial herb often forming extensive patches in calcareous deserts by means of rhizomes; aerial shoots only 3-20 cm. tall, erect, sparingly branched, often somewhat zigzag; leaves firm, markedly spinose-dentate, rotund, appressed to the internodes or ascending, usually 2-4 cm. long and broad; heads solitary at the stem tips, 19-28 mm. high, with 15 to 24 lavender-pink flowers. Frequent in the Trans-Pecos, infrequent in w. part of Edwards Plateau (Sterling and Tom Green cos.), Apr.-Dec. (rarely in summer); Ariz., N.M., Tex., Son., Chih., Coah. and S.L.P.

Not often collected because rarely found in flower in spite of its abundance.

139. CHAPTALIA VENT.

Acaulescent perennial herbs, subrhizomatous with abundant fibrous roots; leaves rosetted, narrowly obovate or oblanceolate, narrowed to a subpetiolar base, the under-

surface whitish-tomentose, marginally entire or usually shallowly lyrate-pinnatifid; heads solitary at the ends of scapose peduncles; phyllaries well-imbricated in 4 or 5 series, acute, often tomentose dorsally; receptacle flat, with a depression at the point of attachment of each flower, the depression-margin often with short hairs but otherwise nude; flowers dimorphic or trimorphic, the more peripheral ones lacking anthers and lacking the upper corolla lip, the more central ones with 2-lipped corollas, the most central flowers either perfect and fertile or merely staminate and infertile; each of the 10 anther thecae with subulate tail at the lower end; achene fusiform, 5- to 7-ribbed, often glandular-pubescent; pappus of numerous rather rigid buffy-white bristles.

About 25 species in warmer parts of America.

1. Central flowers merely staminate, with abortive ovaries; east Texas 1. *C. tomentosa*.
1. Central flowers perfect; not in east Texas 2. *C. nutans* var. *texana*.

1. *Chaptalia tomentosa* Vent. Leaves oblong-elliptic, obtuse or mucronate, entire or toothed, 8-10 cm. long, 12-30 mm. broad, the upper surfaces of the young ones with thin tomentum which becomes lost, the lower surfaces densely white-tomentose; scape bractless, tomentose, to 35 cm. long and 1.5 mm. thick; heads erect at anthesis (nodding when young and nodding also after anthesis); receptacle much broader than the peduncle, with about 60 trimorphic flowers; external pistillate flowers (about 20) in one cycle, their corollas raylike (lacking an upper lip), white, surpassing the involucre by 3-6 mm., 4-nerved; internal pistillate flowers few (5 to 11), the corolla variable, from 2-lipped and somewhat larger than the style to tubular and only half as large as the style; central flowers staminate, about 25, yellow, with abortive ovaries, corolla 2-lipped, the lower lip of 3 toothlike lobes, the upper lip with 2 lobes; achene glabrous, 5- to 7-ribbed, beaked, the beak shorter than the body. Infrequent to rare in sandy forested areas, e. Tex., Mar.-Apr.; Coastal States, N.C. to Tex.

2. *Chaptalia nutans* (L.) Polák var. *texana* (Greene) Burk. SILVER-PUFF. Leaves broad, membranous, at times very thin, ascending or prostrate, 6-15 cm. long, 24-40 mm. broad, lyrate, narrowed to a subpetiolar base, tomentose on the underside, tomentum thick or thin; peduncles 1-6 dm. long, scapelike, ebracteate or rarely with 1 or 2 minute bracts; head nodding, 12-25 mm. high, with about 150 flowers; receptacle broad, flat, naked; pistillate flowers peripheral, raylike (upper lip absent), generally rose-colored, the more internal pistillate flowers very numerous with their corollas filiform; perfect central flowers 2-lipped; achene 5- or 6-ribbed, red-violet, 9-16 mm. long, 0.7 mm. thick, fusiform, with a filiform beak comprising two-thirds the total length. Infrequent or rare in calcareous areas, Edwards Plateau, n.-cen., s.e. and Trans-Pecos Tex., and Rio Grande Plains, Mar.-Apr., again Sept.-Nov.; warmer parts of Am. from Arg. n. to Tex.

140. PINAROPAPPUS LESS.

Perennial herbs; leaves alternate, essentially glabrous, lobed or entire; heads solitary, terminating often somewhat scapelike branches; involucre obconical; phyllaries in several series, well-imbricated, texturally leaflike, linear or lanceolate; receptacle very slightly convex, with a chaffy scale subtending each flower; flowers (type "d") perfect, fertile; corollas rosy-white or lavender-white or nearly pure-white, bilaterally symmetrical, the raylike portion 5-toothed terminally; achene obscurely and rounded 5-ribbed, slender, strongly attenuate upward but the beaklike portion ribbed and of the same texture as the bodylike portion (thus a "true beak" not present); pappus persistent, of a number of microscopically barbed buffy white bristles.

About seven species, all North American.

1. Plants with short rhizomes, forming tight clumps; rhizomes about 2-3 mm. thick but not or rarely ligneous; phyllaries usually with a dead brownish or fuscous tip area 1. *P. roseus*.
1. Plants forming mats over dolomitic limestone cliffs, with much-branched highly ligneous crownlike stems mostly 3-4 mm. thick; phyllaries lacking an obvious sphacelate tip area 2. *P. parvus*.

1. *Pinaropappus roseus* (Less.) Less. ROCK-LETTUCE. Leaves often but not always crowded near the base of the stem which is usually 1-3 dm. tall; heads about 15-25 mm. high including the flowers. Frequent in open limestone areas, Edwards Plateau, Plains Country and n.-cen. Tex., less frequent in Rio Grande Plains and rare in s.e. Tex. (usually brought in with gravel for railroads, roads, etc.), spring; Tex. s.e. to Chis.; another var. in Ariz. and Chis.

2. *Pinaropappus parvus* Blake. A distinctive mat-forming woody-based perennial; scapes scarcely 3 cm. tall, unmistakable. Locally abundant on dolomitic limestone cliffs of Guadalupe and Diablo mts. in the Trans-Pecos, June-July; also N.M.

141. KRIGIA SCHREB.²³¹

DWARF DANDELION

Small herbs; leaves alternate or the uppermost opposite, often crowded near the base, sessile, basally narrowed; heads solitary on the branches; involucre of a single or double row of nearly equal phyllaries; calyculum usually absent; receptacle flat or slightly concave becoming slightly convex in fruit, naked; flowers perfect, fertile, the corolla (of type "d") yellow; achenes ovoid-columnar to prismatic, slightly attenuate upward but not beaked; pappus absent or single or double, when present of a few hyaline scales or an inner ring of scabrous unequal bristles (normally 5 or multiple of 5) and an outer ring of very short scales (usually about 5 or 10). *Cynthia* D. Don; *Cymbia* (T.&G.) Standl.

About 8 species in North America.

1. Phyllaries 4 to 8 times as long as broad, linear-lanceolate to oblong-lanceolate, relatively numerous (8 to 16), becoming shrivelled and reflexed in age, never keeled, scarcely even with a definite midvein; inner pappus of bristles 4.5-8 mm. long, outer pappus of as many or fewer short scales less than a fourth as long (2).
1. Phyllaries 1.5 to 3 times as long as broad, lanceolate to ovate, remaining erect and expanded in age, relatively few (4 to 10), with midvein which in age becomes prominent and keel-like; pappus absent or of short scales or of short bristles to 2 mm. long and an equal number of hyaline scales a third or more as long (3)
- 2(1). Involucre 7-15 mm. high, scarcely enlarged in fruit; perennial from a short caudex1. *K. Dandelion*.
2. Involucres 4-6.5 mm. high (to 9 mm. in fruit); annual or persisting for one winter only2. *K. virginica*.
- 3(1). Stems leafless and unbranched (but robust or partly buried plants may develop short basal internodes); well-developed pappus present or short scales or both scales and bristles3. *K. occidentalis*.
3. Stems leafy, branched (but leaves may be crowded near the base in stunted plants); pappus absent or merely a minute scaly crown (4).
- 4(3). Involucres 3-4.3 mm. high in flower, 3.3-5.3 mm. high in fruit; rays 2-4 mm. long4. *K. oppositifolia*.
4. Involucres 5.3-8.5 mm. high in flower, 6.2-8.5 mm. high in fruit; rays 5-10 mm. long5. *K. gracilis*.

1. *Krigia Dandelion* (L.) Nutt. POTATO-DANDELION. Perennial 10-45 cm. tall, from a crown with fibrous root system and slender rhizome bearing tuberlike enlargements; leaves crowded at the base of the aerial shoot, numerous, with a narrow subpetiolar base, elliptic to oblanceolate or lanceolate or linear-lanceolate, entire to pinnatifid, nearly glabrous; flowering stems scapelike, each terminating in a solitary head; involucre 10-15 mm. high; phyllaries 15, erect, in 2 series, free from each other, oblong-linear to lance-linear, acute, green, scarious-margined; receptacle flat or low-convex, naked; rays 12-17 mm. long; achenes columnar, 10- to 15-ribbed, appressed-pubescent, about 2.5 mm. long and 1 mm. thick, reddish-brown; inner pappus of 25 to 45 unequal scabrous bristles 5-8 mm. long; outer pappus of 10 oblong-lanceolate acute or acuminate hyaline scales 0.6-1 mm. long. Frequent in sandy soils, e. and s.e. Tex., infrequent w. to n.-cen. Tex., spring (-early summer); Gulf States, n. to N.J., Ind., Ill., Mo. and Kan.

²³¹ Adapted from L. H. Shinnars in *Wrightia* 1:187-206. 1947.

2. *Krigia virginica* (L.) Willd. Annual with short taproots, rarely overwintering, 4-35 cm. tall; leaves crowded at the base, narrowed to a subpetiolar base, cuneate-oblong to spatulate-oblong or oblanceolate, sharply and remotely denticulate to pinnatifid, often with glandular-capitate hairs; head-bearing stems scapelike, 1 to many, each with a solitary terminal head; involucre turbinate or broadly campanulate, 4.8-6.5 mm. high in flower, 5.2-9 mm. high in fruit; phyllaries 10, erect or suberect, in 2 equal series, glabrous, long-acute, becoming widely spreading and ultimately reflexed, with hyaline margins; rays linear-oblong, 4-7 mm. long; achenes narrowly conical-columnar, 1.8-2 mm. long, 15-ribbed, more or less angular in transection, scabrous-pubescent, reddish-brown; pappus of 5 scabrous bristles 4.5-5.5 mm. long and 5 rounded-truncate hyaline scales 0.6-1 mm. long. Frequent in sandy soils, e. Tex., infrequent w. to n.-cen. Tex., rare in Llano region, spring (-Nov.); e. U.S.

3. *Krigia occidentalis* Nutt. Annual 4-16 cm. tall, from inconspicuous taproots plus fibrous root systems; leaves crowded at the base, linear-lanceolate to oblong-lanceolate or elliptic to spatulate, narrowed to a subpetiolar base, entire to pinnatifid; stems several, scapelike, each terminating in a solitary head; involucre turbinate or campanulate, 2.5-5.5 mm. high in flower, 4.3-6.5 mm. high in fruit; phyllaries (4 or) 5 (to 7), united in the basal fourth to third their length, more or less overlapping, remaining erect in fruit, the involucre becoming closed by shrivelling after the achenes are shed; phyllaries lanceolate to lance-ovate, with scarious margins; rays 3.5-3.8 mm. long; achenes conical-columnar, 1.3-1.7 mm. long, slightly flared at summit, 10- or 15-ribbed and more or less angular, cinnamon or red-brown at maturity; pappus of 5 scabrous bristles 1.2-2 mm. long (rarely shorter, often unequal) plus 5 transparent flabelliform scales 0.4-0.6 mm. long. Frequent, n.-cen. and e. Tex., infrequent to s.e. Tex. and w. to Llano region, spring; Mo., Okla., Ark. and Tex.

4. *Krigia oppositifolia* Raf. Annual from a predominately fibrous root system; stems erect to half decumbent, usually 35-40 cm. tall, freely branching, glabrous or sparingly pubescent with capitate hairs, the ultimate branchlets pedunculiform and naked for 2-15 mm. below the heads; lower leaves alternate or subopposite, sessile, basally narrowed and subpetiolar, clasping, to 55 mm. long, the distal portion linear-lanceolate to elliptic; upper leaves smaller, the uppermost usually subopposite and unequal in size, elliptic or narrowly oblong to lance-linear; involucre urceolate, 3-4.3 mm. high in flower, 3.4-5.3 mm. high in fruit; phyllaries 5 to 8, in 1 or 2 series, equal, remaining erect; rays 2-4 mm. long; achenes ovoid-columnar, 1.4-1.6 mm. long, strongly 10- or 15-ribbed, cinnamon-red to dark-red-brown at maturity; pappus absent or a minute scaly crown as much as 0.2 mm. long. Common in e., s.e. and n.-cen. Tex., infrequent w. to Llano region, spring (-Nov.); Gulf States, n. to N.C., Tenn., Ark. and Kan.

5. *Krigia gracilis* (DC.) Shinn. Annual from a predominately fibrous root system, erect or ascending, 8-40 cm. tall, freely branching, glabrous or sparingly pubescent with capitate hairs, the ultimate branchlets pedunculiform, naked for 25-160 mm. below the heads; lower leaves alternate or subopposite, sessile, basally narrowed and subpetiolar, clasping, the distal portion lance-linear to narrowly oblong-lanceolate; upper leaves subopposite or opposite, clasping; involucre broadly urceolate, 5.3-8.3 mm. high in flower, 6.3-8.5 mm. in high in fruit; phyllaries 8 to 10, in one series but with overlapping scarious margins, ovate or ovate-lanceolate; rays 5-10 mm. long; achenes ovoid-columnar, 1.4-1.7 mm. long, strongly 15-ribbed; pappus absent or an obscure scaly crown. Local in seasonally moist clay loam, n.-cen. Tex., infrequent w. to the Llano region, e. to the s. part e. Tex., spring (-Nov.); endemic.

142. CICHORIUM L.

About 9 species in temperate parts of the Old World.

1. *Cichorium Intybus* L. CHICORY. Rhizomatous perennial 2-10 dm. tall; rhizomes somewhat fleshy, branching, deep; stems few, simple below, rigidly and divaricately branched above; leaves alternate, sessile, the basal ones lyrate- or runcinate-pinnatifid, those of lower stem merely serrate or dentate and oblanceolate, those of the upper stems reduced to mere rigid bracts, to about 35 cm. long and 2-7 cm. wide; many of the heads borne sessile at the nodes, others solitary at the ends of spreading rigid naked pedunculiform

branches; involucre roughly cylindroid, about 1 cm. high, in an inner double series of erect membranous phyllaries (the distal margins of which are glandular-ciliate) and some much shorter (outer squarrose or reflexed ones), also glandular-ciliate-fringed, the whole involucre basally eventually becoming white-indurate; receptacle convex, furnished with a few chaffy scales; flowers few (about 15); corollas (type "d") blue, terminally 5-toothed; achenes obscurely striate, plump, not regularly compressed, not ribbed, glabrous; pappus a low crown of minute scales. Infrequent, along roads, n. half of Tex., spring-fall; nat. of Eur., now widely adv., sometimes cult.

The ground and roasted roots of this species are commonly mixed with coffee. Another species, *C. Endivia* L. (endive), is a popular green and potherb.

143. NOTHOCALAIS GREENE

About 4 species in North America.

1. *Nothocalais cuspidata* (Pursh) Greene. Acaulescent perennial herb from thick somewhat fleshy scaly vertical rhizomes (or corms?); leaves all crowded at ground level, linear-lanceolate, somewhat fleshy and glaucous, 10-17 cm. long, 5-19 mm. broad, upon drying becoming very undulate along the margins and minutely fringed with crisped white hairs; scapes 13-30 cm. long, erect; heads solitary on the scape; involucre obconical; phyllaries in 2 (or 3) series, subequal or weakly imbricate, the inner lanceolate, 19-27 mm. high, broadly hyaline-margined and acuminate-tipped, the outer ones only slightly shorter; calyculum absent; receptacle slightly convex, naked; flowers numerous, perfect, fertile, all bilaterally symmetrical; corolla raylike, yellow, terminally 5-toothed; achene columnar, very gently tapered apically but truncate and not beaked, brownish, about 1 cm. long, with about 10 prominent smooth ribs; pappus of about 70 shiny white non-plumose persistent bristles, dorsiventrally flattened basally, as long as the achenes, toward the bases united to various lengths into scalelike members. *Agoseris cuspidata* (Pursh) Raf. Rare in prairies, n.e. part of Panhandle (Lipscomb, Ochiltree and Roberts cos.) in Plains Country, May.; Wisc. to Mont., s. to Mo., Tex. and N.M.

144. MICROSERIS D. DON

About 14 species in western North America, plus 1 in Chile, 1 in Australia and 1 in New Zealand.

1. *Microseris linearifolia* (DC.) Sch. Bip. Annual 1-3 dm. tall; taproot whitish, 2-3 cm. thick; stems several from the base, erect, subscapose; leaves alternate, crowded near or at the base, 3-20 cm. long, with minute white crisped hairs near the margins, nearly linear but pinnatifid with short linear lobes; heads solitary, terminating the nearly naked stems; receptacle naked, slightly convex; involucre of roughly 2 series of slightly unequal phyllaries, about 2 cm. high; phyllaries lanceolate, acute or even subulate, very thin-membranous or even scarious with hyaline margins, erect at anthesis, eventually deflexed; flowers 70 to 100, perfect, fertile, bilaterally symmetrical with a long yellow 5-toothed ray; achenes about 8-10 mm. long, essentially linear-cylindric or slightly swollen in the lower half, black at maturity, 10-ribbed; pappus of 5 nearly linear scales a little longer than the achene, basally overlapping, near the apex bifurcate and with a subulate awn in the fork. Rare in moist meadows near springs in the Trans-Pecos (Hueco Tanks, El Paso Co.), May; Wash., Ore., Ida., Calif., Nev., Ut., Ariz., Baja Calif., Son., N.M. and Tex.

145. PYRRHOPAPPUS DC.

FALSE DANDELION

Herbs; leaves alternate (often crowded at the base where the phyllotaxy is obscure), thin, often with a minute fringe of crisped white hairs; stems few, the branches few or none (stems in a few species scapelike); heads solitary at the ends of branches or stems; involucre in flower about 15-23 mm. high, roughly cylindrical but slightly flared upward; phyllaries numerous, lance-subulate, acute, thin, mostly green but with thin hyaline margins, in 2 definite size-classes; inner (longer) phyllaries in 2 subequal series, at

anthesis appearing slightly coalescent but afterwards pulling apart into discrete units and gradually becoming spread and ultimately reflexed at maturity of achenes, each near the tip on the dorsal side with a glandular area which at anthesis projects dorsally as a crest about 1 mm. high making the end of the phyllary appear 2-pointed; outer phyllaries much shorter, calyculate, subulate, 2-4 mm. long; receptacle very slightly convex, naked; flowers all perfect, fertile; corolla sulphur-yellow, bilaterally symmetrical, the ray 5-toothed terminally; achene brown basally with a plump fusiform body portion, with 5 broadly rounded ribs, the upper portion of the body antrorsely scabrous with scale-like projections, the body abruptly giving way upward to the very long filiform beak longer than the body (this beak at the very top slightly flared to form a pedestal for the pappus); pappus pedestal with a villous ring of reflexed microscopic hairs; pappus of a large number of capillary bristles (not plumose), tawny-white or buffy-white, persistent on the pedestal (although the beak itself is easily broken, sometimes making it appear as if the pappus is deciduous as a unit). *Sitilias* Raf.

A genus of about 8 species in North America. The genus is superficially similar to *Taraxacum*, and the plants are often mistaken for the latter (and vice versa). In *Taraxacum* the pappus is always white or yellowish-white, never with a tawny tinge, and the basal leaves are always definitely runcinate; furthermore, the true dandelions are all introduced in Texas, and nearly always found in disturbed areas in towns and other areas of human habitation.

1. Perennial, the slender vertical root terminating 3-10 cm. below ground level in a tuberous thickening about 1 cm. thick 1. *P. grandiflorus*.
1. Annual from slenderly napiform taproots (2)
- 2(1). Leaves of upper half of (sometimes scapelike) stems lanceolate, unlobed or with a small lobe on each side near the base; lower stem and basal leaves lanceolate or oblanceolate, rarely lobed, usually merely toothed 3. *P. carolinianus*.
2. Leaves of upper half of (often scapelike) stems pinnatifid with usually 2 or 3 linear lobes on each side; lower stem and basal leaves usually pinnatifid, sometimes merely toothed when produced very early or very late in the season (February or late May) 2. *P. multicaulis*.

1. *Pyrrhopappus grandiflorus* (Nutt.) Nutt. Perennial herb with vertical roots terminating several cm. below ground level in a globose or prolate tuberous thickening 5-12 mm. thick; leaves pinnatifid, crowded at ground level in a rosette; stems solitary or 2 or 3 scapelike, (1-) 2-3 dm. tall, naked or with a few scattered subulate bracts; heads solitary, terminating the scapes. Frequent in open calcareous areas, Plains Country, rare in n.-cen. and s.e. Tex., and the s. part of e. Tex., Mar.-May(-June); Kan., Colo., Okla., N.M. and Tex.

Exceedingly similar to some forms of *P. multicaulis*. The vast majority of prepared botanical specimens, lacking the complete root system, are not definitely assignable to species. The perennial *P. Rothrockii* Gray, with juncaceous habit, narrow leaves and small heads (only about 14 mm. long, even in fruit) has been reported to occur in Texas, but no specimens have been seen.

2. *Pyrrhopappus multicaulis* DC. Annual herb from slenderly napiform taproots, (1-) 2-5 (-8) dm. tall; stems few, mostly simple except in unusually robust plants; leaves usually crowded toward the base, with only 1 or 2 (or 3) nodes above; basal leaves usually pinnatifid, less commonly merely toothed; leaves of the upper nodes (if any) reduced, pinnatifid, with 2 or 3 linear lobes on each side; heads few to many. *P. Geiseri* Shinn. Abundant in n.-cen. and s.e. Tex. and Rio Grande Plains, less common in Edwards Plateau and s. and w. parts of e. Tex. and Plains Country, spring; Coah., N.L., Tam., Tex. and Okla.

A rather variable species with apparently some of the variability owing to widespread genetic intercontamination with *P. carolinianus*. The proposed segregate *P. Geiseri* consists of a suite of such introgressants. In the Brownsville region occur some plants with shallowly lobed elongate leaves and attenuate habit of *P. Sessaeanus* (D. Don) DC., a Mexican species which probably grades into *P. multicaulis*. Near El Paso occurs a variant in which, as in *P. carolinianus*, the lower lobes of the upper leaves are nearly suppressed.

3. *Pyrrhopappus carolinianus* (Walt.) DC. Annual herb from slenderly napiform

taproots, (2-) 3-7 (-10) dm. tall; some leaves crowded near the base, mostly oblanceolate, dentate or uncommonly shallowly lobed, some well-developed leaves (but smaller than the basal ones) scattered along the stem which is rarely scapiform and sparingly branched; leaves of upper half of plant lanceolate, unlobed or only with a single lobe on each side very near the base. Frequent in sandy soils, e. and s.e. Tex., rare in Plains Country (Hemphill Co.) and n.-cen. Tex., spring-early summer; s.e. U.S., n. to Del., Ind., Mo. and Kan., w. to Okla. and Tex.

146. *LYGODESMIA* D. DON*

SKELETON-PLANT

Annuals or perennials from branched slender subrhizomatous bases; stems green, striate, tough, wiry, usually intricately branched; leaves alternate, the basal ones sometimes much-lobed but most of the leaves reduced to small or minute linear or subulate bracts; heads solitary, terminating the ultimate branches; involucre nearly cylindroid, at least at anthesis; phyllaries definitely of 2 size-classes, few, the inner ones subequal and the outer ones much shorter and forming a calyculum, all grayish-green and with very narrow scarious margins; receptacle slightly convex, naked; flowers relatively few, the rays rosy, pink, lavender, blue or purple, *never yellow*, 5-toothed terminally; achenes narrowly columnar, few-ribbed or few-angled, truncate apically, not narrowed to a beak nor regularly compressed in any direction; pappus of a number of bristles that are weakly dorsiventrally flattened basally and in some species plumose, in some species persistent and in others deciduous in groups. *Stephanomeria* Nutt.

A genus of about 30 species, all North American.

1. Pappus bristles not plumose; involucre 10-21 mm. high (2)
1. Pappus bristles plumose; involucre 8-11 mm. high (3)
- 2(1). Involucre 16-21 mm. high1. *L. texana*.
2. Involucre 10-15 mm. high2. *L. juncea*.
- 3(1). The lateral projections of the pappus very short (about 0.2-0.5 mm. long) and present only in the upper half to two-thirds the length5. *L. Bigelovii*.
3. Lateral projections of bristles longer or if nearly as short as those above then present nearly to the base (4)
- 4(3). Pappus bristles plumose to near the base but not to the base (the basal 0.5-1 mm. of bristles not plumose), the lateral hairs 1-1.4 (-2) mm. long3. *L. pauciflora*.
4. Pappus bristles plumose essentially to the base (plumose to within 0.2 mm. of the base), the lateral hairs averaging only 0.6 mm. long ..4. *L. tenuifolia*.

1. *Lygodesmia texana* (T.&G.) Greene. Loosely clumped perennial from slender branched rhizomes; aerial shoots subsimple to freely branched, (2-) 4-6 dm. tall; basal and lowermost stem leaves pinnatifid, the medial portion and the lobes linear; leaves of midstem somewhat reduced, linear-subulate, the upper half of the plant essentially leafless; involucre 10-21 mm. high; rays usually lavender, varying to bluish or rosy; pappus of a number of nonplumose bristles. *L. ramosissima* Greenm. Frequent in open usually calcareous places in the Trans-Pecos and n.-cen. Tex., Edwards Plateau, Rio Grande Plains and Plains Country, and s. parts of e. and s.e. Tex., spring-fall; Chih., Coah., Tex. and Okla.

The plants of Mexico and Trans-Pecos Texas are more freely branched, on the average, than those east of Trans-Pecos Texas and of Oklahoma, and perhaps deserve separate recognition; they have been called *L. ramosissima* Greenm.

2. *Lygodesmia juncea* (Pursh) D. Don. Clump-forming perennial from deep branched rhizomes; aerial shoots intricately branched, 2-5 dm. tall; essentially all leaves reduced, linear or subulate, bractlike; involucre 10-15 mm. high; rays pink to pale-violet; pappus of a number of bristles, not plumose. Infrequent in prairies, higher parts of the Plains Country, June-Aug. (-Oct.); Wisc. to Alta., s. to Mo., Okla., Tex., N.M. and Ariz.

* See Appendix.

3. *Lygodesmia pauciflora* (Torr.) Shinners. Clump-forming perennial from branched rhizomes; aerial shoots (1-) 2-3 (-5) dm. tall, much-branched, usually grayish and glaucous; basal leaves (usually withered in prepared botanical specimens) and lower stem leaves linear with small linear lateral lobes or teeth; involucre about 9-10 mm. high; rays pink or pale-pinkish-lavender (rarely white?); pappus of a number of bristles, each plumose for most of the length but not in the basal 0.5-1 mm. of the length where merely microscopically scabrous, the axis at the base dorsiventrally flattened, the longest diameter being 1.5 to 2 times as great as the smallest diameter, the lateral hairs of the upper part 1-1.4 (-2) mm. long; achene 1.5-2 mm. long; *Ptiloria scabrella* Greene, *P. neomexicana* Greene. Frequent in crevices and exposed rocky prairies, Plains Country and Trans-Pecos mts., infrequent in w. part of Edwards Plateau, spring-summer; Kan., Colo., Okla., N.M. and Tex. (closely related, perhaps conspecific, taxa w. to Calif.).

The plants of the Plains Country are, on the average, lower in stature, more spreading and more intricately branched than the Trans-Pecos plants which have been given the name *Stephanomeria neomexicana* (Greene) Cory.

4. *Lygodesmia tenuifolia* (Torr.) Shinners. Perennial forming clumps from branched rhizomes; aerial shoots (2-) 3-5 (-7) dm. tall, branched at least in the upper part, often subsimple below; basal and lower stem leaves linear, sometimes with small linear lateral lobes but these often absent; leaves of midstem usually 1-3 cm. long, linear; involucre 8-11 mm. high; rays pink or lavender-pink; pappus of a number of bristles, each plumose for nearly the entire length (at least to within 0.2 mm. of the base), the axis basally dorsiventrally flattened, the longest diameter being 1.5 to 2 times as great as the smallest diameter, the lateral hairs averaging only 0.6 mm. long. *Stephanomeria tenuifolia* (Torr.) Hall, *S. Wrightii* Gray. Infrequent in Trans-Pecos mts., rare in w. part of Edwards Plateau, June-Aug. (-Sept.); N.M., Tex., Coah., Chih. and possibly farther n. and w.

5. *Lygodesmia Bigelovii* (Gray) Shinners. Annual with slenderly napiform taproots; stems simple below, much-branched above, 2-5 dm. tall; basal and lower stem leaves pinnatifid, semiamplexicaul, grading upward to nearly linear leaves and eventually to minute bracteal leaves; heads numerous; involucre about 8 mm. high; rays pink; pappus of a number of bristles, each plumose in the upper half to two-thirds the length (not in the basal portion), the axis basally dorsiventrally flattened (twice as broad as thick), the lateral hairs of the upper portion 0.2-0.5 mm. long. Very rare if still extant (reported to occur at Fronteras, El Paso, but not collected in Texas since 1852), May-June; Ariz., Ut., Calif. and Nev.

147. RAFINESQUIA NUTT.

PLUME-SEED

A genus of 2 species of southwestern United States.

1. *Rafinesquia neomexicana* Gray. Probably winter annual with taproots; stems essentially glabrous, much-branched at and near the base, ascending 2-5 dm. tall, often 3-5 mm. thick near the base, each ultimate branch terminating in a head; lower leaves pinnatifid, upper ones reduced and only about 5-10 mm. long, clasping the stem and with a few lateral lobes near the base; heads (15-) 20-25 mm. high including the rays and the pappus; involucre narrowly campanulate or in flower nearly top-shaped, with a double inner series of long lance-subulate membranous phyllaries with scarious margins and some extremely short outer calyculate ones; receptacle slightly convex, sometimes with a few hairlike bristles; corolla (type "d") purplish-white to usually pale-pink, 5-toothed terminally; achenes about 11 mm. long, with a fusiform body but in the upper third slightly attenuate to a stout beak, brownish, scabrous, basally excavated so that the point of vascular attachment is in the middle of a minute concavity; pappus of about 10 units which are dorsiventrally flattened but very narrow, filiform-subulate and long-plumose for most of the length (but not at the extreme tip!). Infrequent in deserts in the Trans-Pecos (El Paso), Apr.; Calif., Ut., Nev., Ariz., N.M., Tex. and Chih.

148. MALACOTHRIX DC.

A genus of 20 species of western North America.

1. *Malacothrix Fendleri* Gray. Nearly glabrous taprooted annual, many-stemmed from the base, 1-2 dm. tall, with many nearly linear basal and lower stem leaves (the latter

with some teeth or weak lateral lobes); stems sparingly branched, each ultimate branch terminating in a head; heads about 1 cm. high; involucre hemispheric, of a double series of equal inner phyllaries and 2 or 3 outer much shorter somewhat imbricated subcalyculate ones, all thin-membranous and with narrow scarious margins; receptacle slightly convex, quite naked; corolla (type "d") yellow, 5-toothed terminally; achenes columnar, about 2 mm. long, not attenuate toward the apex, dark-brown, with 15 close flutings or ribs, at the very summit with a thin-edged cup fitting around the base of the pappus; pappus of a number of ascending soft nonplumose bristles that are attached to each other, all deciduous as a unit except for 1 persistent pappus bristle. Rare in the Trans-Pecos (El Paso Co.), Apr.; Ariz., N.M., Chih. and Tex.

149. CALYCOSERIS GRAY

A genus of 2 species in North America.

1. *Calycoseris Wrightii* Gray. WHITE CUP-FRUIT. Taprooted annual, several-stemmed from the base, 5-20 cm. tall; leaves crowded near the base, pinnately lobed, the median portion and the lobes nearly linear; upper leaves greatly reduced, to mere bracts on the subscapose stems; stem often sparingly branched near the top and each fork bearing numerous stipitate tack-shaped glands, terminated by a head; heads 11-15 mm. high; involucre roughly hemispheric, with a long double series of equal inner phyllaries that are thin, membranous and broadly scarious-margined, plus 2 or 3 series of much shorter unequal imbricated subequal phyllaries at the base; receptacle essentially naked or with some scattered hairlike projections; corolla (type "d") long, whitish or with a rosy- or purplish-tinge (especially on the dorsal side) and terminally 5-toothed; achenes with a fusiform body basally, contracted into a slender beak in the upper third or fourth the length, with about 6 flutes or ribs, at the very apex with a minute thin-walled cup surrounding the base of the pappus; pappus of a number of whitish slender bristles lightly coalescent at their bases, the whole pappus tending to dehisce as a unit though easily broken into 2 or more units. Rare in the Trans-Pecos (El Paso Co.), Mar.-Apr.; Ut., Calif., Ariz., N.M. and Tex.

150. TRAGOPON L.

Biennials with deep napiform taproots; stems 1 or few, (2-) 3-8 dm. tall, basally (3-) 5-9 mm. thick, sparingly and ascendingly branched above, coarse and very tough (difficult to break); leaves alternate, lance-linear, long-tapered to a fine point; upper (5-) 10-15 cm. of ultimate branches essentially naked, pedunculiform, 5-10 mm. thick, each capped by a head 8-12 cm. in diameter; involucre roughly obconical, 3-4 cm. high at anthesis, to 7 cm. after anthesis; phyllaries in 2 series, subequal, lance-linear or subulate, attenuate to a fine point, the longer ones always surpassing the rays; calyculum absent; receptacle flat, rough, not chaffy; flowers perfect, fertile, numerous; corollas bilaterally symmetrical, yellow or purple, the ray 5-toothed terminally; achenes 25-36 mm. long including the beak, with a narrowly fusiform 5-ribbed basal body with much antrorse subspinose roughening, the slender beak about as long as the body; pappus persistent, of a number of plumose bristles which are dorsiventrally flattened.

A genus of about 50 species of temperate Eurasia (1 reported native to South Africa), several of them now widely adventive in temperate areas.

1. Corolla lemon-yellow 1. *T. dubius*.
 1. Corolla dark-violet 2. *T. porrifolius*.

1. *Tragopogon dubius* Scop. GOAT'S-BEARD. Low and bushy, the branches originating from near stem base; flowers 100 to 200 per head; bracts usually 13 per head, long, narrow; rays lemon-yellow; achene body gradually narrowed to and not strongly differentiated from the beak; outer achenes pale-brown, the inner ones stramineous; pappus white. *T. major* Jacq. Infrequent weed of Plains Country, rare in the Trans-Pecos and n.-cen. Tex., May-June (-July); nat. of Eur., now widely adv.

2. *Tragopogon porrifolius* L. SALSIFY, OYSTER PLANT. Stout but strict, the branches fewer and usually originating higher on the stem than in *T. dubius*; flowers 84 to 117 per head; bracts usually 8 per head, relatively broader and shorter than in *T. dubius*; rays

dark-violet; achene body abruptly narrowed to and clearly differentiated from the somewhat longer beak; outer achenes dark-brown, the inner ones paler; pappus brownish. Infrequent or rare weed in the Trans-Pecos, n.-cen. Tex. and Plains Country, May-June; nat. of Eur., now widely adv.

The somewhat oyster-flavored napiform taproot of this plant is cooked, often as a stew, or is used as a relish.

151. HYPOCHOERIS L.

A cosmopolitan genus of nearly 100 species, many occurring in South America.

1. *Hypochoeris microcephala* (Sch. Bip.) Cabrera var. *albiflora* (O. Ktze.) Cabrera. Perennial from stout underground parts, 3-7 dm. tall; stems 1 to 3, simple below, with many ascending branches above; basal leaves deeply pinnatifid, the medial portion and the lobes nearly linear; stem leaves few, the lower ones pinnately lobed, the upper ones reduced to subulate bracts; heads solitary on the ultimate branches; involucre very narrowly campanulate, 10-17 mm. high, of a number of erect lance-subulate green phyllaries which are well-graduated and not clearly of two size-classes, the midribs whitish; receptacle convex, with long membranous lance-subulate chaffy scales subtending the flowers; corolla (type "d") white, 5-toothed terminally; achene about 1 cm. long, in 2 rather distinct portions, the lower part fusiform, brown, with about 10 ribs and numerous trabecular cross-septa between the ribs, the upper part a slender beak; pappus of about 20 ascending apparently persistent plumose bristles. Rare and local in s.e. Tex. (6 miles n. of Orange) in disturbed ground near a road, spring; nat. of s. S.A., adv. in Tex.

152. HEDYPNOIS SCHREB.

A genus of three species in the Canary Islands, Madeira and Mediterranean region.

1. *Hedypnois cretica* (L.) Willd. Annual from slender taproots; stems usually several from near the base, spreading and distally ascending, 1-3 dm. long, sparingly branched, the branches naked and pedunculiform, smaller upward to the solitary terminal heads; leaves alternate, the basal ones shallowly pinnately lobed and sparsely scabrous-hispid; stem leaves few and much-reduced; involucre roughly campanulate, about 1 cm. long; phyllaries in 2 definite size-classes; inner (longer) phyllaries in a double series, scabrous-hispid, linear, after anthesis becoming curved and boat-shaped (round-keeled dorsally) and somewhat indurated, usually each enclosing one of the peripheral achenes; outer phyllaries less than half as long as the inner, appressed; receptacle nearly flat, naked; flowers perfect, fertile (or some of the central ones infertile); corolla (type "d") yellow, with 5 purple teeth; achenes columnar or curved-columnar, about 5-6 mm. long, with about 15 close ribs, not attenuate, beakless, dimorphic: pappus of outer (peripheral) achenes a scaly fringed crown about 1 mm. high, that of the central achenes (mostly infertile) of several elongate scales about 5 mm. long. *H. rhagadioloides* (L.) Willd. var. *gracilior* (Boiss.) Hegi. Local on coquina beds at shoreline near Corpus Christi, Mar.-Apr.; nat. of Medit. region, Madeira, Canary Is.; adv. in Calif. and Tex.

153. SONCHUS L. SOW THISTLE

Slenderly taprooted annuals, nearly glabrous or some with capitate glands at various places on the stem; leaves alternate with spinose-dentate margins, the lowest ones usually runcinately pinnatifid, those of midstem with a few lateral lobes or nearly lobeless and clasping, the upper ones reduced in size somewhat and usually lance-deltoid, clasping and acute; branches usually few below, but several near the top of the plant, each ultimate one terminating in a head; involucre roughly obconic at anthesis, about 1 cm. high; phyllaries in roughly 2 size-classes, all (especially the longer ones) often with 1 to 3 glandular places near the midnerve which proliferate into capitate glands or minute dorsal crests, or these absent; the longest phyllaries in a double series, subequal, lance-subulate, thin-membranous, green, scarious-margined; the outer shorter phyllaries not at all equal but somewhat imbricated, forming an indistinct calyculum, the bases and broad midnerves

after anthesis becoming whitish-indurate and callous-thickened; receptacle flat or slightly convex, naked; flowers numerous, perfect, fertile; corolla yellow, bilaterally symmetrical, the raylike portion about as long as the very slender tube; achenes dimorphic, the peripheral ones of a paler color (grayish or stramineous), the much more numerous central ones becoming darker and brown to reddish-brown, strongly flattened, elliptic to narrowly obovate in outline, unbeaked, about 3 mm. long, with about 3 to 5 longitudinal slightly curved ribs on each of the 2 faces, roughened by numerous parallel retrorse microscopically spinose transverse ridgelets; pappus dimorphic, of 50 to 100 extremely fine white persistent capillaries plus 6 to 10 white dorsiventrally flattened caducous bristles, the latter being attached nearer the center of the achene apex than the more peripheral capillaries.

Native of Eurasia and Africa with a few dozen species. Ours are troublesome weeds especially in lawns and gardens. The bristly fruits of some species are known to cause skin infections.

1. Achenes 3.5 to 4 times as long as broad, broadest above the middle, the wall rather firm and distinctly transversely roughened (even those of the central achenes); leaves of upper and midstem with acute auricles1. *S. oleraceus*.

1. Achenes about 2 to 2.5 times as long as broad, broadest near the middle, the wall thinner, less firm and less distinctly roughened (the paler peripheral achenes somewhat roughened but the central ones nearly smooth on the faces); leaves of upper and midstem with rounded auricles2. *S. asper*.

1. *Sonchus oleraceus* L. Characters as in the key; in addition the foliage is softer and less distinctly spinose-margined than the other species but the foliage characters are not as reliable as the achene characters in determination of individual plants. Disturbed ground throughout the state, usually spring but most any time of the year; nat. of Eur., now widely adv.

2. *Sonchus asper* (L.) Hill. *ACHICORIA DULCE*. Characters as in the key; foliage rather roughly and harshly spinose-margined but see comments above. Disturbed ground throughout Tex., usually spring; nat. of Eur., now very widely adv.

154. LACTUCA L. LETTUCE

Mostly biennial or winter annual herbs; leaves alternate, lobed or not, marginally serrate and often with each tooth slightly spinose, the upper ones (at least) often clasping; stems tall, erect, mostly simple except in the upper (head-bearing) region; involucre narrowly urceolate just before anthesis, usually after anthesis becoming more or less campanulate; phyllaries well-imbricated, mostly erect (tips sometimes spreading), ovate-lanceolate to lanceolate or lance-linear, green with narrow white margin; receptacle flat-tish, naked; flowers 5 to 35 per head, perfect, fertile; corollas yellow, blue, white, rosy-white or lavender, bilaterally symmetrical, the raylike portion terminally 5-toothed; achenes definitely flattened, some extremely flat and even slightly winged, with a definite body portion below which is usually obovate or elliptic in outline and abruptly narrowed to a long or short thick or thin (or even filiform) beak, the microscopic apex flared as a pappus pedestal; pappus of numerous white or whitish capillary bristles, persistent or tardily deciduous as individual bristles (not as a unit).

An Old World genus of perhaps 100 species. *Lactuca sativa* L., the cultivated lettuce, a native of Europe, is probably the best-known species of the genus, but most of our species are native. Some of our species hybridize, thus making determinations troublesome. The young leaves of all species are used for salads and greens.

1. Acheneal beak absent or stout, only 0.5-1 mm. long (2)

1. Acheneal beak filiform, 2-4 mm. long (3)

2(1). Rhizomatous perennial; involucre at anthesis 12-15 mm. high6. *L. pulchella*.

2. Annual; involucre at anthesis 9-10 mm. high7. *L. floridana*.

3(1). Achene about a third as thick as broad, on each face with about 7 distinct longitudinal nerves, the short wings of the upper sides being pubescent1. *L. Serriola*.

3. Achenes very flat, each face with 1, 2 or 3 longitudinal nerves, the wings (if present) not pubescent (4)

- 4(3). Lower leaves mostly linear, 10-33 cm. long, 5-12 mm. broad; mountains of Trans-Pecos Texas 5. *L. graminifolia*.
4. Lower leaves not linear or (if so) proportionately broader; generally distributed (5)
- 5(4). Achenial body 2 to 2.5 times as long as broad; lower leaves usually pinnatifid and those of upper midstem narrowed basally to a nonclasping base 4. *L. hirsuta* var. *albiflora*.
5. Achenial body 1.5 to 2 times as long as broad; lower leaves either pinnatifid or unlobed, when lobed then usually the leaves of upper midstem clasping (6)
- 6(5). Achenial body 3.5-4.5 mm. long, the beak 2.2-2.5 mm. long; leaves usually unlobed, marginally toothed or entire but not spiny-toothed 2. *L. canadensis*.
6. Achenial body 4.5-5 mm. long, the beak (2-) 2.5-3 mm. long; leaves usually weakly spiny-dentate 3. *L. ludoviciana*.

1. *Lactuca Serriola* L. PRICKLY LETTUCE. Taprooted annual or winter annual; stems (3-) 5-20 dm. tall, erect, simple except in the uppermost reaches; leaves usually pinnatifid (except the uppermost) and usually clasping, the margins usually finely spinose-dentate; involucre 8-11 mm. long at anthesis, 9-13 mm. long in fruit, the inner (longer) phyllaries after anthesis becoming filiform-involute for most of their length; corollas yellow (often the extreme tip discolored bluish or purplish); achene body 2.5-3 mm. long, somewhat compressed but still lenticular in transection and about a third as thick as broad, brownish, oblanceolate or linear-obovate, on each face with about 7 distinct longitudinal nerves, not winged or only very shortly winged on the upper shoulders near the junction with the beak and these thin shoulders microscopically ciliate, the beak filiform and 3-4 mm. long. Frequent in disturbed soil, n.-cen. Tex. and Edwards Plateau, infrequent in e. and Trans-Pecos Tex. and Plains Country, June-July; nat. of Eur., now widely adv. The name is sometimes misspelled "scariola."

2. *Lactuca canadensis* L. Biennial (?) with crowns 1-3 cm. thick; stems 5-25 dm. tall, mostly simple except in the upper fifth of the height where branched, most of the stem leafy; lowermost leaves (in the lower fifth of the height) usually pinnately lobed (rarely even up to half the leaves lobed) but usually most leaves nearly lobeless; upper leaves usually narrowly obovate, acute and basally narrowed to a nonclasping base; leaf margins not spiny-dentate, some with weak teeth; involucre about 1 cm. long at anthesis, later 13-15 mm. long in fruit, the larger outer phyllaries about 1.8-2 mm. broad; corollas yellow; achene body obovate, 3.5-4.5 mm. long, about 1.5 to 2 times as long as broad, very flat and somewhat winged, dark-brown or usually black, each face with 2 or 3 longitudinal nerves and numerous weak transverse ridges, the filiform beak 2.2-2.5 mm. long. Infrequent in sandy soil, e. Tex., rare in n.-cen. and s.e. Tex., June-July (-Aug.); s.e. Can. and e. U.S.

In Texas *L. canadensis* and *L. ludoviciana* intergrade or perhaps simply have contaminated each other genetically through introgression. It would appear that *L. canadensis* has been more contaminated by *L. ludoviciana* than vice versa.

3. *Lactuca ludoviciana* (Nutt.) Ridd. Biennial (?) with crowns 1-2 cm. thick; stems erect, (3-) 5-15 dm. tall, mostly simple except in the upper 1-3 dm. (head-bearing region) where branched, most of the stem very leafy; leaves mostly pinnately lobed except the uppermost which become merely deltoid and clasping; leaf margins slightly spiny-dentate; involucre 1 cm. long at anthesis, (13-) 14-17 mm. long in fruit; larger outer phyllaries 2-3 mm. broad; flowers yellow or at least ochraceous; achene body 4.5-5 mm. long, about 1.5 to 2 times as long as broad, very flat and somewhat winged, dark-brown or black, each face with 1 or 2 (or 3) longitudinal nerves and numerous weak transverse ridges, the beak filiform and (2-) 2.5-3 mm. long. Frequent (in usually calcareous soil), n.-cen. Tex. and Edwards Plateau, less frequent to Plains Country and the Trans-Pecos, rare in the Brownsville region of extreme s. Tex. and in e. Tex. (Jasper Co.), May-June (or Mar.-Apr. in extreme s., July in extreme w.); Ont., Minn., Ia. and Neb. s. to Tex.

4. *Lactuca hirsuta* Muhl. var. *albiflora* (T.&G.) Shinn. Biennial (?) with crowns 7-10 mm. thick; stems erect, 5-16 dm. tall, mostly simple except in the upper 2-5 dm. (head-bearing portion) where are a number of spreading-ascending branches, most of

stem leafy; most of the leaves deeply pinnatifid, the upper ones never clasping but usually also pinnatifid and narrowed to the subpetiolar base, the midrib beneath often hispid; involucre 10-13 mm. long at anthesis, 13-18 mm. long in fruit; larger outer phyllaries 1.5-2.2 mm. broad; flowers very pale-yellow (creamy) or more commonly pink or pale-lavender, never strong yellow; achene body very flat, 4-4.5 mm. long, narrowly obovate in outline, 2 to 2.5 times as long as broad, dark-brown or black, with about 3 longitudinal nerves on each face and numerous weak transverse ridges, the filiform beak 2-2.5 mm. long. Infrequent in sandy woods, e. Tex., May-July; also La.

The var. *hirsuta* and var. *sanguinea* (Bigel.) Fern. occur extensively in e. U.S.

5. *Lactuca graminifolia* Michx. Biennial or weak perennial with taproots; stems erect, (3-) 5-9 dm. tall; basal outer leaves sometimes runcinately pinnatifid but most of the lowest stem leaves unlobed and linear, 10-25 (-33) cm. long, 5-12 mm. broad, remotely toothed or entire marginally; leaves of midstem much-reduced upward, lance-linear or linear, entire, tapered to a fine point; upper 1-2 dm. of plant essentially leafless, sparingly branched; involucre 10-12 mm. long at anthesis, 15-16 cm. long in fruit; corollas lavender or yellow; achene body very flat, about 5 mm. long, oblong or oblong-elliptic in outline, 2 to 2.5 times as long as broad, black, with 2 or 3 longitudinal nerves on each face plus numerous weak transverse ridges, the slender beak 2-4 mm. long, often drying flat. Rare in moist canyons, higher parts of Davis and Guadalupe mts. in the Trans-Pecos, June-Sept.; s. U.S. from N.C. to Fla. and w. to Ariz., s. to n. Mex.

Not clearly separated from *L. pulchella* and probably grading into it; possibly *L. graminifolia* comprises individuals representing ancient genetic mixing of *L. pulchella* with *L. canadensis* or *L. ludoviciana*.

6. *Lactuca pulchella* (Pursh) DC. BLUE LETTUCE. Perennial; rhizomes scaly, extensive, 3-5 mm. thick; aerial shoots erect, 3-8 dm. tall, simple and leafy for nearly the entire length; leaves not greatly reduced upward (those at midstem more than half as long as those at base), mostly linear and unlobed (in some specimens with very remote teeth marginally) or uncommonly nearly all the leaves runcinately pinnatifid; involucre 12-15 mm. long at anthesis, 15-20 mm. long in fruit; corollas blue or lavender-blue; achene compressed, the body oblanceolate, about 4 mm. long, about 1 mm. broad, fuscous-black, with about 5 longitudinal nerves and very weak internerve-roughening, near the top tapering shortly into the stout beak which is 1 mm. long and about 0.4 mm. thick. Very rare in the Davis Mts. in the Trans-Pecos at about 5,000 ft. elev. (Muzquiz Creek) (collected once in Tex., Aug. 12, 1934); widespread in Rocky Mts. and s. to Mex. and Guat.; also Mich., Wisc., Ia., Mo. and Que. to Alas.

7. *Lactuca floridana* (L.) Gaertn. Robust annual (5-) 10-25 (-33) dm. tall, the stem simple for nearly the entire height or branched only very near the top; leaves nearly all deeply runcinate-pinnatifid but with an extremely ample triangular terminal portion and only 1 (or 2) large lateral lobes on each side, marginally toothed; involucre 9-10 mm. long at anthesis, to 10-12 mm. long in fruit; corollas bluish or white; achene body oblanceolate, 4-4.5 mm. long, flattened but not at all winged, about 3 times as long as broad, with 2 or 3 longitudinal nerves on each face and many weak transverse internerve ridges, mottled black and brownish-gray, shortly tapered apically to a stout somewhat beaklike cylindrical apex (0-) 0.5-1 mm. long and 0.5 mm. thick. *L. villosa* Jacq. Frequent in n.-cen. and e. Tex., rare to s.e. Tex., Aug.-Oct.; e. U.S.

155. *HIERACIUM* L. HAWKWEED

Perennial herbs from subrhizomatous bases with fibrous root systems; stems 3-15 dm. tall, erect, sparingly or not branched except in the upper reaches, bearing long spreading tawny hairs in the lower part but glabrous above, upper parts of stems essentially leafless; leaves alternate, sessile but narrowed to a subpetiolar base or rarely with true short petioles, bearing long spreading tawny hairs; heads 5-15 mm. high, often somewhat nodding, solitary on the ultimate branches, 3 to 50 per plant; involucre obconical at anthesis, 5-13 mm. high; phyllaries in 2 fairly well-marked size-classes, the longer ones lance-subulate, in a double row, free, green, pubescent, the outer ones subulate, calyculate; receptacle very slightly convex, naked; flowers perfect, fertile; corollas bilaterally symmetrical, yellow to orange-yellow or dirty-yellowish-white, the raylike portion terminally

5-toothed; achene columnar, in some species gently tapered but never beaked, nearly black at maturity, 10-ribbed, 2-5.5 mm. long; pappus a number of tawny-white bristles, persistent, often somewhat unequal.

A cosmopolitan Temperate Zone genus of about 100 species; several thousands of species have been proposed chiefly on the basis of local apomictic strains.

1. Achenes about 5.5 mm. long3. *H. Fendleri*.

1. Achenes 2-3 mm. long (2)

2(1). Leaves to about a third (of the total height) above the base of the plant, narrowly obovate; east and north-central Texas1. *H. Gronovii*.

2. Leaves to a third the total height from the base of the plant, oblong-linear; Trans-Pecos mountains2. *H. Wrightii*.

1. *Hieracium Gronovii* L. Perennial herb, the stems 4-15 dm. tall; leaves 3 to 12 per stem, borne below the middle of the stem, obovate to narrowly so, blunt; involucre at anthesis about 7-8 mm. high, afterwards to 10 mm. high; achenes 2-3 mm. long. *H. longipilum* Torr. Frequent in sandy rather open-forested areas, e. Tex., infrequent or rare w. to n.-cen. Tex., commonly spring, less commonly again in fall; e. U.S. and s.e. Can.

2. *Hieracium Wrightii* (Gray) Robins. & Greenm. Caudex stout, comose; stems stout, fistulose, 4-9 dm. tall, very hirsute to the summit; leaves 5 to 9, the basal ones oblanceolate, narrowed to a subpetiolar base, glaucescent, obsolete glandular-denticulate, villous-hirsute above and below; stem leaves lance-oblong, attenuate; involucre campanulate, in fruit nearly 1 cm. thick; phyllaries tomentulose and covered with long spreading tawny or darker colored glandular setae; achenes 2-3 mm. long; pappus bright-white or slightly tawny. Frequent in the higher parts of the Trans-Pecos mts., Aug.; Tex., Coah., Chih., Baja Calif., S.L.P. and Dgo.

3. *Hieracium Fendleri* Sch. Bip. Stems 1 to 3, erect, 26-52 cm. tall, hirsute with long fine widely spreading or slightly reflexed bristles, or glabrate; basal leaves 3 to 14, oblanceolate to obovate, acute to rounded and apiculate, cuspidate-serrate, attenuate basally, 5-12 cm. long, 17-60 mm. broad, on both surfaces and marginally covered with long sparse hairs; stem leaves 1 or 2, much smaller, lance-oblong, acute; heads 3 to 40 per plant; inner phyllaries 10-12 mm. long; achene about 5.5 mm. long, tapered almost from the base to the summit; pappus sordid-white. Rare in Davis Mts. in the Trans-Pecos at elev. of 6,000-8,000 ft., June; N.M., Colo., Ariz., Tex. and Chih.

156. PRENANTHES L.

RATTLESNAKE ROOT

Perennial herbs 5-15 dm. tall from thick perennial taproots or corms sometimes connected by slender rhizomes; stems nearly simple, erect and leafy except in the immediate vicinity of the heads; leaves alternate, the lower ones usually withered before anthesis, some of them usually deeply lobed; upper 1-2 dm. of the stem repeatedly branched, each ultimate branchlet drooping and bearing a pendulous head; involucre at anthesis nearly cylindrical, 1-2 cm. long; phyllaries in 2 definite size-classes; inner (longer) phyllaries 5 to 8, linear and in a double row, free but the margins overlapping; outer (smaller) phyllaries lanceolate, much shorter than the inner ones, calyculate; receptacle very slightly convex, naked; flowers 5 to 12, perfect; corollas white or with a roseate or creamy tinge, bilaterally symmetrical, the ray portion 5-toothed terminally; achenes slenderly columnar, 5-10 mm. long, smooth but 5-ribbed, unbeaked; pappus of a number of microscopically barbellate buffy-white bristles, persistent.

A genus of perhaps 40 species in North America, Africa and Asia.

1. Principal phyllaries 6 to 8; heads with 10 to 12 flowers .1. *P. barbata*.

1. Principal phyllaries 5; heads with 5 or 6 flowers2. *P. altissima*.

1. *Prenanthes barbata* (T.&G.) Milstead. Tall virgate perennial; some of the midstem leaves pinnately lobed; principal phyllaries 6 to 8; phyllaries of the calyculum lance-subulate, each usually with a row of coarse short bristles; heads with about 10 to 12 flowers; achenes 8-10 mm. long. *P. Serpentaria* Pursh var. *barbata* (T.&G.) Gray. Rare in sandy forested areas, e. Tex. (Jasper Co.), Oct.; s. e. U. S.

2. *Prenanthes altissima* L. Tall virgate perennial; some of the midstem leaves pal-

mately 3- (or 5-) lobed; principal phyllaries 5; phyllaries of the calyculum bluntly lanceolate, essentially smooth or microscopically puberulent; heads with about 5 or 6 flowers; achenes about 5 mm. long. Very rare in moist rich beech woodland, e. Tex. (Newton Co.), Oct.; Que. to Man. s. to Ga., Tenn. and Tex.

157. YOUNGLIA CASS.

A genus of 35 or 40 species of temperate and tropical Asia.

1. *Youngia japonica* (L.) DC. Annual from short taproots, essentially glabrous; stems sparingly branched except in the upper 2-5 cm. where the branches are numerous with each ultimate one terminated in a head; leaves crowded at the base, lyrate-pinnatifid or runcinate; stem leaves few and reduced; heads about 6-7 mm. high including the pappus and rays; involucre 4-5.7 mm. high, nearly short-cylindrical except abruptly narrowed basally to the peduncle, of an inner double series of equal thin-membranous scarious-margined phyllaries and a few outer much shorter phyllaries near the base; receptacle slightly convex, naked; rays yellow or orange-yellow, 5-toothed terminally; achenes about 2 mm. long, fusiform in outline (occasionally falcate-fusiform), in transection 3- or 4-angular, on each of the 3 or 4 facets with 1 or 2 subordinate ribs, black; pappus of a number of soft white capillary bristles which tend to persist. Rare and local in cult. soil of flower beds and gardens, perhaps not a persistent member of our flora, Oct.-Nov.; nat. of Asia, now widely adv. in s.e. U. S.

This is exceedingly similar to *Crepis capillaris*. The technical details for distinguishing the genera *Crepis* and *Youngia* are tenuous.

158. CREPIS L. HAWK'S-BEARD

Herbs; leaves alternate; phyllaries of two size-classes, the longer ones subequal, in a double inner series, thin-membranous and scarious-margined, the outer calyculate ones deltoid and much shorter; receptacle convex, either naked or sparingly hairy; corollas (type "d") yellow, 5-toothed terminally; achenes terete or subterete in transection, not beaked though upwardly gradually attenuate in some species, with about 10 fine ribs; pappus copious, of numerous fine soft white capillary bristles, not plumose.

A genus of perhaps 200 species of the Northern Hemisphere and Asia.

- 1. Perennial 1. *C. runcinata*.
- 1. Annuals (2)

- 2(1). Achenes 4-6 mm. long, more or less attenuate upward; pappus rather persistent 2. *C. pulchra*.
- 2. Achenes 1.5-2.5 mm. long, terete or subterete, fusiform or oblong and abruptly narrowed at both ends; pappus caducous 3. *C. capillaris*.

1. *Crepis runcinata* (James) T.&G. Essentially glabrous perennial from woody or slightly fleshy rootstocks to 5-10 mm. thick, these apparently branched well-underground; leaves all crowded at the base, 5-12 cm. long, 15-30 mm. broad, oblanceolate, nearly entire or rarely with a few teeth or shallow lobes, rather fleshy and glaucous, essentially sessile; cauline leaves only 1 or 2 per stem and much-reduced to mere bracts, entire and oblanceolate, appressed; scapelike stems sparingly branched, the branches ascending with each terminating in a head; heads few; involucre narrowly campanulate, 12-20 mm. long, an inner double series of subequal linear-subulate thin-membranous scarious-margined phyllaries and 8 to 10 much shorter calyculate ones at the base; receptacle convex, naked or with a few minute hairs; rays yellow, 5-toothed terminally; achenes 4-5.5 mm. long, slightly attenuate apically but not beaked, nearly columnar or the outer ones somewhat compressed, with 10 to 13 ribs; pappus rather persistent, of a number of white fine capillary bristles which are lightly coherent basally. Rare in open seasonally moist prairies, higher parts of Plains Country (Dallam Co.), summer; very widespread in Great Plains and trans-Montane basins.

2. *Crepis pulchra* L. Glandular-pubescent taprooted annual 3-7 dm. tall, with a single stem basally which is simple for most of the height of the plant; lower stem leaves oblan-

ceolate, often shallowly runcinate or merely toothed, apically blunt, basally cuneate, sessile; leaves of midstem smaller, often oblong and clasping, those a little higher up much-reduced and narrowly deltoid-clasping and apically subulate; heads 5 to 50 per plant, not crowded, each terminating an ascending naked pedunculiform branch; involucre nearly cylindrical or narrowly obconical, 8-11 mm. long, of an inner double series of linear-subulate thin-membranous scarious-margined phyllaries and a very few minute calyculate ones basally; receptacle convex, few-flowered, naked; rays orangish-yellow, 5-toothed terminally; achenes 4-6 mm. long, slenderly columnar, more or less attenuate upward, several-ribbed; pappus copious, persistent, of numerous fine white capillary bristles. Rare adv. in sandy soils, e. Tex. (Upshur and Wood cos.), Apr.-May; nat. of Medit. region, middle Eur. and e. to Himalayas and Tien Shan Mts., now sparingly adv. in s.e. U.S.

3. *Crepis capillaris* (L.) Wallr. Annual or biennial, 2-90 cm. tall; stem erect, branched above or profusely branched from base upward; involucre cylindrical (eventually turbinate in fruit); inner phyllaries 8 to 16, thin, scarious-margined, pubescent on the median dorsum; outer phyllaries much shorter, calyculate; receptacle naked; rays yellow; achenes brownish, 1.5-2.5 mm. long, terete or subterete, fusiform or oblong and slightly narrowed at both ends, with 10 ribs; pappus of numerous soft white capillary bristles, caducous. Rare lawn weed at Alpine (in 1928) in the Trans-Pecos, probably not a persistent member of our flora, spring; nat. of Eur., now widely adv.

159. TARAXACUM ZINN DANDELION

A Temperate Zone genus of perhaps 50 species. Hundreds of species have been proposed, based largely on apomictic populations.

1. *Taraxacum officinale* Wiggers. COMMON DANDELION. Winter annual or perennial herb from deep taproots to 1 cm. thick; leaves all crowded in a basal rosette, 5-15 cm. long, runcinately pinnatifid; stems scapose, 3-20 cm. tall, solitary or few, each topped by a solitary head; involucre broadly obconic, about 1-2 cm. broad and high; phyllaries in 2 definite size-classes; inner (longer) phyllaries in 2 equal series, linear-subulate, thin-membranous with hyaline margins, at anthesis appearing very slightly coherent at the overlapping margins but with age pulling apart and eventually spreading at maturity of fruit, each near the apex dorsally with a minute glandular spot which usually during maturation of the fruit proliferates into a low crest or minute horn, making the phyllary appear double-tipped or -appendaged; outer (shorter) phyllaries about half or less as long as the inner, of the same texture and shape, spreading during anthesis, calyculate; receptacle very slightly convex, naked; flowers all perfect, fertile, in some races parthenogenetic and lacking functional stamens; corolla yellow, bilaterally symmetrical, the ray-like portion 5-toothed terminally; achene very slightly flattened (the exterior ones sometimes roughly trigonous but plump and rounded), the basal fusiform body with about 5 major rounded ribs and some lesser intermediate ones, the one in the anterior portion often with a row of antrorse spinose projections, the body giving way abruptly to the filiform beak as long as or longer than the body and slightly flared apically; pappus of a large number of whitish or yellowish-white fine capillary bristles which are either persistent or break off separately but not falling together. *T. erythrospermum* Besser, plus a number of other synonyms. Locally abundant in lawns, roadsides and other disturbed favorable places, throughout the state except the extreme s., spring-summer; nat. of Eur., now widely adv.

A troublesome lawn weed whose leaves are used as a pot herb when young. The color of the achene varies from grayish or buffy to rich-chestnut, but no other characters are correlated with this color and there seems to be no justification for recognition of *T. erythrospermum* as a separate entity.

APPENDIX

POLYPODIACEAE

Cf. *Asplenium* on page 63. A plant of this species was recently found by Jim Blassin-game, of South Plains College, Levelland, Texas, at Boot Springs in the Chisos Mts. of Big Bend National Park.

Asplenium septentrionale (L.) Hoffm. Plant tufted, grasslike in appearance; fronds 5-15 cm. long; blade with 2 to 5 linear to oblong-lanceolate segments tapered at both ends, the margins entire or remotely slender-toothed. Usually in crevices of ledges and rocks. Widely distributed in w. U.S., Eur. and Asia.

The plant differs markedly from all other species of *Asplenium* found in Texas.

HYDROCHARITACEAE

Cf. PAGE 100.

Ottelia alismoides (L.) Pers. Vegetatively resembling a large, coarse *Plantago*; leaves thin, submerged or partly emerged, broadly ovate to suborbicular or cordate-reniform, to 21 cm. in diameter, with 7 to 11 prominent parallel curved veins; peduncle several-angular, to 3 dm. tall; spathe elliptic to ovate, with 2 acute tips, 1-flowered; flowers sessile, fragrant; sepals linear to oblong, obtuse, 1-nerved, to 16 mm. long and 4 mm. wide; petals obovate, 2-3 cm. long, white to very pale pink, slightly darker distally, yellow-based; anthers bright yellow; fruit oblong, rostrate, 2-4 cm. long, crowned by the sepals, bursting irregularly.

This Afro-Asian plant has recently been found in Cameron Parish, Louisiana, in shallow, clear water in McCain's Fishing Lake, about 3 miles southwest of Sweet Lake (15 miles south of Lake Charles), about 30 miles east of the Texas state line. It will probably be only a matter of time before it is found in similar locations in Texas.

LILIACEAE

Cf. *Nothoscordum* ON PAGE 391.

A second species described from Arizona, *N. texanum* M. E. Jones, has been reported (but not seen by us) from west Texas. It has somewhat fragrant, yellowish-white flowers externally tinged with purple. If in Texas, the species should be in mountains of the Trans-Pecos.

CARYOPHYLLACEAE

Cf. PAGE 612.

Cardionema ramosissima (Weinm.) A. Nels. & Macbr. A fragmentary specimen of this littoral species in the U. S. National Herbarium bears the information "Texas, Oct. 1850" on an "Ex Coll. Geo. Thurber" label. The occurrence of this coastal western North American and Latin American species in Texas needs verification. It should be looked for among dunes and along beaches of our coast. It is a tufted perennial with numerous stems forming a mat, and resembles somewhat a congested plant of *Paronychia*. Its subulate, spine-tipped leaves subtended by prominent silvery stipules and its very unequal sepals with the outer, larger ones tipped with stout, divergent spines, are characteristic.

LEGUMINOSAE

Cf. *Acacia* ON PAGE 770.

1. *Acacia tortuosa* (L.) Willd. (cf. page 771). Duane Isely has very recently concluded that this species, in the strictest sense, is confined to the West Indies and Florida.

Texas plants treated by us under this name are referred to *A. Schaffneri* (Wats.) Herm. var. *bravoensis* Isely. The var. *Schaffneri*, in Isely's opinion, is limited to the highlands of Mexico.

2. *Acacia Farnesiana* (L.) Willd. (cf. page 772). Isely has concluded that this species, in the strict sense, occurs in southern Florida, West Indies, Central America and northern South America. Texas huisache is called *A. Smallii* Isely (new name for *Vachellia densiflora* Small) and is said to occur as far east as the Panhandle of Florida and to have disjunct populations in Arizona and California.

7. *Acacia Greggii* Gray. (cf. page 773). Plants treated here by us have recently been treated by Isely under two weak varieties: var. *Greggii* with glabrous to slightly puberulent leaflets and occurring over most of the range west to the Trans-Pecos; var. *arizonica* Isely with pubescent leaflets and occurring from the Trans-Pecos west to California.

12. *Acacia texensis* T. & G. (cf. page 774). Most of the Trans-Pecos plants treated by us under this name are referred by Isely to *A. angustissima* (Mill.) O. Ktze. var. *chisosiana* Isely, described as a low shrub with sparsely puberulent leaves, petiole and rachis together 8-20 (-30) mm. long, pinnae (1 or) 2 to 4 pairs, leaflets 6 to 10 pairs, and 4- to 8- (to 10-) flowered glomerules, and said to occur in the Trans-Pecos and also in Chihuahua and Coahuila. The "true" *A. texensis* is treated as *A. angustissima* var. *texensis* (T. & G.) Isely, described as an herb or suffrutex with small leaves, petioles and rachises together mostly 25-40 mm. long, pinnae (3 or) 4 to 6 pairs, leaflets 9 to 15 pairs per pinna, largely intercalary inflorescences, and 4- to 6-flowered glomerules, and said to occur in "southern and western Texas and southwestern New Mexico."

CF. *Hoffmanseggia* ON PAGE 797.

The transfer of *Caesalpinia oxycarpa* (from page 796) to *Hoffmanseggia* necessitates the following revision of the key to species in that genus.

- 1. Peduncle and calyx with stalked glands (2)
- 1. Peduncle and calyx without stalked glands (3)
- 2(1). Petals conspicuously clawed 1. *H. glauca*.
- 2. Petals not clawed 4. *H. oxycarpa* Gray.
- 3(1). Pinnae 7 to 11; inflorescence 5- to 10-flowered; pod 25-40 mm. long, strongly falcate 2. *H. drepanocarpa*.
- 3. Pinnae 3 to 7; inflorescence 3- or 4-flowered; pod 12-15 mm. long, straight 3. *H. tenella*.

CELASTRACEAE

CF. PAGE 998.

Pachistima myrsinites (Pursh) Raf. BOX-LEAF, MOUNTAIN-LOVER. Densely branched glabrous leafy evergreen shrub to 1 m. tall, sometimes essentially prostrate; branchlets quadrangular; stipules minute, deciduous; leaves decussately opposite, coriaceous, subsessile to shortly petiolate, oblong-elliptic to ovate-elliptic or oblanceolate, obtuse to rounded at apex, serrulate above, 10-15 mm. long, 2-6 mm. wide; flowers perfect, regular, 4-merous, about 4 mm. in diameter, in 1- to 3-flowered short-pedunculate axillary cymes; capsule coriaceous, 4 mm. long, 2-valved, tardily dehiscent. Represented only by a single collection on the Edwards Plateau, should occur in the mts. of the Trans-Pecos, May-Aug.; from B.C. to Calif., s. in the Rocky Mts. to Ariz., N.M., Tex. and Mex. (N.L. and Coah.)

This is a typically prostrate plant with opposite leaves.

LYTHRACEAE

CF. *Cuphea* ON PAGE 1117.

- 1. Perennial; stems thin and wiry, spreading-assurgent; stem leaves sessile or essentially so, about 1.5 cm. long 3. *C. glutinosa*.
- 1. Annuals; stems stoutish and erect; stem leaves distinctly petiolate, usually 2 cm. long or more (cf. key on page 1118).

3. *Cuphea glutinosa* Cham. & Schlecht. Perennial with slender rootstocks, the roots fibrous, the herbage more or less glandular-viscid throughout; stems thin and wiry, spreading-assurgent, 1-3 dm. long, simple or usually sparingly branched; leaves sessile or nearly so, ovate to oblong-lanceolate, acute, about 1.5 cm. long or less; pedicel about 1.5 mm. long; hypanthium 7-8 mm. long, curved, gibbous; calyx limb with 5 minute equal deltoid lobes; petals deep violet-color, elliptic-oblong, obtuse, 5-6.5 mm. long; seeds discoid, about 2 mm. long. Wet meadow about small woodland lake in s.e. Tex. (Tyler Co.), Sept.-Nov.; also La.; nat. of S.A.

MELASTOMATACEAE

Cf. *Rhexia* ON PAGE 1118.

Rhexia alifanus Walt. Erect glabrous perennial with simple or basally branched wand-like stems to about 1 m. high, from an enlarged spongy rootstock; leaves ovate-lanceolate or narrowly elliptic, glabrous, 3-nerved, entire, to 75 cm. long and 1 cm. wide, acute to acuminate at apex, cuneate to the sessile base; flowers few in a paniculate cyme; sepals deltoid, 1-1.5 mm. long; petals rose-color or purplish, somewhat glandular-pubescent on outer surface, 2-2.5 cm. long; anthers yellow, linear-lanceolate, curved, 7-8 mm. long, short-appendaged, with filaments 6-8 mm. long; mature hypanthium 7-10 mm. long, glandular-setose, with a short neck; seeds lustrous, brown, angled, 1-2 mm. long. A plant of savannahs, bogs and peaty pinelands, recently reported from Hardin Co., s.e. Tex., Apr.-Aug.; from e. N.C., s. to Fla. and w. to Tex.

This is one of the most distinctive of all species in this genus. It is an erect, smooth plant with large, rose-color flowers.

GENTIANACEAE

Cf. *Centaurium texense* ON PAGE 1207.

"Lady Bird's centaury." Named for Mrs. Lyndon B. Johnson who, because of her interest in this attractive little plant, made a special effort to collect seeds in 1966 from limestone hills south of Johnson City, and planted them in gravelly-rocky soil along the ranch airfield runway where they grew and bloomed in 1967.

Cf. *Bartonia* ON PAGE 1209.

Bartonia verna (Michx.) Muhl. Stems erect, purplish to rarely yellowish, 5-20 cm. high; leaves opposite or subopposite, reduced to scales 1-3 mm. long; flowers solitary, racemose or sometimes paniculate on robust plants; pedicels 5-20 mm. long, rarely more; sepals triangular-acute, 2-3 mm. long; corolla white, rotate; petals oblanceolate to obovate, obtuse, entire, 5-10 mm. long, 1.5-4 mm. wide; stamens about half as long as corolla, ascending; pistil two thirds as long as corolla; capsule 3-7 mm. long. In pitcher plant bogs and low savannahs in s.e. Tex. (Tyler Co.), Feb.-Mar.; from N.C. s. to Fla. and w. to Tex.

Only recently discovered in Texas by Geraldine Watson of Silsbee. Its habit of early spring flowering and petals 5-10 mm. long distinguish this species from others in this genus.

BORAGINACEAE

Cf. page 1280. In March 1970, Dr. Richard Spellenberg, of New Mexico State University, Las Cruces, discovered this genus and its two species for the first time in Texas.

PECTOCARYA MEISN.

Slender annual herbs with linear leaves and inconspicuous white flowers; pedicels recurving at maturity; mericarps in divergent pairs.

About 10 species in western North America.

1. Mericarps conspicuously heteromorphous, 2 of them more or less ascending and with distinct upturned sparsely toothed or entire margins, the other 2 somewhat recurved and inconspicuously margined 1. *P. heterocarpa*.

1. Mericarps homomorphous or essentially so, all of the mericarps with pectinately lacerate or dentate margins, the body straight or only moderately curved
 2. *P. platycarpa*.

1. *Pectocarya heterocarpa* I. M. Johnst. Plant branched from base; stems prostrate or spreading-ascending; calyx strongly asymmetric; mericarp with linear or oblong body; fruit about base of plant apparently from cleistogamic flowers, its mericarps reflexed and not margined. Rather frequent on east slope of Franklin Mts., El Paso Co., Mar.-Apr.; Calif., Ariz. and s.w. Ut., s. to Son. and w. Tex.

2. *Pectocarya platycarpa* Munz & I. M. Johnst. Plant branched from base; stems prostrate or spreading-ascending; calyx nearly regular; mericarp with linear or oblong straight or moderately curved body, with a conspicuous broad toothed cartilaginous margin, the triangular or cuneate teeth evidently united at base; fruit about base of plant apparently from normal flowers, not noticeably modified. Rather common on east slope of Franklin Mts., El Paso Co., Mar.-Apr.; s. e. Calif., Ariz. and s.w. Ut., s. to n. Son. and w. Tex.

LABIATAE

Cf. *Physostegia* ON PAGE 1359.

Physostegia virginiana (L.) Benth. Stoloniferous herb; stems erect, to 1.5 m. high, simple or paniculately branched at summit; leaves submembranous to firm, linear-oblong to oblong-lanceolate near apex of stem, 4-12 cm. long, 1-3 cm. wide, acute to acuminate, serrate or incised-serrate (at least above middle), narrowed to the sessile base; racemes spikelike, simple or paniced, rather closely flowered, in fruit with overlapping calyces, the longer spikes to 2 dm. long; pedicels much shorter than the calyx; bracts ovate-lanceolate to lanceolate; calyx glandular-viscid and usually hirtellous-puberulent, 6-8 mm. long, the tube cylindric-campanulate, the teeth triangular-lanceolate to lanceolate, acute to somewhat acuminate, more or less spreading, one third as long as the tube; corolla usually purple or roseate, 2.5-3 cm. long, the lower lip irregularly denticulate, the upper lip with 3 lobes notched and apiculate in each notch; cocci 3 mm. long, sharply angled. *Dracocephalum virginianum* L. River banks, swamps and low grounds, introd. and naturalized in n.-cen. Tex., not yet known as an escape, Aug.-Nov.; Que. to n.w. Can., s. to N.C., Tenn., Mo. and Tex. (introd.)

This is our only other *Physostegia* besides *P. praemorsa* that flowers from August to November. It may be distinguished from that species by its slender, elongate rhizomes and large, not bractlike, stem leaves below the inflorescence.

Cf. *Hedeoma* ON PAGE 1379.

Hedeoma pilosum Irving. Small perennial cespitose herb about 4 cm. high, forming mats; stems herbaceous, extremely short, unbranched above, profusely branched below, pubescent with short spreading hairs; leaf pairs crowded, the internodes about 1.5 mm. long; leaves coriaceous and sharply ascending, appressed to the stems, ovate, entire, sessile, tapered to a narrowly obtuse or acutish apex, 5 mm. long, 2-3 mm. wide, the margins pilose-ciliate, upper and lower leaf surfaces glabrous; flowers solitary in the uppermost leaf axils; primary peduncles short; pedicels 1-2 mm. long, canescent; bracteoles short, oblong, ciliate; calyx 7.5 mm. long, somewhat coriaceous, the tube tubular-funnelform, not at all gibbous below, dilated upward, about 5 mm. long, pilose, the hairs long and spreading; upper calyx teeth connate for about one-half their length to form a broad upper lip about 2.5 mm. long, the triangular lobes about 1.2 mm. long and 0.5 mm. wide at the base, slightly laterally spreading and reflexed, pilose-ciliate; lower calyx teeth narrowly triangular-lanceolate, ascending, about 2.5 mm. long, pilose-ciliate; annulus dense, included, about 1 mm. wide and seated deep within the tube, about 2 mm. below the juncture of the upper and lower lips; corolla and cocci not observed. Restricted to summit of "Old Blue Mt." (Brewster Co.), June-July; endemic.

Within our Texas species *H. pilosum* is quite distinct and related only to *H. apiculatum*. Features common to these 2 endemics are plants cespitose, forming mats; leaves coriaceous; flowers solitary or in 3-flowered axillary cymules; very restricted in distribution. They may be distinguished as follows:

1. Plants about 4 cm. high; leaves ovate, pilose-ciliate, about 5 mm. long, apex obtuse or acute; calyces pilose, with hairs long and spreading *H. pilosum*.
1. Plants 10-15 cm. high; leaves lanceolate-elliptic, about 10 mm. long, apex apiculate, the margins tuberculate; calyces hispidulose *H. apiculatum*.

SOLANACEAE

CF. *Chamaesaracha* ON PAGE 1392.

Recent work by John E. Averett on the genus *Chamaesaracha* indicates the need for considerable revision of our treatment. He has kindly contributed the following synopsis of the Texas species of the genus.

1. Leaves ovate to broadly ovate-lanceolate, entire to crenate, 15-35 mm. wide; flowering calyces usually more than 5 mm. long (2)
1. Leaves rhombic to lanceolate, subentire to lobed, less than 20 mm. wide; flowering calyces usually shorter than 4 mm. (3)
- 2(1). Herbage villous with long forked and simple trichomes; leaf blades about half as wide as long, subsessile 4. *C. villosa*.
2. Herbage basically glandular but with some longer simple trichomes; leaf blades about as wide as long, petiolate 5. *C. crenata*.
- 3(1). Herbage glabrous to sparsely or densely pubescent with stellate hairs; leaves linear to linear-lanceolate or rhombic, entire to undulate or deeply undulate or few-lobed; stems often cinereous or purplish at base (4).
3. Herbage pubescent with glandular hairs and/or simple trichomes, or if hairs stellate then leaves not as described above; stems green (6)
- 4(3). Leaves linear to linear-lanceolate, usually few-lobed, sparsely pubescent with scurfy white stellate or branched hairs 1. *C. Coronopus*.
4. Leaves broadly lanceolate to rhombic, entire to undulate or deeply undulate, the pubescence stellate, lacking or otherwise (5)
- 5(4). Leaves densely pubescent with stellate hairs; stems also with stellate hairs 3. *C. pallida*.
5. Leaves essentially glabrous; stems usually with glandular hairs 2. *C. edwardsiana*.
- 6(3). Leaves rhombic to broadly lanceolate or ovate, entire to undulate; pubescence primarily of short glandular hairs 6. *C. sordida*.
6. Leaves with numerous pinnate or irregular lobes; pubescence of longer trichomes (simple or stellate), occasionally mixed with glandular hairs 7. *C. coniodes*.

1. *Chamaesaracha Coronopus* (Dun.) Gray. Erect to diffuse with age; roots slender and subligneous, 1.5-3.5 mm. thick; stem 1-5 dm. long, about 1.5 mm. thick, herbaceous, much-branched primarily from the base, slightly angular or striate, often purplish or cinereous at base, glabrous to sparsely pubescent with scurfy, short, white, stellate or branched hairs; leaves linear to linear-lanceolate, usually pinnately lobed, 2-6.5 cm. long, 1-10 (-15) mm. wide, gradually narrowing to an attenuate subsessile base, with variable lobes to 4 mm. long and about 1.5 mm. wide, at apex acute to rounded or obtuse, with a prominent midnerve but no other conspicuous venation, usually with some stellate hairs, leathery or thick; flowers solitary or in pairs in the axils; pedicels 1-2 cm. long, elongating in fruit; calyx 2.5-4 mm. long, rather densely pubescent, with acute teeth about 2 mm. long or about half the total calyx length and pubescent with stellate or branched hairs or occasionally with mixed trichomes; corolla 6-10 (-15) mm. wide, with prominent contiguous white-tomentose appendages filling the throat, pubescent on the lobes dorsally and especially on the margins; fruit 4-8 mm. thick; chromosome numbers: $n = 24, 36$. N.-cen. Tex., Rio Grande Plains, Trans-Pecos and Plains Country, spring-fall; Tex. to Ariz. and s.e. to S.L.P.

2. *Chamaesaracha edwardsiana* Averett. Roots slender and subligneous, 1.5-3.5 (-7) mm. thick; stems 7-30 cm. long, about 1.5 mm. thick, herbaceous, branching from the

base, terete or only slightly angular to striate, often purplish or cinereous at the base, glabrous to pubescent with stellate hairs or occasionally with simple and branched trichomes (especially in the upper portions); leaves linear-lanceolate to narrowly rhombic, typically undulate but occasionally few-lobed, 2.5-7 cm. long, 7-15 mm. wide, at base attenuate, subsessile to slightly petiolate, with a prominent midrib and inconspicuous secondary venation, essentially glabrous; flowers solitary or less commonly in pairs in the axils; pedicels 2-2.5 cm. long, elongating in fruit, pubescent with trichomes and glandular hairs; calyx 4-5 mm. long, with acute teeth about half the total length and pubescent with stellate, branched and simple trichomes; corolla 10-15 mm. wide, the lobes pubescent dorsally especially near the margins; fruit 5-8 mm. thick; chromosome number; $n = 24$. Primarily on limestone outcrops, Edwards Plateau, summer; also rare in N. L.

3. *Chamaesaracha pallida* Averett. Erect to somewhat diffuse with age; roots usually slender and subligneous but occasionally woody; stems 7-15 (-20) cm. long, herbaceous, much-branched primarily from the base, striate or only slightly angular, often purplish or cinereous at base, usually densely pubescent with stellate or branched hairs; leaves narrowly rhombic to ovate-lanceolate or ovate to oblanceolate, 2-3.5 (-4) cm. long, 1-1.5 cm. wide, about half as long as wide, subentire to deeply undulate, at apex acute to obtuse or rounded, at base attenuate to subsessile or short-petiolate, densely pubescent with stellate or branched hairs; flowers solitary in axils; pedicels slender, 1-2 cm. long, elongating in fruit; calyx 3-4 mm. long, with triangular to acute or slightly rounded teeth 1-1.5 mm. long, hispid with rather stiff branched and/or unbranched trichomes; corolla 10-15 mm. wide but occasionally smaller, the tomentose appendages not filling the throat; fruit about 5-7 mm. thick, mostly enclosed in the calyx; chromosome number: $n = 36$. Scattered in s. part of the Trans-Pecos, rare e. to Uvalde Co., May-Oct.; also N.M., Coah., Chih. and Dgo.

4. *Chamaesaracha villosa* Rydb. Strongly perennial, with woody roots; stems erect to diffuse with age, 15-50 cm. long, 1.5-3.5 mm. thick, herbaceous to basally somewhat woody, much-branched primarily from the base, striate or angular, densely pubescent with long villous forked trichomes and occasionally with some glandular hairs; leaves ovate to ovate-lanceolate, 4-7 cm. long, 15-30 mm. wide, entire to undulate-crenate, at apex acute to obtuse, at base attenuate; petioles about 1 cm. long; flowers solitary or in pairs in the axils; pedicels slender, striate, villous, 1-2 (-4) cm. long, elongating in fruit; calyx about 5 mm. high, pubescent, with ovate obtuse or acute teeth about half the total length; corolla 5-30 mm. wide, with the white-tomentose appendages not filling the throat; fruit 5-8 mm. thick; chromosome number: $n = 12$. Deserts, s. part of the Trans-Pecos, summer-fall; also Dgo., Chih. and Coah.

5. *Chamaesaracha crenata* Rydb. Strongly perennial, with woody roots; stems erect to diffuse with age, 15-40 cm. long or longer, 1.5-3.5 mm. thick, herbaceous or at base somewhat woody, much-branched primarily from the base, striate or angular, densely pubescent with glandular hairs and with some longer usually simple trichomes; leaves ovate to broadly rhombic, 4-6 cm. long, 15-35 mm. wide, entire-undulate to crenate, at apex obtuse, at base cuneate or somewhat attenuate; petioles 2-3 cm. long; flowers solitary or in groups of 2 to 5 in axils; pedicels slender, somewhat striate, 1-2 (-4) cm. long, elongating in fruit; calyx (3-) 5-7 mm. long, densely pubescent primarily with long trichomes and usually with prominent glandular hairs, with ovate acute to obtuse teeth about 3 mm. long; corolla 1-2 cm. wide, the tomentose appendages not filling the throat; fruit 8-10 mm. thick; chromosome number: $n = 12$. Trans-Pecos, summer-fall; also Coah.

This species and *C. villosa* appear to have hybridized in the Big Bend National Park and near Lajitas, Presidio Co. A few plants in that region are difficult to assign definitely to one or the other species.

6. *Chamaesaracha sordida* (Dun.) Gray. Roots subligneous to woody, 2-8 (-10) mm. thick; stems branching primarily from the base, 9-30 cm. long, 1.5-2 mm. thick, occasionally somewhat striate but not conspicuously so, pubescent to the base; herbage densely pubescent with glandular hairs but occasionally also with mixtures of simple and branched trichomes; leaves rhombic, 1.5-4 cm. long, 4-8 (-10) mm. wide, entire to undulate or somewhat lobed, at apex acute to somewhat rounded, at base gradually narrowing and subsessile; flowers solitary or in pairs in the axils; pedicels slender, 1-3 cm. long, elongating in fruit; calyx about 3 mm. long, with acute teeth a third to half the total length, rather densely pubescent; corolla typically 1 cm. wide or less, the tomentose appendages not

filling the throat; fruit 4-8 mm. thick; chromosome number: $n = 12$. Rio Grande Plains, Plains Country and the Trans-Pecos, spring-fall; Tex. to s. Ariz., s. to Chih. and Coah.

7. *Chamaesaracha coniodes* (Dun.) Britt. Roots subligneous to woody, 2-8 (-10) mm. thick; stems erect to diffuse with age, 9-30 cm. long, 2-3 mm. thick, branching primarily from the base, striate or slightly angular; herbage pubescent predominantly with simple trichomes but these often mixed with glandular hairs, usually somewhat villous, the indument of the leaves more glandular and hispid than that of the stems; leaves broadly lanceolate, 2.5-5.5 cm. long, 1-2 cm. wide, crenate to deeply pinnately lobed (the lobes 3-6 mm. long), at apex acute to rounded, at base attenuate and sessile; flowers solitary or in pairs in the axils; pedicels 2-3 cm. long, elongating in fruit; calyx about 4 mm. high, villous and with acute teeth about 1.5 mm. long; corolla 1-1.5 cm. wide; fruit about 7 mm. thick; chromosome numbers: $n = 24, 36$. Plains Country and n.-cen. Tex. s. to the Trans-Pecos and Rio Grande Plains, spring-fall; Colo. and Kans. s. to Chih., Coah. and Tex.

COMPOSITAE

CF. PAGES 1533 AND 1705.

1. *Cotula australis* (Sieb.) Hook. f. Weak slender-stemmed annual herb, branched and spreading from base, to about 15 cm. high, sparsely pubescent with spreading hairs; leaves 1-3 cm. long, finely pinnate with linear lobes; heads 2-5 mm. broad; phyllaries broadly elliptic, with scarious margins; receptacle flattish, not chaffy but beset with minute fuzzy achene pedestals; disk yellow, the corollas 4-toothed; marginal achenes laterally compressed, white-ribbed on the 2 sharp edges, about 1 mm. long, stipitate, minutely glandular on both faces, smooth on margins. A troublesome Australian weed recently discovered on the Texas A&M University campus (Brazos Co.) by Prof. John J. Sperry, Mar.-Apr.; also adv. in S.A., Calif., etc.

Superficially similar to *Soliva* but differs in its stipitate achenes and 4-toothed disk corollas.

CF. *Lygodesmia* ON PAGE 1727.

Recent work by A. S. Tomb on the plants included in our treatment in *Lygodesmia* has shown the need for considerable revision. He has kindly submitted the following short synopsis for Texas plants of this affinity.

1. Pappus plumose (in our species) 146b. *Stephanomeria*.
1. Pappus capillary (2)
- 2(1). Pappus about 4 mm. long 146c. *Prenantheella*.
2. Pappus about 8 mm. long or longer 146a. *Lygodesmia*.

146a. LYGODESMIA D. DON

Pappus not plumose; pollen echinolophate, i.e., patterned with very thick ridges; $x = 6$ or 9 pairs of chromosomes. An American genus of 9 species.

1. Plants annual; lower leaves opposite 2. *L. rostrata*.
1. Plants perennial; lower leaves not opposite (2)
- 2(1). Basal leaves not forming a rosette 1. *L. juncea*.
2. Basal leaves forming a rosette (3)
- 3(2). Involucre of 8 to 10 principal phyllaries; flowers 9 to 12 per head; roots fleshy 3. *L. texana*.
3. Involucre of 5 to 7 principal phyllaries; flowers 5 to 7 per head; roots woody 4. *L. ramosissima*.

1. *Lygodesmia juncea* (Pursh) D. Don. Perennial; basal leaves not opposite and not forming a rosette. Higher parts of the Plains Country, June-Sept.; Alta., Sask., Man. and Br. Col. s. to Tex., Nev. and Ut.

Rarely or perhaps never setting fertile seeds in Texas.

2. *Lygodesmia rostrata* (Gray) Gray. Annual herb with opposite leaves. Loose sandy soils, often blowing dunes, Plains Country, June-Oct.; Alta. and Sask. s. to Tex. (very rare, last collected in Texas about 1850).

3. *Lygodesmia texana* (T. & G.) Greene. Perennial herb; leaves forming a basal rosette; principal phyllaries 8 to 10; flowers 9 to 12 per head; roots fleshy. N.-cen. Tex. (e. to Washington and Austin cos.), Edwards Plateau, Rio Grande Plains, Plains Country and Trans-Pecos, Apr.-Oct.; Okla., N.M., Tex. and Coah.

4. *Lygodesmia ramosissima* Greenm. Perennial herb; leaves forming a basal rosette; principal phyllaries 5 to 7; flowers 5 to 7 per head; roots woody. In the Trans-Pecos at elev. above 4,500 ft., May-Oct.; N.M., Tex., N.L., Chih. and Dgo.

Hybridizing with *L. texana* in the Davis Mts. of the Trans-Pecos.

146b. STEPHANOMERIA NUTT.

Pappus plumose; pollen merely echinate; $x = 8$ pairs of chromosomes.

An American genus of about 16 species.

1. Annual herbs 1. *S. exigua*.

1. Perennial herbs (2)

2(1). Pappus pure white; pappus bristles plumose to the base; plants slender, virgate, usually with a single main stem 2. *S. Wrightii*.

2. Pappus sordid- or tawny-white, not plumose all the way to the base; plants intricately bushy-branched 3. *S. pauciflora*.

1. *Stephanomeria exigua* Nutt. Annual herb. *Lygodesmia Bigelovii* (Gray) Shinners. Rare in the Trans-Pecos (near El Paso), summer; N.M. to Calif., s. to Chih. and Son.

2. *Stephanomeria Wrightii* Gray. Perennial herb; plants slender, virgate, usually with a single main stem; pappus bristles plumose to the base, nearly pure white. *Lygodesmia tenuifolia* (Torr.) Shinners. Infrequent to rare in the Trans-Pecos, summer-fall; also N. M.

3. *Stephanomeria pauciflora* (Torr.) A. Nels. Perennial herb, intricately bushy-branched; pappus bristles not plumose near the base but plumose above, sordid-or tawny-white. *Lygodesmia pauciflora* (Torr.) Shinners. Higher parts of the Plains Country and Trans-Pecos, summer-fall; Tex. to Calif., s. to Chih. and Coah.

146c. PRENANTHELLA RYDB.

A monotypic American genus.

1. *Prenanthes exigua* (Gray) Rydb. Involucre much-reduced, with only 3 or 4 principal phyllaries plus a calyculum of 1 or 2 minute outer phyllaries; flowers 3 or 4 per head; pappus capillary but less than half as long as that of any species of *Lygodesmia*; pollen merely echinate; $x = 7$ pairs of chromosomes. *Lygodesmia exigua* Gray. Type from stony hills above El Paso in the Trans-Pecos but not taken in Texas in the last 115 years, Apr.-July; otherwise Sonoran Desert n. to Ut. and Calif.

GLOSSARY

(Based primarily on the compilation by David D. Keck in Munz' and Keck's "A California Flora" (1959); with permission.)

- A-**. A prefix denoting without, such as *asexual*.
- Abaxial**. Located on the side away from the axis; dorsal.
- Abbreviated**. Shortened, as when one part is shorter than another.
- Aberrant**. Differing from the type of a species, genus or higher taxon in one or more characters but not readily assignable to another taxon.
- Abortive**. Imperfect or barren.
- Abrade**. To rub or scrape off.
- Abrupt**. Terminating suddenly; not tapering.
- Absciss-layer**. A zone of tissue forming a layer of separation, especially with reference to the phenomena of defoliation.
- Abscission**. Act or process of cutting off. *Abscising*: to cut off.
- Acaulescent**. Stemless or essentially so, or with stem subterranean. (Cf. *Caullescent*.)
- Accessory**. Additional to the usual number of organs.
- Accrescent**. Increasing in size with age, as often with the calyx after flowering.
- Accumbent**. Lying against something, as cotyledons against the radicle.
- Aceriform**. Like a maple leaf.
- Acerose**. Needle-shaped, as the leaves of pines.
- Achene (akne)**. A small, dry, indehiscent, one-seeded, usually hard fruit in which the ovary wall is free from the seed. *Achenial*: relating to or like an achene. *Achenelet*: the diminutive.
- Achlorophyllus**. Devoid of chlorophyll, or apparently so.
- Acicular, aciculate**. Needlelike.
- Acidulous**. Slightly sour.
- Acotyledonous**. Destitute of cotyledons.
- Acrid**. Sharp and harsh or bitterly pungent to the taste.
- Acrodome**. Having the principal nerves or veins terminating at the leaf tip.
- Acropctal**. Produced in a succession toward the apex, as applied to the development of organs.
- Acroscopic**. Looking towards the summit (reverse of basiscopic).
- Actinomorphic**. Exhibiting radial symmetry, as a regular flower.
- Aculeate**. Prickly; beset with prickles or sharp points.
- Acumen**. A tapering point. A point the margins of which are not exactly straight but bow inward.
- Acuminate**. Gradually tapering to a diminishing point and with the margin bowing inward; long-pointed. (Cf. *Acute*, *Attenuate*.)
- Acute**. Sharp-pointed, but less tapering than acuminate.
- Adaxial**. Located on the side nearest the axis.
- Adhere**. To stick fast or cleave. *Adherent*: attached or joined, though naturally or normally separate.
- Adnate**. Grown together entirely or partially with an unlike part, as the calyx tube with an inferior ovary, or an anther by its whole length with the filament.
- Adpressed, appressed**. Pressed flat against another organ.
- Adventitious**. Out of the usual place, as a bud produced from the stem instead of in the axils of leaves.
- Adventive**. Applied to an introduced plant, not definitely established or naturalized.
- Aerial**. Epiphytic plants; plants or parts of plants living above the surface of the ground or water.
- Aestival**. Belonging or peculiar to summer.
- Aestivation**. The arrangement of the parts in a flower bud.
- Aggregate**. Collected into dense clusters or tufts. *Aggregate fruit*; one formed by the clustering together of pistils that were distinct in the flower, as blackberry.
- Alate**. Winged.
- Albidus**. Whitish.
- Albumen**. Any deposit of nutritive material within the seed coat and not in the embryo.
- Alkaline**. Of, pertaining to, or having the properties of an alkali (a soluble mineral salt present in some soils of arid regions).
- Alliaceous**. Onionlike, usually in respect to odor.
- Allergenic**. Having the substance to cause allergy or to cause it to become manifest.
- Alluvial**. Soils deposited by running water.
- Alpine**. Strictly applicable to plants growing above timber line.
- Alternate**. Any arrangement of parts along the axis other than opposite or whorled; situated regularly between other organs, as stamens alternate with petals.
- Alveolate**. Honeycombed; with deep angular cavities (alveoli) separated by thin partitions; faveolate.
- Ament**. Catkin; a spike of flowers usually bracteate and frequently deciduous, as the male flowers of willow, beech, oak, etc.
- Amethystine**. Violet-colored.
- Amorphous**. Shapeless, the form not regular or definite.
- Amphibious**. Capable of living on land or in water.
- Amphitropous**. Turned both ways; applied to an ovule with hilum intermediate between the micropyle and chalaza.
- Amplexicaul**. Claspings the stem, as the base of certain leaves.
- Ampliate**. Enlarged; dilated.
- Ampule**. Flasklike traps and floats as in the Utricularias. *Ampulliform*: swollen out in a flask shape.
- Anastomosing (-ed)**. Netted; particularly applied to veins so connected by cross veins as to form a network.
- Anatropous**. An inverted and straight ovule, with the micropyle next to the hilum.
- Ancipital, ancipitous**. Two edged, as certain flattened stems.
- Androecium**. The whole set of stamens.
- Androgynous**. Having staminate and pistillate flowers in the same inflorescence, or in *Carex* in the same spikelet, the former above the latter.

- Androphore.** A support or column on which the stamens are borne.
- Anemophilous.** Wind-pollinated.
- Angiosperms.** Plants having their seeds enclosed in an ovary.
- Angular, angulate.** Angled. Used when an organ shows a determinate number of angles.
- Angustiseptal.** Having a narrow-partitioned fruit, as the silicle of *Thlaspi*.
- Anisolateral.** Laterally unequal.
- Annual.** Of one year's or season's duration from seed to maturity and death. *Winter annual:* a plant from autumn-germinating seeds that fruits in the following spring.
- Annular.** Circular; in the form of a ring, or marked transversely by rings. *Annulate:* ring-shaped.
- Annulus.** A ring-shaped part or organ, such as surrounds the sporangium in some ferns.
- Antepetalous.** Opposite the petals.
- Antero-lateral.** In front and on the sides.
- Anterior.** On the front side; in the flower the side away from the axis and toward the subtending bract.
- Antesepalous.** Opposite the sepals.
- Anther.** The pollen-bearing part of the stamen.
- Antheridium.** The male sexual organ of ferns; analogous to the anther.
- Antheriferous.** Anther-bearing.
- Anthesis.** Strictly, the time of expansion of the flower, but also used for the period during which the flower is open and functional.
- Anthocarp.** A structure in which the fruit proper is united with the perianth or receptacle.
- Anthocyanin.** The blue and sometimes red coloring of most flowers. *Anthocyanous:* showing anthocyanin in the herbage, a class of soluble glucoside pigments producing reddish or purplish coloring. Cf. *betacyanins*.
- Antrorse (-ly).** Directed upward or forward.
- Aperture.** An opening, gap, cleft.
- Apetalous.** Without petals.
- Apex (pl. apices).** The tip of an organ.
- Aphyllodidic.** Without leaves at the base.
- Aphyllous.** Leafless.
- Apical.** Situated at the tip.
- Apicule, apiculus.** A short pointed tip at the apex of a leaf or floral segment. *Apiculate:* terminated abruptly in a little point.
- Apocarpous.** With carpels separate, not united.
- Apomictic.** Producing seed without any form of fertilization or sexual union.
- Apopetalous.** Having free petals; polypetalous.
- Apophysis.** An enlargement or swelling of the surface of an organ; the part of a cone scale that is exposed when the cone is closed.
- Appendage.** Any attached supplementary or secondary part. *Appendiculate:* furnished with an appendage.
- Appressed.** Cf. *adpressed*.
- Approximate.** Near together.
- Aquatic.** Living in water.
- Arachnoid (-ose).** Cobwebby; of soft and slender entangled hairs.
- Arborescent.** Tree-like in tendency.
- Archegonium.** The female sexual organ of ferns; analogous to the pistil.
- Arcuate.** Moderately curved, as if bent like a bow.
- Areola (-ae).** A little area defined on a surface, as the angular space between vein reticulations; in Compositae the circle at the summit of the achene where sat the corolla. *Areolate:* with areolae; reticulate.
- Argillaceous.** Clayey, growing in clay or clay-colored.
- Aril.** A process of the placenta adhering about the hilum of a seed. *Arillate:* with an aril. *Arilliform:* bag-shaped.
- Arista (-ae).** An awn. *Aristate:* awn- or bristle-tipped, as the floral bracts of barley. *Aristulate:* bearing a short awn.
- Armature.** Any kind of defense, as prickles or thorns. *Armed:* bearing thorns or similar defenses.
- Aromatic.** Fragrant, pungent, spicy to smell or taste.
- Arroyo.** A water course, or channel or gully, often dry, carved by water.
- Article.** A joint such as that in the loment of *Desmodium*.
- Articulate.** Jointed; having a place for natural separation with a clean-cut scar.
- Ascending, ascending.** Rising obliquely or curving upward.
- Asepalous.** Without sepals.
- Asexual.** Sexless; without sex; arising without the phenomenon of sex.
- Asperous.** Rough to the touch; scabrid.
- Assimilate.** To absorb or appropriate.
- Assurgent.** Ascending, rising.
- Asterean.** Similar to or belonging to the genus *Aster* or the tribe Astereae.
- Astylous.** Without a style.
- Atrocastaneous.** Very dark chestnut-colored.
- Atropurpureus.** Black-purple.
- Attenuate.** Slenderly tapering or prolonged; more gradual than acuminate.
- Atypical.** Not typical; departing from the norm.
- Auricle.** An ear-shaped appendage. *Auricular, auriculate:* auricled. *Auriform:* ear-shaped.
- Autophyte, autophytic.** A plant or said of a plant able to produce its own food through the presence of chlorophyll.
- Autopolyploid.** A polyploid originating by the multiplication of the chromosome set of an individual.
- Autumnal.** Belonging to autumn; flowering at, or developing vegetative growth peculiar to, that season.
- Auxo-.** Greek combining form to denote concern with or due to growth, as in auxoclone.
- Auxoclone.** An annular clone in which the older, central parts have died, the peripheral ones continuing to spread, as in *Spartina*.
- Awl-shaped.** Tapering from the base to a slender or stiff point.
- Awn.** A terminal slender bristle on an organ.
- Axial.** Relating to the morphological axis, as distinct from its appendages.
- Axil.** Upper angle formed by a leaf or branch with the stem. *Axillary:* situated in the axil.
- Axile.** Belonging to, or situated in, the axil.
- Axis (pl. axes).** The central stem along which parts or organs are arranged; the central line of any organ or structure.
- Baccate.** Berrylike and pulpy.
- Ballistic.** Those fruits that discharge their seeds elastically; catapult-fruits.
- Banner.** Upper petal of a papilionaceous flower.
- Barbate.** Bearded with long stiff hairs.
- Barbed.** Bearing sharp rigid reflexed points like barbs of a fish-hook. *Barbellate:* finely barbed, usually with short stiff hairs. *Barbule:* a small barb.
- Basal.** Relating to, or situated at, the base.
- Basifixed.** Attached by the base.
- Basiscopic.** Looking towards the base (reverse of acroscopic).
- Bayou.** A creek, often slow-moving.
- Beak.** A prolonged firm tip, particularly of a seed or fruit. *Beaked:* ending in a beak.

- Bearded.** Bearing long stiff hairs.
- Berry.** A pulpy indehiscent fruit with no true stone, as the tomato.
- Betacyanins.** The nitrogenous pigments of beet juice and other Chenopodiaceae, and of the flowers of Cactaceae, Nyctaginaceae, Portulacaceae, Aizoaceae, etc.; cf. *anthocyanins*.
- Bi- or Bis-.** Latin prefix signifying two, twice, or doubly.
- Bibracteate.** Having two bracts. *Bibracteolate*: the diminutive.
- Bicolored.** Two-colored or particolored.
- Biconvex.** Convex on both sides.
- Bidentate.** Having two teeth.
- Biennial.** Of two years' duration from seed to maturity and death.
- Bifarious.** Distichous.
- Bifid.** Two-cleft to about the middle.
- Bifoliolate.** A leaf composed of two leaflets.
- Bifurcate.** Two-forked or -pronged.
- Bilabiate.** Two-lipped (calyx or corolla).
- Bilamellate.** Consisting of two plates or lamellae.
- Bilateral (-ly).** Arranged on opposite sides.
- Bilobed.** Divided into two lobes. *Bilobulate*: the diminutive.
- Bilocular.** Two-celled.
- Binate.** In pairs.
- Binomial.** The combination of a generic and specific name to denote a given organism, as *Ulmus americana*.
- Biotype.** One of the local more or less uniform character-combinations found in a polytypic species.
- Bipartite.** Divided into two parts almost to the base; two-parted.
- Bipinnate.** Doubly or twice pinnate; when both primary and secondary divisions of a leaf are pinnate. *Bipinnatifid*: twice pinnately cleft; with the divisions extending deeply but not to the rachis or midvein. *Bipinnatisect*: bipinnate.
- Bisected.** Completely divided into two parts.
- Bisexual.** Having both sexes on the same individual; a hermaphrodite.
- Bivalvate.** With two valves.
- Bladdery.** Thin and inflated.
- Blade.** The expanded part of a leaf or petal.
- Bloom.** (Cf. *blossom*, *glaucous*). The waxy or pruinose covering of many fruits and leaves.
- Blossom.** The flower, more often applied to those of fruit trees.
- Bole.** The trunk or stem of a tree.
- Brackish.** Somewhat salty, as water in saline soils.
- Bract.** A reduced leaf subtending a flower, usually associated with an inflorescence. *Bracteal*: of or pertaining to bracts. *Bracteate*: provided with bracts. *Bracteose*: having conspicuous or numerous bracts. *Bractiform*: bract-shaped.
- Bractlet.** A secondary bract borne on a pedicel instead of subtending it; sepaloid organs subtending the sepals in many Rosaceae. *Bracteole*: a bractlet or small bract. *Bracteolate*: with bractlets.
- Bristle.** A stiff hair. *Bristly*: bearing stiff strong hairs or bristles.
- Bud.** An undeveloped stem, leaf or flower. Buds are often enclosed by reduced or specialized leaves termed bud scales.
- Bulb.** An underground leaf bud with thickened scales or coats like the onion.
- Bulbil.** Daughter bulbs arising around the mother bulb; a diminutive bulb.
- Bulblet.** A small bulb, especially one borne aerially as in a leaf axil or in the inflorescence.
- Bulbose, bulbous.** Having bulbs or the character of a bulb.
- Bullate.** Blistered or puckered.
- Bundles.** A strand of specialized tissue, variously modified.
- Bur.** Any rough or prickly envelope, as of a pericarp, a persistent calyx, or an involucre, like in *Castanea*.
- Bush.** (Cf. *shrub*).
- Caducous.** Falling off very early or prematurely.
- Calcarate.** Spurred.
- Calcareous.** Containing an excess of available calcium, usually in the form of the compound calcium carbonate. "Limy."
- Calcifuge.** Shunning limy situations. *Calciphile*: a plant that is addicted to calcareous soils.
- Caliche.** A crust of calcium carbonate formed on stony soils in arid regions.
- Callosity.** A hardened thickening. *Callus*: a callosity; the thickened extension at the base of the lemma in some grasses. *Callose, callous*: bearing callosities.
- Calycine.** Belonging to, or of the nature of, a calyx.
- Calyculate.** Bearing bracts around the calyx imitating an outer involucre in some Compositae. *Calyculum, calicle*: the involucre simulating an additional calyx; a whorl of bracts outside the true calyx.
- Calyptra.** A lid or hood.
- Calyx** (pl. *Calyxes* or *Calyces*). The external, usually green, whorl of a flower, contrasted with the inner showy corolla.
- Calyx lobe.** In a gamosepalous calyx, the free projecting parts.
- Cambium.** The layer of delicate, rapidly dividing cells that form wood internally and bark externally.
- Campanulate, campanuloid.** Bell-shaped.
- Campylotropous.** (ovule or seed). So curved as to bring apex and base nearly together.
- Canaliculate.** Longitudinally channeled or grooved.
- Cancellate.** Latticed; resembling lattice-work.
- Canescent.** Covered with grayish-white or hoary fine hairs.
- Capillary.** Hairlike; exceedingly slender.
- Capitate.** Head-shaped; aggregated into very dense clusters or heads. *Capitellate*: the diminutive. *Capitulum (-a), capitule*: (cf. *Head*).
- Capsule.** A dry dehiscent fruit composed of more than one carpel. *Capsular*: pertaining to a capsule; formed like a capsule. *Capsuliferous*: bearing capsules.
- Carinate.** Keeled; with a sharp longitudinal ridge.
- Carinal**: relating to the keel in aestivation when the carina includes the other parts of the flower.
- Carnivorous.** Flesh-eating; applied to those plants that digest insects.
- Carpel.** A simple pistil, or one of the modified leaves forming a compound pistil. *Carpellary*: relating to a carpel. *Carpellate*: possessing carpels. *Carpid*: one of the monocarpellary segments resulting from schizocarpous dehiscence.
- Carpophore.** A prolongation of the floral axis between the carpels, as that which supports the pendulous fruit of the Umbelliferae.
- Cartilage.** A tough almost bony tissue. *Cartilaginous*: like cartilage in texture; tough.
- Caruncle.** An excrescence or outgrowth at or near the hilum of certain seeds. *Carunculate*: possessing a caruncle.
- Caryopsis.** The grain or fruit of grasses.
- Castaneous.** Chestnut-colored; dark-brown.
- Catkin.** A scaly deciduous spike; ament.
- Caudate.** Bearing a tail or slender tail-like appendage.

- Caudex** (pl. *caudices*). The woody base of an otherwise herbaceous perennial.
- Caullescent**. With an obvious leafy stem; plants with radical leaves and flowers on a scape are called *acaulescent*.
- Cauline**. Belonging to the stem.
- Cell**. A cavity of an anther containing the pollen, or of an ovary containing the ovules. *Cellulous*, *cellular*, *cellulose*: made up of cells or marked off so as to resemble cells.
- Ccnospecies**. All the ecospecies so related that they may exchange genes among themselves to a limited extent through hybridization.
- Centrifugal**. In inflorescences, blooming from the inside outward, or from top to base.
- Centripetal**. Growing from without toward the center; an indeterminate inflorescence.
- Ccraceous**. Waxy in appearance or color.
- Ceriferous**. Wax-producing; waxy.
- Cernuous**. Nodding; drooping.
- Cespitose**, *caespitose*. In little tufts or dense clumps; said of low plants of turfy habit.
- Chaff**. Thin dry scales. *Chaffy*: paleaceous.
- Chalaza**. That part of the ovule or seed in which the nucellus joins the integuments; the base of the nucellus always opposite the upper end of the cotyledon. *Chalazal*: pertaining to the chalaza.
- Channeled**. Deeply grooved longitudinally, like a gutter.
- Chaparral**. A xerophytic formation of dense, impenetrable thickets composed of stiff or thorny, mostly small-leaved, evergreen shrubs.
- Chartaceous**. With the texture of stiffish writing paper.
- Chasmogamous**. With pollination taking place while the flower is open (the opposite of *cleistogamous*).
- Chiasma**. A crosswise fusion, as of chromosomes.
- Chlorophyll**. The green coloring matter in the cells of autophytic plants. *Chlorophyllous*: containing chlorophyll.
- Chromosome**. One of the small bodies into which the chromatin of the cell nucleus resolves itself previous to the mitotic division of the cell.
- Cilium** (pl. *cilia*). Used generally in the plural to denote marginal hairs. *Ciliate*: fringed with hairs on the margin. *Ciliation*: with a fringe of hairs on the margin. *Ciliate*: the diminutive.
- Cincinnus** (pl. *cincinnati*). A curl; used in the plural here for the branches of a unilateral scorpioid cyme.
- Cinereous**. Ash-colored; light-gray. *Cinerascent*: becoming ashy gray. *Cinereo-*: used in combination to denote gray—.
- Cinnamomeous**. Cinnamon-colored, a light yellowish-brown.
- Circinate**. Coiled from the top downward with the apex as a center.
- Circumpolar**. Occurring around the pole, as of arctic plants mostly confined to far northern latitudes.
- Circumscissile**. Dehiscing by a transverse line around the fruit or anther, the top falling as a lid.
- Cirrhose**. Tendrilled; with a wavy hair-point.
- Cladode**. A branch of a single internode simulating a leaf; a cladophyll. *Cladophyll*: a branch assuming the form and function of a leaf; a cladode.
- Clasping**. Leaf partly or wholly surrounding the stem; amplexicaul.
- Clathrate**. Latticed or pierced with apertures.
- Clavate**. Club-shaped; gradually thickened toward the apex from a slender base. *Clavellate*: the diminutive. *Claviform*: club-shaped.
- Claw**. The narrow petiolelike base of some petals and sepals. *Clawed*: with a claw.
- Cleft**. Cut about halfway to the midrib.
- Cleistogamous**, *cleistogamic*. Small flowers self-fertilizing without opening; usually additional to the ordinary flower and inconspicuous, as in some violets. *Cleistogamy*: the condition described.
- Cleistogene**. A plant that bears cleistogamous flowers; cleistogamous flower.
- Clinandrium**. The anther bed in orchids, that part of the column in which the anther is concealed.
- Cline**. A series of form changes; a gradient of biotypes along an environmental or geographic transition. *Clinal*, *clinally*: pertaining to, and of, a cline.
- Clonc**. The vegetatively produced progeny of a single individual.
- Coalescent**. Said of organs of one kind that have grown together. *Coalesce*: to form union by growth.
- Coarctate**. Crowded together.
- Cob**. Rachis of the pistillate corn (maize) spike.
- Coccus** (pl. *cocci*). A berry; in particular one of the parts of a lobed fruit with one-seeded cells; part of a schizocarp or lobed fruit.
- Cochleate**. Coiled like a snail shell. *Cochleiform*: shaped like a snail shell.
- Coetaneous**. Of the same age; existing at the same time.
- Coherent**. Congenitally united with another organ of the same kind (*coalescent*), or of another kind (*adnate*). *Cohere*: to become coherent.
- Collateral**. Descriptive of accessory buds arranged on either side of a lateral bud.
- Collar**. Outer side of the grass leaf at the junction of sheath and blade.
- Colonial**. Forming colonies by means of underground rhizomes, stolons, etc.; used commonly for plants with asexual reproduction.
- Colporate**. Applied to pollen grains with slits (*colpi*) that have germ pores (*ora*).
- Columella**. The persistent axis of certain capsules.
- Column**. Body formed by union of stamens and pistil in orchids, or of stamens in mallows and milkweeds. *Columnar*: having the form of a column.
- Coma**. A tuft of hairs, particularly at the end of some seeds; the tuft at the summit of the inflorescence, as in the Umbelliferae. *Comose*: furnished with a coma.
- Commissure**. The face by which two carpels cohere, as in Umbelliferae. *Commissural* (adj.).
- Complanate**. Flattened.
- Complete**. Having all the parts belonging to it, as a flower with sepals, petals, stamens and pistils.
- Complicate**. Folded together.
- Compound**. Having two or more similar parts in one organ. *Compound leaf*: one with two or more separate leaflets. *Compound pistil*: having two or more carpels united or at least coalescent.
- Compressed**. Flattened laterally.
- Concave**. Hollow, as the bowl of a spoon. *Concavity*: an existing hollow.
- Concavo-convex**. Concave on one side and convex on the other, as an eggshell or a lens.
- Concentric**. Having a common center.
- Concolor**, *concolorous*. Of uniform color.
- Concrescent**. Growing together.
- Conduplicate**. Folded together lengthwise, as the leaves of many grasses.
- Cone**. The fruit of some fern allies, or a pine or fir-tree with scales forming a strobile; an inflorescence or fruit with overlapping scales. *Conelet*: a small cone. *Conoid*: conelike.
- Confervoid**. Composed of threads.

- Confluent.** Blending of one part into another.
- Congested.** Crowded together.
- Conglomerate.** Densely clustered.
- Conic, conical.** Cone-shaped, with the point of attachment at the broad base.
- Coniferous.** Producing or bearing cones, cf. *Gymnosperms*.
- Conjugate.** Joined in pairs.
- Connate.** Congenitally united, as similar organs joined as one. *Connate-perfoliate:* united at base in pairs around the supporting axis.
- Connective.** Portion of the filament connecting the two cells of an anther.
- Connoent.** Converging or coming together, but not organically united.
- Consimilar.** When both sides are alike, like a bivalve.
- Conspecific.** Of the same species.
- Constricted.** Tightened or drawn together.
- Contiguous.** When neighboring parts are in contact, as most cotyledons.
- Continuous.** Not articulated (grass rachis) or interrupted.
- Contorted.** Twisted, bent, or distorted.
- Contracted.** Narrowed in a particular place, or shortened; the opposite of open or spreading (inflorescence).
- Convergent.** Applied to veins that run from the base to the apex of a leaf in a curved manner. *Converge:* to become convergent.
- Convex.** Rounded on the surface.
- Convolute.** Rolled up longitudinally. Said of blades or floral envelopes in the bud when one edge is outside and the other inside.
- Coralloid.** Coral-like.
- Cordate.** Heart-shaped with the notch at the base and ovate in general outline. *Cordiform:* shaped like a heart.
- Coriaceous.** Leathery in texture; tough.
- Corm.** A short, bulblike, underground stem, as the "bulb" of a gladiolus.
- Corneous.** Of the texture of horn.
- Corniculate.** Bearing little horns or hornlike processes.
- Cornucopiate.** Shaped like a horn of cornucopia.
- Cornute.** Horned or spurred.
- Corolla.** The inner perianth of a flower, composed of colored petals, which may be almost wholly united. *Corolline, corolloid:* belonging to a corolla, corollalike, or seated on a corolla.
- Corona.** A crown; the crownlike cup found at the orifice of the corolla tube in *Narcissus*. *Coroniform:* crown-shaped. *Coronate:* crowned; having a crown.
- Corrugated.** wrinkled; folded.
- Cortex.** Rind or bark.
- Corymb.** A flat-topped or convex racemose flower cluster, the lower or outer pedicels longer, their flowers opening first. *Corymbiform:* shaped like a corymb. *Corymbose:* arranged in corymbs.
- Costa (pl. costae).** A rib; the midrib of a leaf. *Costate:* ribbed; having longitudinal elevations.
- Costapalmate.** Palmately ribbed or veined.
- Cotyledon.** The primary leaf or leaves of the embryo; seed leaf.
- Cotype.** An additional or associate type specimen from which a species is described.
- Crateriform.** Shallowly cup-shaped.
- Creeping.** Spreading over or beneath the ground and rooting at the nodes.
- Crenate.** Having the margin cut with rounded teeth; scalloped. *Crenulate:* the diminutive. *Crenation:* with rounded teeth.
- Crescentic.** Shaped like the moon in its first quarter. *Crescentiform:* crescent-shaped.
- Crest.** An elevation or ridge upon the summit of an organ. *Crested:* having a crest, elevated appendage, or ridge on the summit of an organ.
- Crinite.** Bearded with long and weak hairs.
- Crisped, crispate.** Irregularly curled (said of hairs or leaf margins).
- Cristate.** Crested or tufted.
- Cross.** Hybrid of any description.
- Cross-fertilization.** Fertilization secured by pollen from the flower of another plant.
- Cross-pollination.** Transfer of the pollen of one flower to the pistil of another.
- Crown.** The persistent base of an herbaceous perennial; the top of a tree; a circle of appendages on the throat of a corolla, etc.
- Crozier.** The young coiled leaves of some ferns.
- Cruciate.** Cross-shaped, used especially for the flowers of *Cruciferae*. *Cruciferous:* cross-bearing; a flower with four petals placed opposite each other at right angles. *Cruciform:* cross-shaped.
- Crustaceous. Crustose.** Of brittle or hard texture.
- Crystalline.** Resembling crystals or of the nature of crystals.
- Cube.** The regular solid of six equal square sides. *Cubical:* of cubic form.
- Cucullate.** Hooded, or hood-shaped.
- Cucullus.** A hoodlike process on some seeds; cf. *caruncle*.
- Cucurbitaceous.** Of the nature of plants in the family *Cucurbitaceae*.
- Cuesta.** A topographic ridge; usually a ridge which has a long, gentle slope on one side (usually toward the coast) and a short, steep slope on the other side.
- Culm.** The type of hollow or pithy slender stem found in grasses and sedges.
- Cultigen.** Plant or group known only in cultivation, presumably originating under domestication; contrast with *indigene*.
- Cultivar.** A variety or race that has originated and persisted under cultivation, but not necessarily referable to a botanical species.
- Cuneate, cuneiform.** Wedge-shaped; triangular, with the narrow part at point of attachment.
- Cupule.** The cup of such fruits as the acorn; an involucre composed of bracts adherent by their base at least. *Cupulate, cupular:* cup-shaped, as the cup (involucre) of the acorn. *Cupuliform:* cup- or cupule-shaped.
- Curvate.** Continued flexure or bending from a straight line.
- Curvi-.** A combination form to denote curved or bent.
- Cusp.** A sharp, rigid point. *Cuspidate:* tipped with a cusp, or short, rigid point.
- Cutin.** A substance present as a thin continuous external layer on the outer wall of the epidermis of a leaf or stem. *Cutinized:* covered with cutin.
- Cyathium (pl. cyathia).** The ultimate inflorescence of *Euphorbia*, consisting of a cuplike involucre bearing the flowers from its base. *Cyathiform:* shaped like a drinking cup. *Cyathophorous:* like or of a cup.
- Cyclic.** Said of foliar structures arranged in whorls; coiled into a cycle or related to a cycle.
- Cylindraccous, cylindrical.** Somewhat or nearly cylindrical. *Cylindroid:* of a cylindrical shape. *Cylindro-.* Used in various combinations to denote cylindrical.
- Cymba, cymbiform.** A boat or boat-shaped.
- Cyme.** A determinate flower cluster in which the first flower is terminal on the main axis, the next flower(s) terminal on axes arising from the axils of bracts subtending the first flower, and so on; often cymes are flat-topped or convex (cf. *determinate*).

- Cymose:** arranged in cymes. **Cymiform:** cyme-shaped. **Cymule:** a small or few-flowered cyme. **Cystolith.** Mineral concretions, usually a calcium carbonate on a cellulose stalk, occurring in special cells in the Urticaceae, etc.
- Cytoplasm.** The general protoplasm of the cell.
- Deciduous.** Falling off, as petals fall after flowering, or leaves of nonevergreen trees in autumn or said of plants whose leaves fall, as in "deciduous tree."
- Declinate.** Bent or curved downward or forward. **Declined:** directed obliquely.
- Decompound.** More than once divided or compounded.
- Decorticate.** To deprive of bark.
- Decumbent.** Lying down, but with the tip ascending.
- Decurrent.** Extending down the stem below the insertion; said of leaves or ligules.
- Decussate.** Opposite pairs (usually leaves) alternating at right angles with those above or below.
- Deflexed.** Turned abruptly downward.
- Defoliate.** The act of shedding leaves.
- Dehiscent, dehisce, dehiscence.** Opening spontaneously when ripe to discharge the contents, as an anther or seed vessel.
- Deliquescent.** Dissolving or melting away.
- Deltoid, deltate.** Equilaterally triangular.
- Dendritic, dendroid.** Treelike, as the branching hairs of some Cruciferae.
- Dentate.** Having the margin cut with sharp salient teeth not directed forward. **Denticle:** a small tooth. **Denticulate:** slightly and finely toothed. **Dentiform:** tooth-shaped.
- Depauperate.** Dwarf, starved.
- Depressed.** Low, as if flattened from above.
- Descending.** Tending gradually downward as the branches of some trees.
- Determinate.** Said of an inflorescence (as a cyme) in which the terminal flower blooms slightly in advance of its nearest associates; limited in number and extent.
- Dextrorse.** Turned to the right.
- Di-, dis-** Greek prefix meaning two or double.
- Diadelphous.** Stamens united by their filaments into two sets.
- Diagonal.** A mean between two forces, a compromise of position.
- Diandrous.** Having two stamens.
- Diaphanous.** Transparent.
- Diaphragm.** A dividing membrane or partition as that in the pith of grape vines and the pith in *Juglans*.
- Dibrachiate.** When branches spread and are doubly and widely divergent.
- Dicarpellary.** Having two carpels.
- Dichasium** (pl. *dichasia*). A cyme with two lateral axes. **Dichasial:** provided with *dichasia*.
- Dichotomous.** Repeatedly forking in pairs. **Dichotomy:** a condition of being dichotomous.
- Dicotyledons** (abbr. *dicots*). A class of angiosperms differentiated by possession of two cotyledons.
- Didymous.** Twin; found in pairs.
- Didynamous.** With four stamens in two pairs of unequal length as in most Labiatae.
- Diffuse.** Scattered; widely spread.
- Digitate.** Fingered; shaped as an open hand; compound with the members arising from one point.
- Dilated.** Flattened and broadened, as an expanded filament.
- Dimidiolate.** Halved, as a condition in which half an organ is so much smaller than the other as to seem wanting.
- Dimorphic, dimorphous.** Having two forms, as flowers with short stamens and long styles or long stamens and short styles.
- Diocious.** Having staminate and pistillate flowers in different plants.
- Diploid.** Having two basic chromosome sets (twice the number in normal, haploid gametes).
- Disarticulating.** Separating joint from joint at maturity.
- Discoid.** Disklike, in the Compositae, a head without ray florets. **Disciform:** flat and circular like a disk.
- Discolorous.** Used when the two surfaces of a leaf are unlike in color.
- Discrete.** Separate; not coalescent.
- Disjunct.** Characterized by having separate groups; disconnected.
- Disk, Disc.** A fleshy development of the receptacle about the base of the ovary; in Compositae, the tubular flowers (disk florets) of the head as distinct from the ray.
- Disparate.** Unequal; dissimilar.
- Dissected.** Deeply divided into numerous usually fine segments.
- Dissepiment.** A partition in an ovary or pericarp caused by the adhesion of the sides of the carpellary leaves.
- Distal.** Opposite the point of attachment; apical; away from the axis.
- Distant.** Said of similar parts not closely aggregated; opposed to approximate; remote.
- Distichous.** In two vertical rows or ranks.
- Distinct.** Separate; not united with parts in the same cycle. Cf. *Free*.
- Dithecal.** Having two thecae or cells.
- Diurnal.** Occurring in the daytime; sometimes used meaning ephemeral.
- Divaricate, divaricately.** Widely divergent.
- Divergent.** Extending away from each other by degrees.
- Divided.** Separated to the base.
- Dolabriform.** Axe-shaped or hatchet-shaped.
- Dormant.** Said of plants that are not in active life.
- Dorsal, dorsally.** Pertaining to the back; the surface turned away from the axis. **Dorso-:** used in combination to denote the back of. **Dorsum:** the back or parts of the flower that face the outside.
- Dorsifixed.** Attached by or to the back.
- Dorsiventral.** Having distinct dorsal and ventral surfaces.
- Double.** Used of flowers when the petals are increased in number at the expense of other organs, especially the stamens; twice.
- Down.** Soft pubescence; the pappus of such plants as thistles. **Downy:** closely covered with very short and weak soft hairs.
- Drizzling.** Erectish at base but bending downward above, as the branches of a grass panicle.
- Drupe.** A fleshy one-seeded indehiscent fruit containing a stone with a kernel; a stone-fruit such as a plum. **Drupelet:** a diminutive drupe.
- Drupaceous:** resembling a drupe, possessing its character, or producing similar fruit.
- Duff.** The partly decayed vegetable matter on the forest floor.
- E-, Ex-** Latin prefix meaning without, out of, from, as "ebracteate."
- Ebeneous.** Black as ebony.
- Ebracteate.** Without bracts.
- Echinate.** Prickly, a hedgehog.
- Ecology.** The study of organisms in relation to their environment.
- Ecorollate.** Without a corolla.
- Ecospecies.** All individuals so related that they

- are able to exchange genes freely without loss of fertility or vigor in the offspring.
- Ecotype.** Those individuals that are fitted to only one kind of environment occupied by the species.
- Edaphic.** Pertaining to, or influenced by, soil conditions.
- Edentate.** Without teeth.
- Elaiosome.** Characteristic oily appendages and seeds of some plants, such as arils, crests, glands offering food-bodies to ants.
- Elater.** In *Equisetum*, 4 club-shaped hygroscopic bands attached to the spores, which serve for dispersal.
- Elliptic.** In the form of a flattened circle usually more than twice as long as broad. **Ellipsoid:** an elliptic solid.
- Elongate.** Drawn out in length.
- Emarginate.** With a small notch at the apex.
- Embryo.** The incipient plantlet in the seed.
- Emergence.** Outgrowths from superficial cells on the surface of an organ such as prickles, warts, glands, etc.
- Emersed, emergent.** Raised above and out of the water.
- Enantiostylous.** Flowers whose styles are protruded right or left of the axis, with the stamens opposite.
- Enation.** An outgrowth on the surface of an organ.
- Endemic.** Confined to a given region, as a country or island. **Endemism:** the condition of endemic plants.
- Endocarp.** The inner layer of the pericarp.
- Endodermis.** The layer of ground tissue that abuts on the stele, being differentiated as a sheath around it.
- Endogenous.** Forming new tissue within.
- Endoglossum.** A transverse projection from the dorsal wall of the carpel to make it almost completely septate.
- Endosperm.** The nutritive tissue surrounding the embryo of a seed and formed within the embryo sac.
- Ensiform.** Sword-shaped, as the leaves of *Iris*.
- Entire.** Undivided; the margin continuous, not incised or toothed.
- Entomophilous.** Insect-pollinated.
- Envelope.** The surrounding part. **Enveloping:** involucrate; to enclose.
- Epappose.** Without pappus.
- Epetiolate.** Without petals.
- Ephemeral.** Lasting for a day or less.
- Epi-.** Prefix meaning upon, such as "epiphyte."
- Epicarp.** The outer layer of the pericarp.
- Epidermis.** The true cellular skin or covering of a plant below the cuticle. **Epidermal:** relating to the epidermis.
- Epigynous.** Borne on the ovary; said of floral parts when the ovary is wholly inferior. **Epigyny:** the state of having epigynous flowers.
- Epipetalous.** Borne upon the petals.
- Epiphyte, epiphytic.** Characterized by growing on other plants or objects but not parasitically, such as orchids, bromeliads and ferns.
- Equidistant.** Of equal distance.
- Equitant.** Astride, as if riding, such as the leaves of an *Iris*; folded lengthwise and distichous.
- Erect.** Upright in relation to the ground, or sometimes perpendicular to the surface of attachment; a lip of a corolla is erect when in line with the tube.
- Ericoid.** Said of leaves that are like those of heaths.
- Erose.** Irregularly toothed as if gnawed.
- Escape.** A cultivated plant found growing as though wild, dispersed by some agency.
- Escarpment.** A steep slope, especially if wide.
- Estipulate.** Without stipules. (cf. *exstipulate*).
- Etiolation.** The condition of being lengthened (as a stem) or deprived of color by absence of light.
- Evanescence.** Quickly disappearing.
- Evergreen.** Remaining green through the winter.
- Exalate.** Without wings.
- Exalbuminous.** Without endosperm, referring to seeds.
- Exappendiculate.** Without appendages.
- Excentric (eccentric).** One-sided, off-center, abaxial.
- Excrescence.** Small warty outgrowth.
- Excurrent.** Projecting beyond the edge, as the midrib of a mucronate leaf or nerve of a floral segment.
- Excurved.** Curved outward or away from a central part. **Excurvature:** an excurved part.
- Exfoliate (-ing).** To come off in scales or flakes, as the bark of the sycamore (*Platanus*).
- Exiguous.** Small and narrow.
- Exocarp.** The outer layer of the pericarp.
- Exogenous.** Forming new tissue outside the old.
- Exotic.** Foreign, not native; from another region.
- Explanate.** Spread out flat.
- Exserted.** Protruding, as stamens projecting beyond the corolla; not included.
- Exsiccatae.** Dried plants specimens, usually in sets for sale or for subscribers, or for exchange.
- Exstipulate.** Without stipules.
- Extant.** Still existing.
- Extensile.** Capable of being extended or enlarged.
- Extratropical.** Beyond or outside of the tropics.
- Extrorse.** Facing outward from the axis, as the dehiscence of an anther.
- Exudate, exudation.** The transpiration of liquids from hydathodes, etc., as seen on the leaf tips of Monocotyledons.
- Exvaginate.** Outside of the sheath.
- Eye.** The marked center of a flower, such as in some species of *Physalis* and *Hibiscus*.
- Face.** That surface of an organ that is opposed to the back, usually the upper or inner side.
- Facet.** One of a set of small plane surfaces; a little face.
- Facial.** Applied to a hilum that is on the side and not on the margin of a seed.
- Falcate.** Sickle-shaped. **Falciform:** sicklelike.
- Fan.** The soil and debris outwash formed from a mesa or other elevation.
- Farina.** Starch or starchy matter. **Farinaceous:** containing starch; mealy in texture. **Farinose:** covered with a mealiness. **Farinule:** minutely mealy.
- Fasciated.** An abnormal widening and flattening of the stem as though several stems had coalesced in one plane.
- Fascicle.** A close cluster or bundle of flowers, leaves, stems or roots. **Fasciculate:** in a fascicle.
- Fastigate.** Clustered, parallel, erect branches.
- Faucal.** Pertaining to the throat of a gamopetalous corolla.
- Faveolate, favose.** Honeycombed, as the receptacle in many Compositae; alveolate.
- Fenestrate.** With transparent areas or windowlike openings.
- Feral.** Wild or indigenous; not cultivated.
- Ferruginous.** Rust-colored.
- Fertile.** Said of pollen-bearing stamens and seed-bearing fruits.
- Fertilization.** Effect of pollen deposited on a stigmatic surface resulting in conversion of flower into fruit and of ovule into seed; the union of egg and sperm.
- Fetid.** Disagreeably odorous.

- Fibrillose.** Furnished with little fibers.
- Fibrous.** Having numerous woody fibers, as the scales of some bulbous plants.
- fid.** A suffix meaning deeply cut.
- Filament.** A thread, especially the stalk of an anther. **Filamentous, filamentose:** formed of filaments or fibers.
- Filiferous.** With filaments or threads.
- Filiform.** Threadlike.
- Fimbriate.** Fringed (with longer or coarser hairs as compared with ciliate). **Fimbrillate:** the diminutive.
- Fissured.** To be cracked or fractured, as the bark of a tree.
- Fistular, fistulous, fistulose.** Hollow throughout, as the leaf of an onion.
- Flabellate, flabelliform.** Fan-shaped; broadly wedge-shaped.
- Flaccid.** Weak, limp, soft or flabby.
- Flagellate.** With very slender whiplike runners.
- Flagelliform:** whip-shaped.
- Flange.** A part that spreads out like a rim.
- Flavescent:** Yellowish, becoming yellow. **Flavo-:** used in combinations to denote yellowish.
- Fleshy.** Thick and juicy; succulent.
- Flexuous, flexuose.** Zigzag, bending alternately in opposite directions. (cf. *fractiflex*). **Flexed:** to be alternately bent.
- Floccose.** With flocs or tufts of soft woolly hair.
- Flocculent:** the diminutive. **Floccosity:** state of being floccose.
- Flora.** The aggregate of plants of a country or district, or a work which contains the enumeration of them.
- Floral.** Of or pertaining to flowers. **Floral tube** (or *cup*): a more or less elongate tube consisting of perianth or other floral parts.
- Floret.** The individual flower of the Compositae and Gramineae; a small flower of a dense cluster.
- Florican.** The flowering cane, usually the second year's development of the primocane, in *Rubus*, etc.
- Floriferous.** Bearing or producing flowers.
- Fluted.** Regularly marked by alternating ridges and groove-like depressions.
- Foliaceous.** Leaflike; said especially of sepals or bracts that in texture or appearance resemble leaves. **Foliar:** leafy or leaflike. **Foliose:** having numerous leaves.
- Foliage.** The leafy covering, especially of trees.
- Foliate.** Having leaves. **Foliolate:** having leaflets.
- Follicetum.** A whorl or glomerule of follicles sometimes more or less coalescent at base.
- Follicle.** A dry monocarpellary fruit, opening only on the ventral suture, as in the larkspur. **Follicular:** shaped like a follicle.
- Form.** Subdivision of a variety of species usually differing in one character and usually but not necessarily perpetuated vegetatively, such as differences in flower color and style lengths.
- Fornicate.** Provided with arched scalelike appendages in the corolla tube, as in *Myosotis*.
- Fovea** (pl. *Foveae*). A depression or pit, as in the upper surface of the leaf base in *Isoetes*, that contains the sporangium; the seat of the pollinium in orchids. **Foveate:** pitted. **Foveolate:** the diminutive.
- Fractiflex.** Bending alternately and sharply in opposite directions; zigzag.
- Franserloid.** Of or pertaining to the genus *Franseria* (*Ambrosia*).
- Free.** Not joined to other organs; the reverse of adnate.
- Fronde.** Leaf of a fern, including the stipe and blade.
- Fructiferous.** Producing or bearing fruit.
- Fruit.** The ripened pistil with all its accessory parts.
- Frutescent, fruticose.** Shrubby or bushy in the sense of being woody. **Fruticulose:** applied to a little shrub.
- Fugacious.** Perishing very early.
- Fulvous.** Tawny; dull-yellow.
- Fungoid.** Pertaining to or resembling a fungus.
- Funicle, funiculus.** The cord or thread that sometimes connects the ovule or seed to the placenta.
- Funnelform.** Gradually widening upwards, like a funnel.
- Furcate.** Forked, with terminal lobes that are like prongs.
- Furfuraceous.** Covered with branlike scales; scurfy.
- Furrowed.** With longitudinal channels or grooves; striate on a large scale; sulcate.
- Fuscous.** Grayish-brown.
- Fusiform.** Spindle-shaped; thickest near the middle and tapering toward each end.
- Galea.** The helmetlike upper lip in certain bilabiate corollas. **Galeate:** having a galea. **Galeiform:** helmet-shaped.
- Gametophyte.** The gamete-producing form of the plant (as in ferns) contrasted with the spore-producing form or "sporophyte."
- Gamopetalous.** Corolla with petals united. Same as sympetalous and monopetalous.
- Gamophyllous.** Composed of coalescent leaves or leaflike organs.
- Gamosepalous.** Calyx with sepals united.
- Geminate.** In pairs, binate, twin.
- Gemma** (pl. *gemmae*). A bud or a body analogous to a bud capable of producing a new plant. **Gemmiferous:** bearing buds.
- Gene.** The unit of inheritance, which occupies a fixed chromosomal locus, is transmitted in the germ cells, and which governs, affects or controls the transmission and development of a hereditary character. **Genetic:** that which is inherited.
- Geniculate.** Bent abruptly, as a knee.
- Genitalia.** The stamens and pistils; reproductive organs.
- Genome.** A chromosome set; the chromosome complement of a gamete or other cell or organism.
- Genuflexed.** Bent.
- Genus.** (pl. *genera*). The natural group containing distinct species; a group of one or more related species.
- Germinal.** Relating to a bud.
- Germinate.** To sprout; to begin to grow and develop.
- Gibbous.** Swollen on one side; ventricose. **Gibbosity:** a swelling at the base of an organ.
- Gigantism.** Of unusually large size.
- Glabrous.** Without hairs; incorrectly used in the sense of smooth, the antonym of rough. **Glabrate:** almost glabrous; tending to be glabrous. **Glabrescent:** becoming glabrous.
- Gladiate.** Flat, straight or slightly curved, with acute apex and approximately parallel edges, ensiform, swordlike.
- Gland.** A depression, protuberance, or appendage on the surface of an organ, which secretes a usually sticky fluid. **Glandular:** bearing glands or glandlike. **Glanduliferous:** bearing glands. **Glanduliform:** gland-shaped.
- Glaucous.** Covered or whitened with a bloom, as a cabbage leaf; bluish-white or bluish-gray. **Glaucouscent:** becoming glaucous.
- Globe.** The flower cluster in some species of *Acacia*, etc.

- Globose.** Spherical or rounded. **Globular:** somewhat or nearly globose. **Globule:** a little globe; a small spherical particle.
- Glochid.** A barbed hair or bristle. **Glochidiate:** barbed at the tip, as a bristle.
- Glomerate.** Densely compacted in clusters or heads. **Glomerule:** a compact capitate cyme. **Glomerulate:** arranged in small clusters. **Glomeriform:** head-shaped.
- Glumes.** The pair of bracts at the base of a grass spikelet. **Glumaceous:** resembling glumes.
- Glutinous.** With a gluey exudation.
- Gneiss.** A laminated or foliated metamorphic rock.
- Gourd.** A fleshy one-celled many-seeded fruit, like a melon.
- Graduate.** Marked with small regular distances.
- Gramineous.** Related to grass or grain-bearing plants. **Graminiform:** grass-shaped.
- Granular, granulose.** Covered with very small grains or granules; minutely mealy. **Granuliferous:** granule-bearing.
- Gregarious.** Growing in groups or colonies.
- Grenadine.** A brilliant color of reddish red-yellow hue.
- Grisous.** Of a light color or white, mottled with black or brown.
- Grit cells.** A sclerotic cell, as in the flesh of pears.
- Gymnosperms.** Plants with naked (uncovered) ovules, as the conifers.
- Gynandrous.** Stamens adnate to the pistil.
- Gynecandrous.** Having staminate and pistillate flowers in the same spikelet, the latter above the former.
- Gynobase.** An elongation or dilation of the receptacle to support the carpels or nutlets, as in many borages.
- Gynobasic.** Applied to a style which adheres by its base to a prolongation upwards of the torus between carpels.
- Gynoecium** (pl. **Gynoecia**). The pistils collectively of a flower.
- Gynophore.** The prolonged stipe of a pistil, as in *Cleome*.
- Gynostegium.** A sheath or covering of the gynoecium of whatever nature.
- Gypsaceous, gypsiferous.** Containing calcium sulfate (gypsum). **Gypsophile, gypsophilous:** dwelling on gypsaceous soils, a few plants confined to such places.
- Gyrate.** Curved into a circle or circular; circinate.
- Habit.** General appearance of a plant.
- Habitat.** The normal situation in which a plant lives.
- Halberd-shaped.** Hastate; arrow-shaped with the lobes turned out.
- Halophyte.** A plant of salty or alkaline soils. **Halophytic** (adj.).
- Haploid.** Single; having the reduced number of chromosomes typical of gametes, as opposed to the somatic number.
- Hastate.** Halberd-shaped; of the shape of an arrowhead but with the basal lobes turned outward.
- Haustoria.** The suckerlike attachment organs of parasites like *Cuscuta*.
- Head.** A dense globular cluster of sessile or subsessile flowers arising essentially from the same point on the peduncle; capitulum.
- Heartwood.** The innermost and oldest wood next to the pith.
- Helicoid, helical.** Curved or spiraled like a snail shell.
- Helix.** Having a spiral form.
- Hemi-.** In composition means half.
- Hemicordate.** Half-hearted.
- Hemispheric, hemispheroidal.** Shaped like half a sphere.
- Hemitropous.** Amphitropous, the axis of the ovule being more curved than the anatropous condition.
- Herb.** A plant without persistent woody stem, at least above ground.
- Herbaceous.** Pertaining to a herb; opposed to woody; having the texture or color of a foliage leaf; dying to the ground each year.
- Herbage.** Collectively, the green parts of a plant.
- Herbarium.** A collection of dried and pressed plants, usually mounted on strong sheets of rag paper or otherwise prepared for permanent preservation, and usually systematically arranged.
- Hermaphrodite.** With stamens and pistil in the same flower.
- Hesperidium.** A superior, polycarpellary, syncarpous berry, pulpy within, and externally covered with a tough rind, as an orange.
- Heterochlamydeous.** With the perianth clearly divided into a calyx and a corolla.
- Heterogamous.** Producing two or more kinds of flowers.
- Heterogeneous.** Not uniform in kind.
- Heteromorphic.** Of more than one kind of form.
- Heterophyllous:** Having leaves of different forms.
- Heterophylly:** Two different forms of leaves marked by difference in organization.
- Heterosporous.** Having spores of two sizes or shapes.
- Heterostylous, heterostylic, heterostyled.** The state of having unlike or different length styles.
- Heterozygous.** Having genes for both members of at least one pair of allelomorphous Mendelian characters.
- Hexagonal.** Six angled.
- Hexamerous.** Having the floral whorls composed of six members.
- Hexaploid.** Having six basic chromosome sets (six times the gametic number).
- Hibernacle, hibernaculum.** A winter bud.
- Hilum.** The scar at the point of attachment of an ovule or seed. **Hilar:** relating to the hilum.
- Hip.** The fruit of the rose; technically a cynarrhodium.
- Hippocrepiform.** Horseshoe-shaped.
- Hirsute, hirtus.** Rough with coarse or shaggy hairs. **Hirsutulous (-ose):** the diminutive. **Hirtellous:** minutely hirsute.
- Hispid.** Rough with stiff or bristly hairs. **Hispidulous (-ose):** the diminutive. **Hispidulo-:** used in combination to denote stiff or bristly hairs.
- Hoary.** Covered with white down.
- Holosericeous.** Covered with fine and silky hairs.
- Holotype.** The one specimen on which a species or other taxon is based.
- Homo-.** A Greek prefix denoting all alike or of one sort.
- Homochromous.** Uniform in color.
- Homogamous.** A head or cluster with flowers alike throughout.
- Homogeneous.** Of the same kind or nature, uniform, opposed to heterogeneous.
- Homorphic.** Uniform in shape.
- Homonym.** In nomenclature, a name rejected because it duplicates a name previously and validly published for a group of the same rank based on a different type.
- Homosporous.** With spores all alike in size and shape.
- Homostylous.** The relation of length between all styles and anthers of the same species; the state of having similar or equally long styles.
- Homozygous.** Having genes for only one member of at least one pair of allelomorphous Mendelian characters.

- Hood.** Cf. *cucullate*.
- Horny.** Hard or dense in texture.
- Host.** A plant that nourishes a parasite.
- Humistrate.** Spread over the surface of the ground.
- Humus.** Decomposing organic matter in the soil.
- Husk.** The outer covering of certain fruits or seeds, as in the Juglandaceae.
- Hyaline.** Colorless or translucent, rarely transparent.
- Hybrid.** A cross between two species.
- Hydathode.** An organ that extrudes water or other liquid.
- Hydrophyte.** Partially or wholly immersed water plant. *Hydrophilic, hydrophilous:* dwelling in wet places or water; pollinated by water.
- Hygroscopic.** Susceptible of extending or shrinking on the application or absence of water or vapor.
- Hypanthium.** A cup-shaped enlargement of the receptacle on which the calyx, corolla, and often the stamens are inserted; in perigyny the "calyx tube."
- Hypocotyl.** The axis of an embryo below the cotyledons but not passing beyond them.
- Hypocrateriform.** Salver-shaped, with a salver-shaped corolla.
- Hypodermal.** Beneath the epidermis.
- Hypogynium.** The perianthlike structure subtending the ovary in some genera of the Cyperaceae.
- Hypogynous.** Borne on the receptacle below or free from the pistil; said of petals or stamens.
- Igneous.** Resulting from the action of intense heat, as igneous rock.
- Imbibe.** To saturate, imbue, soak, steep.
- Imbricate.** Overlapping as shingles on a roof.
- Immaculate.** Unspotted.
- Immersed.** Growing under water.
- Imparipinnate.** Odd-pinnate, having a terminal leaflet.
- Imperfect flower.** Having either stamens or pistils, but not both.
- Inarticulation.** With no joints, continuous.
- Incanous.** Quite gray, hoary.
- Incipient.** Beginning to be or to show itself; initial.
- Inclined.** Cut rather deeply and sharply.
- Inclined.** Falling away from the horizontal direction.
- Included.** Not protruding beyond the surrounding organ or envelope.
- Incrasate.** Made thick or stout, as the leaves of some species of *Sedum*.
- Incumbent.** Lying upon anything; said of cotyledons when the back of one rests against the stalk of the embryo.
- Incurved.** Bending inwards.
- Indefinite.** Relating to number, inconstant or very numerous.
- Indehiscent.** Not splitting open, as an achene.
- Indeterminate.** Not terminated absolutely, as a raceme.
- Indigene, indigenous.** Native to the country; not introduced.
- Indument, indumentum.** Any hairy covering or pubescence.
- Induplicate.** Valvate aestivation in which the margins of the leaves are bent or folded inward.
- Indurate.** Hard, hardened.
- Indusium (pl. *indusia*).** In ferns, the epidermal outgrowth that covers or invests the sorus; in Goodeniaceae the 2-lobed or 2-lipped flange or cup surrounding the style near its apex. *Industate:* possessing an indusium.
- Inequilateral.** Unequal-sided.
- Inferior.** Lower or beneath. *Inferior ovary:* one that is adnate to the hypanthium and situated below the calyx lobes.
- Inflated.** Blown up; bladdery.
- Inflexed.** Turned abruptly inward. *Inflexure:* a sudden turn inward.
- Inflorescence.** The flower cluster of a plant, or, more correctly, the disposition of the flowers on an axis.
- Inframedial.** Below the middle.
- Infraspecific.** Within the species.
- Infrastamineal.** Below the stamens.
- Infrastipular.** Below the stipules.
- Infructescence.** The inflorescence in a fruiting stage; collective fruits.
- Infundibular, infundibuliform.** Funnelform.
- Innate.** Borne on the apex of the support; in an anther the antithesis of adnate.
- Innocuous.** Harmless, hence unarmed or spineless, or nontoxic.
- Innovation.** In Gramineae a new sterile basal shoot; an offshoot from a stem, as in *Polygonum*.
- Inrolled.** Rolled inward.
- Insectivorous.** Consuming insects, i.e., by digesting out the organic parts.
- Inserted.** Attached to or growing upon.
- Insertion.** The place or mode of attachment of an organ to its support.
- Integument.** The covering of an organ or body; the envelope of an ovule.
- Inter-.** Used in combinations meaning between.
- Intercostal.** Situated between ribs or costae.
- Interlacunar.** Between air spaces.
- Internerves.** Spaces between the nerves.
- Internode.** The portion of stem between two nodes. *Internodal* (adj.).
- Interpetiolar.** Between the petioles; enclosed by the expanded base of a petiole; also applied to connate stipules that have coalesced from two opposite leaves.
- Interrupted.** Not continuous or regular.
- Interspecific.** Between different species.
- Interstices.** Small air spaces, the larger are termed lacunae, and still larger air passages.
- Interstitial.** Pertaining to the space which intervenes between one thing and another.
- Interstylar.** Between styles.
- Interval.** Space between ridges.
- Interverticillar.** Between verticils.
- Intine.** The innermost coat of a pollen grain.
- Intra-.** A prefix used to denote within.
- Intrafoliar.** Within the leaves.
- Intramarginal.** Placed within the margin near the edge.
- Intrastaminal.** Within the stamens, as the disk of Anacardiaceae.
- Introduced.** Brought from another region.
- Introggression.** Entrance; going in; used for hybridization and repeated back-crossing which can result in genetic contamination of one taxon by another. *Introgressant:* that which goes in; used for the organisms which show the results of introggression.
- Introrse.** Turned inward, towards the axis.
- Intruded.** Projecting inward or forward.
- Intrusive.** To enter though unwelcome; to be unexpected.
- Invaginate.** To enclose in a sheath. *Invagination:* enclosing in a sheath.
- Inverted.** Upside down; turned over.
- Involucel.** A secondary involucre, as the bracts subtending the secondary umbels in the Umbelliferae. *Involucellate:* with a secondary involucre.
- Involucre.** A whorl of bracts (phyllaries) subtending a flower cluster, as in the beads of Compositae. *Involucral:* pertaining to an invo-

- lucre. Involucrate:** having an involucre. *Involucriform:* of the form of an involucre.
- Involute.** With the edges rolled inward, i.e., toward the upper side.
- Iridescent.** Showing several colors as in a rainbow.
- Irregular.** Showing a lack of uniformity; asymmetric, as a zygomorphic flower.
- Isodiametric.** Of equal dimensions.
- Isolateral.** Equal sided.
- Isomorphic.** Of equal form.
- Isotype.** A specimen of the type collection other than the holotype.
- Isthmus (pl. Isthmi).** A narrow, constricted, necklike section of an organ.
- Joint.** The internode of a grass culm; an articulation, as in fruits of *Desmodium*.
- Junceous.** Rushlike.
- Juxtaposed.** The relative position in which organs are placed.
- Keel.** A prominent longitudinal ridge, analogous to the keel of a boat; the two lower and united petals of a papilionaceous corolla.
- Kernei.** The nucellus of an ovule or of a seed; that is, the whole body within the coats.
- Key or Key Fruit.** A winged fruit, like the maples; samara.
- Labellum.** A lip; the odd petal of an orchid.
- Labia, labiate.** Lipped; a member of the Labiales.
- Lacerate.** Appearing irregularly torn or cleft.
- Lacinia.** A slash or slender lobe. *Laciniate:* cut into narrow lobes or segments. *Lacinations:* fission.
- Lactescent.** Producing milky sap, as the milkweeds. *Latex:* the milky sap of some plants.
- Lacuna (-ae).** An air space in the midst of tissue; said of the vallecular canals of *Equisetum*; a hole or cavity.
- Laevigate.** Smooth, as if polished.
- Lamella (-æ).** A thin plate. *Lamellate, lamellar:* made up of thin plates. *Lamelliform:* platelike.
- Lamina (-ae).** The blade or expanded part of a leaf, petal, etc. *Laminar:* of the blade.
- Laminate.** In plates or layers.
- Lanate, lanose.** Woolly; densely clothed with long entangled hairs. *Lanulose:* short-woolly.
- Lanceolate, lance.** Lance-shaped; much longer than broad, tapering from below the middle to the apex and (more abruptly) to the base.
- Lanuginous.** Cottony or woolly; lanate.
- Latent.** Dormant.
- Lateral.** At or on the side.
- Laticiferous.** Latex-bearing.
- Latifoliate, latifolious.** Broad-leaved.
- Latisept.** With broad partitions in their fruits as in the Cruciferae.
- Lax.** Loose, distant.
- Leaf.** The principal appendage or lateral organ borne by the stem or axis.
- Leaflet.** A segment of a compound leaf.
- Leaf scar.** The mark or cicatrice left by the articulation and fall of a leaf.
- Leaf stalk.** The stem of a leaf; petiole.
- Lectotype.** A specimen or other element selected from the original material to serve as the nomenclatural type, when the holotype was not designated at the time of publication, or when the holotype is missing.
- Legume.** The seed vessel of Leguminosae, one-celled and two-valved, but various in form; a superior 1-celled fruit of a simple pistil usually dehiscent into two valves, having the seeds attached along the ventral suture; a leguminous plant.
- Leguminous:** pertaining to a legume or the family Leguminosae.
- Lemma.** In grasses, the lower of the two bracts immediately enclosing the floret.
- Lenticels.** Corky spots on young bark, arising in relation to epidermal stomates. *Lenticellate:* having lenticels.
- Lenticular.** Lens-shaped. *Lenticulate (adj.):*
- Lentiginous.** Minutely dotted as though freckled.
- Lepidote.** Covered with small scurfy scales; scurfy; furfuraceous.
- Liane.** Luxuriant woody climbers in the tropics and subtropics, with anomalous structure.
- Ligament.** Anything that ties or unites one thing or part to another.
- Lignous.** Woody. *Lignescence:* somewhat woody or becoming woody.
- Ligule.** The strap-shaped part of a ray corolla in Compositae; the thin, collarlike appendage on the inside of the blade at the junction with the sheath in grasses. *Ligulate:* provided with a ligule. *Liguliform:* strap-shaped.
- Limb.** A border; in particular, the expanded portion of a gamopetalous corolla or a gamosepalous calyx.
- Limen.** Basal corona in Passifloraceae.
- Linear.** Resembling a line; long and narrow, of uniform width, as the leaf blade of grasses.
- Lineate.** Marked with parallel lines.
- Lineolate.** Marked with fine or obscure lines.
- Lingulate, linguiform.** Tongue-shaped.
- Lip.** One of the two divisions of a bilabiate corolla or calyx, hence an upper lip and a lower lip, although one lip may be wanting; the upper lip of orchids, by a twist of the ovary, usually appears to be the lower.
- Lithophyte.** A plant that grows on rocks but derives its carbon dioxide, water and minerals from the atmosphere and from accumulated humus and weathered materials.
- Littoral.** Of a shore, particularly of the seashore.
- Llano.** A flat plain, usually grassy and treeless.
- Lobe.** A division or segment of an organ, usually rounded or obtuse; cut less than halfway to the midrib (of a leaf). *Lobed:* bearing lobes.
- Lobule.** A small lobe. *Lobulate:* having a small lobe.
- Locular.** Having cells or loculi, as a bilocular pistil or two-celled anther.
- Locule.** *Loculus.* Compartment or cell of pistil or anther.
- Loculicidal.** Dehiscent longitudinally through the middle of the back of a pericarp, between the partitions into the cavity.
- Lodicules.** The 2 or 3 minute hyaline scales at the base of the stamens in grasses, representing the perianth.
- Loess.** Drifting dust held by vegetation.
- Loment.** A flat legume that is constricted between the seeds, falling apart at the constrictions when mature into one-seeded joints.
- Lorate.** Strap-shaped, ligulate. *Loriform:* of the form of a strap.
- Lozenge.** Diamond-shape; rhomb.
- Lunate.** Crescent-shaped.
- Lustrous.** Shining, having a sheen.
- Lutescent.** Becoming yellow.
- Lyrate.** Lyre-shaped; pinnatifid, with the terminal lobe considerably larger than the others.
- Macro-.** Greek prefix meaning large or more properly, long.
- Macrosporangium.** The organ in which macrospores are produced.

- Macrospore.** The larger of the two kinds of spores in Selaginellaceae, etc.
- Macrosporophyll.** The modified leaf that bears the macrosporangium.
- Maculate.** Spotted or blotched. *Maculation:* a spot.
- Male** (plant or flowers). Having stamens but no pistils.
- Malodorous.** Ill-smelling.
- Malpighiaceous hairs.** Straight appressed hairs attached by the middle and tapering to the free tips.
- Mammiform.** Breast-shaped, conical with rounded apex.
- Mamillate.** Having nipples.
- Marbled.** Stained with irregular streaks or blotches of color.
- Marcascent.** When withered, not falling off, especially leaves and corollas.
- Marginal.** Of, pertaining to, or attached to the edge.
- Marginate, margined.** Distinctly margined; the margin distinctly different.
- Marine.** Growing within the influence of the sea or immersed in its water.
- Maritime.** Of the seacoast, pertaining to the sea.
- Marsh.** A tract of wet or periodically inundated treeless land, usually characterized by grasses, cattails or other monocots.
- Massula (-ae).** A group of cohering pollen grains produced by one primary mother cell, as in the orchids; pollen mass.
- Matorral.** Field full of brambles and briars, a brushy place; a thicket, copse.
- Medial. Median.** Of the middle.
- Medifixed.** Fixed or attached by the middle.
- Medullary.** Pertaining to the pith. *Medullose:* the texture of pith.
- Megasporangium.** The sporangium in which megaspores are developed or contained.
- Megaspore.** A synonym of macrospore.
- Membrane, membranaceous, membranous.** Of the nature of a membrane; thin, soft and pliable.
- Meniscoid.** Thin and concavo-convex, like a watch glass.
- Mentum.** An extension of the foot of the column in some orchids, in the shape of a projection in front of the flowers.
- Meristem.** Embryonic or undifferentiated tissue, the cells of which are capable of active division. *Meristematic:* pertaining to the meristem.
- Mericaarp.** One of the two seedlike carpels of an umbelliferous fruit.
- merous.** Greek suffix, having parts, as pentamerous or 5-merous, having 5 parts.
- Mesa.** A flat-topped hill with abrupt or steeply sloping side or sides.
- Mescal.** A drink distilled from the juice of the maguey; a small cactus (*Lophophora*).
- Mesic.** Characterized by or pertaining to conditions of medium moisture supply.
- Mesocarp.** The middle layer or coat of a fruit.
- Mesophyte.** A plant that grows under medium moisture conditions.
- Micro-** Greek prefix meaning small.
- Micron.** A measure of length used for microscopical measurements, equal to 1/1000 of a millimeter or 1/25,000 of an inch.
- Microphyllous.** Small leaved.
- Micropyle.** The minute orifice in the integuments of an ovule through which the pollen tube enters the seed cavity. *Micropylar:* relating to the micropyle.
- Microsporangium.** The organ in which microspores are produced.
- Microsporoc.** The smaller of the two kinds of spores in Selaginellaceae, etc.
- Microsporophyll.** The modified leaf that bears the microsporangium.
- Microtuberculate.** Minutely tuberculate.
- Midrib.** The central rib of a leaf or other organ.
- Mitriiform.** Shaped like a mitre or cap.
- Monadelphous.** Stamens united by their filaments into a tube surrounding the gynoecium, as in malvaceous flowers.
- Monandrous.** With one stamen.
- Moniliform.** Resembling a string of beads.
- Mono-** In Greek compounds meaning one.
- Monocarpic.** An annual or other plant that flowers but once; composed of one carpel only.
- Monocephalous.** Bearing only one head.
- Monochasium (-a).** A one-branched cyme, either pure or resulting from the reduction of cymes.
- Monochlamydeous.** Having only one set of floral envelopes.
- Monocotyledon (-ous, -oid).** (Abbr., *Monocot*). A plant having but one cotyledon or seed leaf.
- Monoccius.** Having staminate and pistillate flowers on the same plant but not perfect ones.
- Monomorphic.** Of one form, only, not polymorphic.
- Monopodium.** A stem of a single and continuous axis. *Monopodial* (adj.).
- Monothecal.** Having a single locus or cell.
- Monotypic.** Having a single type or representative, as a genus with only one species.
- Monstrosity.** Some conformation deviating from the usual and natural structure.
- Montane.** Pertaining to or living in mountains.
- Mucilaginous.** Slimy, composed of mucilage.
- Mucro, mucronation.** A small and short abrupt tip of an organ, as the projection of the midrib of a leaf. *Mucronate:* with a mucro. *Mucronulate:* minutely mucronate.
- Multi-** Latin prefix for many.
- Multicipital.** Descriptive of a crown of roots or a caudex from which several stems arise.
- Multifid.** Cleft into many narrow lobes or segments.
- Multiflorous (-ate).** Many flowered.
- Muricate, murication.** Rough with short and firm sharp excrescences. *Muriculate:* the diminutive.
- Mutation.** A sudden variation, the offspring differing from its parents in some well-marked character or characters.
- Muticous.** Pointless, blunt, awnless.
- Naked.** With a usual covering wanting, as a flower destitute of a perianth.
- Napiform.** Turnip-shaped.
- Nascent.** In the act of being formed.
- Naturalized.** Of foreign origin, but established and reproducing itself as though a native.
- Navicular.** Cymbiform; boat-shaped; shaped like the bow of a canoe.
- Necrotic.** Affected with, characterized by, or producing, necrosis.
- Nectary.** The organ in which nectar is secreted, formerly applied to any anomalous part of a flower, as its spurred petal. *Nectariferous:* nectar-bearing; having a nectary, or an organ which secretes nectar.
- Needle(s).** Stiff, linear leaves as in Pinaceae.
- Neotentially.** A prolongation in reaching maturity.
- Nerve.** A simple vein or slender rib of a leaf or bract. *Nerved, nervature:* with nerves. *Nervelet:* an ultimate branch of a nerve. *Nervation:* the manner in which the foliar nerves or veins are arranged.
- Neuter.** Sexless, as a flower that has neither stamens nor gynoecium. *Neutral:* devoid of functional stamens or gynoecium.
- Nigrescent.** Turning black.
- Nitid.** Smooth and clear, lustrous, glittering.

- Nocturnal.** Occurring at night or lasting for one night only, as night-blooming.
- Node.** The joint of a stem; the point of insertion of a leaf or leaves.
- Nodding.** Hanging down. Cf. *Pendent*.
- Nodifrond.** Bearing fronds or foliage at the node.
- Nodose.** Furnished with knots or knobby nodes. *Nodulose*: the diminutive.
- Novaculite.** A very hard, fine-grained siliceous rock of possible sedimentary origin.
- Nut.** A hard-shelled and one-seeded indehiscent fruit derived from a simple or compound ovary.
- Nutant.** Nodding.
- Nutlet.** Diminutive of nut; applied to any small and dry nutlike fruit or seed. Thicker-walled than an achene.
- Ob-** Latin prefix signifying the reverse or contrariwise.
- Obcompressed.** Flattened the other way, anteroposteriorly instead of laterally, opposite of the usual way.
- Obconic.** Inversely conical, with the point of attachment at the small end.
- Obcordate.** Inversely cordate, the notch at the apex.
- Obdeltoid.** Inversely deltoid.
- Obdiplostemonous.** Where the stamens are double the number of the petals to which the outer series are opposite.
- Oblanceolate.** Inversely lanceolate.
- Oblate.** Flattened at the poles.
- Obligate.** Necessary, essential; the reverse of facultative.
- Oblique.** Of unequal sides (as in leaves), slanting.
- Oblong.** Much longer than broad with nearly parallel sides.
- Obovate.** Inversely ovate.
- Obovoid.** Inversely ovoid.
- Obreniform.** Inversely reniform.
- Obsolete.** Rudimentary or not evident; applied to an organ that is almost entirely suppressed; vestigial. *Obsolescent*: becoming rudimentary or extinct.
- Obtuse.** Blunt or rounded at the end.
- Ocellate.** With a circular patch of color.
- Ochraceous.** Ochre-colored, yellow with a tinge of red.
- Ocrea (-ae).** A sheath around the stem derived from the leaf stipules; used chiefly in the Polygonaceae.
- Ocreola (-ae).** The smaller or secondary sheaths, as in the inflorescences of *Polygonum*.
- Ochroleucous.** Yellowish-white, buff.
- Odd-pinnate.** With a terminal leaflet; imparipinnate.
- Odd-pinnatifid.** Pinnately cleft, with an unpaired terminal leaflet and the lateral leaflets without a distinct petiolule and the rachis winged between them.
- Offsets.** Short basal lateral shoots from which new plants can develop.
- Olivaceous.** Olive green, olive-colored.
- Opaque.** Dull; neither shining nor translucent.
- Operculum.** A lid. *Operculate*: furnished with a lid.
- Opposite.** Set against, as leaves when two at a node; one part before another, as a stamen in front of a petal.
- Oppositifolious.** With opposite leaves.
- Orbicular, orbiculate.** Approximately circular in outline.
- Orifice.** The mouthlike opening of a tubular corolla at the junction of limb and throat or tube.
- Orthotropous** (ovule or seed). Erect, straight, with the micropyle at the apex and the hilum at the base.
- Oval.** Broadly elliptic.
- Ovary.** The part of the pistil that contains the ovules.
- Ovate.** With the outline of an hen's egg in longitudinal section, the broader end downward.
- Ovoid.** Solid ovate or solid oval.
- Ovule.** The megasporangium of a seed plant; the body in the ovary which becomes a seed. *Ovulate, ovuliferous*: bearing ovules.
- Palate.** In personate corollas, the projecting part of the lower lip, which closes the throat, as in the snapdragon.
- Palea (-æ), pale.** One of the chafflike scales on the receptacle of many Compositae; the inner bract of a grass floret, often partly invested by the lemma. *Paleaceous*: chaffy; composed of small membranaceous scales. *Paleiform*: resembling or of the shape of palea.
- Pallid.** Pale.
- Palmate.** Hand-shaped with the fingers spread; in a leaf, having the lobes or divisions radiating from a common point.
- Palmatifid.** Cleft so as to resemble the outstretched fingers of the hand. *Palmatisect*: palmately divided.
- Paludal.** Pertaining to marshes, wet all through the year.
- Palustrine.** Of or pertaining to marshes.
- Pandurate, panduriform.** Fiddle-shaped; obovate and with a contraction on each side.
- Panicle.** A compound racemose inflorescence. *Paniculate*: borne in a panicle. *Paniculiform*: panicle-shaped.
- Pannose.** Feltlike in texture or appearance.
- Papilionaceous.** Applied to the butterflylike corolla of the pea, with banner, wings, and keel.
- Papilla (-ae).** A minute nipple-shaped projection. *Papillate, papillose*: bearing minute conical processes, or papillae. *Papillary*: resembling papilla. *Pappilliform*: shaped like a papilla.
- Pappose.** Pappus-bearing.
- Pappus.** The modified calyx limb in Compositae, consisting of a crown of bristles or scales on the summit of the achene.
- Papule.** A pimple or small pustule.
- Papyraceous.** Papery, white as paper.
- Parabolic.** Ovate-oblong or ovate, obtuse and contracted below the apex (used in reference to a leaf).
- Parallelogramiform.** In the shape of a parallelogram.
- Parasite.** An organism subsisting on another, the host. *Parasitic*: deriving nourishment from another organism.
- Paratype.** A specimen belonging to the original series, but not the type selected by the author.
- Parenchyma.** Soft tissue of cells with unthickened walls, as pith cells.
- Parietal.** Attached to the wall of the ovary, instead of to the axis; said of ovules or a placenta.
- Paripinnate.** See Pinnate.
- Parted, partite.** Deeply cleft nearly to the base.
- Parthenogenetic.** Developing without fertilization.
- Particolored.** Colored with different tints, variegated.
- Patelliform.** Disk-shaped.
- Patent.** Spreading. *Patulous*: standing open, spreading.
- Pauci-** A prefix used in combination to denote few.
- Pectinate.** With narrow closely set divisions like the teeth of a comb.
- Pedate.** Palmate, with the lateral lobes 2-cleft; said of leaves.
- Pedicel.** The stalk of a single flower in a flower cluster or of a spikelet in grasses. *Pedicelled,*

- pedicellary, pedicellate*: having a pedicel, as opposed to sessile.
- Peduncle*. The general term for the stalk of a flower or a cluster of flowers. *Pedunculata, peduncular*: having a peduncle. *Pedunculiform*: in the form of a peduncle.
- Pellicle*. A thin skin or filmy covering.
- Pellucid*. Transparent, clear.
- Peltate*. Shield-shaped; a flat body having the stalk attached to the lower surface instead of at the base or margin, as the petiole attachment to the blade of some species of *Hydrocotyle*.
- Pendent, pendulous*. Suspended or hanging, as an ovule that hangs from the side of the locule; nodding.
- Penicillate*. Ending in a tuft of fine hairs.
- Penninerved*. Pinnately veined or nerved.
- Pentagonal*. Having 5 angles or sides.
- Pentamerous*. With parts of fives, as a corolla of five petals.
- Penultimate*. The last but one of a series.
- Pepo*. A gourd fruit, with hard rind, one-loculed, many-seeded, derived from an inferior ovary.
- Percurrent*. Extending throughout the entire length.
- Perdurant*. Very long lasting.
- Perennate*. Lasting the whole year through.
- Perennial*. Lasting from year to year.
- Perfect*. A flower having both stamens and pistils.
- Perfoliate*. With the leaf entirely surrounding the stem, or with 2 leaves basally united around the stem.
- Perianth*. The floral envelopes collectively; usually used when calyx and corolla are not clearly differentiated.
- Pericarp*. The ripened walls of the ovary, referring to a fruit. *Pericarpial*: in reference to, or like, a pericarp.
- Perigonium*. A perianth.
- Perigyntum (-a)*. The inflated saclike organ surrounding the pistil in *Carex*.
- Perigynous*. Borne around the ovary in contrast to beneath it, as the stamens and corolla are inserted on the floral tube.
- Periphery, Peripheral*. On or near the margin.
- Perisperm*. The nutritive tissue surrounding the embryo of the seed and formed outside the embryo sac.
- Persistent*. Remaining attached, as a calyx on the fruit.
- Personate*. A bilabiate corolla having the throat nearly closed by a prominent palate.
- Petal*. One of the leaves of a corolla, usually colored. *Petaline*: pertaining to a petal; attached to, or resembling a petal. *Petaloid*: having the aspect of or colored as petals. *Petalifcrous*: bearing petals.
- Petiole*. A leaf stalk. *Petiolate*: having a petiole. *Petiolar*: borne on or pertaining to a petiole. *Petioliform*: resembling a petiole in shape.
- Petiolule*. The stalk of a leaflet. *Petiolulate*: having a small petiole; having petiolules of leaflets.
- Phalange*. A bundle of stamens in diadelphous and polyadelphous flowers.
- Phenotype*. A group of individuals of similar appearance but not necessarily of similar genetic constitution.
- Phloem*. The tissue that conducts food in a plant.
- Photosynthesis*. The manufacture of carbohydrates within green leaves by energy derived from light, from simple organic materials such as carbon dioxide and water.
- Phyllary*. An individual bract of the involucre of a member of the Compositae.
- Phyllode, phyllodia*. A dilated petiole serving as a leaf blade.
- Phyllopodic*. With a leafy base.
- Phyllotaxy*. Leaf arrangement.
- Phylogeny*. The race history of a plant or natural group; relationship by descent; ancestral history deduced from development.
- Phylum*. A primary division of the plant kingdom.
- Pilose*. Bearing soft and straight spreading hairs.
- Pilosulous (-ose)*: the diminutive. *Pilosity*: hairiness.
- Pinna (-ae)*. A leaflet or primary division of a pinnate leaf.
- Pinnate*. A compound leaf, having the leaflets arranged on each side of a common petiole; featherlike. *Odd-pinnate*: pinnate with a single terminal leaflet (imparipinnate). *Abruptly pinnate*: pinnate without an odd terminal leaflet (paripinnate).
- Pinnatifid*. Pinnately cleft into narrow lobes not reaching to the midrib.
- Pinnatisect, pinnatipartite*. Pinnately divided to the midrib.
- Pinnule*. A division of a pinna.
- Pistil*. The ovule-bearing organ of a flower, consisting of stigma and ovary, usually with a style between.
- Pistillate*. Provided with pistils and without stamens; female.
- Pistillode, pistillodium*. A rudimentary pistil.
- Pith*. The spongy center of an exogenous stem.
- Pitted*. Having little depressions of pits; foveate.
- Placenta (-ae)*. The ovule-bearing surface in the ovary. *Placental*: a placenta that is long and narrow and bears many ovules. *Placentation*: the arrangement or orientation of the placentas.
- Plait*. A fold, like those of a fan. *Plaited*: pliated, folded.
- Plane*. Surface flat and even, not curved.
- Plano-*. A combining form to denote plane or flat.
- Plano-convex*. Flat on one side and convex on the other.
- Plate (-d)*. A flattened structure.
- Pleat*. A fold. *Pleated*: folded.
- Pleiochastum*. Each relative main axis of a cyme producing more than two branches. *Pleiochasial* (adj.)
- Plexus*. A network.
- Plicate*. Plaited; folded as a fan. *Plicatulate*: the diminutive of plicate.
- Plumbeous*. Lead-colored.
- Plumose*. Feathery; having fine hairs on each side as a plume.
- Plumule*. The primary leaf bud of an embryo.
- Pluriloculate*. Many-celled.
- Pod*. Any dry dehiscent fruit; specifically a legume.
- Podium*. A foot stalk or similar support.
- Pollen*. The male fecundating spores found in the anther.
- Pollen tube*. The tube emitted by a pollen grain passing down from the stigma to the ovary and ovules.
- Pollination*. The placing of the pollen on the stigma or stigmatic surface.
- Pollinia*. The pollen masses of the orchids and milkweeds.
- Polliniferous*: Pollen-bearing.
- Polygamo-dioecious*. Polygamous but chiefly dioecious.
- Polygamo-monoecious*. Polygamous but chiefly monoecious.
- Polygamous*. Bearing unisexual and bisexual flowers on the same plant.
- Polymorphous, polymorphic*. Of various forms.
- Polypetalous*. With many distinct petals.
- PolypHYllous*. Having many leaves.
- Polyploid*. Having a chromosome number that is a multiple of a basic number for a group of forms. *Polyploid series*: examples— $2n = 8$ (diploid), 16 (tetraploid), 24 (hexaploid), 32

- (octoploid), etc. *Polyplloid complex*: intimately related members of a polyplloid series.
- Polystichous*. In several vertical rows or ranks.
- Polytypic*. Having several or many types or representatives.
- Pome*. An applelike fruit.
- Porcelaneous*. With the appearance of, or resembling, porcelain.
- Pore*. A small aperture, as in some anthers for the emission of pollen. *Porose*: with small holes or pores. *Porulus* (-ose): somewhat porous.
- Porticidal*. Opening by pores.
- Porrect*. Directed outward and forward; vertical to the substratum.
- Posterior*. On the side toward the axis; the upper side of the flower.
- Postero-lateral*. Situated back and at the side.
- Praemorse*. As it were, bitten off; said of roots.
- Precocious*. Flowering before the appearance of the leaves.
- Prefloration*. Cf. *Aestivation*.
- Prehensile*. Clasping or grasping, as in tendrils.
- Prickle*. Sharp outgrowth of the bark or epidermis. *Prickly*: armed with prickles, as the rose.
- Primary*. First in order of time or development.
- Primocane*. The first year's cane (usually without flowers) of *Rubus* and similar genera.
- Primordia*. A member or organ in its earliest condition. *Primordial*: first in order of appearance.
- Prismatic*. Of the shape of a prism.
- Process*. Any projecting appendage.
- Procumbent*. Trailing on the ground, but not rooting.
- Prolate*. Drawn out towards the poles.
- Proliferous*. Bearing offsets, bulbils, or other vegetative progeny; abnormal or redundant development, as when a leafy shoot develops from a flower part. *Proliferate*: to develop prolificously.
- Prolification*. The production of terminal or lateral leaf buds in a flower.
- Prominent*. Standing out beyond some other part.
- Prophyllum* (-a). The bracteole at the base of an individual flower, as in *Juncus*; a membranous structure between a branch and the main stem in Gramineae.
- Prostrate*. Lying flat upon the ground.
- Protandrous*. With anthers maturing before the pistils in the same flower.
- Proterandrous*. Shedding the pollen before the stigma of the flower is receptive. *Proterogynous*: having the stigma receptive before the stamens of the flower mature.
- Prothallium* (-a). A cellular, usually flat and thalluslike growth, resulting from the germination of a spore, upon which are developed sexual organs or new plants.
- Prototype*. The assumed ancestral form from which the descendants have become modified.
- Protracted*. Long drawn out.
- Protuberance*. A protrusion or bulge such as a bump or swelling.
- Proximal*. Nearest the axis or base, as contrasted with distal.
- Pruinose*. Covered with a coarse waxy powder, more pronounced than when glaucous.
- Pseudo-*. A Greek combining form to denote false.
- Pseudobulb*. The thickened or bulb-formed stem of certain orchids, the part being solid and borne above ground.
- Pteridologist*. A student of ferns.
- Pteridophyta*. The ferns and fern allies.
- Puberulent*. Minutely pubescent. *Puberulous*: slightly hairy.
- Pubescent, pubescence*. Covered with short soft hairs; downy.
- Pulp*. The juicy or fleshy tissue of a fruit.
- Pulverulent, pulveraceous*. Dusted as with fine powder.
- Pulvinate*. Cushion-shaped.
- Pulvinus* (-i). A swelling close under the insertion of a leaf; the swollen base of a petiole.
- Punctate*. Dotted with punctures or with translucent pitted glands or with colored dots. *Puncticulate* (-ose): the diminutive. *Punctiform*: in the form of a point or dot. *Punctation*: a minute spot or depression.
- Pungent*. Ending in a rigid, sharp point or prickle; acrid (to the taste or smell).
- Purpurascens*. Becoming or turning purple.
- Pustular*. Having slight elevations like blisters. *Pustulate*: bearing blisterlike swellings or pustules; mostly at the base of hairs. *Pustule*: a pimple or blister. *Pustulose*: blistery or pimply.
- Putamen*. The shell of a nut; the hardened endocarp of stone fruits.
- Pyramidal*. Pyramid-shaped.
- Pyrene*. Nutlet, particularly that in a drupe.
- Pyriform*. Pear-shaped.
- Quadrante, quadrangular*. Square.
- Quadri-*. Latin prefix signifying four.
- Quadrifid*. Divided into four parts to about or below the middle.
- Quadrilateral*. Four-sided.
- Quinquefoliolate*. With five leaflets.
- Raceme*. A simple, elongated, indeterminate inflorescence with each flower subequally pedicelled. *Racemelets*: the diminutive. *Racemiform, racemose*: of the nature or shape of a raceme or in racemes.
- Rachilla*. A small rachis, specifically the axis of a grass spikelet; the diminutive rachis in *Schrankia*.
- Rachis*. The axis of a spike or raceme, or of a compound leaf.
- Radial*. Belong to the ray, as in the flowers of Compositae.
- Radiant*. Radiating as from a center.
- Radiate*. Spreading from or arranged around a common center; bearing rays.
- Radical*. Belonging to or proceeding from the root.
- Radicant*. Rooting, usually applied to stems or leaves.
- Radicle*. That portion of the embryo below the cotyledons.
- Radius* (-i). The ray of the Compositae, the outermost florets when distinct in form from those composing the disk; a partial umbel in Umbelliferae; the structures known as the medullary rays; also the radiating branches of a stellate trichome.
- Rameal*. Belonging to a branch.
- Ramentum* (-a). Thin chaffy scales of the epidermis, as the scales of many ferns.
- Ramose*. Branching or branch. *Ramulose*: with many branchlets.
- Raphe*. The ridge connecting the two ends of an anatropous ovule. *Raphal*: relating to the raphe.
- Raphides*. Needle-shaped crystals in the cells of plants. *Raphidulous*: pertaining to or with raphides.
- Ray*. A primary branch of an umbel; the ligule of a ray floret in Compositae, the ray florets being marginal and differentiated from the disk florets.
- Receptacle*. That portion of the floral axis upon which the flower parts are borne, or, in Compositae, that which bears the florets in the head. *Receptacular*: pertaining to the receptacle or attached to the receptacle.

- Reclined, reclinate.* Turned downward, with the tip resting on the ground.
- Recumbent.* Leaning, reclining, lying.
- Recurved.* Bent backwards; curved downward or backward.
- Reduplicate.* Doubled back; a term of aestivation in which the edges are valvate and reflexed.
- Reflexed.* Abruptly bent downward.
- Refracted.* Bent sharply from the base backward.
- Regular.* Said of a flower having radial symmetry, with the parts in each series alike.
- Relic.* A species long-surviving, its near relatives having become extinct presumably through environmental crises; relics are sometimes narrowly endemic. *Relict* (adj.)
- Remote.* Distantly spaced.
- Reniform.* Kidney-shaped.
- Repand.* With an undulating margin, less strongly wavy than sinuate.
- Repent.* Creeping (prostrate and rooting).
- Replicate.* Folded backward.
- Replum.* The marginate septum of certain pods that persist after the valves have fallen, as in the fruit of Cruciferae.
- Resaca.* A former course or channel of a stream, commonly water-filled to form narrow oxbow or meandering lakes.
- Resiniferous, resinous.* Producing resin.
- Resupinate.* Upside down, inverted by the twisting of the pedicel, as the flowers of orchids.
- Reticulate.* With a network; net-veined.
- Reticulum.* A membrane of cross-fibers found in palms at the base of the petiole.
- Retinaculum.* The gland to which one or more pollinia are attached in orchids; in the Asclepiadaceae a horny elastic body to which the pollen masses are fixed; in most Acanthaceae the funiculus which is curved like a hook and retains the seed until mature.
- Retrogression.* Reversion or development towards simpler organization.
- Retorse.* Bent backward or downward.
- Retuse.* Notched shallowly at a rounded apex.
- Revolute.* Rolled backward from both margins, i.e., toward the underside.
- Rhizoid.* A filamentous rootlike structure on the gametophyte of ferns.
- Rhizome.* An underground stem or rootstock, with scales at the nodes and producing leafy shoots on the upper side and roots on the lower side.
- Rhizomatous:* having a rhizome. *Rhizomatiform:* resembling a rhizome in shape.
- Rhizophore.* A specialized structure in *Selaginella* emitting roots.
- Rhombic.* Somewhat diamond-shaped. *Rhombiform:* rhomb-shaped. *Rhomboidal:* a solid with a rhombic outline.
- Rib.* The primary vein of a leaf, or a ridge on a fruit. *Ribbed:* with prominent ribs.
- Ringent.* Gaping, as the mouth of an open-throated bilabiate corolla.
- Rootcap.* Large cells that form a caplike covering for the smaller cells in rear (growing point).
- Rootstock.* See *Rhizome*.
- Rosaceous.* Rose-color, pink; belonging to or resembling the genus *Rosa*.
- Roseate.* Tinged with rose-color.
- Rosette.* A crowded cluster of radiating leaves appearing to rise from the ground.
- Rostellum.* A little beak; a slender extension from the upper edge of the stigma in orchids.
- Rostrate.* Beaked. *Rostellate:* the diminutive.
- Rostrum.* Any beaklike extension; the inner segment of the coronal lobes in Asclepiads.
- Rosulate.* In the form of a rosette.
- Rotate.* Wheel-shaped; said of a sympetalous corolla with obsolete tube and with a flat and circular limb.
- Rotund.* Rounded in outline.
- Rubellous.* Reddish. *Rubescens:* turning red.
- Ruderal.* Weedy; growing in waste places.
- Rudiment.* An imperfectly developed organ or part. *Rudimentary:* imperfectly developed; vestigial; arrested in an early stage of development.
- Rufous.* Reddish-brown. *Rufescent:* becoming reddish-brown.
- Ruga (-e).* A wrinkle or fold. *Rugose:* wrinkled. *Rugulose:* the diminutive of rugose.
- Ruminant.* Having a chewed or "wadded-up" appearance (as in "ruminant endosperm").
- Runcinate.* Sharply pinnatifid or incised, the lobes pointing downward.
- Runner.* A slender trailing stem rooting at the nodes or end; a very slender stolon.
- Russet.* Reddish-brown.
- Sac.* The cavity of an anther; a pouch or bag. *Saccate:* furnished with a sac or pouch.
- Saccharine.* Sugary; sweet.
- Sagittate.* Shaped as an arrowhead, with the basal lobes turned downward. Cf. *hastate*. *Sagittiform:* arrow-shaped.
- Salient.* Projecting forward.
- Saline.* Of or pertaining to salt; growing in salt marshes.
- Salverform.* A corolla with slender tube abruptly expanding into a flat limb.
- Samara.* An indehiscent winged fruit.
- Saponaceous.* Soapy, slippery to the touch. *Saponifying:* to convert into soapiness.
- Saprophyte.* A plant living on dead organic matter and hence without chlorophyll. *Saprophytic:* state of subsisting on humus or similar material.
- Sap wood.* The new wood in an exogenous tree, so long as it is pervious to the flow of water; the albumum.
- Sarmentose.* Bearing long slender prostrate runners.
- Saxicolous.* Growing on rocks, as ferns, etc.
- Scaberulo-ciliolate.* With minute rough hairs.
- Scabrous.* Rough to the touch, owing to the structure of the epidermis or to the presence of short stiff hairs. *Scabrid:* somewhat rough. *Scabrellate, scaberulous:* minutely roughened. *Scabridulous:* slightly rough. *Scabrate:* made rough or roughened.
- Scalariform.* Ladderlike.
- Scale.* Any thin scarious bract; usually a vestigial leaf. *Scalelet:* a diminutive of scale. *Scaly:* squamose; scarious.
- Scalloped.* Crenate.
- Scandent.* Climbing in any manner.
- Scap.* A leafless peduncle rising from the ground in acaulescent plants. *Scapiform, scapose:* resembling or bearing a scape.
- Scap.* Leafless peduncle arising from the ground that may bear scales or bracts but not foliage leaves and may be one- or many-flowered. *Scapiform:* resembling a scape. *Scapose:* bearing or resembling a scape.
- Scarious.* Thin, dry, and membranaceous, not green.
- Schizocarp.* A pericarp that splits into 1-seeded portions, mericarps.
- Sclerenchymatous* (tissue). Composed of thick-walled cells.
- Sclerotic.* Hardened; stony in texture.
- Scobicular.* In fine grains like sawdust.
- Scoparioid.* Resembling a broom.
- Scorpioid.* Said of a unilateral inflorescence circinnately coiled in the bud.

- Scrobiculate.** Marked by minute or shallow depressions.
- Scrub.** Stunted or densely packed bushes; stunted due to want of water, with strong transpiration.
- Scurfy.** Clothed with small branlike scales; furfuraceous.
- Scutellum (-a).** Any of several small shield-shaped parts or organs; the first leaf in a grass embryo attached at the basal node of the mesocotyl and serving as a food storage organ.
- Secondary.** Not primary, subordinate.
- Secund.** Arranged on one side only; unilateral.
- Seed.** The ripened ovule.
- Seep (s).** A moist spot where underground water comes to or near the surface.
- Segment.** A division or part of a leaf or other organ that is cleft or divided but not truly compound.
- Seleniferous.** Containing or yielding selenium.
- Self-fertile.** Capable of self-pollination.
- Self-incompatible.** Incapable of self-fertilization.
- Semi-** A prefix meaning half.
- Seminiferous.** Seed-bearing; used for the special portion of the pericarp bearing the seeds.
- Sepal.** A leaf or segment of the calyx. **Sepaline:** relating to or resembling sepals. **Sepaloid:** sepal-like.
- Septicidal.** Dehiscence of a capsule through the septa and between the locules.
- Septifragal.** With the valves breaking away from the dissepiments in dehiscence.
- Septum (-a).** A partition between cavities. **Septate:** divided by partitions or septa.
- Seriatic, serial.** Disposed in series of rows.
- Sericeous.** Silky; clothed with appressed fine and straight hairs.
- Serotinous.** Produced or occurring late in the season.
- Serrate.** Saw-toothed, the sharp teeth pointing forward. **Serrature:** the toothing of a serrate leaf. **Serrulate:** finely serrate.
- Sessile.** Attached directly by the base; not stalked, as a leaf without petiole.
- Seta (-ae).** A bristle, or a rigid, sharp-pointed, bristlelike organ. **Setaceous, setose:** clothed with bristles, bristly or bristlelike. **Sctiferous, sctigerous:** bristle-bearing. **Setiform:** in the shape of a bristle. **Setulose:** bearing minute bristles.
- Several.** Fewer than many, perhaps 6 to 8 or 10.
- Shaft.** Used for the flowering stalk in *Agave*.
- Sheath.** The tubular basal part of the leaf that encloses the stem, as in grasses and sedges; the composite bracts or scales that surround the individual bundles of pine needles (leaves). **Sheathing:** enclosed as by a sheath, vaginate.
- Shoulder.** In *Yucca* that part of the ovary that rather abruptly curves inward toward the style; used for similar conditions in other plant organs.
- Shrub.** A woody plant of smaller proportions than a tree, which usually produces several branches from the base.
- Sigmoid.** Doubly curved, like the letter S.
- Silica (Silex).** Silicon dioxide; a white or colorless, very hard crystalline mineral substance. **Siliceous:** pertaining to silica.
- Siliqua.** A narrow many-seeded capsule of the Cruciferae, with 2 valves splitting from the bottom and leaving the placentae with the false partition (replum) between them. **Silicle:** a short siliqua, not much longer than wide.
- Silky.** See sericeous.
- Simple.** Unbranched, as a stem or hair; uncompounded, as a leaf; single, as a pistil of one carpel.
- Sinistrorse.** Directed toward the left.
- Sinuate, sinuous.** With a strongly wavy margin. Cf. *Repand*.
- Sinus.** The cleft or recess between two lobes of an expanded organ such as a leaf.
- Slough.** A wet place or deep mud or mire; a sluggish channel.
- Smooth.** Not rough to the touch; cf. *glabrous*, without hairs, which may be either smooth or scabrous.
- Solitary.** Borne singly.
- Sordid.** Of a dull or dirty hue.
- Soriferous.** Bearing sori.
- Sorus (-i).** A fruit dot, or cluster, on the back of the fronds of ferns.
- Spadix (-ices).** A spike on a succulent axis enveloped in a spathe.
- Spathe.** A broad sheathing bract enclosing a spadix, as in the calla. **Spathaceous:** resembling or having a spathe. **Spathiform:** having the shape of a spathe.
- Spatulate.** Like a spatula, a knife rounded above and gradually narrowed to the base.
- Species.** The aggregate of all those individuals that have the same distinctive characters.
- Spermatozoid.** A ciliated motile male gamete produced within an antheridium.
- Sphacelate.** Dark and withered as though dead.
- Spherical.** Globular, orbicular.
- Spicate.** Having the form of or arranged in a spike. **Spiciform:** spikelike.
- Spike.** An elongated rachis of sessile flowers or spikelets. **Spikelct:** a secondary spike; the ultimate flower cluster in grasses, consisting of two glumes and one or more florets, and in sedges. **Spicule:** a diminutive or secondary spike.
- Spine.** A sharp-pointed, stiff, woody body, arising from below the epidermis; commonly the counterpart of a leaf or stipule, cf. *prickle*. **Spinescent:** more or less spiny, spine-tipped. **Spiniferous:** bearing spines. **Spinous, spinose:** bearing spines. **Spinulose:** bearing diminutive spines.
- Spongiose.** Spongy, soft.
- Sporangium.** A spore case or sac.
- Spore.** The reproductive body of pteridophytes and lower plants, analogous to the seed. **Sporeling:** a young plant from germinated spore. **Sporiferous:** spore-bearing. **Sporogenous:** producing spores.
- Sporocarp.** A receptacle containing sporangia or spores.
- Sporophyll.** A spore-bearing leaf.
- Sporophyte.** The asexual or diploid generation of ferns and their allies, the fern plant itself.
- Spreading.** Diverging almost to the horizontal; nearly prostrate. **Spreading hairs:** not at all appressed, but erect. **Spreading lower lip:** diverging from the main axis of the flower.
- Spur.** A slender, saclike, nectariferous process from a petal or sepal.
- Squama (-æ).** A scale, usually the homolog of a leaf. **Squamella (-æ):** diminutive squama, applied to some types of pappus in Compositae. **Squamellate:** like a little scale. **Squamiform:** scalelike. **Squamose, squamate:** covered with scales; scaly. **Squamulose:** provided with small scales.
- Squarrose.** Spreading rigidly at right angles or more, as the tips of bracts.
- Stalk.** The stem of any organ, as the petiole, peduncle, pedicel, filament, culm or stipe.
- Stamen.** The male organ of the flower, which bears the pollen.
- Staminate, staminal.** Having stamens but not pistils; said of a flower or plant that is male, hence not seed-bearing.
- Staminiferous.** Stamen-bearing.
- Staminode (-ia, -ium).** A sterile stamen (not pro-

- ducing viable pollen) or what corresponds to a stamen.
- Standard.** The upper petal of a papilionaceous flower.
- Stele.** The portion of an axis or stem containing the vascular tissue.
- Stellate.** Star-shaped. **Stellular, stellulate:** resembling a little star or stars.
- Stem.** The axis or axes of a plant arising from its roots.
- Sterile.** Infertile or barren, as a stamen lacking an anther, a flower wanting a pistil, a seed without an embryo, etc.
- Stigma.** The receptive part of the pistil on which the pollen germinates. **Stigmatal, stigmatic:** pertaining to the stigma. **Stigmatose:** provided with stigmas or having them conspicuous. **Stigmatiferous:** stigma-bearing.
- Stipe.** The leaf stalk of a fern; the stalk beneath an ovary. **Stipitate:** having a stipe or stalk, as an elevated gland.
- Stipel.** A minute stipule on a partial petiole of compound leaves. **Stipellate:** furnished with stipels.
- Stipule.** One of the pair of usually foliaceous appendages found at the base of the petiole in many plants. **Stipulate, stipular:** possessing stipules.
- Stolon.** A modified stem bending over and rooting at the tip; or creeping and rooting at the nodes; or a horizontal stem that gives rise to a new plant at its tip. Cf. *Runner*, a very slender stolon, and *Rhizome*, a subterranean stem. **Stoloniferous:** having stolons. **Stoloniform:** having the form of stolons, stolonlike.
- Stomate.** A breathing pore or aperture in the epidermis. **Stomatiferous:** bearing stomates.
- Stomium.** Line of dehiscence in a fern sporangium.
- Stone.** The bony endocarp of a drupe. **Stone cells:** the individual cells that have become hardened by secondary deposit, the components of sclerogen.
- Stool.** The base of a plant from which offsets or layers are taken; several stems arising from the same root, as in wheat.
- Stramineous.** Straw-colored.
- Striate.** Marked with fine longitudinal lines or furrows. **Striolate:** finely striate.
- Strict.** Very straight and upright, not at all lax or spreading.
- Strigose.** Clothed with sharp and stiff appressed straight hairs. **Strigillose or strigulose:** minutely strigose.
- Strobilus, strobile.** Conelike aggregation of sporophylls. **Strobilaceous:** relating to or resembling a cone.
- Strophiole.** An appendage at the hilum of certain seeds, a caruncle. **Strophiolate:** possessing such appendages.
- Style.** The contracted portion of the pistil between the ovary and the stigma. **Style branches** may be only in part stigmatic, the remainder then being *appendage*. **Stylar:** relating to the style. **Styliferous:** bearing a style.
- Stylopodium.** An enlargement or disklike expansion at the base of the style, as in *Umbelliferae*.
- Sub-** Latin prefix meaning somewhat, almost of inferior rank, beneath.
- Suberose.** Corky in texture.
- Submerged, submersed.** Growing under water.
- Subtend.** To be below and close to, as the leaf subtends the shoot borne in its axil.
- Subterranean, subterraneous.** Underground.
- Subulate.** Awl-shaped. **Subuliferous:** bearing sharp points.
- Succulent.** Juicy; fleshy and soft.
- Sucker.** A shoot of subterranean origin; a haustorium, sometimes restricted to the penetrating organ or papilla.
- Suffrutescent.** Obscurely shrubby; very little woody, but not necessarily low.
- Suffruticose, suffruticulose.** With only the lower parts of the stems woody, the upper stems herbaceous and annual. Cf. *fruticulose*.
- Sulcate.** Longitudinally grooved, furrowed or channeled.
- Sulcus (-i).** A furrow or groove.
- Superimposed.** Cf. *superposed*.
- Superior.** Growing above, as an ovary that is free from the other floral organs.
- Superjacent.** Lying above or upon; overlying; superincumbent.
- Superposed.** Placed vertically over some similar or other part.
- Suprabasal.** Above the base.
- Suculose.** Producing suckers.
- Surficial.** Of or pertaining to a surface, as the face of umbelliferous seeds.
- Suture.** The line of dehiscence of fruits or anthers; the line of a natural union or division between coherent parts.
- Swale.** A moist meadowy area lower than the surrounding areas.
- Symmetrical.** Possessing one or more planes of symmetry (i.e., planes which divide the object into mirror-image halves).
- Sympatric.** Growing together with, or having the same range as.
- Sympetalous.** With petals united in a one-piece corolla; gamopetalous.
- Symphodium.** An apparent main axis formed of successive secondary axes, each of which represents one fork of a dichotomy, the other being much weaker or entirely suppressed. **Symphodial:** of the nature of a symposium.
- Syn-** Greek prefix meaning united; adhesion or growing together.
- Synanthesis.** The simultaneous maturing of stamens and pistils.
- Synanthetic.** A plant whose fruit is compounded of many carpels or whose flowers are regularly coalescent (as in species of *Lonicera*).
- Syncarp.** A multiple or fleshy aggregate fruit, as the mulberry or magnolia.
- Syngenesious.** Belonging to the *Compositae*; with anthers cohering in a ring.
- Synonym.** A systematic name, as for a species, that was superfluous when published, or for some other reason is rejected in favor of another for the same taxon.
- Talus.** Rock debris at the base of a cliff or slope, chiefly as the result of gravitational roll or slide.
- Tangential.** At right angles to the radial or medullary rays.
- Taproot.** A primary stout vertical root giving off small laterals but not dividing.
- Tawny.** Dull-brownish-yellow; fulvous.
- Taxon (pl., taxa).** Any taxonomic unit, as an order, genus, species, variety, etc.
- Taxonomy.** The classification of plants or animals in a systematic order.
- Tectiform.** Rooflike; serving as a cover or lid.
- Tendril.** A slender, coiling or twining organ by which a climbing plant grasps its support.
- Tepal.** Used in the plural for sepals and petals of similar form and not readily differentiated, as in *Amaryllidaceae*.
- Teratology.** The study of malformations and monstrosities. **Teratological** (adj.).
- Terete.** Cylindrical; round in cross section.

- Terminal.** Proceeding from, or belonging to, the end or apex.
- Ternary.** Consisting of threes; trimerous. *Ternate:* in threes, as a leaf consisting of three leaflets.
- Terrestrial.** Growing in the ground and supported by soil.
- Tertiary.** Of the third formation, order or rank.
- Tessellate.** The surface marked by checkered work, either as depressions or color patterns.
- Testa.** The outer seed coat.
- Testiculate.** Shaped like the tubers of some orchids and some didymous fruits.
- Tetra.** A Greek prefix to mean four.
- Tetrad.** A group of four similar objects, as the four pollen grains formed from one pollen mother cell, often remaining coalescent.
- Tetradynamous.** Having four long and two short stamens.
- Tetragonal, tetragonous.** Four-angled.
- Tetramerous.** Having the floral organs in fours or multiples of four.
- Tetraploid.** Having four basic chromosome sets (four times the gametic number).
- Thallus.** A flat leaflike organ; used sometimes for entire plant in Lemnaceae.
- Theca (-ae).** An anther; the loculus of an anther.
- Thorn.** Cf. *Spine*, but technically a sharp-pointed stiff woody body derived from a modified branch.
- Throat.** The orifice of a gamopetalous corolla; the expanded portion between the limb and the tube proper.
- Thyrse, thyrus (-i).** A compact, ovate panicle; strictly, with main axis indeterminate, but with other axes cymose. *Thyrsiform:* shaped like a thyrse. *Thyrsoid:* like a thyrse.
- Tomentose.** With tomentum; covered with a rather short, densely matted, soft white wool. *Tomentulose:* the diminutive. *Tomentum:* a covering of such densely matted woolly hairs.
- Tooth.** Any small marginal lobe. *Toothed:* dentate.
- Topotype.** A specimen of a named species from the original or type locality.
- Torose.** Cylindrical with alternate swellings and constrictions, as a rhizome. *Torulose:* the diminutive.
- Tortile.** Twisted or twining.
- Tortuous.** Bent or twisted in different directions.
- Torus.** Cf. *Receptacle*.
- Trabecula (-ae).** A cross-bar. *Trabecular:* like a cross-bar. *Trabeculate:* cross-barred.
- Trailing.** Prostrate but not rooting.
- Transection.** Transverse section.
- Translator.** Employed for the retinaculum of the Asclepiadaceae.
- Translucent.** Transparent to light only.
- Trapeziform:** an unsymmetrical four-sided figure, as a trapezium, almost the same as rhombiform. *Trapezoid:* like a trapezium.
- Tree.** A woody plant with one main stem, and at least four or five meters tall.
- Tri-.** A Latin prefix signifying three, thrice, or triply.
- Triadelphous.** Stamens in three sets.
- Triandrous.** Having three stamens.
- Trichome.** Any hairlike outgrowth of the epidermis, as a hair or bristle.
- Trichotomous.** Three-forked.
- Tricoccos.** Consisting of three cocci.
- Tridentate.** Three-toothed.
- Trifid.** Three-cleft to about the middle.
- Trifoliolate.** Having three leaves, as in *Trillium*. *Trifoliolate:* with three leaflets.
- Trifurcate.** Having three forks or branches.
- Trigonous, trigonal.** Three angled, the faces between planes.
- Trilobed, trilobate.** Three-lobed.
- Trilocular.** Three-celled.
- Trimerous.** Having the parts in threes.
- Trimorphic, trimorphous.** Occurring under three forms, of stamens or styles—long, short and intermediate.
- Tripartite.** Three-parted.
- Tripinnate.** Thrice pinnate. *Tripinnatisect:* thrice pinnatisect.
- Triquetrous.** Three-edged, the faces between concave.
- Tristichous.** In three vertical rows.
- Triternate.** Thrice ternate.
- Trulliform.** Shaped like a bricklayer's trowel.
- Truncate.** As if cut off squarely at the end.
- Trunk.** The main stem of a tree; used for the body of the petal in *Drymaria*.
- Tube.** The narrow basal portion of a gamopetalous corolla or a gamosepalous calyx. *Tubiform:* tubular or trumpet-shaped.
- Tuber.** A thickened, solid, and short underground stem, with many buds. *Tuberous, tuberiferous:* bearing a tuber; resembling a tuber. *Tuberiform:* shaped like a tuber. *Tuberoid:* said of a fleshy-thickened root, resembling a tuber, as in many terrestrial orchids.
- Tubercle.** A small tuberlike prominence or nodule; the persistent base of the style in some Cyperaceae. *Tubercled, tuberculate:* beset with tubercles or warty excrescences; verrucose. *Tuberculose:* consisting of or having tubercles.
- Tubillus.** The tube of the filaments in Compositae; the elongate stylelike inner bracts of the ovule integument in *Ephedra*.
- Tubular, tubiform.** Shaped like a hollow cylinder.
- Tuft, tufted.** Cespitose, clustered or clumped.
- Tumid.** Inflated, swollen.
- Tunicate, tunicated.** Having coats or tunics, as a bulb.
- Turbinate.** Top-shaped; inversely conical.
- Turgid.** Swollen; inflated.
- Turion.** A scaly, often thick and fleshy, shoot produced from a bud on an underground rootstock, as in some species of *Potamogeton*.
- Tylose.** A cell intruding into a duct.
- Type.** A nomenclatural type is that constituent element of a taxon to which the name of the taxon is permanently attached, whether as an accepted name or as a synonym.
- Type specimen.** The original specimen from which a description was written, at least in part.
- Umbel.** A flat or convex flower cluster in which the pedicels arise from a common point, like rays of an umbrella. *Umbellate:* borne in an umbel. *Umbellet:* a secondary umbel. *Umbelliferous:* bearing umbels. *Umbelliform:* umbel-shaped. *Umbellule:* an ultimate umbel in a compound one.
- Umber.** Brown with a reddish hue.
- Umbilicus.** A navel; the hilum of a seed. *Umbilicate:* depressed in the center.
- Umbo, umbone.** A boss or protuberance. *Umbonate:* bearing an umbo or boss or conical projection in the center, as the scale of a pine cone.
- Umbracliform.** Having the general form of a parasol, as the stigmas of *Sarracenia*.
- Uncinate.** Hooked at the tip. *Uncinulate:* the diminutive.
- Undershrub.** A very low shrub.
- Undulate.** Wavy; repand; with less pronounced "waves" than sinuate.
- Unguiculate.** Contracted at base into a claw.
- Uni-.** A prefix, meaning one.
- Uniflorous.** One-flowered.
- Unifoliolate.** One leaf. *Unifoliolate:* with one leaflet only.

- Unilateral.** One-sided, or turned to one side of an axis; secund.
- Unilocular.** Having one locule or cell.
- Uniseriate.** Arranged in one horizontal row.
- Unisexual.** Flowers having only stamens or pistils; of one sex.
- Urceolate.** Urn-shaped or pitcherlike, contracted at the mouth.
- Utricle.** A small, bladderlike one-seeded fruit. *Utricular:* having little bladders; inflated.
- Vaginate.** Loosely surrounded by a sheath. *Vaginiform:* sheath-shaped.
- Valve.** One of the segments into which a dehiscent capsule or legume separates. *Valvate, valvular:* opening as if by valves, as most capsules and some anthers; in aestivation, meeting at the edges without overlapping.
- Varicose.** Abnormally enlarged in places, irregularly swollen.
- Variegated.** Irregularly colored in patches, blotched.
- Variety.** Plants having minor characters or variations that separate them from one or more similarly characterized varieties.
- Vascular.** Provided with conducting cells such as vessels, sieve tubes or tracheids.
- Vegetative, vegetal:** having the power to grow—as stems and leaves—opposed to growth from reproduction.
- Vein.** A vascular bundle of a leaf or other flat organ, cf. *nerve*. *Veinlet:* one of the ultimate branches of a vein.
- Velum.** The membranous indusium in *Isoetes*.
- Velutinous.** Velvety; covered with a fine and dense silky pubescence.
- Venation.** The arrangement of the veins of a leaf; nervation; veining. *Venose:* veiny, abounding in veins. *Venulose:* abounding in veinlets.
- Venter.** Belly; under part.
- Ventral.** Relating to the inward face of an organ, in relation to the axis; anterior; front; opposed to dorsal.
- Ventricose.** Inflated or swelling out on one side or unequally; gibbous.
- Verdigris.** The sea-green "rust" of brass.
- Vermicular, vermiform.** Worm-shaped or wormlike. *Vermiculate:* marked with tortuous impressions, as if worm-eaten. *Vermiculiiform:* shape of a small worm.
- Vermilion.** Scarlet, brilliant red approaching orange.
- Vernal.** Appearing in spring.
- Vernation.** The arrangement of foliage leaves within the bud.
- Vernicose.** As if varnished, shiny.
- Verruca (-ae).** A wart or elevation sometimes of a glandular nature. *Verrucose:* warty; covered with wartlike excrescences; tuberculate. *Verruculose:* very warty, much covered with warts.
- Versatile.** An anther attached near the middle and capable of swinging freely on the filament.
- Verticil.** A whorl, or circular arrangement of similar parts about the same point on an axis. *Verticelled, verticillate:* whorled.
- Verticillaster.** A false whorl, composed of a pair of nearly sessile cymes in the axils of opposite leaves, as in many mints. *Verticillastrate:* possessing false whorls.
- Vesicle.** A little bladder or air cavity. *Vesicular:* pertaining to, or having the form of, a vesicle. *Vesiculate; vesiculous:* as if composed of little bladders.
- Vespertine.** Blossoming in the evening.
- Vestigial.** Reduced to a vestige or trace of a part or organ originally more perfectly developed.
- Vestiture.** That which covers the surface, as hair, scales etc.
- Villous (-ose).** Bearing long and soft and not matted hairs; shaggy. *Villosity:* shagginess, a coating of long weak hairs.
- Vinaceous.** Wine-colored, purplish-red.
- Virgate.** Wand-shaped; slender, straight and erect.
- Viscid, viscous.** Sticky; glutinous. *Viscidulous;* slightly viscid.
- Vitreous.** Transparent, hyaline, formerly used for the light green of glass.
- Vitta.** An aromatic oil tube of the pericarp of most Umbelliferae. *Vittate:* bearing vittae; longitudinally striped.
- Viviparous.** Germinating or sprouting from spores or buds while still attached to the parent plant.
- Whorl.** A ring of similar organs radiating from a node; verticil.
- Wing.** A thin and usually dry extension bordering an organ; a lateral petal of a papilionaceous flower. *Winged:* bearing a wing; alate.
- Woolly.** Having long, soft, entangled hairs; lanate. Cf. *tomentose*.
- Wort.** A plant or herb of any kind, especially a pot herb.
- Xeric.** Characterized by or pertaining to conditions of scanty moisture supply.
- Xerophyte.** A drought-resistant or desert plant. *Xerophytic* (adj.).
- Xylem.** The water and mineral conducting elements of a vascular bundle.
- Zygomorphic, zygomorphous.** Bilaterally symmetrical; that which can be bisected by only one plane into similar halves. *Zygomorphy:* state of being zygomorphic.
- Zygote.** A cell produced by fertilization or conjugation of two gametes.

ABBREVIATIONS AND SIGNS

- Adj., adjacent.
 Adv., adventive.
 Afghan., Afghanistan.
 Afr., Africa.
 Ags. or Aguasc., Aguascalientes.
 Ala., Alabama.
 Alas., Alaska.
 Alt., altitude(s).
 Alta., Alberta.
 Am., America or American.
 Arct., Arctic.
 Arg., Argentina.
 Ariz., Arizona.
 Ark., Arkansas.
 Assoc., association(s).
 Atl., Atlantic.
 Auct., auctor (originator).
 Austral., Australia.
 Auth., authors.
 Bah. I., Bahama Islands.
 Baja Calif., Baja California.
 B.C., British Columbia.
 Berm., Bermuda.
 Bol., Bolivia.
 Braz., Brazil.
 Br. Gui., British Guiana.
 Br. Hond., British Honduras.
 C.A., Central America or Central American.
 Calif., California.
 Can., Canada.
 Carib., Caribbean.
 Cen., central.
 Cf., compare, confer.
 Chih., Chihuahua(n).
 Chis., Chiapas.
 Cm., centimeter(s), the 100th part of a meter = about 2/5 of an inch.
 Co. or cos., county(ies).
 Coah., Coahuila.
 Col., Colombia.
 Colo., Colorado.
 Conn., Connecticut.
 Cont., continental.
 Corr., corrected, as "(Corr. Willd.)".
 C.R., Costa Rica.
 Cult., cultivated or cultivation.
 D.C., District of Columbia.
 Del., Delaware.
 Descr., description.
 D.F., Distrito Federal.
 Dgo., Durango.
 Disj., disjunct.
 Dm., decimeter(s), the 10th part of a meter = about 4 inches.
 E., east or eastern.
 Eastw., eastward.
 Ecu., Ecuador.
 E.I., East Indies.
 Elev., elevation(s).
 Emend., emendavit (emendate).
 Eng., England.
 Err., error.
 Eur., Europe, European.
 Euras., Eurasia(n).
 F., filius, son, or the younger (when following the name of an author); form (forma), in relation to a plant variant.
 Fl., flower.
 Fla., Florida.
 Fr., France, fruit.
 Ft., feet.
 Ga., Georgia.
 Gr. Ant., Greater Antilles.
 Greenl., Greenland.
 Gro., Guerrero.
 Gto., Guanajuato.
 Guat., Guatemala.
 Gui., Guiana(s).
 Hgo., Hidalgo.
 H.I., Hawaiian Islands.
 Hisp., Hispaniola.
 Hond., Honduras.
 I. or Is., island(s).
 Ia., Iowa.
 Icel., Iceland.
 Ida., Idaho.
 Ill., Illinois.
 Illegit., illegitimate.
 Incl., including.
 Introd., introduced.
 Ind., Indiana.
 Ire., Ireland.
 Isr., Israel.
 It., Italy.
 Jal., Jalisco.
 Jam., Jamaica.
 Kan., Kansas.
 Ky., Kentucky.
 La., Louisiana.
 Lab., Labrador.
 Less. Ant., Lesser Antilles.
 L.I., Long Island.
 M., meter(s) = about 39.3 inches.
 Madag., Madagascar.
 Man., Manitoba.
 Mass., Massachusetts.
 Md., Maryland.
 Me., Maine.
 Medit., Mediterranean.
 Mex., Mexico.
 Mich., Michigan.
 Michoac., Michoacan.
 Midwest., midwestern.
 Minn., Minnesota.
 Miss., Mississippi.
 Mm., millimeter(s) = about 1/25 on an inch.
 Mo., Missouri.
 Mont., Montana.
 Mor., Morelos.
 Mt., mts., mountain(s).
 N., north or northern.
 N.A., North America or North American.
 N.Afr., North Africa.
 Nat., native.
 Nay., Nayarit.
 N.B., New Brunswick.
 N.C., North Carolina.
 N.D., North Dakota.
 N.E., New England.
 N.e., northeast or northeastern.
 Neb., Nebraska.
 Nev., Nevada.
 Nfld., Newfoundland.
 N.H., New Hampshire.

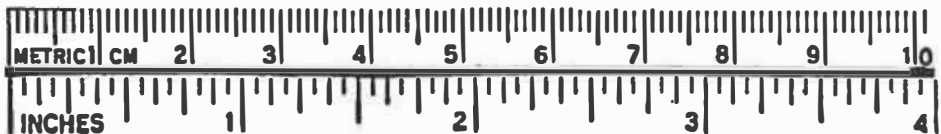
N. Hemis., Northern Hemisphere.
 Nic., Nicaragua.
 N.J., New Jersey.
 N.L., Nuevo Leon.
 N.M., New Mexico.
 Nom. conf., nomina confusa (confused name).
 Nom. rej., nomina rejicienda (rejected name).
 Northw., northward.
 N.S., Nova Scotia.
 N.w., northwest.
 N.Y., New York.
 N.Zeal., New Zealand.
 O., Ohio.
 Oax., Oaxaca.
 Okla., Oklahoma.
 Ont., Ontario.
 Ore., Oregon.
 Orthogr., orthographical.
 Pa., Pennsylvania.
 Pac., Pacific.
 Pan., Panama.
 Pantrop., pantropical.
 Parag., Paraguay.
 P.E.I., Prince Edward Island.
 Pen., peninsula (r).
 Phil., Philippines.
 Polyn., Polynesia.
 P.p., pro parte (in part).
 P.R., Puerto Rico.
 Pue., Puebla.
 Que., Quebec.
 Queensl., Queensland.
 Qro., Queretaro.
 Q. Roo, Quintana Roo.
 Ref., reference.
 R.I., Rhode Island.
 Russ., Russia.
 S., south or southern.
 S.A., South America or South American.
 S.Afr., South Africa.
 Salv., Salvador.
 S.C., South Carolina.
 Scot., Scotland.
 S.D., South Dakota.
 S.e., southeast or southeastern.
 Sect., Section.

Sens. amplo (or s. amplo), senior amplo (broad sense).
 Sens. lat. (or s.l.), senior latior (broad sense).
 Sens. str., senior strictior (strict sense).
 Senu, in the sense of.
 Ser., Series.
 Sib., Siberia.
 Sin., Sinaloa.
 S.L.P., San Luis Potosí.
 Son., Sonora.
 Sp. or spp., species
 S.Pac., South Pacific.
 Southw., southward.
 Southwestw., southwestward.
 Subg., subgenus.
 Subsp. or ssp., subspecies.
 Subtrop., subtropical.
 S.w., southwest.
 Tab., Tabasco.
 Tam., Tamaulipas.
 Temp., temperate.
 Tenn., Tennessee.
 Tex., Texas.
 Trin., Trinidad.
 Trop., tropical or tropics.
 U.S., United States.
 Urug., Uruguay.
 Ut., Utah.
 Va., Virginia.
 Var., variety.
 Venez., Venezuela.
 Ver., Veracruz.
 Vic., vicinity.
 Virg. I., Virgin Islands.
 Vt., Vermont.
 W., west or western.
 Wash., Washington.
 Westw., westward.
 W. Hemis., Western Hemisphere.
 W.I., West Indies.
 Wisc., Wisconsin.
 W.Va., West Virginia.
 Wyo., Wyoming.
 Yuc., Yucatan.
 Yuk., Yukon Terr.
 Zac., Zacatecas.

? = Indicates doubt.

X = Crossed with, the symbol for a hybrid.

Figures or words connected by the short dash indicates the extremes of variation, as "5-10 mm. long; few- to many-flowered," i.e., varying from five to ten millimeters in length, and from few- to many-flowered.



ABBREVIATIONS OF AUTHORS' NAMES

(Arranged alphabetically in regard to the abbreviation and not the full name. Based primarily on the compilation by David D. Keck in Munz' and Keck's "A California Flora" (1959); with permission.)

- Abrams. LeRoy Abrams, 1874-1956, professor of botany, Stanford University, California; author of "Flora of Los Angeles and Vicinity" (1917), "An Illustrated Flora of the Pacific States" (vol. I, 1923, vol. II, 1944, vol. III, 1951, vol. IV (with Roxana Judkins (née Stinchfield) Ferris, 1960).
- Adams. William Preston Adams, 1930- , Dept. of Botany, DePauw University, Greencastle, Indiana; Hypericaceae (*Hypericum*).
- Adams & Robson. W. P. Adams and N. K. B. Robson.
- Adans. Michel Adanson, 1727-1806, French botanist and explorer; author of "Familles des Plantes" (1763); originated some 1600 generic names.
- Aellen. Paul Aellen, 1896- , professor in Basel, Switzerland; student of Chenopodiaceae.
- Agardh. Carl Adolf Agardh, 1785-1859, noted Swedish algologist, professor at Lund (1807-1835); later bishop of Karlstad.
- Ahles. Harry E. Ahles, 1924- , Dept. of Botany, University of North Carolina, Chapel Hill; later University of Massachusetts, Amherst; author (with A. E. Radford and C. Ritchie Bell) of "Guide to the Vascular Flora of the Carolinas" (1964) and "Manual of the Vascular Flora of the Carolinas" (1968).
- Ait. William Aiton, 1731-1793, famous English botanist, Royal Gardener at Kew; issued "Hortus Kewensis" (1789)
- Ait. f. William Townsend Aiton, the son, 1766-1849, director of Kew (1793-1841); issued "Hortus Kewensis," ed. 2 (1810-1813).
- Alef. Friedrich Georg Christoph Alefeld, 1820-1872, German physician and botanist.
- Alex. Edward Johnson Alexander, 1901- , New York Botanical Garden; authority on botany of southeastern United States; Iridaceae (*Iris*).
- All. Carlo Allioni, 1725(?) -1804, Italian physician and botanist, professor of botany, Turin; author of "Flora Pedemontana" (1785).
- Alston. Arthur Hugh Garrit Alston, 1902-1958, English pteridologist, British Museum, London.
- Ames. Oakes Ames, 1874-1950, director of the Botanical Museum, Harvard University; eminent orchidologist and economic botanist; author of numerous works.
- Ames & Correll. O. Ames, and D. S. Correll.
- Ames & C. Schweinf. O. Ames, and Charles Schweinfurth, 1890- , Oaks Ames Orchid Herbarium, Harvard University; eminent orchidologist; author of Orchidaceae in Macbride's "Flora of Peru" (1958-1961).
- Anders. Edgar Shannon Anderson, 1897-1969, Missouri Botanical Garden, St. Louis; experimental taxonomy.
- Anders. & Woods. E. S. Anderson, and R. E. Woodson.
- L. C. Anderson. Loran Crittenden Anderson, 1936- , Kansas State University, Manhattan; Compositae (*Chrysothamnus*).
- Anderss. Nils Johan Andersson, 1821-1880, Swedish botanist, director of the Botanical Museum, Stockholm; collected in California in 1852; *Salix*, *Andropogon*.
- Andrz. Antoni Lukianowicz Andrzejowski, 1784-1868, professor of botany, Vilna, Lithuania.
- Anthony. Margery Stuart Anthony, 1924- , Chico State College, California; Cactaceae (Opuntias of the Big Bend), ecology.
- Ard. Pietro Arduino, 1728-1805, Italian botanist and agriculturist, Padua.
- Arech. José Arechavaleta, 1838-1912, Spanish-born Uruguayan botanist; author of "Flora Uruguaya" (1898-1911).
- Arn. George Arnold Walker Arnott, 1799-1868, Edinburgh and Glasgow botanist.
- Arthur. Joseph Charles Arthur, 1850-1942, authority on plant rusts, Purdue; editor of BOTANICAL GAZETTE.
- Asch. Paul Friedrich August Ascherson, 1834-1913, professor of botany, Berlin.
- Asch. & Graebn. P. F. A. Ascherson, and Karl Otto Robert Peter Paul Graebner, 1871-1933, professor of botany, Berlin.
- Ashe. William Willard Ashe, 1872-1932, North Carolina botanist and forester, U. S. Forest Service; *Panicum*, *Asarum*, *Crataegus*, *Polycodium*.
- Aubl. Jean Baptiste Christophe Fusée Aublet, 1720-1778; French botanical collector and author of a French Guiana flora (1775).
- Aust. Coe Finch Austin, 1831-1880, American botanist; Lemnaceae.
- Averett. John Earl Averett, 1943- , Dept. of Botany, University of Texas, Austin; *Chamaesaracha* (Solanaceae).
- Backeberg. Curt Backeberg, 1894- , cactus specialist, Germany.
- Bailey. Liberty Hyde Bailey, 1858-1954, Cornell University; eminent horticulturist and author, "Standard Cyclopedia of Horticulture" (1914-1917), "Manual of Cultivated Plants" (1925), "Hortus" (1930), etc.; founder of GENTES HERBARUM; student of *Carex*, *Rubus*, palms, Cucurbitaceae.

- Baill. Henri Ernest Baillon, 1827-1895, Paris botanist and physician; author of "Histoire des Plantes" (1827-1895) and many other works.
- Baird. Published on Cactaceae in 1931.
- Baker. John Gilbert Baker, 1834-1920, Keeper of the Herbarium, Kew (1890-1899); student of ferns, Amaryllidaceae, Bromeliaceae, Iridaceae, Liliaceae, Compositae, and the flora of tropical Africa.
- E. G. Baker. Edmund Gilbert Baker, the son, 1864-1949, British Museum, London.
- Baldw. William Baldwin, 1779-1819, Pennsylvania physician and botanist who collected and studied plants of Delaware, Georgia and South America, died while on expedition to Rocky Mountains.
- Ball. Carleton Roy Ball, 1873-1958, Senior agronomist, United States Dept. of Agriculture, Washington; authority on *Salix*.
- Ball & Heywood. P. W. Ball, and Vernon Hilton Heywood, 1927- , professor of botany, University of Liverpool, England; flora of Iberian Peninsula (especially of southeastern Spain), *Digitalis*.
- P. W. Ball. Peter William Ball, 1932- , botanist, University of Liverpool, England; Flora Europaea.
- Banks. Sir Joseph Banks, 1743-1820, British naturalist, traveler, philanthropist and scientist, accompanied Capt. Cook in his first voyage of circumnavigation in 1768; early director of Kew; president of the Royal Society.
- D. Banks. Donald Jack Banks, 1930- , Oklahoma State University, Stillwater; Gramineae (*Paspalum*).
- Barkl. Fred Alexander Barkley, 1908- , Professor of botany Northeastern University, Boston (1965-), formerly University of Texas, Austin (1943-47), U. S. State Dept., Medellin, Colombia (1947-49), Inst. Miguel Lillo, Tucuman, Argentina (1949-51), industrial chemicals (1951-61), University of Baghdad, Iraq (1963-1965); Anacardiaceae; *Begonia*.
- Barneby. Rupert Charles Barneby, 1911- , New York Botanical Garden; student of the North American Great Basin flora; *Astragalus*.
- Barnh. John Hendley Barnhart, 1871-1949, American bibliographer, New York Botanical Garden; Lentibulariaceae.
- Barr. Joseph Barratt, 1796-1882, Connecticut; geologist.
- Bart. William Paul Crillon Barton, 1786-1856, professor of botany, Pennsylvania; author of "A Flora of North America" (1820-1823).
- Bartal. Biagio Bartalini, 1746-1822, Italian botanist.
- Bartl. Friedrich Gottlieb Bartling, 1798-1875, professor of botany, Göttingen.
- Bartlett. Harley Harris Bartlett, 1886-1960, professor of botany, University of Michigan, Ann Arbor.
- Bartr. William Bartram, 1739-1823, American botanist in Philadelphia; author of "Travels through North and South Carolina, etc." (1791).
- Bates. Rev. John Mallory Bates, 1846-1930, Nebraska clergyman, botanist and ornithologist who studied plants of the state; Cyperaceae.
- Batsch. August Johann Georg Karl Batsch, 1761-1802, German botanist and horticultural writer, Jena.
- Baum. Bernard Rene Baum, 1937- , Paris-born Canadian botanist, Plant Research Institute, Ottawa, Canada; *Avena*; *Tamarix*.
- Baumg. Johann Christian Gottlob Baumgarten, 1765-1843, German botanist.
- Baxt. Edgar Martin Baxter, 1903-1967, Cactaceae hobbyist; author of "California Cactus," 1935.
- Beadle. Chauncey Delos Beadle, 1866-1950, Canadian-born botanist with Biltmore Herbarium, North Carolina (1890-1916); botany of southern United States.
- Beadle & Boynt. C. D. Beadle, and F. E. Boynton.
- Beal. William James Beal, 1833-1924, Michigan State University, East Lansing, agrostologist, botanist; author of "Michigan Flora" (1904).
- E. O. Beal. Ernest Oscar Beal, 1928- , North Carolina State University, Raleigh; later Western Kentucky University, Bowling Green; Nymphaeaceae (*Nuphar*), Lemnaceae, Experimental Taxonomy of aquatic plants.
- Beaman. John Homer Beaman, 1929- , Michigan State University, East Lansing; Compositae; high altitude floras of Mexico and Central America.
- L. S. Beard. Luther Stanford Beard, 1929- , University of North Carolina, Chapel Hill and Campbell College, Buies Creek, North Carolina; Leguminosae (*Schrankia*).
- Beaudry. Jean Romuald Beaudry, 1917- , Dept. Biol. Sciences, University of Montreal, Canada; Compositae (*Solidago*).
- Beauv. Baron Ambroise Marie François Joseph Palisot de Beauvois, 1752-1820, French naturalist; Gramineae.
- Bebb. Michael Schuck Bebb, 1833-1895, Illinois; *Salix*.
- Becc. Odoardo Beccari, 1843-1920, Italian botanist and world authority on palms and flora of Borneo.
- Beck. Lewis Caleb Beck, 1798-1853, United States.
- Beer. Joseph Georg Beer, 1803-1873, Austrian writer on orchids and bromeliads.
- Beetle. Alan Ackerman Beetle, 1913- , professor of agronomy, University of Wyoming, Laramie; Gramineae, Cyperaceae.
- Benedict. Ralph Curtiss Benedict, 1883-1965, professor of botany, Brooklyn College, New York; pteridologist; one of the organizers of the American Fern Society.
- Benke. Hermann Conrad Benke, 1869-1946, school teacher, photographer, botanist, Chicago, Illinois.
- Benner. Walter Mackinnett Benner, 1888- , Academy of Natural Sciences, Philadelphia; *Lycopus*; student of flora of Bucks Co., Pennsylvania.
- L. Benson. Lyman David Benson, 1909- , professor of botany, Pomona College, California; author (with Robert A. Darrow) of "A Manual of Southwestern Desert Trees and Shrubs" (1945); "Plant Classification" (1957); *Ranunculus*; Cactaceae.
- L. Benson & Walkington. L. D. Benson, and David Leo Walkington, 1930- , California State College, Fullerton; chemical studies of Cactaceae.
- Benth. George Bentham, 1800-1884, long-time president of the Linnaean Society; outstanding English taxonomist; author of "Plantas Hartwegianae . . . enumerat" (1839); "Handbook of

- the British Flora" (1858, with later editions); "Flora Hongkongensis" (1861); "Flora Australiensis" (1863-1878); and monographic works on Leguminosae, Labiatae, Scrophulariaceae, etc.
- Benth. & Hook. (or B. & H.). G. Bentham, and Sir J. D. Hooker; authors of "Genera Plantarum" (1862-1883).
- Bercht. & Presl. Friedrich Graf von Berchtold, 1781-1876, Austrian botanist, and K. B. Presl.
- Berg. Peter Jonas Bergius, 1730-1790, Swedish physician and botanist.
- Berger. Alwin Berger, 1871-1931, curator of the garden at La Mortola, Italy; student of Cactaceae and other succulents.
- Berl. Jean Louis Berlandier, 1805-1851, French-Swiss physician who collected plants in northern Mexico and Texas; Grossulariaceae.
- Bernh. Johann Jacob Bernhardt, 1774-1850, professor of botany, Erfurt, Germany.
- Bert. Antonio Bertoloni, 1775-1869, professor of botany, Bologna (1815-1869); author of "Flora Italica" (1833-1854).
- Bess. Wilibald Swibert Joseph Gottlieb von Besser, 1784-1842, Austrian botanist, professor in the Wolhynien Lyceum (Poland); student of the flora of Galicia and southwest Russia.
- Betcke. Ernst Friedrich Betcke, b. ? -1865, Mecklenburg, Germany.
- Beyr. Heinrich Carl Beyrich, 1796-1834, Prussian botanist who collected in Georgia, South Carolina and Texas.
- Bickn. Eugene Pintard Bicknell, 1859-1925, New York banker and amateur botanist.
- Bieb. Baron Friedrich August Marschall von Bieberstein, 1768-1826, Stuttgart; German explorer and author of works on the flora of southern Russia and the Caucasus.
- Biehler. Johann Friedrich Theodor Biehler, published in 1807, Germany.
- Bigel. Jacob Bigelow, 1787-1879, professor of botany, Boston; author of "Florula Bostoniensis" (1814), and "American Medical Botany" (1817).
- Bisch. Gottlieb Wilhelm Bischoff, 1797-1854, professor of botany, Heidelberg, Germany.
- Bissell. Charles Humphrey Bissell, 1857-1925, one of a group of authors who published "Catalogue of the flowering plants and ferns of Connecticut growing without cultivation" (1910).
- Biv. Baron Antonio Bivona-Bernardi, 1778-1837, Messina, Sicily.
- Bl. Carl Ludwig von Blume, 1796-1862, Dutch botanist, director of the botanic garden at Batavia and writer (with J. B. Fischer) on the flora of Java (1828-51).
- Blackwell. Will Hoyle Blackwell, Jr., 1939- , Miami University, Oxford, Ohio; Flora of Ohio, Rubiaceae.
- Blake. Sidney Fay Blake, 1892-1959, United States Dept. of Agriculture, Beltsville, Maryland; authority on Compositae, *Polygala*, bibliographer; author of "Geographical Guide to the Floras of the World" (with Alice C. Atwood), Pt. I (1942), Pt. II (1961).
- Blake & Shiller. S. F. Blake, and I. Shiller.
- Blank. Joseph William Blankinship, 1862-1938, botanist and plant pathologist, Montana Agricultural College, Bozeman, later with smelting companies.
- Boeck. Johann Otto Boeckeler, 1803-1899, apothecary-botanist of Oldenburg, Germany; Cyperaceae.
- Boehm. Georg Rudolf Boehmer, 1723-1803, German botanist, Leipzig.
- Bogin. Clifford Bogin, 1920- , New York Botanical Garden; later Woodmere Academy, Long Island, New York; *Sagittaria*.
- Bogusch. Edwin Robert Bogusch, 1905- , biologist, Texas College of Arts and Industries, Kingsville.
- Boiss. Pierre Edmond Boissier, 1810-1885, Swiss botanist and traveller, Geneva; one of the outstanding systematists of the 19th century; author of the monumental "Flora Orientalis" (1867-1884); monographer of the Plumbaginaceae and *Euphorbia*.
- Boiss. & Reut. P. É. Boissier, and Georges François Reuter, 1805-1872, Swiss botanist and traveller, conservator of the Herbarium Boissier, Geneva.
- Boivin. Joseph Robert Bernard Boivin, 1916- , Dept. of Agriculture, Ottawa, Canada; *Thalictrum*.
- Bojer. Wenjel Bojer, 1797-1856, Austrian.
- Bomhard. Miriam Lucille Bomhard, 1898-1952, United States Forest Service, Washington; author of "Palm trees in the United States," U.S.D.A. Bul. 22 (1950).
- Boott. Francis Boott, 1792-1863, American caricologist and physician who settled in London.
- W. Boott. William Boott, 1805-1887, Boston; *Carex*.
- Bor. Alexandre Boreau, 1803-1875, French botanist who wrote a flora of central France (1857).
- Borbás. Vinczé von Borbás, 1844-1905, Hungarian botanist.
- Bosc. Louis Augustin Guillaume Bosc, 1759-1828, French naturalist.
- Boyle. William Sidney Boyle, 1915- , professor of botany, Utah State University, Logan; Gramineae (*Melica*).
- Boynt. Frank Ellis Boynton, 1859- ? botanical collector for the Biltmore Herbarium, Biltmore, North Carolina; Supt. of Biltmore Estates to about 1935.
- Boynt. & Beadle. (cf. Beadle & Boynt.)
- A. Br. Alexander Carl Heinrich Braun, 1805-1877, professor of botany and director of the botanical garden, Berlin; Characeae, *Selaginella*, *Marsilea*.
- N. E. Br. Nicholas Edward Brown, 1849-1934, Kew; authority on the South African flora.
- P. Br. Patrick Browne, 1720-1790, Irish physician and naturalist, explorer of Jamaica, and an author of its natural history (1756).
- R. Br. Robert Brown, 1773-1858, British botanist, librarian and first keeper of botany, British Museum; a chief exponent of the Natural System; noted morphologist and cytologist.
- Brackett. Amelia Ellen Brackett, 1896-1926, Gray Herbarium, Harvard University.
- Brainerd. Ezra Brainerd, 1844-1924, president, Middlebury College, Vermont; *Viola*.
- Brand. August Brand, 1863-1930, German student of Polemoniaceae, Hydrophyllaceae and Boraginaceae.
- Brandeg. Townshend Stith Brandege, 1843-1925, civil engineer and his wife gave their valuable

- herbarium and library to the University of California in 1906; early collector and publisher of flora of Baja California, Mexico (1889, 1894).
- K. Brandeg. Mary Katharine (Layne) (Curran) Brandege, the wife, 1844-1920, California.
- Briq. John Isaac Briquet, 1870-1931, Swiss botanist, director of the Conservatoire Botanique, Geneva; Labiatae, Umbelliferae, Compositae; noted for his work to advance modern nomenclature through the Botanical Congresses.
- Britt. Nathaniel Lord Britton, 1859-1934, director-in-chief, New York Botanical Garden (1896-1930); flora of North America, West Indies, Bolivia; a prolific writer.
- Britt. & Rose. N. L. Britton, and J. N. Rose; authors of "The Cactaceae," 4 vols. (1919-23).
- Britt. & Rusby. N. L. Britton, and Henry Hurd Rusby, 1855-1940, dean of the New York College of Pharmacy, an active collector in South America; leader of the ill-fated South American expedition described in the book, "White Waters and Black" (1926, reprint 1931) by Gordon MacCreagh.
- Brizicky. George Konstantin Brizicky, 1901-1968, Gray Herbarium, Harvard University, Cambridge, Massachusetts; dendrology, forest pathology, researcher on generic flora of southeastern United States and Florida Keys.
- Brongn. Adolphe Théodore Brongniart, 1801-1876, noted paleobotanist and systematist of Paris.
- Brot. Felix di Avelar Brotero, 1744-1828, professor of botany, Coimbra, Portugal; author of "Flora Lusitanica" (1804).
- Broun. Maurice Broun, 1906- , Massachusetts, ornithologist; author of "Index to North American Ferns" (1938).
- Brummitt. Richard Kenneth Brummitt, 1937- , botanist, Royal Botanic Garden, Kew, England.
- B.S.P. N. L. Britton; Emerson Ellick Sterns, 1846-1928; Justus Ferdinand Poggenburg, 1840-1893, United States.
- Buch. Franz Georg Philipp Buchenau, 1831-1906, professor in Bremen; Alismataceae, Juncaceae.
- Buchh. John Theodore Buchholz, 1888-1951, professor of botany, Illinois; authority on the embryology of the Coniferae.
- Buchh. & Palm. J. T. Buchholz, and E. J. Palmer.
- Buc'hoz. Pierre Joseph Buc'hoz (Buchoz), 1731-1807, French (Lorraine) physician and naturalist.
- Buckl. Samuel Botsford Buckley, 1809-1884, state geologist of Texas; collected plants, shells and insects from Georgia to Texas.
- Bullock. Arthur A. Bullock, 1906- , English botanist, Kew; Asclepiadaceae and Periplocaceae (especially of Africa), Rubiaceae of Africa, nomenclature.
- Bunge. Alexander Andrejewitsch von Bunge, 1803-1890, Russian botanist and explorer, professor of botany, Dorpat; author of the flora of Russian and central Asia (1851); *Astragalus*.
- Bur. Edouard Bureau, 1830-1918, French botanist.
- Burgess. Edward Sandford Burgess, 1855-1928, professor of science, Hunter College, New York City, a student of the flora of Chautauqua County, New York; Compositae.
- Burk. Arturo Burkart, 1906- , Instituto de Botánica Darwinian, San Isidro, Argentina; Leguminosae.
- Burn. Johannes Burman, 1706(?) - 1779, Dutch physician and botanist.
- Burm. f. Nicolaas Laurens Burman, the son, 1734(?) - 1793, Dutch physician and botanist.
- Bush. Benjamin Franklin Bush, 1858-1937, postmaster, Independence, Missouri; amateur botanist.
- Butt. & St. John. Frederick King Butters, 1878-1945, professor of Botany, University of Minnesota, and Harold St. John, 1892- , professor of botany, Hawaii, formerly at Pullman; student of the flora of eastern Washington.
- Cabrera. Angel Lulio Cabrera, 1908- , Museo de la Plata, La Plata, Argentina; Compositae, phytogeography, Flora of Jujuy; author of "Manual de la Flora de los Alrededores de Buenos Aires" (1953).
- Camb. Jacques Cambessèdes, 1799-1863, French botanist.
- Camp. Wendell Holmes Camp, 1904-1963, Curator New York Botanical Garden (1936-1949), then professor of botany, University of Connecticut, Storrs, a leader in the founding of the American Society of Plant Taxonomists; Ericaceae (*Vaccinium*).
- A. Camus. Aimee Antoinette Camus 1879- , French taxonomist, specialist on Orchidaceae, and on flora of Indo-China.
- Canby. William Marriott Canby, 1831-1904, Delaware businessman; accumulator of a large herbarium.
- Carr. Elie Abel Carriere, 1818-1896, French horticulturist, Muséum d'Histoire Naturelle, Paris; editor of *Revue Horticole*; Coniferae.
- Caruel. Teodoro Caruel, 1830-1898, Italy.
- Casp. Johann Xaver Robert Caspary, 1818-1887, professor of botany, Königsberg.
- Cass. Alexandre-Henri Gabriel Comte de Cassini, 1781-1832, French botanist; Compositae.
- Cav. Antonio José Cavanilles, 1745-1804, Spanish botanist, professor of botany and director of the botanic gardens, Madrid; author of "Icones et descriptiones plantarum" (1791-1801).
- Čelak. Ladislav Josef Čelakovský, 1834-1902, professor of botany, Prague, Czechoslovakia; author of "Prodromus der Flora von Böhmen" (1867).
- Celarier. Robert P. Celarier, 1921-1959, Oklahoma State University, Stillwater; cytogenetics, experimental taxonomy, Andropogoneae.
- Celarier & Harlan. R. P. Celarier, and J. R. Harlan.
- Cels. Jacques Martin Cels, 1743-1806, French horticulturist.
- Cerv. Vincente de Cervantes, 1759?-1829, professor of botany and director of the botanic garden, Mexico City.
- Chab. S. B. Chabaud, 1833-1915, France.
- Cham. Adelbert Ludwig von (formerly Louis Charles Adelaide Chamisso de Boncourt) Chamisso, 1781-1838, poet-naturalist, Berlin; botanist on the ship *Rurik*, which visited California in 1816.

- Cham. & Schlecht. A. L. Chamisso, and D. F. L. von Schlechtendal.
- Chapm. Alvan Wentworth Chapman, 1809-1899, American botanist, Florida; author of "Flora of the Southern United States" (1860, 2nd ed. 1883, 3rd ed. 1897).
- Chase. Mary Agnes (Merrill) Chase, 1869-1963, Custodian of Grasses, U. S. National Herbarium, Washington; eminent agrostologist; author (with Cornelia D. Niles) of "Index to Grass Species" (1962).
- Chât. Jean Jacques Châtelain, published work in 1760, Switzerland.
- Chaudhri. Mohammad Nazeer Chaudhri 1932- , West Pakistan botanist, Botanical Museum and Herbarium, Utrecht, Netherlands; reviser of the *Paronychiinae* (Caryophyllaceae).
- R. H. Cheney. Ralph Holt Cheney, 1896- , paleobotanist, Brooklyn College and Long Island University, New York; *Delphinium*, *Coffea*, medicinal and drug plants.
- Cherm. Henri Chermезon, 1885-1939, France; student of the flora of Alsace and Haute-Tarentaise.
- Ching. Ren-Chang Ching, 1899- , Chinese pteridologist.
- Chiov. Emilio Chiovenda, 1871-1940, Italian botanist, director of the Botanical Institute of the University, Modena.
- Chod. Robert Hippolyte Chodat, 1865-1934, Switzerland.
- Choisy. Jacques Denis Choisy, 1799-1859, Swiss philosopher, protestant clergyman and botanist, professor in Geneva; collaborator in De Candolle's *Prodromus*; Guttiferae, Convolvulaceae, Nyctaginaceae.
- C. Chr. Carl Frederick Albert Christensen, 1872-1942, Danish student of ferns; author of "Index Filicum" (1905-1912).
- Christ. Konrad Hermann Heinrich Christ, 1833-1933, Swiss authority on ferns; Coniferae, *Carex*, *Rosa*; author of the classic "Pflanzenleben der Schweiz" (1879).
- Christm. Gottlieb Friedrich Christman, 1752- ?, Germany.
- Clark. Robert Brown Clark, 1914- , Missouri Botanical Garden, St. Louis, Missouri, *Bumelia*.
- Clarke. Charles Baron Clarke, 1832-1906, superintendent of the Royal Botanic Gardens, Calcutta; student of the flora of India; Cyperaceae.
- Clausen. Robert Theodore Clausen, 1911- , professor of botany, Cornell University, Ithaca, New York; Ophioglossaceae, *Sedum*.
- Clayt. John Clayton, 1685-1773, physician in Virginia; collector for Gronovius.
- Clem. & Clem. Frederic Edward Clements, 1874-1945, American plant ecologist and climatologist, Carnegie Institution, and Edith Gertrude (Schwartz) Clements, 1877- , ecologist; authors of "Rocky Mountain Flowers" (3rd ed. 1928).
- I. Clem. Ian Duncan Clement, 1917- , American taxonomist, director Atkins Garden and Research Laboratory of Harvard University, Soledad, Cuba (1948-1962), later National Science Foundation, Washington; Malvaceae, tropical economic botany.
- Clewell. Andre F. Clewell, 1934- , botanist, Florida State University, Tallahassee; Leguminosae (*Lespedeza*).
- Clute. Willard Nelson Clute, 1869-1950, professor of botany, Butler University, Indianapolis, Indiana; founder of The American Fern Society; editor of the FERN BULLETIN and the AMERICAN BOTANIST; author of "The Fern Allies of North America north of Mexico" (1905, 2nd ed. 1928), and "Our Ferns: Their Haunts, Habits and Folklore" (1938).
- Cockll. Theodore Dru Alison Cockerell, 1866-1948, professor of Entomology, New Mexico Agricultural College, Mesilla Park; plant explorer and student of southwestern United States and Jamaican natural history.
- Cockll. & Barker, P. and M. T. D. A. Cockerell, and P. and M. Barker; published together in 1901.
- Cogn. Célestin Alfred Cogniaux, 1841-1916, Verviers, Belgium; Cucurbitaceae, Melastomataceae, Orchidaceae.
- Collad. Louis Theodore Frederic Colladon, 1792-1862, French medical botanist.
- Collins. Lawrence Turner Collins, 1937- , botanist, University of Wisconsin, Milwaukee; Orobanchaceae.
- Commers. Philibert Commerson, 1727-1773, France; naturalist of the Bouganville expedition (1767-1769) to South America and Africa.
- Conrad. Solomon White Conrad, 1779-1831, United States.
- Const. Lincoln Constance, 1909- , professor of botany, University of California, Berkeley; student and monographer of Umbelliferae, Hydrophyllaceae, etc.
- Const. & Shan. L. Constance, and Ren-hwa Shan, 1909- , Academia Sinica, Peiping; Umbelliferae (especially of China).
- Cook. Orator Fuller Cook, 1867-1949, U. S. Dept. Agriculture, Beltsville, Maryland; Palmae, *Gossypium*, rubber plants, botanical explorer in Africa and South America.
- Core. Earl Lemley Core, 1902- , professor of botany, West Virginia University, Morgantown; Cyperaceae (*Scleria*), Caryophyllaceae (*Paronychia*, *Siphonochia*), author (with P. D. Strausbaugh) of "Flora of West Virginia" (1952-1964).
- Correll. Donovan Stewart Correll, 1908- , Botanical Museum, Harvard University (1938-1946), U. S. Dept. Agriculture, Beltsville, Maryland (1946-1956), Head, Botanical Laboratory, Texas Research Foundation, Renner, Texas (1956-); ferns, orchids, *Solanum*, flora of southwestern United States; author of "Native Orchids of North America, north of Mexico" (1950), "The Potato and its Wild Relatives" (1962), (with Oakes Ames) "Orchids of Guatemala" (1952-1953), and (with I. W. Knobloch) "Ferns and Fern Allies of Chihuahua" (1962), etc.
- H. Correll. Helen Butts Correll, 1907- , wife of D. S. Correll, botanist and zoologist, Smith College, Northampton, Massachusetts, 1929-1931, Wellesley College, Wellesley, Massachusetts, 1934-1939, Texas Research Foundation, Renner, Texas, 1956-; teacher, botanical collector and researcher; aquatic and marsh plants of southwestern United States; author (with D. S. Correll) of "A collection of plants from Louisiana" (Am. Midl. Nat. 26: 30-64. 1941).
- Cory. Victor Louis Cory, 1880-1964, Southern Methodist University, Dallas, Texas, botanist and collector of Texas plants.

- Cory & Parks. V. L. Cory, and H. B. Parks; authors of "Catalogue of the Flora of Texas" (1937).
- Coss. Ernest Saint-Charles Cosson, 1819-1889, French botanist.
- Coss. & Dur. E. St.-C. Cosson, and M. C. Durieu de Maisonneuve; authors of "Flore d'Algérie" (1854-1867).
- Coult. John Merle Coulter, 1851-1928, professor of botany, University of Chicago; founder and longtime editor of the *BOTANICAL GAZETTE*; author of "Botany of Western Texas" (1891-1894) and "Manual of the Botany of the Rocky Mountain Region" (1885, rev. by A. Nelson, 1909).
- Coult. & Fish. J. M. Coulter, and Elmon McLean Fisher, 1861-1938, Indiana.
- Coult. & Rose. J. M. Coulter, and J. N. Rose.
- Cov. Frederick Vernon Coville, 1867-1937, curator, U. S. National Herbarium (1893-1937); botanist of the Death Valley Expedition in 1891.
- Cov. & Berger. F. V. Coville, and A. Berger.
- Crantz. Heinrich Johann Nepomuk von Crantz, 1722-1799, professor of medicine, Vienna; author of a flora of Austria; Cruciferae, Umbelliferae.
- Crép. François Crépin, 1830-1903, director of the botanic garden, Brussels.
- Cristóbal. Carmen Lelia Cristóbal, 1932- , Facultad de Agronomía y Veterinaria, Corrientes, Argentina; Sterculiaceae (*Ayenia*, *Byttneria*).
- Croizat. Leon Camille Marius Croizat, 1894- , Caracas, Venezuela; Euphorbiaceae, Cactaceae.
- Cronq. Arthur John Cronquist, 1919- , curator, New York Botanical Garden; Compositae; author (with H. A. Gleason) of "Manual of Vascular Plants of Northeastern United States and adjacent Canada" (1963), and (with other authors) "Vascular Plants of the Pacific Northwest" (1955-1964).
- Cronq. & Keck. A. J. Cronquist and D. D. Keck.
- Crosswhite. Frank Samuel Crosswhite, 1940- , University of Wisconsin, Madison; Scrophulariaceae (*Penstemon*).
- Curt. William Curtis, 1746-1799, English botanist, entomologist and editor, founder of the *BOTANICAL MAGAZINE*; author of "Flora Londinensis" (1777-1798).
- M. A. Curtis. Moses Ashley Curtis, 1808-1872; author of "The Shrubs and Woody Vines of North Carolina" (1946, reprinted from Geol. and Nat. Hist. Survey of N. C., 1860).
- Cutak. Ladislaus Cutak, 1908- , Missouri Botanical Garden, St. Louis; Cactaceae, Bromeliaceae, Araceae.
- Cutler. Hugh Carson Cutler, 1912- , Missouri Botanical Garden, St. Louis; *Ephedra*, economic botany.
- Cutler & Anders. H. C. Cutler, and E. S. Anderson.
- Cyr. Domenico Cyrillo, 1739-1799, professor of botany, Naples, Italy.
- Dandy. James Edgar Dandy, 1903- , botanist, Director of British Museum, London; Magnoliaceae, Hydrocharitaceae, Potamogetonaceae.
- Daniels. Francis Potter Daniels, 1869-1947, botanist, ordained minister and linguist, Georgia State College for Women (1923-35); collected and published on Colorado plants (1911).
- Danser. Benedictus Hubertus Danser, 1891-1943, Dutch botanist.
- Darby. John Darby, 1804-1877, New York botanist; author of "Botany of the Southern States" (1855).
- Darl. Josephine Darlington, 1905- , publ. in *Annals Missouri Botanical Garden* in 1934; *Mentzelia*.
- Daveau. Jules Alexandre Daveau, 1852-1929, director, Botanic Garden, Lisbon.
- Davenp. George Edward Davenport, 1833-1907, Massachusetts businessman; student of ferns.
- Davids. Anstruther Davidson, 1860-1932, physician, student of Arizona and California floras; author (with G. L. Moxley) of "Flora of Southern California" (1923).
- L. I. Davis. Louie Irby Davis, 1897- , collected plants in Mexico and Texas in 1941-1965; published on *Verbena* in 1941.
- R. J. Davis. Ray Joseph Davis, 1895- , professor of botany, Idaho State College, Pocatello; author of "Flora of Idaho" (1952).
- Day & V. Grant. Alva Day (*later* Grant), and V. E. Grant.
- Dayton. William Adams Dayton, 1885-1958, dendrologist, U. S. Forest Service, Washington; leader in standardization of English plant names; author of "United States Tree Books," U.S.D.A. Bul. 20 (1952), "Important Western Browse Plants," U.S.D.A. Misc. Publ. 101 (1931), etc.
- DC. Augustin Pyramus de Candolle (also *Décandolle*), 1778-1841, Swiss botanist, professor of botany, Geneva; first in an illustrious line of systematists; founder of the *Prodromus*, a fundamental work in the development of the modern phylogenetic system.
- A. DC. Alphonse Louis Pierre Pyramus de Candolle, the son, 1806-1893, Geneva; author of the last 10 vols. of the *Prodromus*; founder of *Monographiae Phanerogamarum*, a continuation and revision of the *Prodromus*.
- Dcne. Joseph Decaisne, 1807-1882, Belgian botanist, director, Jardin des Plantes, Paris; Asclepiadaceae, Plantaginaceae.
- DeJong. Diederik Cornelius Dignus DeJong, 1931- , Botany Dept., Miami University, Oxford, Ohio; Compositae.
- Delile. Alire Raffeneau Delile, 1778-1850, French botanist and physician who accompanied Napoleon to Egypt.
- Dempst. Lauramay (Tinsley) Dempster, 1905- , research assistant to W. L. Jepson, University of California, Berkeley; Jepson Herbarium; *Galium*.
- den Hartog. Cornelis den Hartog, 1931- , Amsterdam, Netherlands; Alismataceae. Hydrocharitaceae.
- Dermen. Haig Dermen, 1895- , Cytologist, U. S. Dept. Agriculture, Beltsville, Maryland.
- Desf. René Louiche Desfontaines, 1750-1833, French botanist, professor in the Jardin des Plantes, Paris; author of "Flora Atlantica" (1798-1799).
- Des Moul. Charles Robert Alexandre Des Moulins, 1798-1875, France.

- Desr. Louis Auguste Joseph Desrousseaux, 1753-1838, French cloth manufacturer; contributor to Lamarck's Encyclopedia.
- Desv. Nicaise Auguste Desvaux, 1784-1856, French botanist, professor of botany, Angers; editor of *JOURNAL DE BOTANIQUE*.
- Detl. LeRoy Ellsworth Detling, 1898- , professor of botany, University of Oregon, Eugene; Cruciferae (*Dentaria*, *Descurainia*).
- Dev. Rev. Chester Dewey, 1784-1867, professor, University of Rochester, New York; specialist in *Carex*.
- L. H. Dewey. Lyster Hoxie Dewey, 1865-1944, Michigan botanist, published on flora of islands in The French River, Ontario in 1939.
- de Wit. Hendrik Cornelis Dirk de Wit, 1909- , University of Agriculture, Wageningen, Netherlands; Leguminosae (Caesalpiniaceae), aquatic plants, Cryptocoryne.
- Didr. Didrik Ferdinand Didrichsen, 1814- , Museum and Library, Botanic Garden, Copenhagen.
- Dietr. Friedrich Gottlieb Dietrich, 1768-1850, garden director at Eisenach, Germany.
- A. Dietr. Albert Gottfried Dietrich, 1795-1856, German gardener, curator of the Berlin botanical garden.
- D. Dietr. David Nathanael Friedrich Dietrich, 1799-1888, German botanist, Jena.
- Dode. Louis Albert Dode, 1875- , France, botany and forestry.
- Doell & Asch. Johann Christoph Doell, 1808-1885, German librarian and botanist, and P. F. A. Ascherson.
- D. Don. David Don, brother of George, 1799-1841, British botanist, professor in King's College, London; librarian to the Linnaean Society.
- G. Don. George Don, 1798-1856, British plant collector for the Horticultural Society in Brazil, West Indies and Africa.
- Donn. James Donn, 1758-1813, British gardener under Aiton at Kew, later curator of Cambridge Garden; author of "Hortus Cantabrigiensis" (1796), which went through 13 editions.
- Dougl. David Douglas, 1798(?)-1834, ardent Scotch botanical collector in northwestern America, taking nearly 500 species in California alone for the Royal Horticultural Society; collected extensively along the Columbia River; ". . . his cost of maintenance during three years came to £66."
- Drapalik & Mohlenbrock. Donald Joseph Drapalik, 1934- , Georgia Southern College, Statesboro; Asclepiadaceae (*Matelea*), and Robert H Mohlenbrock, 1931- , Southern Illinois University, Carbondale; Leguminosae, Cyperaceae, flora of Illinois.
- Drew. William Brooks Drew, 1908- , professor of botany, Michigan State University, East Lansing.
- Drude. Carl Georg Oscar Drude, 1852-1933, Germany.
- Duchartre. Pierre Étienne Simon Duchartre, 1811-1894, French botanist.
- Duchn. Antoine Nicolas Duchesne, 1747-1827, France; author of a work on useful plants, especially strawberries (*Fragaria*).
- Dufr. Pierre Dufresne, 1786-1836, Geneva, Switzerland.
- Duham. Henri Louis Duhamel de Monceau, 1700-1781, French agronomist, forester and botanist.
- Dum. Count Barthélemy Charles Joseph Dumortier, 1797-1878, Belgian botanist, president of the Belgian Chamber of Deputies.
- Dumont. Georges Louis Marie Dumont de Courset, 1746-1824, French agronomist and horticultural writer.
- Dun. Michel Félix Dunal, 1789-1856, French botanist, professor of botany, Montpellier; Vacciniaceae, Solanaceae, contributor to De Candolle's Prodrômus.
- Durand. Elias Magloire Durand, 1794-1873, Philadelphia pharmacist.
- Durazz. Ippolito Durazzo, 1750-1818, Italy.
- Durieu. Michel Charles Durieu de Maisonneuve, 1796-1878, French botanist, director of the botanic gardens, Bordeaux; student of the flora of southern France, Spain, and especially Algeria.
- Du Roi. Johann Philipp Du Roi, 1741-1785, Germany.
- Duval. Charles Jeunet Duval, 1751-1828, France.
- Dyal. Sarah Creecie (*later* Nielsen) Dyal, 1907- , Cornell University, Ithaca, New York; *Plectritis*, *Valerianella*.
- Eastw. Alice Eastwood, 1859-1953, Canadian-born California botanist, curator of botany, California Academy of Sciences (1892-1950); tireless student of the West American flora and of cultivated plants.
- Eat. Amos Eaton, 1776-1842, American botanist, lecturer and writer, New York; produced first botanical manual in America with descriptions in English.
- A. A. Eat. Alvah Augustus Eaton, 1865-1908, New England and Florida; student of ferns and early collector in Florida for Oakes Ames.
- D. C. Eat. Daniel Cady Eaton, grandson of Amos, 1834-1895, professor of botany, Yale University, New Haven, Connecticut; authority on ferns.
- Ediger. Robert Ike Ediger, 1937- , Chico State College, California; *Senecio* (Compositae).
- Eggert. Heinrich (Karl Daniel) Eggert, 1841-1904, American botanical collector.
- Eggl. Willard Webster Eggleston, 1863-1935, botanist, U. S. Dept. Agriculture, Washington; student of poisonous and drug plants, prodigious and indiscriminate collector of American plants.
- Ehrh. Friedrich Ehrhart, 1742-1795, German botanist of Swiss origin, pupil of Linnaeus; advocate of monomial nomenclature.
- Ehrend. Friedrich Ehrendorfer, 1927- , Botanical Institute, University of Vienna, Austria.
- Eichler. August Wilhelm Eichler, 1839-1887, Berlin; important editor of and contributor to "Flora Brasiliensis" (1829-1833).
- Eifert. Imre János Eifert, 1934- , Department of Botany, University of Texas; Leguminosae (*Hoffmanseggia*, *Caesalpinia*).
- Eiten. George Eiten, 1923- , Instituto de Botanica, Sao Paulo, Brazil; *Oxalis*, vegetation of Brazil.

- Ekman. Erik Leonard Ekman, 1883-1931, Swedish botanist, botanical collector for 17 years in Cuba and Hispaniola for I. Urban and the Berlin Botanical Garden during which time he obtained over 35,000 numbers including about 6 new genera and 2,000 new species.
- Ell. Stephen Elliott, 1771-1830, American botanist, professor in Charleston; author of "A sketch of the botany of South Carolina and Georgia" (1821-1824).
- Elliot. George Francis Scott Elliot, 1862-1934, Great Britain.
- Ellis. John Ellis, 1710(?) - 1776, Irish-born merchant in London.
- W.H.P. Emery. William Henry Perry Emery, 1924- , professor of biology, Southwest Texas State University, San Marcos; Gramineae.
- Endl. Stephen Friedrich Ladislaus Endlicher, 1804-1849, Austrian botanist, professor of botany and director of the botanic garden, Vienna; author of "Genera Plantarum" (1836-1840), and many other large works; student of Coniferae.
- Engelm. George Engelmann, 1809-1884, German-born physician in St. Louis and eminent botanist; painstaking student of North American *Cuscuta*, *Juncus*, Euphorbiaceae, Isoetes, *Yucca*, Cactaceae, *Pinus*, *Abies*, *Juniperus*, *Agave* and *Vitis*.
- Engelm. & Bigel. G. Engelmann, and J. Bigelow.
- Engelm. & Gmy (or E. & G.). G. Engelmann, and A. Gray.
- Engelm. & Prantl. G. Engelmann, and K. A. E. Prantl.
- Engl. Adolf (Heinrich Gustaf Adolf) Engler, 1844-1930, director of the botanic garden and museum, Berlin; founder and editor of *BOTANISCHE JAHRBÜCHER, DIE VEGETATION DER ERDE*, and *DAS PFLANZENREICH*; outstanding systematist and tireless worker; Araceae, monographer of *Saxifraga*.
- Engl. & Graebn. A. Engler, and Karl Otto Robert Peter Paul Graebner, 1871-1933, professor of botany, Berlin.
- Ensign. Margaret Ruth (later Lewis) Ensign, 1919- , Pomona College, Claremont, California; *Forsellestia*.
- Epl. Carl Clawson Epling, 1894-1968, Dept. of Botany, University of California, Los Angeles; specialist on American Labiateae, author of numerous works.
- Erbe & B. L. Turner. Lawrence Wayne Erbe, 1924- , University of Southwestern Louisiana, Lafayette; *Phlox* (annuals), and B. L. Turner.
- Erickson. Ralph Orlando Erickson, 1914- , Missouri Botanical Garden, St. Louis; *Clematis*.
- Eschs. Johann Friedrich Eschscholtz, 1793-1831, zoologist in Dorpat; surgeon and naturalist on the ship *Rurik*, of the Russian Romanzoff Expedition under Kotzebue, which visited California in 1816, and on the *Predpriaetie*, also under Kotzebue, which reached San Francisco and the Sacramento River in the fall of 1824.
- Evans. Walter Harrison Evans, 1863-1941, U. S. Dept. Agriculture Office of Experiment Stations (1891-1933); Cornaceae, Alaskan vegetation.
- Everly. Mary Louise Everly Hammack, 1922- ; Compositae (published on *Perityle* in 1947).
- Ewan. Joseph Andorfer Ewan, 1909- , professor of botany, Tulane University, New Orleans, Louisiana; *Delphinium*, botanical historian; author of "Rocky Mountain Naturalists" (1950).
- Fabr. Philipp Conrad Fabricius, 1714-1774, German physician and botanist, professor at University of Helmstedt.
- Faruqi, Celarier & Mehr. Shamin Ahmad Faruqi, 1933- , University of Karachi, Pakistan; Leguminosae of West Pakistan, Commelinaceae (*Setcreasea*), R. P. Celarier, and K. L. Mehra, 1930- , Central Grasslands Research Institute, Jhansi, U. P. India; Gramineae, Commelinaceae, Leguminosae.
- Farw. Oliver Atkins Farwell, 1867-1944, consulting botanist for Parke, Davis & Co., Detroit, Michigan.
- Fassett. Norman Carter Fassett, 1900-1954, professor of botany, University of Wisconsin, Madison; author of "A Manual of Aquatic Plants" (1940, revised by E. C. Ogden in 1957), "Spring Flora of Wisconsin" (1947), etc.
- Fawc. & Rendle. William Fawcett, 1851-1926, and Alfred Barton Rendle, 1865-1938, English botanists; authors of "Flora of Jamaica" (1910-1936).
- Featherly. Henry Ira Featherly, 1893- , Oklahoma State University, Stillwater; author (with Clara E. Russell) of "The Ferns of Oklahoma" (1939), Gramineae.
- Featherm. Americus Featherman, 1822- ? , Prof. of Romance Languages, Louisiana State Seminary of Learning (later La. State Univ.); collector and author of Louisiana plants (1870-1872).
- Fedde. Friedrich Karl Georg Fedde, 1873-1942, professor and editor in Berlin; Papaveraceae; founder and editor of *FEDDES REPERTORIUM SPECIERUM NOVARUM REGNI VEGETABILIS* (1905-).
- Fée. Antoine Laurent Apollinaire Fée, 1789-1874, French botanist, professor at Strassburg; noted student of cryptogams.
- Fenzl. Eduard Fenzl, 1808-1879, Austrian botanist, curator in Vienna Botanical Museum.
- Ferg. Alexander McGowen Ferguson, 1874- , Texas plant breeder.
- Fern. Merritt Lyndon Fernald, 1873-1950, director of Gray Herbarium (1937-1947); a founder of *RHODORA* (associate editor, 1899-1928, editor, 1929-1950); noted plant geographer and systematist; *Potamogeton*; author of "Gray's Manual of Botany, Eighth Edition" (1950).
- Fern. & Brack. M. L. Fernald, and A. E. Brackett.
- Fern. & Grisc. M. L. Fernald and Ludlow Griscom, 1890-1959, Harvard University research ornithologist.
- Fern. & Rehd. M. L. Fernald, and A. Rehder.
- Fern. & Schub. M. L. Fernald, and B. G. Schubert.
- Fern. & Wieg. M. L. Fernald, and K. M. Wiegand.
- Fieb. Franz Xaver Fieber, 1807-1872, Hungary.
- Fing. Karl Anton Fingerhuth, 1802-1876, German botanist.

- Fisch. Friedrich Ernst Ludwig von Fischer, 1782-1854, director of the botanic garden, St. Petersburg (1823-1850).
- Flory. Walter S Flory, prof. of botany and director of Reynolda Gardens, Wake Forest University, Winston-Salem, North Carolina; Amaryllidaceae.
- Fisch. & All. F. E. L. Fischer, and C. Allioni.
- Fisch. & Mey. F. E. L. Fischer, and C. A. Meyer.
- Fisher. E. M. Fisher; published on *Caesalpinia* in 1892.
- Flügge. Johann Flügge, 1775-1816, German botanist, botanical garden in Hamburg.
- Flyr. Lowell David Flyr, 1937- , Department of Botany, University of Texas, Austin, later Gray Herbarium, Harvard University; Compositae (*Brickellia*).
- Focke. Wilhelm Olbers Focke, 1834-1922, physician in Berne, Switzerland; student of *Rubus*.
- Forsk. Petrus Forsskål (also Pehr Forskål), 1732-1763, Danish student of Linnaeus who traveled to Arabia and wrote a flora of Egypt and Arabia; died on the desert of starvation and exposure after repeated encounters with bandits.
- Forst. Johann Reinhold Forster, 1729-1798, German explorer and botanist, Halle.
- Forst. & Forst. f. J. R. Forster, and his son, J. G. A. Forster, who traveled together to Russia and England and on Captain Cook's Second Voyage.
- G. Forst. Johann Georg Adam (also George Forster) Forster, son of J. R. Forster, 1754-1794, professor of natural history, Cassel, Germany.
- Fort. Robert Fortune, 1813-1880; noted Scottish plant explorer for Royal Horticultural Society in China, Java, etc. (1843-45, 1848-50), introduced tea into India in 1851; author of "Wanderings in China" (1847), etc.
- Fosb. Francis Raymond Fosberg, 1908- , U. S. Geological Survey, Washington; student of the California, South American and Polynesian floras; Rubiaceae.
- Foster. Robert Chighton Foster, 1904- , Gray Herbarium, Harvard University; Iridaceae.
- Foug. Auguste Denis Fougeroux de Bondaroy, 1732-1789, France.
- Fourn. Eugene Pierre Nicolas Fournier, 1834-1884, physician in Paris; Asclepiadaceae.
- Franch. Adrien René Franchet, 1834-1900, French botanist.
- Franch. & Sav. A. R. Franchet, and Paul Amedée Ludovic Savatier, 1830-1891. French marine medical officer and botanist.
- Franco. João Manuel Antonio Paes do Amaral Franco, 1921- , Lisbon, Portugal.
- S. V. Fraser. Samuel Victorian Fraser, 1890- , student of flora of Cloud County, Kansas.
- F. L. Freeman. Florence L. Freeman, 1912- , published on *Psoralea* in 1937.
- J. D. Freeman. John Daniel Freeman, 1941- , Auburn University, Alabama; Liliaceae (*Trillium*).
- Fresen. Johann Baptist Georg Wolfgang Fresenius, 1808-1866, German physician and botanist.
- Friedl. Solomon Friedland, 1912- , New York Botanical Garden; *Hemicarpha*.
- Fries. Elias Magnus Fries, 1794-1878, professor of botany, Uppsala; noted mycologist and student of *Hieracium*.
- R. E. Fries. Robert Elias (i.e., Klas Robert Elias) Fries, 1876- , a student of Northern Rhodesian and Argentine plants.
- Friesner. Ray Clarence Friesner, 1894-1952, botanist, editor and dean, Butler University, Indianapolis, Ind.
- Fritsch. Karl F. Fritsch, 1864-1934, Graz, Austria.
- Gaertn. Joseph Gaertner, 1732-1791, German physician and botanist, Stuttgart; writer on the structure of fruit and seeds.
- Gaertn. f. Carl Friederich von Gaertner, 1772-1850, son of Joseph, German physician and botanist at Calw.
- Gagnebin. Abraham Gagnebin, 1707-1800, Swiss botanist.
- Gaiser. Lulu Odel Gaiser, 1896-1965, Canadian botanist, Barnard College, New York, and Gray Herbarium, Harvard University; Compositae (*Liatris*), flora of Lambton County, Ontario.
- Gal. Henri (Guillaume) Galeotti, 1814-1858, director of botanical gardens, Brussels; collector of and author regarding Mexican plants.
- Gale. Shirley (later Cross) Gale, 1915- , Gray Herbarium, Harvard University, later a housewife; Cyperaceae (*Rhynchospora*).
- Gand. Michel Gandoger, 1850-1926, French botanist and abbé; author of "Flora Europae" (27 vols.); voluminous writer; amasser of a huge herbarium now at Lyon; a "splitter" who named thousands of unacceptable species.
- Garden. Alexander Garden, 1730-1791, physician and amateur botanist of Charleston, South Carolina, for whom Linnaeus named the genus *Gardenia*.
- Garrett. Albert Osburn Garrett, 1870-1948, high-school teacher in Salt Lake City, Utah; author of "Spring Flora of the Wasatch Region" (1911; 1936).
- Gates. Reginald Ruggles Gates, 1882-1962, Canadian-born botanist, Peabody Museum, Harvard University.
- Gatt. Augustin Gattinger, 1825-1903, author of "The flora of Tennessee and a philosophy of botany" (1901), etc. His herbarium housed at the University of Tennessee was regrettably destroyed by fire.
- Gaud. Jean François Aimée (Gottlieb) Philippe Gaudin, 1766-1833, Swiss clergyman and agrostologist, Nyon.
- Gaudich. Charles Gaudichaud-Beaupré, 1789-1854, French botanist and traveller.
- Gay. Jacques Etienne Gay, 1786-1864, French student of the flora of Switzerland and the Pyrenees, systematist and morphologist.
- Gay & Durieu. J. E. Gay, and M. C. Durieu de Maisonneuve.
- Gentry. Howard Scott Gentry, 1903- , botanist, U. S. Dept. Agriculture, Beltsville, Maryland; Amaryllidaceae (*Agave*); economic plants; flora of northwest Mexico; botanical explorer par excellence.
- Geyer. Carl (Charles) Andreas Geyer, 1809-1853, Austrian botanist with Nicolle's expedition;

- collected in northern Idaho and Washington in 1844.
- Gilib. Jean Emmanuel Gilibert, 1741-1814, French botanist, professor in Wilna, Lithuania, later in Lyon, France; author of "Flora Lithuanica" (1785).
- Gill. Lake Shore Gill, 1900—, American forest pathologist.
- Gill. & Arn. John Gillies, 1747-1836, Scotch physician who resided some years in Argentina and collected in Chile, and A. W. Arnott.
- Gill. & Hook. J. Gillies, and W. J. Hooker.
- Gilly. Charles Louis Gilly, 1911—, botanist, Michigan State University, East Lansing.
- Giseke. Paul Dietrich Giseke, 1741-1796, German botanist, pupil of Linnaeus, professor of botany, Hamburg; Compositae.
- Gke. Christian August Friedrich Garcke, 1819-1904, German botanist, curator of the herbarium, Berlin; author of "Flora von Nord- und Mittel-Deutschland" (1849) that went through 20 editions.
- Gl. Henry Allan Gleason, 1882—, assistant director and head curator, New York Botanical Garden; author of "New Britton & Brown Illustrated Flora" (1952), etc.
- Gmel. Johann Georg Gmelin, 1709-1755, German botanist who traveled in Siberia and Kamchatka (1733-1743), and gave first account of their floras; author of the classic "Flora Sibirica" (1747-1769); later professor in Tübingen, Germany.
- C. C. Gmel. Carl Christian Gmelin, 1762-1837, physician in Karlsruhe, Germany; author of "Flora Badensis Alsatica" (1805-1826).
- J. F. Gmel. Johann Friedrich Gmelin, nephew of J. G. Gmelin, 1748-1804, professor in Tübingen, then in Göttingen, Germany; editor of the 13th ed. of Linne's "Systema Naturae" (1788-1793).
- Godfrey. Robert Kenneth Godfrey, 1911—, professor of botany, Florida State University, Tallahassee; floristics, southeastern United States, Compositae; author (with Herman Kurz) of "Trees of Northern Florida" (1962), etc.; botanical collector par excellence.
- Godr. Dominique Alexandre Godron, 1807-1880, French botanist of Nancy.
- Gomes. Bernardino Antonio Gomes, 1769-1823, Portuguese botanist; student of Brazilian plants.
- Goodd. Leslie Newton Goodding, 1880-1967, student of Aven Nelson, botanist, U. S. Soil Conservation Service, Arizona; forest pathology, southwestern flora, conservation.
- C. Goodd. Charlotte Olive (*later* Reeder) Goodding, the daughter, 1916—, Yale University, *later* University of Wyoming; Gramineae (*Bouteloua*, *Muhlenbergia*).
- Goodm. George Jones Goodman, 1904—, professor of botany, University of Oklahoma, Norman; West American genera of Polygonaceae, flora of the Redlands.
- Gould. Frank Walton Gould, 1913—, professor of range and forestry, Texas A&M University, agronomist; author of "Texas Plants—a Checklist and Ecological Summary" (1962), "Grass Systematics" (1968), etc.
- Gould & Kapadia. F. W. Gould, and Zarir Jamasji Kapadia, 1935—, Bangalore, India; Gramineae (*Bouteloua*).
- Grab. Robert Graham, 1786-1845, professor of botany, Edinburgh, Scotland.
- Grant. Adele Lewis Grant, 1881-1969, Missouri Botanical Garden, *later* professor of botany, University of Southern California, Los Angeles; monographer of *Mimulus*.
- A. & V. Grant. Alva (Day) (Hansen) Grant, 1920—, Rancho Santa Ana Botanic Garden, California; Polemoniaceae, and V. E. Grant.
- V. Grant. Verne Edwin Grant, 1917—, cytogeneticist, Rancho Santa Ana Botanic Garden, Anaheim, California, *later* Boyce Thompson Southwestern Arboretum, Arizona; Polemoniaceae.
- Gray. Asa Gray, 1810-1888, professor of botany, Harvard University, preeminent American systematist; author of "Manual of the Botany of the Northern States" (1848, now through 8 editions); (Gamopetalae of California) in Brewer and Watson's "Botany of California" (1876); "Synoptical Flora of North America" (1878-1897); botanical textbooks, numerous reports of collections and revisions.
- Gray & Engelm. (or G. & E.). A. Gray, and G. Engelmann.
- S. F. Gray. Samuel Frederick Gray, 1766-1836 (?28), British naturalist; author of "Natural Arrangement of British Plants" (1821), a work much in advance of its time.
- Greene. Edward Lee Greene, 1843-1915, first professor of botany, University of California (1885-1895), Berkeley, then at Catholic University of America and Smithsonian Institution in Washington; editor of PITTONIA and LEAFLETS OF BOTANICAL OBSERVATION AND CRITICISM; believer in absolute priority in nomenclature, the names of his microspecies are called "chloronyms."
- Greenm. Jesse More Greenman, 1867-1951, curator of the herbarium, Missouri Botanical Garden (1913-1948); *Senecio*.
- Greenm. & Thomps. J. M. Greenman and C. H. Thompson.
- Grenz. Myrle Grenzbach (Mrs. Lawrence Sherod), Missouri Botanical Garden, St. Louis, published on *Bouchea* (Verbenaceae) in 1926; *later* housewife in Ohio.
- Grev. & Hook. Cf. Hook. & Grev.
- Griffiths. David Griffiths, 1867-1935, agronomist, U. S. Dept. Agriculture, Washington.
- Griffiths & Hare. D. Griffiths, and Raleigh Frederick Hare, 1870-1934, plant chemist, New Mexico State University, Las Cruces.
- Griseb. August Heinrich Rudolph Grisebach, 1814-1879, professor of botany, Göttingen, Germany; noted for his "Vegetation der Erde" (1872, ed. 2, 1884), and studies on the West Indian flora (1857-66); Gentianaceae.
- Grub. Valery Ivanovich Grubov, 1917—, botanist at Leningrad; *Rhamnus* and *Frangula*.
- Guill. Jean Baptiste Antoine Guillemin, 1796-1842, French botanist who traveled in Brazil.
- Gürke. Robert Louis August Max Gürke, 1854-1911, Germany.
- Guss. Giovanni Gussone, 1787-1866, professor of botany, Naples; author of valuable works on the flora of southern Italy and Sicily.
- H. & A. W. J. Hooker and G. A. Arnott; authors of "The Botany of Captain Beechey's Voyage" (1830-1841).

- H. & B. Baron Friedrich Wilhelm Heinrich Alexander von Humboldt, 1769-1859, German zoologist, and Aimé Jacques Alexandre Bonpland, 1773-1858, French botanist; authors of the classic "Voyage aux Régions Equinoxiales du Nouveau Continent, etc." (1805-1837).
- Haage & Schmidt. Ferdinand Haage, 1859-1930, and Friedrich Schmidt, 1832-1908, Germany; Verbenaceae.
- Haage f. Friedr. Ad Haage, 1859-1930, son of F. Haage, Germany.
- Hack. Eduard Hackel, 1850-1926, noted Austrian agrostologist.
- Hack. & Arech. E. Hackel, and J. Arechavaleta.
- Hall. Harvey Monroe Hall, 1874-1932, professor of botany, University of California, Berkeley, then staff member Carnegie Institution of Washington; pioneer in experimental taxonomy; student of the Compositae (*Haplopappus*, Madiinae); author (with Carlotta Hall) of "A Yosemite Flora" (1912).
- Hall & Clem. H. M. Hall, and F. E. Clements; authors of "The Phylogenetic Method in Taxonomy" (1923), in which North American *Artemisia*, *Chrysothamnus* and *Atriplex* are monographed.
- C. Hall. Carlotta (Case) Hall, the wife, 1880-1949, California; student of ferns.
- Haller. Albrecht von Haller, 1708-1777, Swiss botanist, physician, poet and statesman; professor in Göttingen, Germany, later in Berne, Switzerland.
- Hallier f. Hans Gottfried Hallier, 1868-1932, Dutch botanist of Buitenzorg and Leiden; student of phylogeny.
- Hamilt. William Hamilton, 1783-1856, British physician and traveler; student of West Indian plants.
- A. Hamilt. Arthur Hamilton, Swiss botanist, Geneva, author of a monograph on *Scutellaria* in 1832.
- Hara. Hiroshi Hara, 1911- , Japanese taxonomist, cytologist, synantherologist.
- Harbison. Thomas Grant Harbison, 1862-1936, naturalist and botanist, curator of Herbarium, University of North Carolina, Chapel Hill; a close colleague of W. W. Ashe.
- Harlan. Jack Rodwey Harlan, 1917- , University of Illinois, Urbana; crop plants.
- Harms. Vernon L. Harms, 1930- , professor of botany, University of Alaska, College, then University of Saskatchewan, Saskatoon, Canada; Compositae (*Heterotheca*, *Petasites*), northwestern U. S. and Canada, *Sparganium*.
- Harper. Roland McMillan Harper, 1878-1966, Maine-born Alabama botanist; unique field botanist and author of works on botany, geology, ecology, etc. of southeastern U. S.
- Harrington. Harold David Harrington, 1903- , professor of botany, Colorado State University, Ft. Collins; author of "Manual of the Plants of Colorado" (1954).
- Hartm. Carl Johan Hartman, 1790-1849, Swedish botanist.
- Harv. William Henry Harvey, 1811-1866, professor of botany and keeper of the herbarium, Trinity College, Dublin; made known the California collections of Thomas Coulter; author (with O. W. Sonder) of "Flora Capensis" (1859-1865).
- Harv. & Gray. W. H. Harvey, and A. Gray.
- L. H. Harvey. LeRoy Hatfield Harvey, 1911- , University of Montana, Missoula; *Eragrostis*.
- Hassk. Justus Carl Hasskarl, 1811-1894, German botanist at Buitenzorg, Java.
- Hassl. Emil Hassler, 1861-1937, student of the Argentine and Paraguayan floras.
- Hausskn. Heinrich Karl Haussknecht, 1838-1903, professor in Weimar; monographer of *Epilobium*.
- Haw. Adrian Hardy Haworth, 1767(?88)-1833, English gardener and entomologist; student of succulents, *Mesembryanthemum*.
- Hawksworth. Frank Goode Hawksworth, 1926- , forest pathologist, U. S. Forest and Range Experiment Station, Ft. Collins, Colorado; *Arceuthobium*.
- Hawksworth & Wiens. F. G. Hawksworth, and Delbert Wiens, 1932- , University of Utah, Salt Lake City; Viscaceae.
- Hayek. August von Hayek, 1871-1928, Austrian plant geographer, University of Vienna; author of a flora of Steiermark.
- Hayne. Friedrich Gottlob Hayne, 1763-1832, professor of botany, Berlin.
- Hayward. Wyndham Hayward, 1903- , Lakemont Gardens, Winter Park, Florida; Amaryllidaceae.
- H.B.K. Baron F. W. H. A von Humboldt, A.J.A. Bonpland, the two forming the most famous scientific expedition to tropical America, and C. S. Kunth, who wrote the text of their descriptive work "Nova genera et species Plantarum" (1815-1825).
- Hegelm. Christof Friedrich Hegelmaier, 1833-1906, professor of botany, Tübingen, Germany; Lemnaceae, *Callitriche*.
- Hegi. Gustav Hegi, 1876-1932, German botanist; author of "Illustrierte Flora von Mittel-Europa" (1906-1931).
- Heimerl. Anton Heimerl, 1857-1942, professor in Vienna, Austria; Nyctaginaceae, *Achillea*.
- Heiser. Charles Bixler Heiser, Jr., 1920- , professor of botany, University of Indiana, Bloomington; Compositae, Solanaceae.
- Heist. Lorenz Heister, 1683-1758, professor in Helmstedt, Germany.
- Heller. Amos Arthur Heller, 1867-1944, Pennsylvania botanist, noted collector of western American plants; founder and editor of *MUHLENBERGIA*.
- Hemsl. William Botting Hemsley, 1843-1924, British botanist, keeper of the herbarium, Kew (1899-1908); author of the 5 vol. work on the botany in Godman and Salvin's "Biologia Centrali-Americana" (1879-1888).
- Henr. Jan Theodoor Henrard, 1881- , Conservator, Rijksherbarium, Leiden; *Aristida*.
- Herb. William Herbert, 1778-1847, English politician and botanist, then a churchman, becoming Dean of Manchester; Amaryllidaceae.
- Herm. Frederick Joseph Hermann, 1906- , U. S. Dept. Agriculture, Beltsville, Maryland, later U. S. Forest Service, Washington; *Carex*, bryophytes.
- Herter. Wilhelm Gustav Herter, 1884-1958, German botanist who resided in Uruguay after 1924; author of an illustrated flora of Uruguay (1939-57).
- Hester. J. Pinckney Hester, contemporary southern California writer on succulents. Resident of Fredonia, Arizona.

- Hevly. Richard Holmes Hevly, 1934—, botanist, Northern Arizona University, Flagstaff; *Martyniaceae* (*Proboscidea*), Pteridophyta.
- Heynh. Gustav Heynhold, 1800—?, Saxony; *Hieracium*.
- Hieron. Georg Hans Emo Wolfgang Hieronymus, 1846-1921, professor in Berlin; student of the Argentine and Andean flora.
- Hildmann. H. Hildmann, about 1891.
- Hill. John Hill, 1716-1775, London apothecary and naturalist, author of herbals and nature books; produced the first flora of England on the Linnaean system.
- A. W. Hill. Arthur William Hill, 1875-1941, South Africa.
- Hitchc. Albert Spear Hitchcock, 1865-1935, botanist, U. S. Dept. Agric., Washington, leading American agrostologist; author of "Manual of Grasses of the United States" (1935) and other works.
- Hitchc. & Chase. A. S. Hitchcock, and M. A. Chase.
- Hitchc. & Maguire. C. L. Hitchcock, and B. Maguire.
- Hitchc. & Moldenke. C. L. Hitchcock, and H. N. Moldenke.
- C. L. Hitchc. Charles Leo Hitchcock, 1902—, professor of botany, University of Washington, Seattle; *Lycium*, *Draba*, *Lepidium*, *Lathyrus*, *Sidalcea*, etc.; senior author of "Vascular Plants of the Pacific Northwest" (1955-1984).
- Hochr. Bénédict Pierre Georges Hochreutiner, 1873-1959, director, Conservatoire de Botanique, Geneva.
- Hochst. Christian Ferdinand Hochstetter, 1787-1860, botanist at Stuttgart.
- Hodg. Albion Reed Hodgdon, 1909—, Professor of botany, University of New Hampshire, editor of *RHODORA* (1962—); student of Cistaceae.
- Hoffm. Georg Franz Hoffman, 1760-1826, professor of botany, Göttingen, later in Moscow (1804-1826); student of lichens, *Salix* and Umbelliferae.
- Hoffmsg. & Link. Johann Centurius Graf von Hoffmannsegg, 1766-1849, Dresden, and J. H. F. Link; authors of "Flore Portugaise" (1809-1840).
- Hogg. Thomas Hogg, 1777-1855, England.
- Hohenack. Rudolph Friedrich Hohenacker, 1798-1874, Switzerland.
- Holmgren. Noel Herman Holmgren, 1937—, botanist, New York Botanical Garden; Scrophulariaceae (*Castilleja*).
- Holz. John Michael Holzinger, 1853-1929, German-born American bryologist, teacher in State Teachers College, Winona, Minnesota.
- Hook. Sir William Jackson Hooker, 1785-1865, director of Kew (1841-1865); author of "Flora boreali-americana" (1833-1840) and many other illustrious works; founder and editor of *JOURNAL OF BOTANY* and *ICONES PLANTARUM*; editor of *BOTANICAL MAGAZINE*.
- Hook. f. Sir Joseph Dalton Hooker, the son, 1817-1911, British botanist and explorer, director of Kew (1865-1885); talented editor and student of New Zealand, Himalayan and Indian floras; visited America in 1877.
- Hook. & Grev. W. J. Hooker and Robert Kaye Greville, 1794-1866, professor in Edinburgh; authors of "Icones Filicum" (1827-1832).
- Höpffer. Carl Höpffer, 1810—, interested in Cactaceae.
- M. Hopk. Milton Hopkins, 1906—, professor of botany, Oklahoma (1936-1945), then editor for publication houses; *Arabis*, *Cercis*.
- Horkel. Johann Horkel, 1769-1846, Germany; Lemnaceae.
- Hornem. Jens Wilken Hornemann, 1770-1841, professor of botany, Copenhagen.
- Host. Nicolaus Thomas Host, 1761-1834, imperial physician in Vienna; author of "Flora Austriaca" (1827-1831).
- Houghton. Arthur Duvernoix Houghton, 1870-1938, California.
- House. Homer Doliver House, 1878-1949, New York state botanist (1914-1948); author of "Wild Flowers of New York" (1918); later "Wild Flowers . . ." (1934).
- Houst. William Houstoun, 1695-1733, British surgeon who collected in Central America and the West Indies.
- Houtt. Maarten Houttuyn, 1720-1794(?), Dutch physician and naturalist.
- Hu. Shiu-ying Hu, 1910—, Arnold Arboretum, Harvard University; student of the Chinese flora, monographer of *Philadelphus*.
- C. E. Hubb. Charles Edward Hubbard, 1900—, agrostologist, Kew.
- F. T. Hubb. Frederick Tracy Hubbard, 1875-1962, librarian in Economic Botany and editor, Botanical Museum, Harvard University; agrostologist.
- H. Huber. Hans Huber, 1919—, University of Basel, Switzerland; primarily interested in bryophytes.
- Huds. William Hudson, 1730-1793, London apothecary and botanist; author of "Flora Anglica" (1762, first of 3 ed.).
- Hult. Oskar Eric Gunnae Hultén, 1894—, professor of botany, Stockholm, student of American Arctic floras; author of "Flora of Kamtchatka" (1927-1929), "Flora of the Aleutian Islands" (1937), "Flora of Alaska and Yukon" (1941-1950).
- Hult. & St. John. O. E. G. Hultén, and Harold St. John.
- Hutchins. John Hutchinson, 1884—, Kew; author of "Families of Flowering Plants" (1959); a new system of phylogeny proposed in 1926, 1934.
- Hylander. Nils Hylander, 1904—, Institution for Systematic Botany, Uppsala, Sweden.
- Iltis. Hugh Hellmut Iltis, 1925—, Czechoslovakian-born American botanist, professor of botany, University of Wisconsin, Madison; Cappariaceae, flora of Wisconsin.
- J. Ingram. John William Ingram, Jr., 1924—, L. H. Bailey Hortorium, Cornell University, Ithaca, New York; Euphorbiaceae (*Argythamnia*), cultivated Liliaceae and Iridaceae.
- Irving. Robert Stewart Irving, 1942—, botanist, University of Montana, Missoula; Labiatae.
- Irwin. Howard Samuel Irwin, 1928—, New York Botanical Garden; Leguminosae; flora of central Brazil.

- Isely. Duane Isely, 1918—, professor of botany, Iowa State University, Ames; Leguminosae.
- Ives. Eli Ives, 1779-1861, professor at Yale.
- R. C. Jackson. Raymond C. Jackson, 1928—, professor of botany, University of Kansas, Lawrence; Compositae, Astereae.
- Jacobi. Georg Albano von Jacobi, 1805-1874, Prussian army general who collected plants in Austria and Bohemia.
- Jacq. Nikolaus Joseph Baron von Jacquin, 1727-1817, professor of botany and director of the botanic garden, Vienna; noted systematist.
- James. Edwin James, 1797-1861, surgeon-naturalist, first botanical collector in Colorado, also probably first botanical collector in Texas, with Major S. H. Long's Expedition to the Rocky Mountains (1819-1820).
- Jeffs & Little. Royal Edgar Jeffs, 1879-1933, professor of botany, University of Oklahoma, Norman; flora of Oklahoma, and E. L. Little, Jr.
- Jaume St.-Hil. Jean Henri Jaume Saint-Hilaire, 1772-1845, French botanist.
- Jeps. Willis Linn Jepson, 1867-1946, professor of botany, California; author of "A Flora of California" (1909-39), "A Manual of the Flowering Plants of California" (1923, 1925, 1950), and other works; founder of the California Botanical Society.
- R. R. Johnson. Raymond Roy Johnson, 1932—, Prescott College, Prescott, Arizona; flora (especially Compositae) of southwestern New Mexico and western Texas, *Porophyllum*.
- I. M. Johnst. Ivan Murray Johnston, 1898-1960, professor of botany, Harvard University; authority on world floras, Boraginaceae, plant explorer, prolific author.
- J. R. Johnst. John Robert Johnston, 1880-1953, American plant pathologist; student of the plants of Guatemala and Venezuela.
- M. C. Johnst. Marshall Conring Johnston, 1930—, Dept. of Botany, University of Texas, Austin; Euphorbiaceae, Rhamnaceae, student of the Texas and Mexican floras; author of numerous papers.
- F. B. Jones. Frederick Butler Jones, 1909—, botanist, Welder Wildlife Foundation, Sinton, Texas; author (with C. M. Rowell, Jr. and M. C. Johnston) of "Flowering Plants and Ferns of the Texas Coastal Bend Counties" (1961).
- G. N. Jones. George Neville Jones, 1904—, professor of botany, University of Illinois, Urbana; author of floras on the Olympic Peninsula (1936), Mt. Rainier (1938), and Illinois (1945).
- M. E. Jones. Marcus Eugene Jones, 1852-1934, Utah mining consultant; assembled very extensive herbarium of Great Basin plants now at Pomona College; published his botanical observations in a private journal, "Contributions to Western Botany," that is marked by his cutting criticism of almost all contemporaries.
- Jord. Alexis Jordan, 1814-1897, Lyon, France; proved the existence of many genetically distinct races (which he elevated to specific rank) in such complexes as *Erophila verna*; such microspecies are now often called "jordanons."
- Juss. Antoine Laurent de Jussieu, nephew of Bernard, 1748-1836, professor in the Jardin de Plantes, Paris; first characterizer of natural families; expounder of his uncle's new system.
- A. Juss. Adrien Henri Laurent de Jussieu, the son of Antoine, 1797-1853, professor in the Jardin des Plantes, Paris.
- B. Juss. Bernard de Jussieu, 1699-1776(?), arranger of the garden of La Trianon at Versailles after a new system of classification which was an outgrowth of the teaching of Tournefort.
- Karst. Gustav Karl Wilhelm Hermann Karsten, 1817-1908, German botanist, professor in Vienna; author of "Flora von Deutschland, Oesterreich und der Schweiz" (1895).
- Kaulf. Georg Friedrich Kaulfuss, 1786-1830, professor in Halle an der Saale, Germany; student of ferns.
- Kearn. Thomas Henry Kearney, 1874-1956, U. S. Dept. Agriculture and California Academy of Sciences; taxonomist and cotton breeder, Malvaceae.
- Kearn. & Peeb. T. H. Kearney, and R. H. Peebles; authors of "Flowering Plants and Ferns of Arizona" (1942), "Arizona Flora" (1951).
- Keck. David Daniels Keck, 1903—, Head Curator, New York Botanical Garden (1951-58), Assistant Director (1956-58); National Science Foundation, Washington (1958-67); emigrated to New Zealand in 1967; Compositae (Madiinae), California flora, *Penstemon*, experimental taxonomy.
- Kell. Albert Kellogg, 1813-1887, San Francisco physician and botanist; a founder of the California Academy of Sciences.
- Keng. Yi Li Keng, 1898—, China.
- Ker. John Bellenden Ker, or John Ker Bellenden, or (before 1804) John Gawler, 1764-1842, British botanist, first editor of EDWARDS' BOTANICAL REGISTER.
- Kern. Ritter Anton Josef Kerner von Marilaun, 1831-1898, professor of botany, Innsbruck, later Vienna; made the first scientific transplant experiments using climatically unlike gardens; author of "Pflanzenleben" (1887-1891).
- King & Rob. R. M. King, and Harold Ernest Robinson, 1932—, botanist, U. S. National Herbarium, Washington; Compositae, bryophytes.
- R. M. King. Robert Merrill King, 1930—, botanist, U. S. National Herbarium, Washington; Compositae (Eupatorieae).
- Kit. Paul Kitaibel, 1757-1817, professor of botany and chemistry, and director of the botanic garden, Budapest.
- Kittell. Sister Teresita Kittell, 1892—, Catholic University of America, Washington, later Holy Family College, Manitowoc, Wisconsin; author of "Critical Revision of the Compositae of Arizona and New Mexico" (1941) (cf. Tidestrom).
- Kl. Johann Friedrich Klotzsch, 1805-1860, curator of the herbarium, Berlin; monographer of Begoniaceae.
- Kl. & Gke. J. F. Klotzsch, and F. A. Garcke.
- Klatt. Friedrich Wilhelm Klatt, 1825-1897, Hamburg; Iridaceae.
- Knerr. Ellsworth Brownell Knerr, 1861-1942, Missouri physician.

- Kneuck. Johann Andreas Kneucker, 1862-1946, director, Karlsruhe, Germany.
- Knight. Ora Willis Knight, 1874-1913, United States; Orchidaceae.
- Knuth. Reinhard Gustav Paul Knuth, 1874-1957, German student of Primulaceae, Geraniaceae, etc.
- Kobuski. Clarence Emmeren Kobuski, 1900-1963, Arnold Arboretum, Harvard University; Theaceae.
- Koch. Wilhelm Daniel Joseph Koch, 1771-1849, German botanist, professor of botany, Erlangen; author or editor of three floras of Germany and Switzerland, Umbelliferae.
- K. (or C.) Koch. Karl Heinrich Emil Koch, 1809-1879. German traveler in the Orient, dendrologist, professor in Berlin; author of "Hortus Dendrologicus" (1853).
- Koehne. Bernhard Adalbert Emil Koehne, 1848-1918, professor in Berlin; Lythraceae.
- Koel. Georg Ludwig Koeler, 1765-1807, professor in Mainz; author of a treatise on the grasses of Germany and France.
- Konig. Karl Dietrich Eberhard Koenig, 1774-1851, German geologist at the British Museum; while in England (most of his life) he was known as "Charles Konig."
- Körn. Friedrich Körnicke, 1828-? (after 1859), German botanist; Eriocaulaceae.
- Koyama. Tetsuo Koyama, 1933- , Japanese-born American botanist, New York Botanical Garden; earlier Botanical Institute, University of Tokyo, Japan; Cyperaceae.
- Kral. Robert Kral, 1926- , Dept. of Biology, Vanderbilt University, Nashville, Tennessee; Cyperaceae, Xyridaceae, Eriocaulaceae, Flora of Alabama and Middle Tennessee.
- Krauskopf. Englebert Krauskopf, 1820-1881, gunsmith and amateur botanist, Fredericksburg, Texas.
- Krok. Thorgny Ossian Bolivar Napoleon Krok, 1834-1921, Swedish botanist, Stockholm; *Valerianella*.
- O. Ktze. Carl Ernst Otto Kuntze, 1843-1907, German traveler and botanist, advocate of strict priority in nomenclature; author of "Revisio Generum Plantarum" (1891) in which the names of over 30,000 species were changed.
- Kuhn. Friedrich Adalbert Maximilian Kuhn, 1842-1894, German student of ferns.
- Kükenth. Georg Kükenthal, 1864-1956, clergyman of Coburg, Germany; authority on Cyperaceae.
- Kunth. Carl Sigismund Kunth, 1788-1850, professor of botany, Berlin; excellent systematist and voluminous writer.
- Kunth & Bouché. C. S. Kunth, and Carl David Bouché, 1809-1881, German botanist.
- Kunze. Gustav Kunze, 1793-1851, German botanist and physician, director of the Leipzig botanical garden; student of ferns.
- Kurtz. Fritz (Frederico) Kurtz, 1854-1920, German botanist who moved to Córdoba, Argentina in 1884 as professor of botany.
- Kütz. Friedrich Traugott (Kuetzing) Kützing, 1807-1893, German algologist, Nordhausen.
- L. Carolus Linnaeus (*afterwards* Carl von Linné), 1707-1778, Uppsala, Sweden; founder of binomial nomenclature and the Sexual System of classification in "Species Plantarum" (1753); the "Father of Botany," as we know and practice it today, a prodigious author.
- L. f. Carl von Linné, the son, 1741-1783, successor to his father in the professorship of botany in Uppsala.
- Labill. Jacques Julien Houtton de Labillardière, 1755-1834, French botanist and explorer.
- Lag. Mariano Lagasca y Segura, 1776-1839, professor and director of the botanic garden, Madrid; his collections were destroyed by a mob, and he was exiled to England.
- Lag. & Rodr. M. Lagasca y Segura, and José Demetrio Rodriguez, 1780-1846, director of the botanic garden, Madrid.
- Lahman. Bertha Marion Lahman (née Sherwood), 1872- , married 1898, United States; Cactaceae.
- La Llave & Lex. Pablo de La Llave, 1773-1833, Spain and Mexico, and Juan José Martínez de Lexarza, 1785-1824, Mexico; authors of "Nov. Veg. Descr. Orch. Opusc." (1824-25).
- Lam. Jean Baptiste Antoine Pierre Monnet de Lamarck, 1744-1829, famous French botanist and zoologist who propounded a theory of evolution by the transmission of acquired characters; first to use dichotomous keys in natural history in his "Flore Française" (1778).
- Lam. & DC. J. B. A. P. M. de Lamarck and A. P. de Candolle.
- Lamb. Aylmer Bourke Lambert, 1761-1842, an original member and vice-president of the Linnean Society in London, patron of botany; author of "A Description of the Genus Cinchona" (1797), "A Description of the Genus Pinus" (1803-1842, in 5 ed.), etc.
- Larisey. Mary Maxine Larisey, 1909- , professor, School of Pharmacy, Medical College of South Carolina.
- Larsen. Esther Louise Larsen (Mrs. Kenneth Doak), 1901- , Missouri Botanical Garden (1927-28); Compositae (*Townsendia*).
- Laws. Peter Lawson, d. 1820, and Sir Charles Lawson, the son (?), 1794-1873, Edinburgh nurserymen.
- Leavenw. Melines Conklin Leavenworth, 1796-1862, student of southern U. S. botany.
- Le Conte. John Eatton Le Conte, 1784(?) - 1860(?), English-born Philadelphia botanist.
- Ledeb. Carl Friedrich von Ledebour, 1785-1851, professor in Dorpat; author of "Flora Altaica" (1829-1833) and "Flora Rossica" (1842-1853).
- Legrand. C. Diego Legrand, contemporary Uruguayan botanist; published on *Portulaca* in 1962.
- Lehm. Johann Georg Christian Lehmann, 1792-1860, director of the botanic garden, Hamburg; authority on *Potentilla* and other genera.
- Lej. Alexandre Louis Simon Lejeune, 1779-1858, Belgian physician.
- Lem. Charles Antoine Lemaire, 1801-1871, French botanist, professor in Ghent; student of Cactaceae and cultivated plants; editor of *FLORE DES SERRES* (1845-1855) and *L'ILLUSTRATION HORTICOLE* (1854-1869).
- Lemm. John Gill Lemmon, 1832-1908, pioneer California botanist and schoolteacher in Sierra Valley, early correspondent of Asa Gray; Coniferae.
- Leonard. Emery Clarence Leonard, 1892- , botanist, U. S. National Herbarium, Washington; authority on the Acanthaceae.
- Less. Christian Friedrich Lessing, 1809-1862, German physician; student of Compositae.

- Lévl. & Van. A. B. H. Léveillé, and Eugène Vaniot, ?-1910 (?)
- H. Lévl. Auguste Abel Hector Léveillé, 1863-1918, France.
- Lewis & Moore. W. H. Lewis, and Dwight Munson Moore, 1891- , Arkansas Technology College, Russellville; flora and ecology of Arkansas.
- W. H. Lewis. Walter Hepworth Lewis, 1930- , Canadian-born U. S. botanist, curator, Washington University and Missouri Botanical Garden, St. Louis; Rosaceae (*Rosa*), Rubiaceae (*Hedyotis*), Portulacaceae.
- Lewton. Frederick Lewis Lewton, 1874-1959, American economic and taxonomic botanist; Malvaceae (*Gossypium*, *Cienfuegosia*).
- Ley. Francis Arline (*later* Fitch) Ley, 1919- , Claremont Graduate School, California; *Holodiscus*.
- L'Hér. Charles-Louis L'Héritier de Brutelle, 1746-1800, celebrated French magistrate and botanist.
- Liebm. Frederick Michael Liebman, 1813-1856, Danish professor of botany and director of the Botanic Gardens, Copenhagen, Denmark; collected 40,000 plant specimens in Mexico.
- Lillo & Parodi. Miguel Lillo, 1862-1931, and L. R. Parodi, Argentine botanists.
- Lindh. Ferdinand Jakob Lindheimer, 1801-1879, German-born collector of Texas plants (1836-1879), and correspondent of Asa Gray and George Engelmann; resided in New Braunfels, Texas.
- Lindl. John Lindley, 1799-1865, professor of botany, London; editor of EDWARDS' BOTANICAL REGISTER (1829-1847), horticulturist, eminent orchidologist, textbook writer.
- Lingelsh. Alexander von Lingelsheim, 1874-1937, professor in Breslau; Oleaceae.
- Link. Johann Heinrich Friedrich Link, 1767-1851, professor of natural science and director of the botanic garden, Berlin.
- Link, Kl. & Otto. J. H. F. Link, and J. F. Klotzsch, and Christoph Friedrich Otto, 1763-1856, garden director of Schöneberg, near Berlin.
- Link & Otto. J. H. F. Link, and C. F. Otto.
- Lint & Epl. Harold LeRoy Lint, 1917- , California State Polytechnic College, Pomona; Labiatae (*Agastache*), Juncaceae (*Juncus*), and C. C. Epling.
- Little. Elbert Luther Little, Jr., 1907- , dendrologist, U. S. Forest Service, Washington; author of "Check List of Native and Naturalized Trees of the United States (including Alaska)" (1953), "Southwestern Trees", U.S.D.A. Handb. 9 (1950), (with F. H. Wadsworth) "Common Trees of Puerto Rico and the Virgin Islands" (1964), etc.
- Lloyd. James Lloyd, 1810-1896, London and Nantes; student of the flora of western France.
- Lloyd & Underw. Francis Ernest Lloyd, 1868-1947, professor of botany, McGill University, Montreal, Canada; author of works on guayule and carnivorous plants (1942), and L. M. Underwood.
- Lodd. Conrad Loddiges, 1738-1826, English nurseryman.
- Loefl. Pehr (Peter) Loeffing, 1729-1756, Swedish student of Linnaeus, who traveled to Venezuela for him and died there.
- Loes. Ludwig Eduard Theodor Loesener, 1865-1941, Germany; student of plants of Mayan region in Yucatan.
- Lois. Jean Louis Auguste Loiseleur-Deslongchamps, 1774-1849, French botanist and physician; author of "Flora Gallica" (1806-1807, 2nd ed. 1828).
- Lott. Henry J. Lott, publ. in 1938 from Arnold Arboretum, Harvard University.
- Loud. John Claudius Loudon, 1783-1843, English horticulturist, prolific author and editor of garden books.
- Lour. João de Loureiro, 1710-1791, Portuguese missionary and naturalist.
- Löve & Löve. Askell Löve, 1916- , Icelandic botanist; University of Lund, Sweden (1940-45), University of Iceland, Reykjavik (1945-51), University of Manitoba, Winnipeg (1951-56), University of Montreal, Canada (1956-64), University of Colorado, Boulder (1964-); Polygonaceae (*Rumex*), arctic-alpine-plants, and Doris (Mrs. Askell) Löve, 1918- , University of Colorado, Boulder; Caryophyllaceae, arctic-alpine plants.
- Lundell. Cyrus Longworth Lundell, 1907- , botanist and chief scientist, founder and director of Texas Research Foundation, Renner; author (with collaborators) of "Flora of Texas" (1942-1969, vols. 1, 2 and 3 publ.), "The Vegetation of Peten" (1936), "The Genus Parathesis of the Myrsinaceae" (1966), student of Texas, Mexican and Central American floras; Celastraceae, Myrsinaceae; author of numerous papers in agriculture and botany; founder of S.M.U. and Lundell herbaria.
- Lunell. Joel Lunell, 1851-1920, North Dakota, advocate of strict priority in nomenclature.
- Macbr. James Francis Macbride, 1892- , Gray Herbarium, Harvard University, *later* Chicago Natural History (Field) Museum; student of the West American flora; author (with collaborators) of "Flora of Peru" (1936-).
- Macbr. & Pays. J. F. Macbride, and E. B. Payson.
- Macf. James Macfadyen, 1798(?1800)-1850, Scottish botanist; author of "The flora of Jamaica" (1837).
- Macfarl. John Muirhead Macfarlane, 1855-1943, professor of botany and director of botanical garden, University of Pennsylvania, Philadelphia.
- Mack. Kenneth Kent Mackenzie, 1877-1934, New York City corporation attorney and noted caricologist.
- Mack. & Bush. K. K. Mackenzie, and B. F. Bush.
- MacM. Conway MacMillan, 1867-1929, state botanist, Minnesota; author of "Minnesota Plant Life" (1899).
- Macoun. John Macoun, 1831(?) -1920, eminent Irish-born Canadian botanist, professor of botany, Albert College, Belleville, Ontario; author of "Catalogue of Canadian Plants" (1883-1902), etc.
- Magnus. Paul Wilhelm Magnus, 1844-1941, German taxonomist; *Najas*.
- Maguire. Bassett Maguire, 1904- , curator, then assistant director, New York Botanical Garden; flora of the Great Basin and northeastern South America.
- Malme. Gustav Oskar Andersson Malme, 1864-1937, botanical explorer and author of a work on the flora of Rio Grande do Sul, Brazil (1936).
- Malte. Malte Oscar Malte, 1880-1933, Chief Botanist, National Herbarium of Canada (1921-1933).

- W. Manning. Wayne Eyer Manning, 1899—, Professor of Botany, Wellesley College, Massachusetts, *later* Bucknell University, Lewisburg, Pennsylvania; Juglandaceae, flora of western Massachusetts and central Pennsylvania.
- Mansf. Rudolf Mansfeld, 1901-1960, assistant in the botanical museum, Berlin; Orchidaceae.
- S. Manso. Antonio Luiz Patricio da Silva Manso, 1788-1818, Brazilian naturalist-botanist.
- Marsh. Humphrey Marshall, 1722-1801, Pennsylvania, the father of American dendrology; author of "Arbustum Americanum" (1785).
- W. T. Marsh. William Taylor Marshall, 1886-1957, Desert Botanic Garden, Papago Park, Phoenix, Arizona; author (with T. M. Bock) of "Cactaceae" (1941), and "Arizona's Cactuses" (1950).
- Mart. Karl Friedrich Philipp von Martius, 1794-1868, German botanist and traveler, professor in Munich; founder of the classic "Flora Brasiliensis" (1840-1906) and prolific writer on systematic botany and zoology.
- Mart. & Gal. M. Martens, and H. G. Galeotti.
- Mart. & Schrad. K. F. P. von Martius, and H. A. Schrader.
- Martens. Martin Martens, 1797-1863, Belgian taxonomist, Löwen.
- Martin. Robert Franklin Martin, 1910—, Division of Plant Exploration and Introduction, U. S. Dept. Agriculture, Beltsville, Maryland, *later* lawyer in West Virginia; Papaveraceae.
- F. L. Martin. Floyd Leonard Martin, 1909—, Claremont Graduate School, and teacher, Mark Keppel High School, Alhambra, California; Rosaceae (*Cercocarpus*).
- Martinez. Maximo Martinez, 1888—, distinguished Mexican botanist; authority on Pinaceae.
- Mason. Herbert Louis Mason, 1896—, professor of botany, University of California, Berkeley; Polemoniaceae, fossil floras of California, author of "Flora of the Marshes of California" (1957).
- Mast. Maxwell Tylden Masters, 1833-1907, England; editor of *THE GARDENER'S CHRONICLE*, contributor to Martius' "Flora Brasiliensis" and Oliver's "Flora of Tropical Africa."
- Math. & Const. Mildred Esther (*later* Hassler) Mathias, 1906—, professor of botany, University of California (Los Angeles); Umbelliferae, and L. Constance.
- Math., Const. & Theobald. M. E. Mathias, L. Constance, and William Louis Theobald, 1936—, Occidental College, Los Angeles, California; Umbelliferae (tribe Peucedaneae: *Lomatium*, *Angelica*, etc.).
- Mattf. & Kükenth. Johannes Mattfeld, 1895-1951, curator of the herbarium, Berlin; Compositae, Caryophyllaceae, Cyperaceae, and G. Kükenth.
- Matuda. Eizi Matuda, 1894—, Instituto de Biologia, Universidad N. A. Mexico; Flora of state of Mexico (diverse groups).
- Maxim. Carl Johann (Karl Ivanovich Maksimovich) Maximowicz, 1827-1891, Russian botanist, director of the botanic garden, St. Petersburg.
- Maxon. William Ralph Maxon, 1877-1948, curator of plants, U. S. National Herbarium, Washington; eminent American pteridologist, prolific author and longtime editor (1934-1947) of the *AMERICAN FERN JOURNAL*.
- Mayr. Heinrich Mayr, 1856-1911, German forester; author of a work on the forests of North America (1890).
- McAtee. Waldo Lee McAtee, 1883-1962, United States Fisheries and Wildlife Service; student of island floras of the U. S. and Alaska, *Viburnum*.
- McCl. Elizabeth May McClintock, 1912—, botanist, California Academy of Sciences; Labiatae.
- McCl. & Epl. E. M. McClintock, and C. C. Epling.
- R. L. McGreg. Ronald Leighton McGregor, 1919—, professor of botany, University of Kansas, Lawrence; Compositae (*Echinacea*), student of flora of the northern United States plains.
- McKelvey. Susan Adams (Delano) McKelvey, 1883-1964, Philadelphia botanist, Arnold Arboretum, Harvard University; author of "Yuccas of Southwestern United States" (1938), "Botanical Exploration of the Trans-Mississippi West" (1955).
- McNair. James Birtley McNair, 1889—, California phytochemist.
- McVaugh. Rogers McVaugh, 1909—, professor of botany, University of Michigan, Ann Arbor; Campanulaceae, student of Mexican flora, botanical history, author (with J. H. Pyron) of "Ferns of Georgia" (1951), etc.
- Mears. James Austin Mears, 1944—, botanist, Academy of Natural Sciences, Philadelphia, *formerly* University of Texas, Austin; Amaranthaceae, *Parthenium* (Sect. *Bolophyta*).
- Medic. Friedrich Casimir Medicus, 1736-1808, German botanist.
- Meerb. Nicolaas Meerburgh, 1734-1814, Dutch gardener.
- Meisn. Carl Friedrich Meisner (*also* Meissner), 1800-1874, Swiss botanist in Basel; Polygonaceae, Lauraceae, Ericaceae, Convolvulaceae.
- T. E. Melchert. Thomas E. Melchert, 1936—, Dept. of Botany, University of Iowa, Iowa City; Compositae (*Thelesperma*).
- Merr. Elmer Drew Merrill, 1876-1956, director of New York Botanical Garden, *later* administrator of the botanical collections, Harvard University; bibliographer, prolific contributor on the flora of the Philippine Islands, China, and Indo-Malaysia; at first a student of American grasses.
- Merr. & Lee. E. D. Merrill, and Henry Atherton Lee, 1894—, Entreprises Agricoles Pan-Americaines, Port-au-Prince, Haiti; plant physiologist, tropical agriculture.
- Mert. Franz Carl Mertens, 1764-1831, professor in Bremen.
- Mertens. Thomas Robert Mertens, 1930—, botanist, Ball State University, Muncie, Indiana; *Polygonum*.
- Mert. & Koch. F. C. Mertens, and W. D. J. Koch.
- Mett. Georg Heinrich Mettenius, 1823-1866, German pteridologist, professor of botany, Leipzig; *Salvinia*.
- Metz. Johann Metzger, 1789-1852, director of botanic garden, Heidelberg.
- C. Metz. Sister Mary Clare Metz, 1907—, Our Lady of the Lake College, San Antonio, Texas.
- Mey. Georg Friedrich Wilhelm Meyer, 1782-1856, German botanist, professor in Göttingen; author of "Flora of Hanover" (1849).

- C. A. Mey. Carl Anton von Meyer, 1795-1855, director of the botanic garden, St. Petersburg.
- E. Mey. Ernst Heinrich Friedrich Meyer, 1791-1858, German botanist, professor in Königsberg; Juncaceae.
- Mez. Carl Christian Mez, 1866-1944, professor in Königsberg; Bromeliaceae.
- Mich. Pietro Antonio Micheli, 1679-1737, Italian botanist, director of the gardens in Florence; Onagraceae.
- Michx. André Michaux, 1746-1802, French botanist and explorer of North America; author of "Flora Boreali-Americana" (1803), *Quercus*.
- Michx. f. François André Michaux, the son, 1770-1855, French botanist; author of "The North American Sylva" (1817-1819, first English ed.).
- Miers. John Miers, 1789-1879, London; student of the South American flora.
- Milde. Carl August Julius Milde, 1824-1871(?), German student of Pteridophyta.
- Mill. Philip Miller, 1691-1771, British gardener; author of "The Gardeners Dictionary" (1731), which went through eight editions.
- Mill. & Standl. Gerrit Smith Miller, Jr., 1869-1956, U. S. National Museum, Washington, zoologist, and P. C. Standley.
- L. Mill. Lillian Wood Miller, 1937- , Jacksonville University, Jacksonville, Florida; Euphorbiaceae (*Acalypha*).
- Millais. John Guille Millais, 1865-1931, English artist and natural historian (game birds).
- Millán. Aníbal Roberto Millán, 1892- , Argentine agricultural and botanical bibliographer.
- Miller. Kim Irving Miller, 1936- , botanist, Jacksonville University, Florida; Euphorbiaceae (*Tragla*).
- Millsp. Charles Frederick Millspaugh, 1854-1923, curator, Dept. of Botany, Field Museum, Chicago (1894-1923); student of Yucatan flora (1903-04), author (with N. L. Britton) of "The Bahama Flora" (1920), prolific writer on floras of West Virginia, California, Florida, West Indies, etc.
- Millsp. & Chase. C. F. Millspaugh, and M. A. Chase.
- Millsp. & Sherff. C. F. Millspaugh, and E. E. Sherff.
- Milne-Redhead & Schweickerdt. Edgar Wolston Bertram Handsley Milne-Redhead, 1906- , Kew, and Herold Georg Wilhelm Johannes Schweickerdt, 1903- , Kew.
- Milstead. Wayne Lavine Milstead, 1932- , East Montana College, Billings; Compositae (*Prenanthes*).
- Miq. Frederik Anton Wilhelm Miquel, 1811-1871, Dutch botanist, professor of botany, Utrecht; Urticaceae, Primulaceae, prolific writer.
- Mirb. Charles François Brisseau de Mirbel, 1776-1854, Paris.
- Mitch. John Mitchell, 1676-1768, English-born Virginia physician.
- Moç. & Ses. José Mariano Moçño, 1757-1820, Mexican physician, and M. Sessé y Lacasta.
- Moench. Conrad Moench, 1744-1805, German botanist, professor in Marburg, Germany.
- Mohr. Charles Theodore Mohr, 1824-1901, German chemist who eventually settled in Alabama; author of "Plant Life of Alabama" (1901).
- Mol. Juan Ignacio (Giovanni Ignazio) Molina, 1740-1829, Chilean Jesuit; author of a natural history of Chile (1782).
- Moldenke. Harold Norman Moldenke, 1909- , New York Botanical Garden (1929-1952), later Director of Trailside Nature and Science Center, Mountainside, New Jersey, then Paterson State College, Wayne, New Jersey; Verbenaceae, Avicenniaceae, Eriocaulaceae, author of "American Wild Flowers" (1949), "Plants of the Bible" (1952); editor and publisher of *PHYTOLOGIA*.
- Moldenke & Lundell. H. N. Moldenke, and C. L. Lundell.
- Moore. Thomas Moore, 1821-1887, curator, Chelsea Botanic Garden, England; student of ferns and orchids.
- A. H. Moore. Albert Hanford Moore, 1883- , American biologist; United Fruit Company.
- T. V. Moore. Thomas Verner Moore, 1877-1969, American priest, educator and psychologist, Catholic University of America, Washington; published on *Rudbeckia* (Compositae).
- W. O. Moore. Winifred Olivia Moore, 1904- , Ann Arbor, Michigan; Cactaceae (1957).
- Moq. Christian Horace Bénédicte Alfred Moquin-Tandon, 1804-1863, French botanist, pupil of A. P. de Candolle; Chenopodiaceae, Amaranthaceae.
- Moretti. Giuseppe Moretti, 1782-1853, professor of botany and director of the botanic garden, Pavia.
- Moric. Moise Étienne Moricand, 1779-1854, Swiss botanist, Geneva.
- Moris. Giuseppe Giacinto Moris, 1796-1869, Italian botanist, professor in Turin.
- Morong. Rev. Thomas Morong, 1827-1894, Massachusetts minister and amateur botanist; Najadaceae, Potamogetonaceae.
- Morris. Edward Lyman Morris, 1870-1913, high school teacher, Washington, D.C.; Plantaginaceae.
- Morton. Conrad Vernon Morton, 1905- , Curator of ferns, U. S. National Herbarium, Washington; eminent pteridologist, prolific author and longtime editor (1945-) of the *AMERICAN FERN JOURNAL*.
- E. Mosher. Edna Mosher, American entomologist, received B.S. at Cornell University in 1908; Gramineae.
- Mouillef. Pierre Mouillefert, 1845(?) - 1903, French dendrologist.
- Moxley. George Loucks Moxley, 1871-(d. after 1920); author (with A. Davidson) of "Flora of Southern California" (1923).
- Muell. Arg. Jean (Argoviensis, i.e., of Aargau) Mueller, 1828-1896, Swiss botanist; Euphorbiaceae, Buraceae, Resedaceae.
- Muell. & Muell. C. H. Muller (formerly Mueller), and Mary Taylor Muller, (?) 1907-
C. Muell. Karl Mueller, 1817-1899, German horticulturist, Berlin.
- F. v. Muell. Baron Ferdinand Jacob Heinrich von Mueller, 1825-1896, German-born Australian botanist, director, Melbourne Botanic Garden; eminent student of the Australian flora.

- Muenchh. Otto Frieherr von Muenchbausen, 1716-1774, German botanist.
- Muhl. Henry Muhlenberg (formerly Gotthilf Heinrich Ernst Muehlenberg, also Heinrich Ludwig Muehlenberg), 1753-1815, German-educated Lutheran minister and pioneer botanist of Pennsylvania.
- Mühlenpfordt. F. Mühlenpfordt, German (Hannover) horticulturist (Cactaceae) of middle 19th century.
- C. H. Mull. Cornelius Herman Muller (formerly Mueller), 1909—, Texas-born and -reared, professor at University of California (Santa Barbara); *Quercus*; author of "The Oaks of Texas" (1951).
- F. J. Mull. F. J. Muller; *Callicarpa*.
- Munro. William Munro, 1818-1880, English general and agrostologist.
- Munson. Thomas Volney Munson, 1843-1913, grape breeder of Denison, Texas.
- Munz. Philip Alexander Munz, 1892—, professor of botany, Pomona College, Claremont, California, later director, Rancho Santa Ana Botanic Garden, Anaheim, California; author of "Manual of Southern California Botany" (1935), "A California Flora" (1959), Onagraceae, *Aquilegia*.
- Munz & I. M. Johnst. P. A. Munz, and I. M. Johnston.
- Munz & Klein. P. A. Munz, and William McKinley Klein, Jr., 1933—, Colorado State University, Fort Collins; Onagraceae (*Oenothera*).
- Murr. Johann Andreas Murray, 1740-1791, Swedish professor of medicine and botany, Göttingen, Germany (1760-1791); student of Linnaeus and editor of some of his later editions.
- Muschler. Reno (Reinhold) Muschler, 1883—, German botanist; student of Egyptian flora.
- Mutis. José Celestino Mutis, 1732-1811, Spanish botanical explorer in Colombia; correspondent of Linnaeus.
- Myint. Tin Myint, 1936—, Burmese botanist, Mandalay; published on *Stylisma* (Convolvulaceae) in 1966.
- Nash. George Valentine Nash, 1864-1921, head gardener, New York Botanical Garden; agrostologist.
- Naud. Charles Victor Naudin, 1815-1899, director of the botanic garden, Villa Thuret, Antibes; student of the flora of the Pyrenees, of the Solanaceae, Melastomataceae, Cucurbitaceae and *Eucalyptus*.
- Neé. Luis Neé, 18th-19th century, botanist with T. Haenke on the Malaspina Expedition, visiting California in 1791; his collections are preserved at Madrid.
- Nees. Christian Gottfried Daniel Nees von Esenbeck, 1776-1858, German botanist, professor in Breslau; prolific botanical writer, Acanthaceae, Cyperaceae, Gramineae.
- Nees & Arn. C. G. D. Nees von Esenbeck, and G. A. W. Arnott.
- Nees & Eberm. C. G. D. Nees von Esenbeck, and Carl Heinrich Ebermaier, 1802-1870, Germany.
- Nees & Mey. C. G. D. Nees von Esenbeck, and Franz Julius Ferdinand Meyen, 1804-1840, German physician and botanical artist who collected in Brazil and Peru.
- Nels. & Cockll. A. Nelson, and Theodore Dru Alison Cockerell.
- A. Nels. Aven Nelson, 1859-1952, professor of botany and president, University of Wyoming, Laramie; student of the Rocky Mountain flora, reviser of Coulter's "New Manual of Botany of the Central Rocky Mountains" (1909).
- A. Nels. & Macbr. A. Nelson, and J. F. Macbride.
- E. Nels. Elias Emanuel Nelson, 1876-1949, Swedish-born American agriculturist, U. S. Dept. Agriculture Experimental Farm, Bend, Oregon; horticulture, forage plants for arid regions, editor, author of "The Shrubs of Wyoming" (1902).
- H. Ness. Helge Ness, 1861-1928, Norwegian-born horticulturalist, Texas A&M University, College Station; *Rubus*, *Quercus*.
- Nevskii. Sergeĭ Arsenjevic Nevskii, 1908-1938, senior agrostologist at Botanical Institute of Academy of Science in U.S.S.R., Leningrad.
- Nicora. Elisa G. Nicora, contemporary Argentine agrostologist, Técnica, Facultad de Agronomía y Veterinaria de Buenos Aires.
- Nieuw. Julius Aloysius Arthur Nieuwland, 1878-1936, professor of botany (1904-1918) and professor of organic chemistry (1918-1936), Notre Dame University, Indiana; founder and first editor of THE AMERICAN MIDLAND NATURALIST.
- Nisbet & Jackson. Gladys T. Nisbet, 1895—, Arizona botanist; *Penstemon* (Scrophulariaceae), and R. C. Jackson.
- Norm. Eliane Meyer Norman, 1931—, Rutgers University, New Brunswick, New Jersey; Loganiaceae (*Buddleja*).
- Nort. John Bitting Smith Norton, 1872-1966, plant pathologist, University of Maryland, College Park.
- Nutt. Thomas Nuttall, 1786-1859, English-American naturalist, botanist and ornithologist who resided in Philadelphia (1808-1841), collector of western America plants; author of "The Genera of North American Plants" (1818), "The North American Sylva" (1842), also a noted ornithologist.
- Oakes. William Oakes, 1799-1848, Massachusetts; student of Vermont flora.
- Ockendon. David Jeffery Ockendon, 1940—, Imperial College, London, England; *Linum*, *Psoralea*.
- O'Donell. Carlos Alberto O'Donell, 1912-1954, Instituto Miguel Lillo, Tucuman, Argentina; Convolvulaceae.
- Oeder. Georg Christian von Oeder, 1728-1791, Danish botanist, professor in Copenhagen; first editor of "Flora Danica" (1761-1771).
- Oerst. Anders Sandøe Oersted, 1816-1872, Danish botanist who collected in Costa Rica and Colombia.
- Ohwi. Jisaburo Ohwi, 1905—, National Science Museum, Tokyo; student of flora of Japan, Gramineae and Cyperaceae of eastern Asia.
- R. Oliv. Royce Ladell Oliver, 1929—, Missouri Botanical Garden, St. Louis; Iridaceae (*Sisyrinchium*).
- O'Neill. Hugh Thomas O'Neill, 1894-1969, curator of the Langlois Herbarium, The Catholic University of America, Washington; Cyperaceae.

- Opiz. Philipp Maximilian Opiz, 1787-1858, zealous Bohemian botanist who named great numbers of "species" of little worth.
- Orcutt. Charles Russell Orcutt, 1864-1929, San Diego, California, botanical collector.
- Ort. Casimiro Gomez Ortega, 1740-1818, Spanish botanist, director of the botanical garden, Madrid.
- Osbeck. Pehr Osbeck, 1723-1805, Sweden.
- Osterh. George Everett Osterhout, 1858-1937, Colorado lumberman and amateur botanist.
- Ottley. Alice Maria Ottley, 1882—, professor of botany, Wellesley College, Massachusetts; *Lotus*.
- Otto & Dietr. Friedrich Otto, 1782-1856, and A. Dietrich, Germany.
- G. Ownbey. Gerald Bruce Ownbey, brother of Marion, 1916—, professor of botany, University of Minnesota; *Argemone*, *Corydalis*.
- M. Ownbey. Francis Marion Ownbey, 1910—, professor of botany, State College of Washington, Pullman; *Calochortus*, *Allium Tragopogon*; co-author of "Vascular Plants of the Pacific Northwest" (1955-1964).
- Pall. Peter Simon Pallas, 1741-1811, German botanist, student of the Russian and Siberian floras; early monographer of *Astragalus* (1800), also eminent as zoologist.
- Palm. & Steyer. E. J. Palmer, and J. A. Steyermark.
- E. J. Palm. Ernest Jesse Palmer, 1875-1962, field collector for Missouri Botanical Garden and Arnold Arboretum (1913-1948); specialist on *Crataegus*.
- Palmer. F. Palmer, published on cactaceae in 1865 (*Echinocereus Blanckii*).
- Pammel. Louis Hermann Pammel, 1862-1931; professor of botany, Iowa State College, Ames; student of poisonous plants, flora of Iowa, etc.
- Panz. Georg Wolfgang Franz Panzer, 1755-1829, German taxonomist.
- Parish. Samuel Bonsall Parish, 1838-1928, pioneer botanist of San Bernardino who made known much of the southern California flora.
- Parker. Kittie Lucille (Fenley) Parker, 1910—, George Washington University, Washington, later U. S. National Herbarium; Compositae (*Hymenoxys*), weeds of Arizona.
- Parks. Harris Braley Parks, 1879-1958, apiculturist, Texas A&M University, College Station; collector of Texas plants and author.
- Parl. Filippo Parlatore, 1816-1877, Italian botanist, professor in Florence and founder of the herbarium; Gnetaceae, Coniferae.
- Parodi. Lorenzo Raimundo Parodi, 1895-1966, agrostologist of Buenos Aires, Argentina.
- Patt. Harry Norton Patterson, 1853-1919, Oquawka, Illinois printer and botanist; published a catalogue of Illinois plants in 1876.
- Pax. Ferdinand Albin Pax, 1858-1942, professor of botany, Breslau; Aceraceae, Primulaceae.
- Pax & K. Hoffm. F. A. Pax, and Kaethe Hoffmann, 1883—, professor in Breslau; made the huge contribution to *Das Pflanzenreich* on the Euphorbiaceae.
- Paxt. Sir Joseph Paxton, 1801(?) - 1865, British gardener and architect, editor of PAXTON'S MAGAZINE OF BOTANY and author of other horticultural works.
- Payne. Willard William Payne, 1934—, botanist, University of Illinois, Urbana; Compositae (*Ambrosia*).
- Pays. Edwin Blake Payson, 1893-1927, professor of botany, University of Wyoming, Laramie; Cruciferae, *Cryptantha*.
- Pearson. Thomas Gilbert Pearson, 1873-1943, New York ornithologist and wildlife conservationist.
- Peck. Morton Eaton Peck, 1871-1959, professor of biology, Wilamette University, Salem, Oregon; author of "A Manual of the Higher Plants of Oregon" (1941).
- Peeb. Robert Hibbs Peebles, 1900-1956, cotton agronomist, U. S. Dept. Agriculture.
- P'ei. Chien P'ei, 1903—, Chinese botanist; collector of the genus *Vitex* (Verbenaceae).
- Penl. Charles William Theodore Penland, 1899—, professor of botany, Colorado College, Colorado Springs; botanized throughout Colorado, published on alpine vegetation of the Rocky Mts. and Ecuadorian Andes (1941).
- Penn. Francis Whittier Pennell, 1886-1952, curator of botany, Academy of Natural Sciences of Philadelphia; authority on Scrophulariaceae; author of "The Scrophulariaceae of Eastern Temperate North America" (1935).
- Perdue. Robert Edward Perdue, Jr., 1924—, botanist, U. S. Dept. Agriculture, Beltsville, Maryland; *Rudbeckia*.
- Perkins. Janet Russell Perkins, 1853-1933, American botanist, longtime worker in Berlin-Dahlem Museum.
- Perry. Lily May Perry, 1895—, botanist, Arnold Arboretum, Harvard University; *Verbena*.
- Perry & Fern. L. M. Perry, and M. L. Fernald.
- Pers. Christian Hendrik Persoon, 1761(?) - 1836, bizarre individual and brilliant mycologist, born in South Africa, studied in Germany, lived in Paris; author of "Synopsis Plantarum" (1805-1807) and other valuable botanical works.
- Peterm. Wilhelm Ludwig Petermann, 1806-1855, Leipzig.
- Peters. Otto Georg Petersen, 1847-1937, Copenhagen, Denmark.
- Pfeiffer. Norma Etta Pfeiffer, 1889—, Boyce Thompson Institute for Plant Research, Yonkers, New York; *Isoetes*.
- Phil. Rudolf Amandus Philippi, 1808-1904, Chilean botanist, director, Museo Nacional and professor of botany, Santiago; student of botany, zoology and paleontology of Chile.
- Pick. Charles Pickering, 1805(?) - 1878, American physician and botanist on the Wilkes Expedition to explore the western slope of the Rocky Mts. in the Columbia River area; plant geographer, ethnologist, historian.
- Pilg. Robert Knud Friedrich Pilger, 1876-1953, director of the botanic garden and museum, Berlin; Plantaginaceae, Coniferae.
- Pinkava. Donald John Pinkava, 1933—, botanist, Arizona State University, Tempe; Compositae; Cactaceae.
- Piper. Charles Vancouver Piper, 1867-1926, professor of botany and zoology, Washington Agric.

- College, Pullman, *later* agrostologist, U. S. Dept. Agriculture; author of "Flora of the State of Washington" (1906).
- Planch. Jules Émile Planchon, 1823-1888, French botanist, assistant to W. J. Hooker (1844-1848), professor of botany, Ghent, Nancy and Montpellier; Ulmaceae, Vitaceae.
- Plum. Charles Plumier, 1646-1704, French Franciscan monk who explored and wrote on the flowering plants and ferns of tropical America.
- Poepp. Eduard Friedrich Poeppig, 1798-1868, Austrian biologist and explorer, professor of zoology, Leipzig; published on plants collected during a trip to Chile, Peru and the Amazon.
- Poepp. & Kunth. E. F. Poeppig, and C. S. Kunth.
- Pohl. Johann Baptist Emanuel Pohl, 1782-1834, Austrian botanist and traveler.
- Poir. Jean Louis Marie Poiret, 1755-1834, French botanist and traveler in North Africa; completed Lamarck's "Encyclopédie Méthodique Botanique" (1783-1817).
- Poit. Pierre Antoine Poiteau, 1766-1854, French botanist and horticulturist.
- Polák. Karl Polák, 1847-1900, Bohemian botanist.
- Pollard. Charles Louis Pollard, 1872-1945, Vermont librarian and plant collector.
- Pollard & Ball. C. L. Pollard, and C. R. Ball.
- Port. & Coult. T. C. Porter, and J. M. Coulter.
- Porter. Thomas Conrad Porter, 1822-1901, professor of botany, Lafayette College, Pennsylvania; author of "Flora of Pennsylvania" (1903).
- D. M. Porter. Duncan MacNair Porter, 1937- , botanist and curator of Panamanian plants, Missouri Botanical Garden, St. Louis; Zygophyllaceae.
- Poselger. Heinrich Poselger, died 1883, Germany; Cactaceae.
- Powell. Albert Michael Powell, 1937- , Sul Ross State University, Alpine, Texas; Compositae (*Perityle*).
- Prantl. Karl Anton Eugen Prantl, 1849-1893, German botanist, professor of botany, Breslau; prepared (with H. G. A. Engler) the classic work "Die natürlichen Pflanzenfamilien" (1887-1915).
- Presl. Karel Bořiwag Presl, 1794-1852, professor of natural history, Prague; in "Reliquiae Haenkeanae" (1825-1835) he described the collections made along the western side of the American continent by Thaddeus Haenke, the first botanist to visit California.
- J. Presl. Jan Swatopluk Presl, the brother, 1791-1849, professor in Prague.
- J. & C. Presl. J. S. Presl, and K. B. Presl; authors of "Flora Čechica" (1819).
- Price. Sarah Frances Price, 1849-1903; author of "Flora of Warren County, Kentucky" (1893).
- Prince. William Robert Prince, 1795-1869, American nurseryman.
- Pursh. Frederick Traugott Pursh, 1774-1820, born in Saxony, settled in Philadelphia; author of "Flora Americae Septentrionalis" (1814).
- Quehl. Leopold Quehl, 1849-1922, Halle an der Saale, Germany; amateur cactologist.
- R. & P. Hipólito Ruiz Lopez, 1754-1815, and José Antonio Pavon, 1754-1844, Spanish botanical explorers and authors of a flora of Peru and Chile (1794 and 1798-1802).
- R. & S. J. J. Roemer, and J. A. Schultes, produced an edition of Linnaeus' "Systema Vegetabilium" (1817-1830).
- Raddi. Guiseppe Raddi, 1770-1829, Italian botanist, student of the Brazilian flora.
- Radlk. Ludwig Adolph Timotheus Radlkofer, 1829-1927, Germany.
- Raeusch. Ernst Adolf Raeuschel, 18th-19th century, longtime professor of botany at Munich, Germany.
- Raf. Constantin Samuel Rafinesque (*or* Rafinesque-Schmaltz), 1783-1840, born in Constantinople, lived in Sicily and Kentucky, brilliant, eccentric pioneer naturalist; profligate author of binomials, with many "species" quite untraceable.
- Raven. Peter Hamilton Raven, 1936- , Stanford University, Stanford, California; Onagraceae of western North America; flora of Chiapas.
- Raven & Gregory. P. H. Raven, and David Palache Gregory, 1930- , Keene State College, Keene, New Hampshire; Onagraceae (pollination studies).
- Raven & Parnell. P. H. Raven, and Dennis Richard Parnell, 1939- , California State College, Hayward; Onagraceae.
- Ray. James Davis Ray, Jr., 1918- , professor of Botany, University of South Florida, Tampa; *Lysimachia*.
- Raymond. Marcel Raymond, 1915- , Curator, Montreal Botanical Garden, Montreal, Canada; Cyperaceae and Gesneriaceae.
- Rech. f. Karl Heinz Rechinger, 1906- , Natural History Museum, Vienna; flora of the Mediterranean and the Near East; *Rumex*.
- Reed. Clyde Franklin Reed, 1918- , professor of biology, Coppin State College, Baltimore, Maryland; student of ferns, Amaranthaceae, Chenopodiaceae, Nyctaginaceae, Bryophytes, etc.
- E. L. Reed. Edward Looman Reed, 1874-1946, Texas A&M University, *then* John Tarleton College, *then* Texas Technological College, Lubbock; collector and student of Texas botany.
- C. G. Reeder. Charlotte Gooding Reeder (cf. C. Goodd.)
- Regel. Eduard August von Regel, 1815-1892, director of the botanic garden, St. Petersburg; editor of *GARTENFLORA*, Betulaceae.
- Rehd. Alfred Rehder, 1863-1949, German-born American botanist, curator of the herbarium, Arnold Arboretum, Harvard University; author of "Manual of Cultivated Trees and Shrubs Hardy in North America" (1927, 2nd ed. 1940).
- Reich. Johann Jakob Reichard, 1743-1782, German physician and botanist, Frankfurt am Main.
- Reichb. Heinrich Gottlieb Ludwig Reichenbach, 1793-1879, German naturalist, professor in Dresden; first editor of "Icones Florae Germanicae et Helveticae" and author of many other extensive works on plants and animals.
- Reichb. f. Heinrich Gustav Reichenbach, 1823(?) - 1889, the son, German professor of botany and director of the botanic garden, Hamburg; famous orchidologist.

- Remy. Ezechiel Jules Remy, 1826-1893, French naturalist and traveller, student of the Andean flora.
- Retz. Anders Johan Retzius, 1742-1821, Swedish botanist, professor in Lund; prolific writer on botany and zoology.
- Reveal. James Lauritz Reveal, 1941- , Brigham Young University, Provo, Utah; later University of Maryland, College Park (1969-); Intermountain Flora, *Eriogonum*.
- Rich. Louis Claude Marie Richard, 1754-1821, French botanist and collector in South America and the West Indies.
- A. Rich. Achille Richard, 1794-1852, the son, physician and botanical demonstrator to the faculty of medicine, Paris.
- A. Rich. & Gal. A. Richard, and H. G. Galeotti.
- Richards. Sir John Richardson, 1787-1865, Scotch botanist and zoologist attached to Capt. Sir John Franklin's expedition to arctic America.
- Ricker. Percy Leroy Ricker, 1878- , agronomist, U. S. Dept. of Agriculture, Washington; Gramineae, Leguminosae.
- Rickett. Harold William Rickett, 1896- , New York Botanical Garden; writer of textbooks, and a series of volumes entitled "Wild Flowers of the United States" (1966-).
- Ridd. John Leonard Riddell, 1807-1865; author of "Catalogus florae ludoviciana" (1852).
- Risso. J. Antoine Risso, 1777-1845, French botanist.
- Robbins. James Watson Robbins, 1801-1879, Massachusetts.
- Roberty & Vautier. Guy E. Roberty, 1907- , Institut d'Enseignement et de Recherches Tropicales, Seine, France; Gramineae, Malvaceae (*Gossypium*), flora and phytogeography of West Africa, and Vautier, French botanist (further data not obtained).
- Robins. Benjamin Lincoln Robinson, 1864-1935, curator of Gray Herbarium, Harvard University (1892-1935); student of Compositae, an editor of Gray's "Synoptical Flora of North America."
- Robins. & Fern. B. L. Robinson, and M. L. Fernald; authors of "Gray's New Manual of Botany," ed. 7 (1908).
- Robins. & Greenm. B. L. Robinson, and J. M. Greenman.
- Robson. Norman Keith Bonner Robson, 1928- , botanist, British Museum (Natural History), London; *Hypericum*.
- Rock. Howard Francis Leonard Rock, 1925-1964, professor of biology, Vanderbilt University, Nashville, Tennessee; Compositae (*Helenium*).
- Roem. Johann Jacob Roemer, 1763-1819, Swiss botanist, professor in Zürich; active editor.
- Rogers. Claude Marvin Rogers, 1919- , Dept. of Biology, Wayne State University, Detroit, Michigan; Linaceae.
- D. Rogers. David James Rogers, 1918- , botanist, University of Colorado, Boulder; Euphorbiaceae (*Manihot*).
- Rohrb. Paul Rohrbach, 1847-1871, Berlin; Portulacaceae, *Silene*.
- Roll. Reed Clark Rollins, 1911- , director of Gray Herbarium, Harvard University; Cruciferae, *Parthenium*.
- Roscoe. William Roscoe, 1753-1831, British historian and amateur botanist, one of the founders of the Liverpool botanic garden.
- Rose. Joseph Nelson Rose, 1862-1928, assistant botanist, U. S. Dept. Agric., later associate botanist, U. S. National Herbarium, Washington; Cactaceae, Umbelliferae, Crassulaceae.
- Rose & Bush. J. N. Rose, and B. F. Bush.
- Rose & Painter. J. N. Rose, and Joseph Hannum Painter, 1879-1908, U. S. National Museum, Washington.
- Rose & Standl. J. N. Rose, and P. C. Standley.
- Rosend., Butt. & Lak. Carl Otto Rosendahl, 1875-1956, professor of botany, University of Minnesota; Saxifragaceae, and Frederick King Butters, 1878-1945, professor of botany, University of Minnesota; authors of works on the flora of Minnesota, and Olga Lakela, 1890- , professor of botany, University of Minnesota (Duluth Branch).
- Rostk. Friedrich Wilhelm Gottlieb Rostkovius, 1770-1848, physician in Stettin, Poland; author (with W. L. E. Schmidt) of "Flora Sedinensis" (1824).
- Roth. Albrecht Wilhelm Roth, 1757-1834, German physician and botanist.
- Rothr. Joseph Trimble Rothrock, 1839-1922, student of Asa Gray, forester, professor of botany, University of Pennsylvania, Philadelphia (1877-1904); surgeon and botanist on Lt. Wheeler's Survey in Colorado, New Mexico and California (1873-75).
- Rottb. Christen Friiss Rottboell, 1727-1797, professor of botany and director of the botanical garden, Copenhagen, Denmark.
- Rowlee. Willard Winfield Rowlee, 1861-1923, American student of *Salix*.
- Roxb. William Roxburgh, 1751-1815, Scotch physician and botanist, director of the Royal Botanic Gardens, Calcutta; author of "Flora Indica" (1820-1824 and later editions).
- Rudge. Edward Rudge, 1763-1846, British botanist and antiquarian.
- Rudolphi. Karl Asmund Rudolphi, 1771-1832, Germany.
- Rugel. Ferdinand Rugel, 1806-1878, German-born plant explorer in southeastern United States.
- Rümpel. Theodor Rümpel, 1817-1891, Germany; Cactaceae, etc.
- Rupr. Franz Joseph Ruprecht, 1814-1870, Czech-born Russian botanist, curator of the herbarium of the Academy of Science, St. Petersburg; Gramineae, Umbelliferae, *Botrychium*, algae.
- Russell. Norman Hudson Russell, 1921- , professor of botany, Central State College, Edmond, Oklahoma, then at Buena Vista College, Storm Lake, Iowa; Violaceae.
- Rydb. Per Axel Rydberg, 1860-1931, Swedish-born American botanist, curator, New York Botanical Garden; author of "Flora of Colorado" (1906), "Flora of the Rocky Mountains and Adjacent Plains" (1917), "Flora of the Prairies and Plains of Central North America" (1932), etc.
- Salish. Richard Anthony (born Markham) Salisbury, 1761-1829, British botanist; early proponent of the natural system of classification.

- Salm-Dyck. Joseph Maria Franz Anton Hubert Ignaz Zu Salm-Reifferscheid-Dyck, 1773-1861, German amateur botanist and horticulturist; owner of a fine living collection of succulents, Cactaceae.
- Salzm. Philipp Salzmann, 1781-1851, born in Germany, botanized in Brazil, Spain, North Africa, south France.
- Sandw. Noel Yvri Sandwith, 1901-1965, eminent English plant taxonomist, curator of plants, Kew: Bignoniaceae, Papaveraceae (*Fumaria*), student of Tropical South America and Mediterranean floras.
- Sarg. Charles Sprague Sargent, 1841-1927, botanist and dendrologist, creator and director of Arnold Arboretum, Harvard University; author of "The Silva of North America" (1891-1902), "Manual of the Trees of North America" (1905), etc.
- Sarg. & Engelm. C. S. Sargent, and G. Engelmann.
- Sartw. Henry Parker Sartwell, 1792-1867; author of "Catalogue of plants, growing without cultivation in the vicinity of Seneca and Crooked Lakes, in western New York" (1845).
- Sauer. Jonathan Deininger Sauer, 1918- , professor of botany, University of Wisconsin, Madison; *Amaranthus, Canavalia*.
- Savi. Gaetano Savi, 1769-1844, Italian botanist; author of a flora of Pisa (1798).
- Sch. Bip. Carl Heinrich Schultz, *Bipontinus* (i.e., of Zweibrücken), 1805-1867, Germany; Compositae.
- J. H. Schaffn. John Henry Schaffner, 1866-1939, professor of botany, Ohio State University; *Equisetum*, phylogeny, author of "Field Manual of the Flora of Ohio and Adjacent Territory" (1928).
- Schauer. Johann Conrad Schauer, 1813-1848, professor at Greifswald, Germany; Verbenaceae.
- Scheele. Georg Heinrich Adolf Scheele, 1808-1864, German botanist who described plants from Texas (1849).
- Scheidw. Michael J. Scheidweiler, 1799-1861, Germany; Cactaceae.
- Schery. Robert Walter Schery, 1917- , Missouri Botanical Garden, St. Louis, later with a commercial seed house; student of the Panamanian flora.
- Schiede. Christian Julius Wilhelm Schiede, ? -1836, German-born physician who collected plants in Mexico.
- Schindl. Anton Karl Schindler, 1879- , Germany.
- Schinz & Thell. Hans Schinz, 1858-1941, director, botanic garden and museum, Zürich, and editor of numerous works on the flora of subtropical Africa, and A. Thellung; authors of the 4th ed. of Schinz and Keller's "Flora der Schweiz" (1923).
- Schkuhr. Christian Schkuhr, 1741-1811, German botanist and "university mechanic" in Wittenberg; student of the German flora.
- Schlecht. Diederich Franz Leonhard von Schlechtendal, 1794-1866, German botanist and botanical editor, professor in Halle an der Saale; Eleagnaceae.
- Schlecht. & Cham. D. F. L. von Schlechtendal, and A. L. von Chamisso.
- Schleid. Matthias Jakob Schleiden, 1804-1881, Germany; author of botanical handbooks.
- Schltr. Friedrich Reichardt Rudolf Schlechter, 1872-1925, Berlin; famous botanical collector, and prolific writer on the Orchidaceae.
- Schmid. Casimir Christoph Schmidel, 1718-1792, German physician and botanist at Erlangen.
- Schneid. Camillo Karl (*formerly* Carl Camillo) Schneider, 1876-1951, Austria and Germany; dendrologist.
- Schoenl. Johann Lucas Schoenlein, 1793-1864, Bamberg, Bavaria.
- Schoepf. Johann David Schoepf, 1752-1800, German physician-botanist who wrote on American medicinal plants.
- Schott. Heinrich Wilhelm Schott, 1794-1865, Austrian botanist, director of the royal garden in Schönbrunn, Vienna; Araceae.
- Schott & Endl. H. W. Schott, and S. F. L. Endlicher.
- Schrad. Heinrich Adolph Schrader, 1767-1836, German botanist, professor in Göttingen; monographer of *Verbascum*.
- Schrank. Franz von Paula von Schrank, 1747-1838, German botanist, professor in Munich; author of floras of Bavaria, Salisburg, and Monaco.
- Schreb. Johann Christian Daniel von Schreber, 1739-1810, German botanist, professor in Erlangen; editor of the 8th ed. of Linnaeus' "Genera Plantarum" (1789-1791).
- Schub. Bernice Giduz Schubert, 1913- , Gray Herbarium, Harvard University (1941-50), Brussels (1950-52), U. S. Dept. Agriculture, Beltsville (1952-61), Arnold Arboretum, Harvard University (1962-), editor, JOURNAL OF THE ARNOLD ARBORETUM (1963-); *Desmodium, Begonia, Dioscorea*.
- Schult. Joseph August Schultes, 1773-1831, Austrian botanist, professor of botany in Vienna, Cracow and Landeshut.
- Schulz. Otto Eugen Schulz, 1874-1936, German taxonomist; Cruciferae.
- K. Schum. (or K. Sch.) Karl Moritz Schumann, 1851-1904, German botanist, curator of the herbarium, Berlin; Cactaceae.
- K. Schum. & Sydow. K. M. Schumann, and Paul Sydow, 1851-1925, German botanist.
- Schum. & Thonn. K. M. Schumann, and Peter Thonning, 1775-1848, Denmark.
- Schuyler. Alfred Ernest Schuyler, 1935- , botanist, Academy of Natural Sciences of Philadelphia, Pennsylvania.
- Schwein. Lewis David von Schweinitz, 1780-1834, German-born Pennsylvania clergyman; noted student of fungi.
- Schwein. & Torr. L. D. von Schweinitz and J. Torrey.
- Schwerin. Graf Fritz von Schwerin, 1856-1934, Germany.
- Scop. Johann Anton (Giovanni Antonio) Scopoli, 1723-1788, Austrian botanist, physician and professor of natural history, Pavia.

- Scora. Rainer Walter Scora, 1928—, University of California, Riverside; Labiatae, Rutaceae, chemosystematics, evolution.
- Scribn. Frank Lamson Scribner, 1851-1938, agrostologist, U. S. Dept. Agriculture, Washington.
- Scribn. & Ball. F. L. Scribner, and C. R. Ball.
- Scribn. & Merr. F. L. Scribner, and E. D. Merrill.
- Scribn. & Sm. F. L. Scribner, and J. G. Smith.
- Seaton. Henry Eliason Seaton, 1869-1893, American student of the Pteridophyta.
- Seem. Berthold Carl Seemann, 1825-1871, German naturalist and world traveler living in England, editor of *BONPLANDIA*, founder of the *JOURNAL OF BOTANY*; author of "Botany of the Voyage of H. M. S. Herald" (1852-1857).
- v. Seem. Karl Otto von Seemen, 1838-1910, German botanist.
- Séguier. Jean-François Séguier, 1703-1784, French botanist.
- Sér. Nicolas Charles Seringe, 1776-1858, French botanist, at first curator of the Candolle herbarium, later professor of botany in Lyon; important collaborator in De Candolle's *Prodromus*; Caryophyllaceae, Rosaceae, Cucurbitaceae, *Salix*, *Aconitum*.
- Ses. Martin des Sessé y Lacasta, 175?-1809, Spanish botanist, director of the botanic garden in Mexico City.
- Ses. & Moç. M. Sessé y Lacasta, and J. M. Moçifio.
- Seub. Moritz Seubert, 1818-1878, professor in Karlsruhe; student of monocots, Amaranthaceae.
- Shafer. John Adolf Shafer, 1863-1918, custodian of the museum, New York Botanical Garden; made the most extensive collections of Cuban plants.
- Sharp. Ward McClintic Sharp, 1904—, U. S. Fish and Wildlife Service, State College, Pennsylvania.
- Shaw. George Russell Shaw, 1849-1937, student of Pinus; author of "Pines of Mexico" (1909).
- E. Shaw. Elizabeth Anne Shaw, 1938—, botanist, Gray Herbarium, Harvard University; Cruciferae.
- Shear. Cornelius Lott Shear, 1865-1956, plant pathologist and agrostologist, U. S. Dept. Agriculture, Washington; collected widely in the Rocky Mts., published with P. A. Rydberg on grasses (1897).
- Sheer. Early 19th century German interested in Cactaceae (*Coryphantha*).
- Sheld. Edmund Perry Sheldon, 1869—, resident first in Minnesota, later in Portland, Oregon, forestry; author of "The Forest Wealth of Oregon" (1904).
- Sherff. Earl Edward Sherff, 1886-1966, botanist, Chicago Teachers College; student of *Bidens* and the Hawaiian flora.
- Shiller. Ivan Shiller, 1895—, U. S. Dept. Agriculture, Brownsville, Texas; economic entomology and botany (Malvaceae of South Texas).
- Shinners. Lloyd Herbert Shinners, 1918—, Canadian-born botanist, professor of botany, Southern Methodist University; student of floras of North-Central Texas, Southeastern U. S., Gulf Southwest of U. S., Convolvulaceae, Compositae, Caryophyllaceae, author of "Spring Flora of the Dallas-Fort Worth Area Texas" (1958), founder and editor of journal "Sida," etc.
- Short. Charles Wilkins Short, 1794-1863, medical botanist, professor in Louisville, Kentucky; author of "A Sketch of the Progress of Botany in Western America" (1836). His herbarium housed at the University of Kentucky was regrettably destroyed by fire.
- Shreve. Forrest Shreve, 1878-1950, Carnegie Institution Desert Laboratory, Arizona; ecologist and taxonomist, one of authors of "The Plant Life of Maryland" (1910), "Vegetation and Flora of the Sonoran Desert" (with Ira L. Wiggins) (1964), etc.
- Shreve & Wiggins. F. Shreve, and Ira Loren Wiggins, 1899—, professor of botany and director of the natural history museum, Stanford University, Stanford, California; student of flora of Sonoran Desert; Malvaceae; Pteridophyta. (cf. Shreve.)
- Shuttlew. Robert James Shuttleworth, 1810-1874, English botanist and conchologist who resided most of his life in Berne; amassed an herbarium of 170,000 specimens now in the British Museum.
- Sibth. John Sibthorp, 1758-1796, professor of botany, Oxford, England.
- Sibth. & Sm. J. Sibthorp, and J. E. Smith; authors of "Flora graeca" (1806-1840).
- Sieb. & Zucc. Philipp Franz von Siebold, 1796-1866, German botanist, made several trips to study the botany, agriculture and ethnography of Japan, and J. G. Zuccarini; authors of a flora of Japan (1835-1870).
- Sims. John Sims, 1749-1831, England; for 25 years editor of *CURTIS' BOTANICAL MAGAZINE*.
- Sm. Sir James Edward Smith, 1759-1828, British botanist, founder and for 40 years president of the Linnaean Society; purchaser of the Linnaean herbarium and library (1784), now at the Linnaean Society of London.
- Sm. & Rydb. J. G. Smith, and P. A. Rydberg.
- E. B. Sm. Edwin Burnell Smith, 1936—, University of Arkansas, Fayetteville; Compositae (*Haplopappus*).
- J. D. Sm. John Donnell Smith, 1829-1928, botanical collector and author of works on Guatemalan plants (1889-1907).
- J. G. Sm. Jared Gage Smith, 1866-1925, agrostologist, U. S. Dept. Agriculture, Washington, later Hawaii; *Sagittaria*.
- L. B. Sm. Lyman Bradford Smith, 1904—, Gray Herbarium, Harvard University, (1930-1947), U. S. National Herbarium, Washington (1947—); taxonomy of flowering plants especially of Latin America, flora of southern Brazil, Bromeliaceae, Begoniaceae.
- Small. John Kunkel Small, 1869-1938, American botanist, head curator, New York Botanical Garden; author of "Flora of the Southeastern United States" (1903), "Manual of the Southeastern Flora" (1933), etc.
- Small & Heller. J. K. Small, and A. A. Heller.
- Small & Penn. J. K. Small, and F. W. Pennell.
- Smyth. Bernard Bryan Smyth, 1843-1913, librarian, Kansas Academy of Science, Topeka.
- Soderstrom & Decker. Thomas Robert Soderstrom, 1936—, U. S. National Herbarium, Washington;

- Gramineae, and Henry Fleming Decker, 1930–, Dept. of Botany, Ohio Wesleyan University, Delaware; grass systematics.
- Soland. Daniel Carl Solander, 1736-1782, England, gifted Swedish student of Linnaeus; accompanied Banks on Capt. Cook's first voyage of circumnavigation.
- Solbrig. Otto Thomas Solbrig, 1930–, Argentine-born U. S. botanist, University of Michigan, Ann Arbor, later Gray Herbarium, Harvard University; cytotaxonomy and genetics of plants.
- Solms. Count Hermann Maximilian Carl Ludwig Friedrich Solms-Laubach, 1842-1915, professor of botany, Strassburg; Lennoaceae.
- Spach. Edouard Spach, 1801-1879, French botanist; author of "Histoire Naturelle des Végétaux Phanérogames" (1834-1848).
- Speg. & Girola. Carlos Luis Spegazzini, 1858-1926, and Carlos De Alberti Girola, 1867-1934, Argentine botanists.
- Spenner. Fridolin Karl Leopold Spenner, 1798-1841, German botanist, professor in Freiburg.
- Sperry. Omer Edison Sperry, 1902–, botanist, Sul Ross State College, Alpine, Texas, later Texas A&M University; author of "A check list of the ferns, gymnosperms, and flowering plants of the proposed Big Bend National Park of Texas" (1938).
- Spreng. Kurt Polykarp Joachim Sprengel, 1766-1833, professor of medicine and botany, Halle; author of works on the flora of Halle, on the Umbelliferae, on the history of botany, and editor of the 18th edition of Linnaeus' "Systema Vegetabilium" (1825-1828).
- Spring. Frédéric Antoine Spring, 1814-1872, professor in Liéttich, Belgium; Lycopodiaceae.
- St.-Hil. Auguste François César Prouvençal de Saint-Hilaire, 1779-1853, French botanist and explorer; collected 7,000 species of plants during extensive travels in Brazil and Paraguay, published many works.
- St.-Hil. & A. Juss. A. Saint-Hilaire, and A. H. L. Jussieu.
- St. John. Harold St. John, 1892–, professor of botany and curator, Bishop Museum, University of Hawaii, formerly at Washington State College, Pullman; student of the flora of eastern Washington.
- St. John & White. H. St. John, and Donald White, b. about 1892–, high school teacher and owner of horticulture firm.
- E. St. John. Edward Porter St. John, 1866-1952, student of Florida ferns.
- R. St. John. Robert Porter St. John, 1869-1960, the brother, student of Florida ferns.
- Standl. Paul Carpenter Standley, 1884-1963, curator, U. S. National Herbarium (1909-1928), Chicago (Field) Natural History Museum (1928-1950), then Zamorano, Honduras; student of the Mexican and Central American floras; also of southwestern United States, author of "Plants of Glacier National Park" (1926), "Trees and Shrubs of Mexico" (1920-1924) and many other notable works.
- Stapf. Otto Stapf, 1857-1933, Austrian botanist on the staff at Kew from 1890, as keeper from 1909-1922; contributor to Harvey and Sonder's "Flora Capensis" and Oliver's "Flora of Tropical Africa."
- Stapf & Hubb. O. Stapf, and C. E. Hubbard.
- Staudt. G. Staudt, contemporary German botanist, Max-Planck Institut, Germany; *Fragaria*.
- Steb. George Ledyard Stebbins, Jr., 1906–, professor of genetics, University of California (Davis); cytogeneticist and cytotaxonomist; *Crepts*, *Antennaria*, Gramineae.
- Steen. Cornelis Gijsbert Gerrit Jan van Steenis, 1901–, Rijksherbarium, Leiden, Netherlands; vegetation, ecology and taxonomy of the flora of Malaysia and adjacent countries.
- Sterrett. William Dent Sterrett, 1881–, American forester, U. S. Forest Service.
- Steud. Ernst Gottlieb Steudel, 1783-1856, German physician and botanical bibliographer; agrostologist.
- Stevens. George Thomas Stevens, 1832-1921, American physician who had an interest in botany.
- S. R. Stewart. Sara R. (later Hinckley) Stewart, 1913–, Hanover, Pennsylvania.
- Steyerm. Julian Alfred Steyermark, 1909–, curator, Chicago (Field) Natural History Museum (1937-1958), botanist, Instituto Botanico of the Ministry of Agriculture, Caracas, Venezuela (1958–); botanical explorer and student of Central and South American floras, *Grindelia*, author of "Flora of Missouri" (1962), floristic works on Central and South American countries, etc.
- Stokes. Jonathan Stokes, 1755-1831, British botanist.
- S. Stokes. Susan Gabriella Stokes, 1868-1954, botanist and high school teacher in San Diego, California; student of *Eriogonum*.
- Stone. Witmer Stone, 1866-1939; author of "The plants of southern New Jersey" (1911).
- Strother. John Lance Strother, 1941–, Herbarium, University of California, Berkeley; Compositae (*Dyssodia*, *Tetradymia*).
- Stuck. Teodoro Stuckert, 1852-1932, Argentina.
- Stuckey. Ronald Lewis Stuckey, 1938–, Ohio State University, Columbus; taxonomy and distribution of angiosperms; Cruciferae (*Rorippa* of North America).
- Stuessy. Tod Falor Stuessy, 1943–, Ohio State University, Columbus; Compositae (Heliantheae: *Melampodium*, *Lecocarpus*).
- Sturm. Jacob Sturm, 1771-1848, German botanical artist.
- Sudw. George Bishop Sudworth, 1864-1927, chief dendrologist, U. S. Forest Service, Washington; author of "Check List of the Forest Trees of the United States, Their names and Ranges" (1898, 1927), "Forest Trees of the Pacific Slope" (1908), etc.
- Suksd. Wilhelm Nikolaus Suksdorf, 1850-1932, German-born American botanist, Bingen, Washington, whose valuable herbarium was bequeathed to State College of Washington, Pullman.
- Sulliv. William Starling Sullivant, 1803-1873, eminent Ohio bryologist for whom the Sullivant Moss Society (now American Bryological Society) was named.
- Svens. Henry Knute Svenson, 1897–, Brooklyn Botanic Garden, American Museum of Natural History, U. S. Geological Survey; *Eleocharis*.

- Sw. Olof Peter Swartz, 1760-1818, Swedish botanist, professor in Stockholm, student of Linnaeus; organizer of the botany of the West Indies in his "Flora Indiae Occidentalis," 3 vols. (1797-1806).
- Swall. Jason Richard Swallen, 1903—, curator, U. S. National Herbarium, Washington; Gramineae.
- Sweet. Robert Sweet, 1783-1835, England, horticulturist and ornithologist; monographer of the Geraniaceae (1820-1830).
- Swezey. Goodwin Deloss Swezey, 1851-1934, professor of astronomy, Nebraska.
- Swingle. Walter Tennyson Swingle, 1871-1952, U. S. Dept. Agriculture, Washington; authority on *Citrus*, introduced commercial date palm into California in 1900 and the fig insect, *Acala* cotton, etc.
- T. & G. John Torrey and Asa Gray; authors of "A Flora of North America" (1838-1840, 1843).
- T. & H. J. Torrey, and Sir W. J. Hooker.
- Tateoka. Tuguo Tateoka, 1931—, National Science Museum, Tokyo, Japan; Gramineae.
- Taub. Paul Hermann Wilhelm Taubert, 1862-1897, Germany.
- Tausch. Ignaz Friedrich Tausch, 1793-1848, Bohemian botanist known for his studies in *Hieracium*.
- Ten. Michele Tenore, 1780-1861, Italian botanist, professor in Naples.
- Terán & Berl. General Manuel de Mier y Terán, ?-1832(?), Mexican, Ft. Terán on Neches River in Tyler Co., Texas, named for him, and J. L. Berlandier.
- Terrac. Achille Terracciano, 1861-1917, Italian botanist.
- Terscheck. Published on the Cactaceae (1843).
- Tharp. Benjamin Carroll Tharp, 1885-1964, Professor of Botany, University of Texas, Austin; student of the Texas flora; author of "Texas Range Grasses" and other works.
- Tharp & Barkl. B. C. Tharp, and F. A. Barkley.
- Tharp & M. C. Johnst. B. C. Tharp, and M. C. Johnston.
- Tharp & L. O. Wms. B. C. Tharp, and L. O. Williams.
- Theil. Albert Thellung, 1881-1928, keeper in the Botanical Institute of the University of Zurich; Cruciferae.
- Thomas. John Hunter Thomas, 1928—, Occidental College, Los Angeles, California; Onagraceae, student of Alaskan and California floras.
- Thomps. Charles Henry Thompson, 1870-1931, Missouri Botanical Garden, St. Louis.
- Thomps. & Zavortink. H. J. Thompson and J. R. Zavortink.
- H. J. Thomps. Henry Joseph Thompson, 1921—, professor of botany, University of California (Los Angeles); Loasaceae, *Dodecatheon*.
- Thornb. John James Tomber, 1872-1962, professor of botany, University of Arizona; student of flora of Arizona and Nebraska.
- Thou. Louis Marie Aubert Du Petit-Thouars, 1758-1831, French taxonomist and botanical writer.
- Thuill. Jean Louis Thuiller, 1757-1822, French gardener, professor in Paris; author of a flora of Paris (1790).
- Thunb. Carl (Pehr) Peter Thunberg, 1743-1828, professor of botany, Uppsala, student of Linnaeus; collected in South Africa, Japan, Ceylon, prolific author of notable works including "Flora Japonica" (1784) and "Flora Capensis" (1820).
- Thurb. George Thurber, 1821-1890, New York; botanist and quartermaster with the Mexican Boundary Survey (1850-53); editor of the AMERICAN AGRICULTURIST.
- Tidest. Ivar T. Tidestrom, 1864-1956, Swedish-born American botanist, professor of botany, Catholic University of America, Washington; author of "Flora of Utah and Nevada" (1925) and (with Sister T. Kittell) "A Flora of Arizona and New Mexico" (1941).
- Tiegel. Interested in the Cactaceae.
- Tomb. Andrew Spencer Tomb, 1943—, Dept. of Botany, University of Texas, Austin; Compositae (Cichorieae).
- Torr. John Torrey, 1796-1873, physician, professor of chemistry and botany, College of Physicians and Surgeons, New York; collector and describer of many western American plants, an outstanding systematist and botanical author.
- Torr. & Frém. John Torrey and John Charles Frémont, 1813-1890, soldier and explorer; first botanical collector in the Sierra Nevada and first presidential candidate of the Republican Party.
- Tourn. Joseph Pitton de Tournefort, 1656-1708, French botanist, professor in the royal garden, Paris; first clear characterizer of genera, his botanical system was the highest pre-Linnaean development.
- Towner & Raven. Howard Frost Towner, 1943—, Stanford University, Stanford, California; Onagraceae (*Calylophus*), and P. H. Raven.
- Traub. Hamilton Paul Traub, 1890—, U. S. Dept. Agriculture, horticulturist; Amaryllidaceae, etc.
- Trel. William Trelease, 1857-1945, director, Missouri Botanical Garden, St. Louis (1885-1912), then professor of botany, University of Illinois, Urbana (1913-1926), first president of the Botanical Society of America; *Yucca*, *Agave*, *Epilobium*, *Quercus*, *Piper*.
- Trew. Christoph Jakob Trew, 1695-1769, physician and naturalist of Nürnberg, Germany.
- Tricker. Published on *Nymphaea* in 1897.
- Trin. Carl Bernhard von Trinius, 1778-1844, Russian court physician, also poet and noted agrostologist.
- Trin. & Rupr. C. B. von Trinius, and F. J. Ruprecht.
- Troncoso. Nelida S. Troncosa, 1914—, wife of A. S. Burkart, Instituto Botánica Darwinion, San Isidro, Argentina; Verbenaceae.
- A. Tryon. Alice Faber Tryon, 1920—, Gray Herbarium, Harvard University; Polypodiaceae (Tribe Cheilantheae, *Pellaea*, *Notholaena*, *Cheilanthes*).
- R. Tryon. Rolla Milton Tryon, 1916—, curator, Missouri Botanical Garden, St. Louis, later curator of ferns, Gray Herbarium, Harvard University; author (with others) of "The Ferns and Fern Allies of Wisconsin" (1940, 1953), "The Ferns and Fern Allies of Minnesota" (1954), "The

- Ferns of Peru Polypodiaceae (Dennstaedtieae to Oleandreae)" in *Contrib. Gray Herb.* 194 (1964), etc.
- Tuckerm. Edward Tuckerman, 1817-1886, professor at Amherst, Massachusetts; lichenologist.
- Tul. Louis Rene Tulasne, 1815-1885, French student of cryptogams.
- Turcz. Nicolaus (Nikilai Stepanovich Turchaninov) Turczaninow, 1796-1864, Russia; author of "Flora baicalensi-daburica." (1842-1856).
- Turner & Horne. B. L. Turner, and David Bertram Horne, 1940- , Sam Houston State College, Huntsville, Texas; Compositae (*Machaeranthera*), Leguminosae (*Baptisia*).
- B. L. Turner. Billie Lee Turner, 1925- , professor of botany, University of Texas, Austin, plant taxonomy, chromosomal studies of higher plants; author of "Legumes of Texas" (1959), (with Ralph E. Alston) "Biochemical Systematics" (1963) and numerous papers, poems and essays.
- Turp. Pierre Jean François Turpin, 1775-1840, French botanical artist and naturalist.
- Tutin. Thomas G. Tutin, 1908- , University College, Leicester, England; flora of the British Isles.
- Uline & Bray. Edwin Burton Uline, 1867-1933, New York high school principal, and William L. Bray, 1865-1953, adjunct and later professor of botany, University of Texas at Austin (1898-1907) where he was first teacher of botany, then forest pathologist, U. S. Dept. Agriculture, later botanist and dean of the graduate school, Syracuse University, New York; student and collector of Texas and southwestern U. S. plants.
- Underw. Lucien Marcus Underwood, 1853-1907, professor of botany, Columbia University, New York; student of ferns; author of "Our Native Ferns and Their Allies" (1880 and subsequent editions).
- Underw. & Cook. L. M. Underwood, and O. F. Cook.
- Urban (or Urb.). Ignatz Urban, 1848-1931, German authority on the flora of tropical America; monographer of *Medicago*, Loasaceae, author of "Symbolae Antillanae . . ." (1898-1908).
- Urban & Gilg. I. Urban and Ernst Friedrich Gilg, 1867-1933, both of the Botanical Museum, Berlin.
- Vahl. Martin Hendriksen Vahl, 1749-1804, Danish botanist, professor in Copenhagen; student of Linnaeus and one of the editors of "Flora Danica."
- Vail. Anna Murray Vail, 1863-1955, librarian, New York Botanical Garden; Asclepiadaceae, Leguminosae.
- Van Eselt. Glen Parker Van Eseltine, 1888-1938, U. S. Dept. Agriculture; Martyniaceae.
- Van Heurck & Muell. Arg. Henri Ferdinand van Heurck, 1838-1909, Belgian botanist and microscopist, and J. Mueller.
- Van Melle. Peter Jacobus Van Melle, 1891-1953, nurseryman of Poughkeepsie, New York.
- v. Ooststr. Simon Jan van Ooststroom, 1906- , Rijksherbarium, Leiden, Netherlands; Convolvulaceae, Borneo flora.
- Vasey. George Vasey, 1822-1893, English-born American botanist, eminent agrostologist, curator, U. S. National Herbarium, Washington.
- Vasey & Hack. G. Vasey, and E. Hackel.
- Vasey & Scribn. G. Vasey, and F. L. Scribner.
- Vatke. Georg Caral Wilhelm Vatke, 1849-1889, assistant in the botanical garden, Berlin.
- Vaughn. Alice Vaughn, published on *Trifolium* in 1939.
- Vell. José Marianno da Conceição Velloso, 1742-1811, Portuguese-Brazilian botanist; posthumously published writer on the flora of Brazil.
- Vent. Etienne Pierre Ventenat, 1757-1808, professor of botany, Paris; horticulturist.
- Vest. Lorenz Chrysanth von Vest, 1776-1840, professor in Graz, Austria.
- Vicé. Frere Marie-Victorin (*formerly* Conrad Kirouac), 1885-1944, director of the botanical institute, Montreal; author of "Flore Laurentienne" (1935), the first flora in which chromosome numbers appeared.
- Vill. Dominique Villars, 1745-1814, physician and professor in Grenoble, *finally* in Strassburg; author of a basic work on the flora of the West Alps.
- Vilm. Several generations of the family of Vilmorin in Paris; seedsmen and authors of many books and memoirs on botany and horticulture; Pierre Philippe André Levéque de Vilmorin, 1746-1804; Pierre Vilmorin, 1816-1860; Henry L. de Vilmorin, died 1899; Maurice Levéque de Vilmorin, 1849-1919; Philippe de Vilmorin, 1872-1917.
- Vitman. Fulgencio Vitman, 1728-1806, Italian botanist.
- Viv. Domenico Viviani, 1772-1840, Italian botanist.
- Vog. Julius Rudolph Theodor Vogel, 1812-1841, German botanist and explorer in Africa.
- Voigt. Johann Otto Voigt, 1798-1843, botanist in Calcutta, India.
- Volk. Albert von Volkart, 1873-1951, Switzerland.
- Voss. Andreas Voss, 1857-1924, German student of conifers.
- J. Voss. John William Voss, 1907- , Pomona College, Claremont, California, school principal; *Phacelia*.
- Wagenkn. Burdette Lewis Wagenknecht, 1925- , Biology Dept., Norwich University, Northfield, Vermont; Compositae.
- Wahl. Göran (Georg) Wahlenberg, 1780-1851, Swedish botanist, professor in Uppsala, plant geographer; author of "Flora Lapponica" (1812), "De Vegetatione et Climate Helvetiae" (1813), "Flora Carpatorum Principalium" (1814), "Flora Upsaliensis" (1820), "Flora Suecica" (1824-1826).
- H. A. Wahl. Herbert Alexander Wahl, 1900- , professor of botany, Pennsylvania State University; *Chenopodium*.
- Wall. Nathanael (*formerly* Nathan Wolff) Wallich, 1786-1854, Danish physician; superintendent of the Royal Botanic Garden, Calcutta, 1815-1841(?).
- Wallr. Carl Friedrich Wilhelm Wallroth, 1792-1857, Danish physician and botanist.
- Walp. Wilhelm Gerhard Walpers, 1816-1853, German botanist; author of "Repertorium Botanices Systematicae" (1842-1853), "Annales Botanices Systematicae" (1848-1868), etc.

- Walraven. Wesley Clifton Walraven, 1936- , Kennesaw Junior College, Marietta, Georgia; Leguminosae (*Rhynchosia*).
- Walt. Thomas Walter, 1740-1789, British-American botanist, Charleston planter; author of "Flora Caroliniana" (1788).
- Wang. Friedrich Adam Julius von Wangenheim, 1747-1800, German forester.
- Ward. George Henry Ward, 1916- , professor of botany, Knox College, Galesburg, Illinois; *Artemisia*, arctic flora.
- Warder. John Aston Warder, 1812-1883, physician and horticulturist, Cincinnati, Ohio.
- Warming. Eugenius Warming, 1841-1924, University Professor and director of Botanic Garden and Museum, Copenhagen; plant geographer.
- Warnock. Barton Holland Warnock, 1911- , professor of botany, Sul Ross State University, Alpine, Texas; student and collector of the flora of Trans-Pecos Texas.
- Warnock & M. C. Johnst. B. H. Warnock, and M. C. Johnston.
- Wasshausen. Dieter Carl Wasshausen, 1938- , Assistant Curator, U. S. National Herbarium, Washington; Acanthaceae.
- Waterfall. Umaldy Theodore Waterfall, 1910- , professor of botany, Oklahoma State University, Stillwater; Solanaceae (*Physalis*), Malvaceae (*Callirhoe*); author of "Keys to the Flora of Oklahoma" (1953-1960, 2nd ed. 1962).
- Wats. Sereno Watson, 1826-1892, assistant to Asa Gray, curator of Gray Herbarium, Harvard University (1888-1892), critical student of West American plants.
- E. E. Wats. Elba Emanuel Watson, 1871-1936, high school biology teacher in Michigan and New York; *Helianthus*.
- P. W. Wats. Peter William Watson, 1761-1830, English horticulturist-dendrologist.
- Watt. David Allan Poe Watt, 1830-1917, Montreal, Canada; student of ferns.
- Weath. Charles Alfred Weatherby, 1875-1949, Gray Herbarium, Harvard University; student of ferns, bibliographer.
- Weath. & Blake. C. A. Weatherby, and S. F. Blake.
- Webb. Philip Barker Webb, 1793-1854, British botanist, botanical traveler and accumulator of a rich herbarium and botanical library, which are now in Florence.
- Webb & Berth. P. B. Webb, and Sabin Berthelot, 1794-1880, French consul on Teneriffe; authors of "Histoire Naturelle des Illes Canaries" (1835-1844).
- Webb & Moq. P. B. Webb, and C. H. B. A. Moquin-Tandon.
- Weber. Frederick Albert Constant Weber, 1830-1903, French botanist with special interest in succulents, particularly the Cactaceae, member of French expedition to Mexico (1865-6).
- G. L. Webst. Grady Linder Webster, 1927- , Texas-born and -reared, University of California (Davis); Euphorbiaceae (American and Pacific).
- Wedd. Hugh Algernon Weddell, 1819-1877, British botanist and traveler, collector in South America.
- Weigel. Christian Ehrenfried Weigel, 1748-1831, professor at Greifswald, Germany.
- Weinm. Johann Anton Weinmann, 1782-1858, director, botanic garden, St. Petersburg, Russia.
- Wendl. Hermann Wendland, 1823-1903, director of the royal garden at Herrenhausen, Hannover, Germany; Palmae.
- West. Richard Weston, 1733-1806, England.
- Wettst. Richard Ritter von Westersheim Wettstein, 1863-1931, director of the botanic garden, Vienna; outstanding systematist, proposer of an important phylogenetic system.
- Wheeler. Louis Cutter Wheeler, 1910- , professor of botany, University of Southern California, Los Angeles; *Euphorbia* and other genera of Euphorbiaceae.
- Wherry. Edgar Theodore Wherry, 1885- , professor of botany, University of Pennsylvania; student of ferns, Polemoniaceae, author of "Guide to Eastern Ferns" (1942), "The Genus Phlox" (1955), "The Southern Fern Guide" (1964), etc.
- White. Theodore Greeley White, 1872-1901, student at New York Botanical Garden; Leguminosae (*Lathyrus*).
- Whiteh. Eula Whitehouse, 1892- , Southern Methodist University, Dallas, Texas; student and collector of flora of Texas, author of "Texas Flowers in Natural Color" (1936, 1948).
- Wieg. Karl McKay Wiegand, 1873-1942, professor of botany, Cornell University, Ithaca, New York; author (with A. J. Eames) of "The Flora of the Cayuga Lake Basin, New York" (1926).
- Wiens. Delbert Wiens, 1932- , University of Utah, Salt Lake City; Viscaceae, Loranthaceae.
- Wiggers. Friedrich Heinrich (Wichers) Wiggers, 1746-1811; author of a "Flora of Holstein" (1780).
- Wight & Arn. Robert Wight, 1797(?) - 1872, British botanist who resided in India (1819-1853); superintendent of the Madras botanic garden and student of the flora of India, and George Arnold Walker Arnott, 1799-1868, Edinburgh and Glasgow botanist.
- Wight & Hedr. W. F. Wight, and Ulysses Prentiss Hedrick, 1870-1951, pomologist, Director of Agricultural Experiment Station, Geneva, New York.
- W. Wight. William Franklin Wight, 1874-1954, U. S. Dept. Agriculture, Palo Alto, California; botanical and agricultural collector in South America, author of "Origin, Introduction and Primitive Culturo of the Potato" in Proc. 3rd. Ann. Meet., Potato Assoc. Am. 3:35-52. 1916.
- Wilbur. Robert Lynch Wilbur, 1925- , professor of botany, Duke University, Durham, North Carolina; *Sabatia*, Cistaceae, Clethraceae.
- Willd. Carl Ludwig Willdenow, 1765-1812, German botanist, director of the Berlin Botanical Garden (1801-1812); produced the 4th ed. of Linnaeus' "Species Plantarum" (1797-1810).
- Willem. Pierre Remi Willemet, 1735-1807, French taxonomist; student of the flora of Lorraine.
- J. S. Wils. James Stewart Wilson, 1932- , Kansas State Teachers College, Emporia, Kansas; ecology of *Persicaria*.
- K. A. Wils. Kenneth A. Wilson, 1928- , professor of botany, University of Michigan, Ann Arbor; Myrtaceae (*Eugenia*), Convolvulaceae.

- P. Wils. Percy Wilson, 1879-1944, New York Botanical Garden; student of flora of North America and West Indies.
- Wimm. Christian Friedrich Heinrich Wimmer, 1803-1868, German philologist and botanist, school official in Breslau.
- Windler. Donald Richard Windler, 1940- , botanist, Towson, Maryland; Leguminosae (published on *Neptunia* in 1966).
- Winkl. Hubert Winkler, 1875-1941, Botanical Garden, Tubingen, Germany.
- With. William Withering, 1741-1799, British physician and botanist; author of a British flora (1776, plus 3 additional editions).
- L. O. Wms. Louis Otho Williams, 1908- , botanist, Botanical Museum, Harvard University, then Escuela Agricola Panamericana, Zamorano, Honduras, then U. S. Dept. Agriculture, Beltsville, later Chicago Natural History (Field) Museum; orchidologist, student and collector of Latin American flora, author of "Orchids of Mexico," Ceiba, Vol. 2 (1951), etc.
- C. B. Wolf. Carl Brandt Wolf, 1905- , botanist, Rancho Santa Ana Botanic Garden, Anaheim, California (1930-1945), published on *Erythronium* in 1941 and *Rhamnus* in 1939.
- v. Wolf. Nathanael Matthaeus von Wolf, 1724-1784, German physician and botanist.
- W. Wolf. Contemporary botanist, St. Bernard College, Alabama; student of Liliaceae (*Erythronium*, 1941).
- Wood. Alphonso Wood, 1810-1881, principal, Brooklyn Female Academy, New York; author of "Class-Book of Botany" (1845, 2nd. ed. 1861), in which dichotomous keys were first employed in America, collected in California in 1866.
- Woods. Robert Everard Woodson, 1904-1963, Missouri Botanical Garden, St. Louis; authority on Asclepiadaceae and Apocynaceae.
- Woodv. William Woodville, 1752-1805, English student of medical botany.
- Woodv. & Wood. W. Woodville, and William Wood, 1745-1808, English botanist; *Cyperus*.
- Woot. Elmer Otis Wootton, 1865-1945, professor of biology, New Mexico State College, Mesilla Park (1890-1911), U. S. Dept. Agriculture, Washington (1911-1935); student of the New Mexican flora, author of "Trees and Shrubs of New Mexico" (1913), etc.
- Woot. & Standl. E. O. Wootton and P. C. Standley; authors of "Flora of New Mexico" (1915).
- Wright. Charles Wright, 1811-1885, world-wide botanical collector but mainly in Texas (1837-1852), Cuba and his native Connecticut; correspondent of Asa Gray and other notables of his time.
- S. H. Wright. Samuel Hart Wright, 1825-1905, New York; published on *Dichromena* (Cyperaceae).
- Y. Wright. Ysabel Wright, published on the Cactaceae in 1937.
- Yates. Harris Oliver Yates, 1934- , David Lipscomb College, Nashville, Tennessee; Gramineae.
- Yunck. Truman George Yuncker, 1891-1962, professor of botany, De Pauw University, Indiana; monographer of *Cuscuta*, *Piper*, *Peperomia*.
- Zavortink. Joyce Robert Zavortink, 1930- , University of California, Los Angeles; Loasaceae.
- Zinn. Johann Gottfried Zinn, 1727-1759, professor of medicine, Göttingen, Germany.
- Zucc. Joseph Gerhard Zuccarini, 1797-1848, German botanist, professor in Munich.
- Zuccagn. Attilio Zuccagni, 1754-1807, Italian botanist.

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- Vines, Robert A. Trees, Shrubs and Woody Vines of the Southwest. The University of Texas Press, Austin. 1960.
- Waterfall, U. T. Keys to the Flora of Oklahoma. Okla. State Univ., Stillwater. Ed. 2. 1962.
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